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ТЕМАТИЧЕСКИЙ РЕФЕРАТИВНЫЙ СБОРНИК № 50-2/1

“Energy Saving and Consumption Reducing”
(«Энергосбережение»)

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"A Knowledge-based Message Filtering Algorithm in Scalable DVE Systems"

In scalable Distributed Virtual Environments (DVE), communication between the users can maintain the consistent state of system, but consume the network bandwidth at the same time. Message filtering is necessary to be adopted in order to support more users in a large scale virtual environment. Existing message filtering algorithms are, in our opinion, somewhat deficient either in users' AOI management or consistency maintenance. In this paper, a knowledge-based message filtering algorithm is proposed. The knowledge base is built in order to divide effectively the user's vision domain. Users send update messages to receivers in its interaction area and in its perception area with different frequency to reduce the traffic and improve the consistency. Experimental results show that the knowledge-based message filtering algorithm can reduce the redundant traffic and save the consumption of network resources. [C1]

"Numerical Simulation of the Thermal Performance of Solarwall"

Energy consumed for heating in northern China amounts to 40% of the total energy consumption of cities and towns of the country, and the resulting environmental pollution is very severe as coal is the main fuel for heating in China. As a result, there is a growing, government-led trend of applying renewable energy in China. One area of interest lies in the use of solar energy. Although Chinese government has been promoting the use of solar energy, the development of building-integrated solar technology in China is relatively slow. Solar air heating system based on unglazed transpired collector (also known as solar wall) is a simple and inexpensive technique and is easy to be integrated in building. Solar wall is a potential replacement for glazed flat plate collectors. Such systems have been used in several large buildings in Canada, USA, and Europe, effecting considerable savings in energy and heating cost. However, the application of solar wall in China has just begun. A mathematical model of solar wall was established and numerical simulation was conducted to investigate the relationship between solar absorptive, thermal emissivity, outlet air temperature, and heat output by solar wall. Simulation results showed that solar radiation and airflow rate have strong effect on solar wall efficiency, and the effect of solar absorptivity on heat output is stronger than thermal emissivity. The effect of thermal emissivity on heat output is significant at higher outlet air temperature. Outlet air temperatures in the range of 20-35°C that is suited for ventilation can be easily achieved by solar wall. Solar wall is viable for China to reduce heating energy consumption and improve indoor air quality in winter. [C2]

"Development of a Self-Adapting Intelligent Sensor for building energy saving and smart services"

In this paper we propose a Self-adapting Intelligent Sensor (SIS) in order to provide the building energy saving and smart services. In order to optimize the system resources the SIS dynamically reconfigures its middleware and network topology according to environmental changes. Our proposed system reduces the power consumption of our real test bed up to 25.7%. [C3]

"Adaptive Fuzzy-MAC for Power Reduction in Wireless Sensor Networks"

Wireless Sensor Networks (WSNs) are used in an increasing number of applications in different fields, from agricultural monitoring to energy-saving systems for buildings. The development of WSNs has been always constrained by the power consumption of nodes that constitute the network since they should be as much autonomous as possible and human intervention must be reduced to the minimum. Several algorithms and protocols have been designed with the goal of reducing power consumption. Related works take into consideration Media Access Control (MAC) protocols that keep sensors' power consumption low at that layer. Nevertheless, these protocols require some parameters, e.g. duty cycle, to be configured according to network characteristics in order to achieve an acceptable level of efficiency. In this work, we propose a Fuzzy Logic Controller (FLC) which adapts the MAC protocol parameters by employing local node inputs such as battery power and average packet traffic. We present the FLC design and perform simulations that show its feasibility. We evaluate the FLC in terms of its power savings capabilities and show that for high-traffic and low-energy

nodes power consumption may be reduced up to 50%. [C4]

"Cross-Layer Secrecy Design on TCP/IP and 802.11 for Energy Saving"

Electronic services (mail, web, etc.) can operate, at present over wireless networks. 802.11 networks are an example, where wireless devices use its resources to access to networks and services and in particular to Internet. The security mechanisms in the MAC layer are added to existing security mechanisms in other layers of the TCP/IP model, and therefore it generates multiple encryption of information. The implementation of encryption mechanisms in wireless networks consumes resources in the devices, and among others, the battery power. In a wireless terminal the battery is limited and the reduction of the number of encrypted bytes can reduce the energy consumption. In this paper we resume the security architecture in TCP/IP over IEEE 802.11 networks. Then we explain the impact of encryption mechanisms on the energy consumed in a mobile node in a case scenario. We propose a solution that eliminates redundancy in the encryption of the data at different layers applying the Cross-Layer design, we analyze the architecture for exchanging security information between layers and, finally, we propose an algorithm for security inter-layer communication and a solution for Cross-Layer signalling between nodes. [C5]

"Energy-efficient transmission of DWT image over OFDM fading channel"

In many applications retransmission of lost packets are not permitted. In an OFDM system, due to channel fading, only a subset of carriers are usable for successful data transmission. If the channel state information is available at the transmitter, it is possible to take a proactive decision of mapping the descriptions optimally onto the good subcarriers and discard at the transmitter itself the remaining descriptions, which would have been otherwise dropped at the receiver due to unacceptably high channel errors. In this paper we present a energy saving approach to transmission of discrete wavelet transformation based compressed image frames over the OFDM channels. Based on one-bit channel state information at the transmitter, the descriptions in order of descending priority are assigned to the currently good channels. In order to reduce the system power consumption, the mapped descriptions onto the bad subchannels are dropped at the transmitter. Via analysis, supported by MATLAB simulations, we demonstrate the usefulness of our proposed scheme in terms of system energy saving without compromising the received quality in terms of peak signal-noise ratio. [C6]

"The Effect of Unwanted Internet Traffic on Cellular Phone Energy Consumption"

Unwanted Internet background traffic (often called "Internet background radiation") is received to every public IPv4 address. This is a problem for cellular phones with an always-online GPRS connection, because receiving the unwanted sporadic data traffic will cause the cellular radio to be used, which in turn drains the device battery. We present measurements of the effect of unwanted Internet traffic to cellular phone energy consumption, and simulate different 3G fast dormancy timeout values to find out a way to reduce the time the radio is active. The simulations demonstrate that the use of a well-chosen static fast dormancy timeout value enables large power savings without causing too much extra 3G state transition signalling between the cellular phone and the 3G base station. [C7]

"Implementation of EN-Elman Backprop for Dynamic Power Management"

Power utilization has become a major issue in portable designs, since its battery storage is less compared to its usage. One of the popular techniques to solve this problem is to use Dynamic Power Management (DPM) at the system level. Dynamic power management is a technique used to save power when the system is idle. Earlier it was assumed that the prediction can be done only in long range dependent systems which may be a random process or short range dependent. But a single user will not work similarly the next time, so a single assumption will not hold good. To overcome the above assumptions, we propose an Elman Model which uses Moving Average, Elman Back prop network and random walk model to predict the idle period. Here we use Artificial Neural Network (ANN) in which we train the neurons in a particular way the user desires, replacing neurons by time series we can calculate how much power is saved. Our enhanced version consequently reduces energy consumption, noise and cooling requirements. There by we achieve prolong battery life. By simulation we can show that this method achieves higher power saving compared to other methods. [C8]

"Multicast-Aware Mapping Algorithm for On-chip Networks"

Networks-on-Chip (NoCs for short) are known as the most scalable and reliable on-chip communication architectures for multi-core SoCs with tens to hundreds IP cores. Proper mapping the IP cores on NoC tiles (or assigning threads to cores in chip multiprocessors) can reduce end-to-end delay and energy consumption. While almost all previous works on mapping consider higher priority for the application's flows with higher required bandwidth, a mapping strategy, presented in this paper, is introduced that considers multicast communication

flows in addition to the normal unicast flows. To this end, multicast and unicast traffic flows are first characterized in terms of some new metrics which are then used for arranging communication flows based on their volume and priority. A heuristic approach is used to assign IP cores to NoC tiles. Simulation results for both synthetic and real applications show up to 49% (28% on average) performance improvement and 44% (22% on average) energy saving when compared to the best known mapping algorithm, nMap. [C9]

"Using video technology for reducing TV energy"

In this paper we present a new approach to lower energy consumption of television set. Unlike existing methods, which "sense" a TV viewer through motion sensor or remote controller, our approach "monitors" the viewer through a video camera. The proposed method keeps TV screen active only if there is someone looking at the screen. When no viewer is present in front of the camera, the TV screen is dimmed to save power while the TV audio system is kept ON. Experiments show that such energy management can reduce the TV power consumption significantly especially when TV is left ON unwatched. [C10]

"Low Power Subthreshold D Flip Flop"

Energy performance requirements are forcing designers of next-generation systems to explore approaches to least possible power consumption. Scaling of power supply voltage is major factor to reduce the power consumption. Threshold voltage may be reduced to achieve higher drive current and hence better speed, but at the cost of increase in the stand-by power. The technique to achieve ultra low power is to operate the circuit with supply voltage lower than the threshold voltage i.e. subthreshold region. Subthreshold operation is being examined to stretch low-power circuit designs beyond the normal modes of operation, with the potential for large energy savings. Ultra low-power consumption can be achieved by operating digital circuits with scaled supply voltages. In this report proposed subthreshold circuit is based on GDI (Gate Diffusion Input)-a new technique of low power digital combinational circuit design. This technique allows reducing power consumption, delay and area of digital circuits, while maintaining low complexity of logic design as compared to other CMOS circuits [C11]

"More efficient home energy management system based on ZigBee communication and infrared remote controls"

This paper describes more efficient home energy management system to reduce power consumption in home area. We consider the room easily controllable with an IR remote control of a home appliance. The room has power outlets, a light, and a ZigBee hub. The ZigBee hub has an IR code learning function and educates the IR remote control signal of a home appliance connected to the power outlet. Then it can control the power outlets and the light in the room. The ZigBee hubs in each room communicate with the home server and report the power consumption information to the home server. The proposed architecture gives more efficient energy-saving HEMS. [C12]

"The impact of inverse narrow width effect on sub-threshold device sizing"

Sub-threshold operation has been proved to be successful to achieve minimum energy consumption. It is well known that the sub-threshold device sizing is different from super-threshold due to different current behavior. The previously reported sub-threshold sizing methods assume that the current is proportional to the transistor width. However, we have found that the inverse narrow width effect has a significant influence on the threshold voltage in the sub-threshold region, causing non-proportional current-width relationship. Sizing without considering this effect may result in significant imbalance in the rise and fall delay which degrades the performance, power consumption and the functional yield of the design. We have proposed a new sub-threshold sizing method to balance the rise and fall delay by taking into account the influence of inverse narrow width effect while minimizing the transistor size. Compared with the previous sub-threshold sizing method the delay and power-delay-product (PDP) are reduced by up to 35.4% and 73.4% with up to 57% saving in the area. Further, due to symmetric rise and fall delay the minimum operating voltage can be lowered by 8% which leads to another 16% of energy reduction. [C13]

"Characterization of Baseband Implementations Using Energy Efficiency Metric Based Quantification"

Energy consumption is an issue in general in information and communication technologies (ICT), but also cellular communications in particular. Base station sites are the main energy consumers in a mobile network. Their energy consumption significantly contributes to green house gas (Co2) emissions. It has been found that digital baseband is the main contributor to dynamic part of the power consumption in new base station

deployments due to its explosive computational complexity. Hence, the implementations of baseband subsystem need to be energy efficient in advanced systems and thus to reduce Co2 foot print and save on energy costs. In this paper, we have presented an approach for evaluating energy efficiency metrics for any signal processing algorithm on TI's DSP and Xilinx FPGA. This evaluation of energy metrics is very much required to characterize the implementations and for quantifying the gains achieved from any energy efficient strategy. In addition, we showed that reducing execution cycles taken by signal processing algorithm effectively reduces its dynamic power consumption. As an example, FFT/IFFT algorithm, one of the critical block in OFDMA systems is considered for energy analysis. [C14]

"An Efficient Approach for Reducing Power Consumption in a Production-Run Cluster"

In recent years there has been renewal of interest in the relation between Green IT and High Performance Computing. The growing use of supercomputers has caused marked energy burden, putting negative pressure on electricity cost of computing centers. Scientists could foresee that the power consumption of computing facilities will double, triple, or even more in the next decade. Each year more and more network switches, storages and computers are put to use, but it is not just the number of machines purchased from vendors driving cost upward. The way how we use these supercomputers might also increase energy consumption. This paper proposes a new approach to reduce energy utilization in PC clusters. In particular, our approach relies on recalling services dynamically onto appropriate amount of the computers according to user's job request and temporarily shutting down the computers after finishing jobs in order to conserve energy. We present initial work on the innovative integration of resource management system and remote power management system that aims at reducing power consumption such that they suffice for meeting the minimizing quality of service required by a Production-Run cluster. Given the estimated energy consumption, the proposed effort has the potential to positively impact power consumption. The results from the experiment concluded that energy indeed can be saved by powering off idle computers and its negative effect can be mitigated with proper settings. [C15]

"Reducing the costs of electrical energy in the Copper Mining and Smelting Complex RTB Bor by the use of distributed control system"

Monitoring and control of consumption of electricity for great consumers, such as Copper Mining and Smelting Complex RTB Bor (Serbia), requires synchronized actions in different production plants. First of all, it is necessary to achieve an effective exchange of actual information between the production units and control centers. The responce time has to be small enough in order to implement timely impact on the reduction of peak power at the consumer transformer stations. Such control systems can be classified as soft real time systems. The fact is that for large customers reduction of peak power on a monthly basis for only 1% is reflected in substantial financial savings (in the order of magnitude of thousands of euros). This data justifies the need for existence and proper functioning of these control systems. The paper presents results of development and implementation of our own solutions for distributed systems management of electricity consumption, both at the company level and in each individual production plant. A special attention is paid to presentation of the software solutions, as well as achievements in practical implementation. [C16]

"A Novel Dvs Algorithm for Distributed Fusion Sensor System"

Distributed fusion sensor system will enable the reliable monitoring and control of a variety of applications for remote environment monitoring. The sensors have to be designed in a highly integrated fashion, optimizing across all levels of system abstraction, with the goal of minimizing energy dissipation. Crucial to long system lifetimes for these micro sensors are algorithms and protocols that provide the option of trading quality for energy savings. Dynamic Voltage Scaling (DVS) has been a key technique in exploiting the hardware characteristics of processors to reduce energy dissipation by lowering the supply voltage and operating frequency. In this paper a novel DVS algorithm is presented, which achieves dynamic voltage scaling on the sensor node’s processor enables energy saving and been demonstrated using a commercial processor, a digitally adjustable DC-DC regulator and a power aware operating system. The simulations results show that up to 60% less energy is consumed with DVS than with a fixed supply voltage. [C17]

"An Adaptive Energy Saving and Reliable Routing Protocol for Limited Power Sensor Networks"

In wireless sensor networks, the value of transmission range has a direct impact on energy utilization. A sensor node makes use of the maximum transmission power and transmission range to send packets in a network which results in wastage of energy, since maximum transmission range is mostly longer than the distance between node and its extreme neighbor due to node distribution. In this paper, we present an adaptive energy saving and reliable routing protocol (AESRR) for wireless sensor networks. In AESRR, sensor node reduces its maximum transmission range in order to reach the extreme neighbor for saving energy before sending the first

packet. The route discovery process of AESRR is on-demand. In the route discovery process, a combined link weight is determined based on the parameters transmission success ratio and node's residual energy. The best route is selected based on this link weight value. The sensor node must readjust the transmission range when remaining energy reaches bellow a threshold link weight value. Our proposed protocol saves energy, and prolongs the lifetime of node while enhancing the reliability. By simulation results, we demonstrate that AESRR has better delivery ratio and less energy consumption and delay. [C18]

"The influence of wall's insulation thickness to building energy consumption"

Wall insulation is one of the commonly used energy-saving measures. But many factors, such as climate, building type and indoor heat gain, have great influence on the effectiveness of building insulation. In this paper, the influence of thickness of building insulation layer on the building HVAC energy consumption has been analyzed for three different indoor heat gain, 20, 50, 80 W/m2, for an office building in Changsha, China. And results showed that the increase of thickness of wall insulation layer will help to reduce building HVAC energy consumption. But the increasing trend of energy saving rate would be reduced as the increasing of the thickness of building insulation layer. And for the building with higher indoor heat gain, the energy-saving rate associated with wall insulation tends to be lower. [C19]

"Flexible and energy-efficient duty cycling in wireless networks with MacZ"

In wireless networks formed of battery-powered nodes, energy consumption is a major concern. On the communication side, energy can be saved by switching transceivers to idle or power-down mode when not needed. To this end, duty cycling protocols located at MAC level have been devised. These protocols have in common that they define modified CSMA/CA schemes, and that they assume the availability of some time synchronization mechanism. This strongly limits their potential to reduce energy consumption, as well as their flexibility regarding activity phases. In this paper, we propose a more flexible and energy-efficient solution for duty cycling, which is based on our experimental wireless MAC protocol MacZ. Flexibility is strengthened by the possibility to define weakly periodic activity periods. Energy-efficiency is improved by the possibility to reserve and use exclusive transmission slots, thereby switching transceivers to active mode only when needed. Both measures are supported by an underlying protocol for accurate, deterministic tick and time synchronization. We assess our solution and compare it to a well-known duty cycling protocol based on real-life scenarios. [C20]

"Environmental strategies analysis of cohousing based on ecological footprint"

Cohousing is a type of housing in which residents actively participate in the design and operation of their own neighborhoods. In order to reduce construction and living costs, most of cohousing reach a consensus of resource sharing and energy saving on the common values of pro-environment and sustainability. Five dimensions, site planning and design, food consumption, trip mode, resource usage and energy system, enter into environmental strategies analysis and assessment of cohousing based on ecological footprint. It is concluded that compact layout and building size; cutback are direct ways to reduce footprint of cohousing; sharing common meals and resources, less driving and more recycling are proactive and effective environmental strategies by altering behaviors and lifestyle of cohousers; using renewable energy and energy-saving technologies to reduce energy consumption is an active approach conventionally applied in cohousing to reduce human ecological footprint. [C21]

"Discussion on energy-saving mesures for fly-ash cement particleboard poduction line"

Power consumption is very large in fly-ash cement particleboard poduction. By technical innovation, creating the greatest economic benefits with minimal power consumption and the lowest cost is the only route of enterprise development. In this paper, fly-ash cement particleboard production characteristics was analyzed, energy-saving measures for energy-saving transformation of atmospheric pressure heat curing process and steam curing process were researched, and frequency conversion energy-saving transformation of energy-consumption equipment was also discussed. The results showed, the time of heat curing could be significantly reduced by improving atmospheric pressure heat curing process, whose power consumption was decreased; the surplus heat energy can be efficiently recycled by energy-saving transformation for steam curing process; power configuration of poduction line was more reasonable by frequency conversion energy-saving transformation for part energy-consumption equipment, energy-saving effect was significant. [C22]

"A self-adaptive DVS scheduling algorithm for multi-core systems"

Dynamic Voltage Scaling (DVS) is widely supported in modern general purpose systems, like desktops. Interval-based DVS algorithms have been used in some operating systems (OSs), like Linux. But their load prediction models can't fit various needs of users so well, since most of them employ one prediction method only. In this

paper, a self-adaptive algorithm called SADVS is presented. It selects the best algorithm according to the prediction accuracy of historical records, and the selector will be used to adjust the CPU speed in the following interval. SADVS behaves well in both simulations and actual implementation. For actual implementation, we find that SADVS reduces energy consumption 0.02%~0.4% without time extension compared to results of ondemand policy in Linux kernel. [C23]

"A low-power VLSI implementation for variable block size motion estimation in H.264/AVC"

Variable block size motion estimation (VBSME) is becoming the new coding technique in H.264/AVC. This paper presents a low-power VLSI implementation for full-search VBSME. Compared to existing hardware architectures and implementations for VBSME, the proposed design employs a fast full-search block matching algorithm to reduce power consumption, while preserving the optimal solution and the throughput. The proposed architecture has been implemented and tested in Xilinx XtremeDSP Video Starter Kit Spartan-3ADSP 3400A Edition, and also verified using standard cell approach in UMC 0.18μm CMOS technology. Compared to other VBSME designs that give optimal solutions of Motion Vectors (MV), the proposed design can save power consumption by more than 56%. [C24]

"Optimization of clock-gating structures for low-leakage high-performance applications"

Clock Gating (CG) is a well known technique to reduce dynamic power consumption by stopping the clock to avoid unnecessary transitions in synchronous circuits. The abilities of different CG-styles to save power at a flip-flop level, depending on the input activity, are analysed in this paper. Also, since conventional CG techniques usually do not take into account leakage power, some optimization procedures and guidelines are presented for leakage reduction. Focusing on those structures that do not need a latch to remove undesired transitions in gated clock, a leakage value of a fourth of the original one is achieved without degradation in timing performances. [C25]

"A novel mutli-cores MCU architecture based on data flow computing"

The concept of data flow computing is increasingly being used to the multi-core and parallel computing architecture in nowadays. This paper presents a new multi-cores MCU architecture, named DFF (Data Flow driven on Function-level), which possesses the characteristics of function-level parallelism and data driven. It efficiently synthesizes the middle grain parallelism of data flow computing and the sequential computing commonly used in von Neumann structure. The main process of the design is explained by an example of data-driven computation implementing where the custom function stored in the single core (NIOSII), in the initialization phase, will begin to run only when all its operands are available, and the system will be in the sleep state when no effective data can be used to drive and the power will be saved significantly. Moreover, the multi-cores can carry out parallel operation under the data-independent. Some feasible verifications of multi-cores MCU architecture are implemented in Altera EP20K200EFC484-2 to prove the validity of this approach. It is shown that the novel architecture with DFF mode can reduces the hardware overhead and the power consumption. [C26]

"Energy efficient cooperation in underwater sensor networks"

Energy efficient communication is a key requirement of energy-constrained underwater sensor networks (UWSNs). In this paper, we show that the cooperative diversity, which is conventionally utilized to improve reliability in UWSNs, can be employed to reduce energy consumption and preserve a reasonable level of data reliability and communication delay. We first elucidate in what circumstances the cooperative diversity saves energy compared to the non-cooperative diversity. We show that this largely depends on parameters such as distance between the source and the destination node, the location of potential partner node, and the requirements of reliability and communication delay. Second, we propose a simple but effective cooperation scheme to take advantage of the cooperative diversity. The cooperation diversity can achieve a near-optimal energy saving in some circumstances, and it is no worse than the non-cooperative diversity in all cases. Our work provides instructive theoretical guidelines for designing practical UWSNs. [C27]

"Traffic-aware base station sleeping in dense cellular networks"

The energy consumption of information and communication technology (ICT) industry has become a serious problem, which mostly comes from the network infrastructure, rather than the mobile terminals. In this paper, we consider densely deployed cellular networks where the coverage of base stations (BSs) overlaps and the traffic intensity varies over time and space. An energy saving algorithm is proposed by dynamically adjusting the working modes (active or sleeping) of BSs according to the traffic variation with respect to certain blocking probability requirement. In addition, to prevent frequent mode switching, BSs are set to hold their current working

modes for at least a given interval. Simulations demonstrate that the proposed strategy can greatly reduce energy consumption with blocking probability guarantee, and the performance is insensitive to the mode holding time within certain range. [C28]

"Energy saving in metro-transit systems: Impact of braking energy management"

In the urban mobility of big cities and metropolitan areas, the metro-transit system plays a fundamental role and it is one of the most energy-impactive. Considering the actual general upward interest for energy saving and sustainability in city transport, with the consumptions increasing and the technological evolution, new studies and projects on metro-transit lines are in progress. The aim is achieving new design proposals -including new technologies and management techniques -based on high-quality simulation models and software for energy evaluations. In this framework a study on a line of the metro-transit system of Rome has been performed. The study tasks are to provide future upgrading actions for energy saving with a reduced economic impact thanks to the maximum exploitation of existing electric power systems. The analysis principally regards the assessment of the impact of the braking energy recovering on the energy consumption. Its results point out the necessity of a revaluation of the choices on the power system design for its management, also according to the actual storage technologies, confirmed by a wide literature overview. [C29]

"Targeting ultra-low power consumption with non-uniform sampling and filtering"

Today signal processing systems uniformly sample analog signals without taking advantage of their intrinsic properties. For instance, temperature, pressure, electrocardiograms, speech signals significantly vary only during short moments. The digitizing system does not take into account this specificity and furthermore is highly constrained by the Shannon theory which fixes the sampling frequency at least twice the input signal frequency bandwidth. It has been proved that Analog-to-digital Converters (ADCs) using a non equi-repartition in time of samples leads to interesting power savings compared to Nyquist ADCs. A new class of ADCs called A-ADCs (for Asynchronous ADCs) based on level-crossing sampling (which produces non-uniform samples in time) and asynchronous technology has been developed. This article will present a fully non-uniform filtering technique associated to such an ADC which is able to drastically reduce the power consumption. [C30]

"A simple energy efficient transceiver for IEEE 802.15.4"

Power saving in wireless sensor networks (WSNs) has been the focus of much recent research due to the fact that the nodes are usually battery-powered. Wireless communication accounts for a strikingly high proportion of the total power consumption, so we want to reduce the power consumption by adopting a low-power transceiver in the physical layer. IEEE 802.15.4 is a popular communication standard for WSNs which has many good features that can be used for power-saving. In this paper, we propose a simple transceiver for IEEE 802.15.4. It utilizes the constant-envelope feature of the offset quadrature phase shift keying (O-QPSK) signal with half-sine shaping defined in the standard to simplify the structure of the transceiver. Compared with conventional transceivers, the proposed transceiver adopts a hard-limiter rather than a digital-to-analog converter (DAC) and an analog-to-digital converter (ADC), which results in a simpler structure and lower power consumption, furthermore, the correlation operation could be efficiently implemented just by a reversible counter. The performance of the proposed transceiver is effectively demonstrated by both computer simulation and hardware test. [C31]

"Complexity-effective dynamic range compression for digital hearing aids"

Dynamic range compression (DRC) is an essential function in digital hearing aids, which have stringent power consumption constraints. This work minimized the complexity of the DRC algorithm through adopting functional approximation for those involved nonlinear operations. The tradeoff between computation reduction and approximation error was explored for reducing hardware cost without introducing audible artifact. Moreover, finite wordlength analysis is conducted for the wordlength minimization and further complexity saving. The experimental result shows that our design totally reduces 96% computing complexity of the straightforward implementation without introducing audible difference in the output signals. Compared with other approximation methods, our design also requires lower hardware complexity. [C32]

"Study of energy consumption problem in wireless sensor networks"

A new low-power wireless sensor node design for structures wireless monitoring and control application is introduced in this paper, reviewed of energy consumption source of wireless sensor node. The Energy-saving technology is discussed with respect to integrated circuit (IC), power management and data transmitting, which greatly reducing system power consumption. [C33]

"A novel MUX-FF circuit for low power and high speed serial link interfaces"

In this paper, a novel multiplexer-flip-flop (MUX-FF) topology using the current mode logic (CML) is presented. A CML multiplexer-latch (MUX-latch) is proposed by combining a multiplexer and the loopback storage part of a latch into a single module so that the buffer part of a latch can be removed. A MUX-FF is implemented by cascading two stages of MUX-latches. The output of a MUX-FF is edge-triggered, so it is insensitive to input noise. All the paths from inputs to the output are symmetric. Power and area can be reduced due to the removal of DFFs. Simulation results show that a MUX-FF can achieve a similar frequency as a conventional tree-type MUX by saving 56% of area and 72% of power consumption. [C34]

"Hardware implementation of the double-tree scan architecture"

In a scan-based test architecture, the scan power and and test data volume can be reduced by utilizing a double tree scan (DTS) architecture. This paper presents a novel hardware implementation of the DTS architecture and compares the hardware overhead with the conventional scan architecture. The implementation proposed utilizes a clock structure which greatly decreases the number of clocked flip-flops and thereby reduces power consumption. A test chip is designed and fabricated in a 0.5 μm CMOS technology to verify the power saving properties of the architecture. [C35]

"Minimal Logic Depth adder tree optimization for Multiple Constant Multiplication"

Research on optimization of fixed coefficient FIR filters modeled as Multiple Constant Multiplication (MCM) has been ongoing for two decades. An analysis of Minimal Signed Digit (MSD) reveals that potential good solutions are omitted by Common Subexpression Elimination (CSE) algorithms as they are hidden in the MSD representations. Some CSE algorithms ensure that all coefficients are implemented at minimal Logic Depth (LD) which is advantageous from power saving perspective. Imposing this requirement on a graph dependant (GD) algorithm reduces the search space as well as the runtime. It also eliminates the long critical path of GD algorithm. This paper presents a minimal logic depth GD algorithm which requires no lookup table. Simulation results show that it has lower number of adders than CSE algorithms while having the minimal logic depth. For all filters tested, it consumes less switching power than the latest LD constrained GD methods based on the Glitch Path Count and Glitch Path Score metrics. [C36]

"Improving energy efficiency of functional units by exploiting their data-dependent latency"

Conventional timing-optimized synchronous circuit is designed and constrained by the longest critical path delay, i.e. the worst-case design. However, the path delay of the circuit is absolutely data-dependent. In the example of an 8-bit multiplier simulation, for the 10,000 random input patterns, only about 1% of the input patterns exercise the critical path. This fact motivates us to exploit data-dependent latency of the functional unit to achieve significant energy reduction with negligible performance degradation. In this paper, we propose a design flow for the energy-efficient, variable-latency functional unit which exploits the data-dependent latency. In the 8-bit signed Booth-Wallace multiplier simulation (clock period: 1.2ns @UMC 90nm CMOS cell library), the proposed design can save energy by 21% with only 0.17% performance degradation. Besides, compared to other popular energy reduction technique, the pipelined architecture, for the classical 5-stage RISC processor, the proposed technique improves about 23-28% energy-delay metric performance efficiency. [C37]

"Energy Minimization on Thread-Level Speculation in Multicore Systems"

Thread-Level Speculation (TLS) has shown great promise as an automatic parallelization technique to achieve high level performance by partitioning a sequential program into threads, which are expected to be optimistically executed in parallel. In this paper, we propose a load-balancing approach to save energy using dynamic voltage scaling. By scaling the voltage of processors running short threads, energy consumption on these processors can be reduced while keeping a similar speedup of the overall system. Two voltage selection strategies have been investigated. With the assistance of some profiling tools, we propose a static voltage selection algorithm that can minimize energy consumption without degrading the parallelism provided by the pure TLS. The other dynamic algorithm selects voltage for each thread with prediction during the execution. Our experimental results show that its energy consumption is reduced to 78.8% and execution time is stretched to 1.07 times, on average, of the pure TLS in a 16-core CMP processor. [C38]

"Improving efficiency of power gated circuits through concurrent optimization of power switch size and forward body biasing"

Power gating (PG) has emerged as an effective technique to reduce standby leakage power in portable devices where battery life time is vital. However, it comes at the cost of timing overhead which is a problem for most of

the applications where real-time constraints exist. Designing efficient power gated circuits is very challenging problem due to contrasting requirements in active mode (low timing overhead implying larger power switch size) and standby mode (low standby leakage power implying smaller power switch size). In this work, we show that applying Forward Body Biasing (FBB) to the logic gates in conjunction with power gating (PG + FBB) will provide us with an additional degree of freedom which can be utilized to improve the efficiency of the power gated circuit. We propose an optimization algorithm to find the optimum power switch size and FBB value such that total leakage energy of the design (active + standby) in minimized. Results show that our PG + FBB technique on an average improves the leakage energy savings by 2X-5X as compared to using only power gating. With PG + FBB technique, one can also design a zero delay penalty power gated circuit which is not possible if only power gating is used. [C39]

"Web browser energy consumption"

In this paper, we present a prospective approach to save energy in web sessions. By observing energy consumption during a session, we can measure various parameters which impact on that consumption, like the size, the number and the dynamic behavior of the downloaded objects, as well as the user behavior. Thus we can present three possibilities to reduce the energy consumption: 1) a classification of web sites depending of their downloadable content, making the users aware of the session costs, 2) a better use of the web level cache, 3) a better use of the kernel mode and idle state in the user end software. [C40]

"The Research on an Environment-Friendly Air Conditioning System"

In this paper, some of the present environment-friendly air conditioning systems were reviewed. A new air conditioning system, named displacement ventilation system with dew point evaporative and radiation cooling was presented. The operational principle of the system was discussed. The air-handling process in different weather conditions was analyzed as well. It was found that the new system can save a lot of energy consumed and reduce the emission of greenhouse gases. [C41]

"CFD Modeling for Thermal Behavior of Open-Type Double-Skin Facades"

Open-type double-skin facades (DSF) depend on natural ventilation without any mechanical devices. In order to study thermal performances of the open-type DSF, principles of energy saving and heat transfer procedure of this facade are illustrated through theoretical analysis; a computer modeling is conducted by use of Computational Fluid Dynamics (CFD) technology, in which changes of environment temperature, opening-closing state and air velocity variety are considered. Based on that, example simulations and parameter analyses are performed. Analytical results indicate that opening or closing thermal channel timely would reduce energy consumption by 40%~60%; adoption of different glasses for inner and outside glass layers would realize better energy saving effects; rational design of thermal channel width and construction details would affect thermal behavior. The thermal transfer coefficient K, which provides bases for thermal design, is presented. Finally relevant design recommendations are also put forward. [C42]

"A coordinate control approach for energy saving of central variable- frequency air conditioning systems"

This paper presents a coordinate control approach for energy saving of central variable-frequency air conditioning systems. The major contributions of this paper are composed of four parts. First, optimal driving conditions of induction motors used for central air conditioning systems are established to reduce motor losses. Second, the optimal operation condition of the air condition system under rated loading is used to find the optimal flow rates of the cooling water pumps using Lagrangian approach, thereby providing the optimal input frequencies of the induction motors under consideration. Third, the coordinate control algorithm is proposed to minimize total power consumption and determine the optimal cooling water temperatures under rated loading condition. Finally, the multi-adjustable speed drives controlled by PI controllers with the optimal setting and a wet ball temperature compensation strategy are used to conduct experimentation. Experimental results for a small-scale variable-frequency air conditioning system show that the proposed coordinate control is capable of achieving satisfactory energy saving. [C43]

"Double opportunistic transmit relaying system with GSC for power saving in Rayleigh fading channel"

Conventional opportunistic transmit (COT) relaying system does not consider the received SNR between R-D path. For that reason, it can't guarantee all the received SNRs exceed the threshold at destination. In this paper, we propose double opportunistic transmission relay (DOT) system which considers the received SNR both from

S-R and R-D paths. It is noticed that the proposed system can be reduced to 6.9, 20.9, 32.4, and 41.4 % of power saving to that of COT relay system for K = 3, 5, 7, and 9, respectively at a given condition of Pout=1Ч10-3and γSR/Г = 30 dB. And the performance of DOT system is superior than that of COT system for the identical number of active transmit relays under the same condition of γRD/ГRD. [C44]

"A Novel Multi-ACK Based Data Forwarding Scheme in Wireless Sensor Networks"

Data forwarding schemes that use a single ACK-based retransmission mechanism are widely used to increase the packet delivery ratio in wireless sensor networks. However, these schemes may waste a considerable amount of energy for data transmissions, especially when the link quality is low for ACK transmissions. In this paper, we propose a novel multi-ACK-based data forwarding scheme to minimize the energy consumption for unnecessary data retransmissions. The next hop forwarder selection significantly affects the energy efficiency of communications. Hence, we also develop a new next hop forwarder selection metric, called effective energy consumption (EEC), which makes the proposed data forwarding scheme suitable for geographic routing protocols. Mathematical analysis and simulation results demonstrate that the proposed multi-ACK data forwarding scheme can save much energy and reduce the total amount of traffic load in the network. More specifically, the combination use of multi-ACK data forwarding and EEC metric increases the energy efficiency by 47.8% when node density is low, and 75.0% when node density is high, compared to the geographic forwarding protocols which use a well-known metric, PRR Ч Distance. [C45]

"Constructing Rate-Compatible LDPC Codes with a Novel Efficient Ranking Criterion"

In this paper, we consider the construction of efficient rate-compatible (RC) low-density parity-check (LDPC) codes. Specifically, we introduce a novel criterion to rank puncturing patterns and splitting patterns for RC LDPC codes. Based on the Gaussian approximation density evolution (GADE), cost functions are devised to characterize the degree distribution of the punctured or split code matrices, which are derived from a given code's parity check matrix by some matrix row transformations. These cost functions allow us to effectively compare the estimated performance of the candidate patterns and to sort out good ones. Based on the proposed ranking criterion, we provide a good RC LDPC code structure, which can support a wide range of code rates and outperform most of the existing RC LDPC codes in literatures. Moreover, the proposed scheme has the important advantage of reduced decoding latency and complexity without sacrificing performance. Numerical results demonstrate that the proposed RC LDPC codes can lead to nearly 25% decoding complexity saving and latency reduction at comparable or even better performance. [C46]

"The Effects of Cell Size on Energy Saving, System Capacity, and Per-Energy Capacity"

Future mobile communication systems demand much higher data rates which may require significantly more energy consumption, compared with the current 3G systems. Recently, green radio has attracted worldwide attention. Energy efficiency is considered as a very important factor for designing future communication systems in this green radio environment because reducing energy consumption of base stations (BSs) and mobile stations (MSs) can directly contribute to reducing CO2emission. We investigate the effects of cell size on energy saving and system capacity and then show the effectiveness of small-cell based future mobile communication systems in terms of energy efficiency. If the path-loss exponent increases and cell-radius ratio becomes smaller, the per-energy capacity ratio becomes larger. For example, if the path-loss exponent is 4 and the per-energy capacity of a macro-cell is normalized to 1, the per-energy capacities of a micro, pico-, and femto-cell are 16,104, and 108in downlink and 64,106, and 1012in uplink, respectively. The amount of CO2emission of one BS transmitter is approximately 181[kg] in a year, if the cell radius is 1[km]. If the cell radius is 500[m], 100[m], and 10[m], the amount of CO2emission in a year is reduced to 45.25[kg], 1.81[kg], and 18.1[g], respectively. Thus, small-cell based mobile communication systems can be a very effective solution to accommodate high data rates with low energy consumption in a future green radio environment. [C47]

"A code-based sleep and wakeup scheduling protocol for low duty cycle sensor networks"

One of the key challenges in wireless sensor networks is to design an energy efficient communication protocol. In this paper, we present an innovative code-based sleep and wake-up scheduling scheme to minimize energy consumption caused by idle listening. The proposed scheme called SWAP divides time into slots of equal length, and at the beginning of each slot a sensor node enters either an active or power-saving state. The slot scheduling at each node is based on a binary vector, which is constructed using the mathematical properties of finite fields. The set of scheduling vectors generated by SWAP distributes active slots of nodes evenly over entire time frame. This distribution of active slots reduces channel contention and allows better channel utilization. The SWAP scheduling scheme also ensures that any pair of neighboring nodes using the proposed scheduling scheme will be able to communicate each other since their active periods overlap at least once within a cycle of

the sleep and wake-up slots. We also design a packet prioritization scheme in SWAP to reduce the packet latency of delay sensitive packets. To evaluate the energy efficiency and performance of the proposed mechanism, we have implemented SWAP in TOSSIM, and compared it with a widely used channel access protocol, BMAC with LPL, in terms of packet delivery ratio, power consumption and delay. The results of our study show that SWAP outperforms BMAC in terms of energy consumption while maintaining comparable packet delivery ratio and latency. [C48]

"A Wireless Sensor Network Based System for Reducing Home Energy Consumption"

In this paper we present a work in progress within the European project AIM for the design of a system based on wireless sensor networks to save energy in home environments. [C49]

"A multilayer nanophotonic interconnection network for on-chip many-core communications"

Multi-core chips or chip multiprocessors (CMPs) are becoming the de facto architecture for scaling up performance and taking advantage of the increasing transistor count on the chip within reasonable power consumption levels. The projected increase in the number of cores in future CMPs is putting stringent demands on the design of the on-chip network (or network-on-chip, NOC). Nanophotonic interconnects have recently emerged as a viable alternate technology solution for the design of NOC because of their higher communication bandwidth, much reduced power consumption and wiring simplification. Several photonic NOC approaches have recently been proposed. A common feature of almost all of these approaches is the integration of the entire optical network onto a single silicon waveguide layer. However, keeping the entire network on a single layer has a serious implication for power losses and design complexity due to the large amount of waveguide crossings. In this paper, we propose MPNOC: a multilayer photonic networks-on-chip. MP-NOC combines the recent advances in silicon photonics and three-dimensional (3D) stacking technology with architectural innovations in an integrated architecture that provides ample bandwidth, low latency, and energy efficient on-chip communications for future CMPs. Simulation results show MPNOC can achieve 81.92 TFLOP/s peak bandwidth and an energy savings up to 23% compared to other proposed planar photonic NOC architectures. [C50]

"Development of real-time simulator theory and modeling technique based on NS-2"

By using information technology, smart grid saves energy, reduces cost and improves reliability. By delivering the information of power production and consumption to a bidirectional on a real time, energy efficiency is optimized. However, the operating method of the distribution system needs to be changed by increase of capacity of Distributed Energy Resource (DER) and new load (e.g., PHEV, fuel cell). Thus, every country, the lively study about smart grid in the national dimension is in progress. However, actual research did not progress nearly that can be applied to real system. This paper propose real time simulation theory and modeling skill for utilizing the smart grid in the IP network. By using Network Simulator version2 (NS-2), a grid was designed and a simulation was performed. And, we examined possibility of applying at the IP network. [C51]

"A program based on compression and difference transmission for image acquisition in wireless sensor networks"

A program based on compression and difference transmission for image acquisition in wireless sensor networks has been proposed in this article. Node captures image and compresses the image in the format of JPEG, while based on the time redundancy of images at fixed point, eliminates the correlation between collected image and reference image using difference algorithm, and then the extracted variation will be filtered by threshold, the result is called difference which is the final data carried out in the network, the gateway node or remote server reconstructs image according to the information received and reference image. Simulation results show that when we collect image in wireless sensor networks, the program can significantly reduce the amount of data, save network resources, thus the lifetime of network can be prolonged. [C52]

"Replacing an old household furnace with a new one: An evaluation"

A Hull-White one factor model based analysis has been presented to evaluate the savings of replacing an old residential furnace with a new high efficiency residential furnace. Savings is calculated by a dynamic programming approach based on a trinomial tree representing the spot prices of natural gas, the most widely used fuel for residential furnaces. The analysis may help both policy makers in government agencies and homeowners in saving energy costs and reducing carbon emissions. [C53]

"Finding optimal energy-saving operations in Home Network System based on effects between appliances and environment"

We have been studying energy-saving schemes using the Home Network System (HNS), integrating multiple appliances and sensors at home. In our previous research, we defined an appliance/environment effect, with which a set of lower-energy operations were explored. However, this method did not consider the side-effects to multiple environment properties, nor optimization of the operations. To cope with the restrictions, this paper first presents a method that analyzes the contribution of each operation to the environment properties, using the Goal-Oriented Requirement Language. We then represent the selection of energy-saving operations by a boolean vector X, and characterize each property by a polynomial f(X) with coefficients of the contribution. Finally, the problem is reduced to a mathematical programming, finding an optimal solution Xothat minimizes the power consumption. [C54]

"A path-based traffic control method for green networks"

With the power consumed by networks expected to increase rapidly due to significant growth forecast in traffic volumes, green networks that reduce CO2emissions are becoming increasingly important. Besides the energy-saving technologies currently under development for application to individual devices, technology that provides system-wide energy-savings for networks overall will be necessary to achieve green networks. In this paper, we propose a path-based traffic control method that achieves green networks by controlling the usage probability of pre-defined multiple paths to bring about a situation where some nodes can transition to sleep state when the traffic volume is small. The behavior and efficiency of the proposed method was evaluated using a simulation. From the simulation results, we confirm that the proposed method controls traffic in a timely and stable way in accordance with the variation in traffic, and saves energy during off peak times. [C55]

"Design considerations of high efficiency high density telecom rectifier"

Energy savings continues to build momentum on a global scale. The telecommunication industry has responded with high efficiency DC power systems to reduce energy consumption. This paper explores the design considerations of high efficiency (96%) telecom rectifiers in concert with high power density requirements (34W/inch3). Specifically, the design considerations of a high efficiency, high density bridgeless PFC stage followed by a LLC DC-to-DC stage is explained. Experimental results are presented to validate the design approach. [C56]

"Evaluation results of power supply to ICT equipment using HVDC distribution system"

In recent years, Higher Voltage Direct Current (HVDC) distribution systems have been proposed to reduce power consumption in telecommunication buildings and data centers. NTT FACILITIES and NTT Data conducted verification tests of a HVDC distribution system at a Tokyo data center from January 29 to October 30, 2009. This paper summarizes the results of studies on HVDC distribution systems obtained so far, describes verification tests based on those results, and examines the test results. The verification tests were conducted with the cooperation of domestic and international ICT equipment vendors. We measured the energy savings and stability of the power supply involved long-term powering of ICT equipments (servers and storages) with an HVDC system. The test results show the superiority of the HVDC distribution system over the existing AC system. These test results also validate the HVDC system specifications proposed by the NTT group for standardization. These results may develop the current vigorous discussion of international standardization for HVDC distribution systems. [C57]

"PreDVS: Preemptive dynamic voltage scaling for real-time systems using approximation scheme"

System optimization techniques based on dynamic voltage scaling (DVS) are widely used with the aim of reducing processor energy consumption. Inter-task DVS assigns the same voltage level to all the instances of each task. Its intra-task counterpart exploits more energy savings by assigning multiple voltage levels within each task. In this paper, we propose a voltage scaling technique, named PreDVS, which assigns voltage levels based on the task set's preemptive scheduling for hard real-time systems. Our approach is based on an approximation scheme hence can guarantee to generate solutions within a specified quality bound (e.g., within 1% of the optimal) and is different from any existing inter- or intra-task DVS techniques. PreDVS exploits static time slack at a finer granularity and achieves more energy saving than inter-task scaling without introducing any extra voltage switching overhead. Moreover, it can be efficiently employed together with existing intra-task scaling techniques. Experimental results demonstrate that PreDVS can significantly reduce energy consumption and outperform the optimal inter-task voltage scaling techniques by up to 24%. [C58]

"Development of 400-Vdc output rectifier for 400-Vdc power distribution system in telecom sites and data centers"

We outline the specifications and performance of a 400-Vdc distribution system and 400-Vdc output rectifier

prototypes. In 2008, The NTT-group began developing a 400-Vdc distribution system for reducing power consumption and the usage of materials, such as copper in power cables. In conjunction with this project, NTT Facilities developed prototype rectifiers, a prototype voltage compensator used during interruption periods, and a prototype battery charger in 2008, and reported a portion of their verification test results. From their developments, we found some problems for installing and operating in telecommunication buildings and data centers. Therefore, we developed new prototypes for resolving these problems. They have almost equal efficiency and output regulation, saving installation space, and they are more maintainable and safer for operating than previously developed prototypes. [C59]

"A solution to dynamically decrease power consumption of wireless base stations and power them with Alternative energies"

Wireless network operators are facing the challenge of reducing their operating costs and carbon footprint, while extending operations to areas beyond electricity grids. In mature countries, reducing energy bill becomes a priority to support data growth despite flat revenues, and help finance strategic goals of innovation and differentiation. In emerging countries, alternative energy solutions are required to connect the next billion subscribers located in areas off the electricity grid without wasting all revenues in diesel generators running: diesel generator power can account for up to 35% of a Base Station site Total Cost of Ownership (TCO). The proposed paper describes how wireless equipment power consumption savings can be combined with efficient power management and by adding a mix of Alternative Energy sources to reduce the operating expenses of network operators, open wide opportunities to expand their network in off-grid regions and reduce their carbon footprint. [C60]

"Energy efficiency and conservation: A way forward for Jamaica"

Jamaica, like many developing states, is heavily dependent on oil imports, and is thus vulnerable to fluctuations on the world energy market. Implementing energy efficient methods and conservation in the public and private sectors are not only a way of reducing expenditure on the local energy bill, but, also aids in reducing CO2emissions which also acts as a catalyst for global climate change. Conservation if properly managed may compensate for rise in energy costs, and can eliminate the need for additional power plants, and energy imports. The paper explores energy conservation strategies that can be employed in developing states such as Jamaica. This paper will further investigate possible ways energy savings can be realized from innovative interventions as experimented by the University of the West Indies. This will complement attempts to reduce Jamaica's dependency on oil imports by applying alternative and renewable energy technologies and fuels to provide the sustainability needed for Jamaica to attain developed status. [C61]

"Using Data Compression for Delay Constrained Applications in Wireless Sensor Networks"

Data compression is a technique used to save energy in Wireless Sensor Networks by reducing the quantity of data transmitted and the number of transmission. Actually, the main cause of energy consumption in WSN is data transmission. There exist critical applications such as delay constrained activities in which the data have to arrive quickly to the Sink for rapid analysis. In this article, we explore the use of data compression algorithms for delay constrained applications by evaluating a recent data compression algorithm for WSN named K-RLE with optimal parameters on an ultra-low power microcontroller from TI MSP430 series. The relevance of the parameter K for the lossy algorithm K-RLE led us to propose and compare two methods to characterize K: the Standard deviation and the Allan deviation. The last one allow us to control the percentage of data modified. Experimental results show that data compression is an energy efficient technique which can also perform in certain cases the global data transfer time (compression plus transmission time) compared to direct transmission. [C62]

"Analysis on sail selection and energy conservation of a Panamax bulk carrier"

Sail-assisted ships are able to release the less exhaust gas than conventional ships with diesel engines. In this paper, the characteristics of different types of sailing rigs are discussed, and one type of the sails is chosen to be applied on an ocean-going bulk carrier. Then, the efficiency of the ocean-going ship is investigated through establishing the dynamic model. The sail-assisted bulk carrier can cut emission of carbon dioxide or fuel consumption by 7 percent totally compared to a conventional bulk carrier on route of Tianjin-Dalian. The research also includes the assessment of the sailing performance of the ship and maximum initial allowable investment of sails. Sail-assisted ships would make an important contribution to improving global environment by reducing the demands of fuel. [C63]

"A Cooperative Power-Saving Technique Using DVS and DMS Based on Load Prediction in

Sensor Networks"

In wireless sensor networks (WSN), energy saving is the main issue of research, and many energy saving techniques have been proposed. Dynamic Voltage Scaling (DVS) and Dynamic Modulation Scaling (DMS) are techniques reduce energy consumption by using the idle time of the sensor node. When we use both techniques at the same time, an appropriate mechanism of cooperation is required because of the limitation of available idle time of the sensor node. Therefore, we propose a cooperative power. saving technique that applies DVS and DMS to sensor nodes for minimizing energy consumption. It uses a prediction mechanism that estimates the load of the processor and the radio communication device based on the log data to realize proper cooperation. We observed that the adaptation of the proposed technique is able to achieve the energy reduction up to 40 percent compared to without any energy saving techniques. [C64]

"The power-saving approach by critical section detections of multi-cores embedded systems"

The use of multi-threading and multi-cores leads to performance improvements of embedded systems. On the other hand, the power consumption increases due to the use of more processors. The energy wastages could be critical in embedded systems with limited resources. Therefore, the issues of performance and power-saving are important for multithreaded applications which are executed on multi-cores embedded systems. The dynamic CPU frequency leveling which is based on critical section detections is proposed in this paper. Based on this approach, the energy wastages are reduced significantly with the maintenances of performance at the same time. The results indicate the battery life of multi-cores embedded systems can be extended by proposed power-saving approach effectively. [C65]

"Energy-Efficient Multiple Targets Tracking Using Target Kinematics in Wireless Sensor Networks"

Target tracking is one of the cardinal applications of a wireless sensor network. Tracking multiple targets is more challenging than tracking a single target in a wireless sensor network due to targets' movement in different directions, targets' speed variations and frequent connectivity failures of low powered sensor nodes. If all the low-powered sensor nodes are kept active in tracking multiple targets coming from different directions of the network, there is high probability of network failure due to wastage of power. It would be more realistic if the tracking area can be reduced so that the less number of sensor nodes will be active which ultimately saves the energy consumption. Tracking area can be reduced by using the target's kinematics. There is almost no method to track multiple targets, based on targets' kinematics. In our paper, we propose a distributed tracking method for tracking multiple targets considering targets' kinematics. We incorporate sensor network properties which results into a novel and service priority based dynamic tracking framework. We simulate our method by a sensor network simulator OMNeT++ and empirical results state that our proposed methodology outperforms traditional tracking algorithms. [C66]

"Study on the energy efficient potential of natural ventilation for residential building in Guangzhou"

Natural ventilation is the most effective to reduce the energy consumption of air conditioning for residential building in Guangzhou with subtropical climate. But the effect of natural ventilation on energy saving couldn't be evaluated quantitatively at present. In this paper, an analysis method to evaluate quantitatively the energy saving potential of natural ventilation was proposed. Firstly, the base room temperature with different air change times of natural ventilation was simulated. The number of hours in that the indoor air temperature could meet thermal comfort requirement only by natural ventilation in occupied period was calculated. Secondly, the cooling loads of building were simulated when the air conditioning intermittently run. The air conditioning system run when the base room temperature is higher than 29°C with natural ventilation even the air change times could reach 120h-1. Then cooling loads reduced rate was calculated by comparing the result to the baseline, which is the cooling loads of building with the air change time 1h-1. Based on the results of calculation, it was found that air change times 80h-1could be as a requirement to realize the largest energy saving potential of natural ventilation. The energy saving effect of natural ventilation is the most obvious while air change time is not less than 20h-1. The energy saving potential of natural ventilation in general structure in 1980s is smaller than that in the building with the new structure according to the energy efficiency standard of China. [C67]

"Investigating the impact of thermal mass on building performance using computational simulation"

Many building designers believe that thermal mass can significantly enhance the thermal performance of buildings in cold climate. This paper presents the technical details of a computational simulation study, showing that thermal mass distribution do not generate significant energy saving for a high-rise apartment buildings in cold climate. Six configurations, each with different level of thermal mass and distribution schemes, are studied. The results indicate that, for a high-rise apartment with Toronto's cold climatic condition, the optimal design option is capable of achieving a thermal lag up to 9 hours and maintaining indoor surface temperature to within 1

degree Celsius of difference. Consequently, the peak loads of heating and cooling systems are reduced, resulting in better indoor temperature control. However, the simulation results show that the distribution of thermal mass does not significantly influence the building's energy efficiency. This paper also discusses ongoing and future research. [C68]

"Energy saving strategy in Sro Paulo Metro"

In this paper describes a different approach in order to save energy consumption for metros systems. It consists on reduce the maximum station-to-station speed through increase acceleration and deceleration values. [C69]

"Automobile intelligent control system based on effective idling stop"

Automobile idling stop control system which can make vehicle get good fuel economy and reduce emission as a new energy saving device has received worldwide attention. Working mechanism of idling stop control system was introduced, determination conditions of current idling stop control system were analyzed, and fuel consumption and emissions were analyzed when engine restarted. The current idling stop control system executes idling stop regardless of parking time, fuel consumption and emissions will increase because of short time idling stop. In order to avoid idling stop in a very short time, an intelligent idling stop control system was designed, this system can decide to stop the engine based on vehicle effective stop time. The design ideology and control strategies of intelligent idling stop control system are offered. The simulation runs based on hardware-in-the-loop simulation testing platform, test cycles are CYC_MANHATTAN, CYC_NEWYORKBUS and CYC_WVUCITY. Test results show that: vehicle fuel economy with effective idling stop system improves respectively 12.31%, 20.81% and 10.47% compared with traditional idling stop system. [C70]

"A time-slot scheduling algorithm for e-health wireless sensor networks"

For e-health wireless sensor networks presenting significant traffic loads, MAC protocols based on deterministic scheduling algorithms are consensually considered more adequate than protocols based on random access algorithms. Indeed, TDMA-based MAC protocols are able to control the delay bound and save power by eliminating collisions. However, these protocols always require some expedite scheme to assign the superframe time-slots to the network devices that need to transmit data. Knowing that patients of an e-health wireless network are normally monitored by the same number and types of motes, originating a regular traffic pattern, a simple collaborative time-slot allocation algorithm can be achieved, as introduced in this paper. In the proposed algorithm, the announcement of time-slot allocation by the network coordinator is avoided, which helps to improve the packet delivery ratio and reduce the energy consumption in the e-health wireless network. [C71]

"Nonthreshold-based node level algorithm of data compression over the wireless sensor networks"

Energy saving is an important issue in wireless sensor networks (WSNs) since the nodes are typically powered by batteries with a limited capacity and the energy is limited. As data communication usually consumes much energy and bandwidth, decreasing energy consumption can be generally achieved by reducing the communication of data, for instance, through data compression. Thus, it is an important research issue that how to decrease energy consumption as well as maximize the lifetime of WSNs and increase the efficiency of data communication through data compression on the WSNs nodes where energy supply, memory space and processing resources are constrained. Considering the basic idea of edge operator in the field of image processing and the characteristic that the data stream collected by the nodes of WSNs is time series data, this paper proposes a nonthreshold-based node level algorithm of data compression over the WSNs. The algorithm, with simple calculating and low complexity, compresses the time series data collected by sensor nodes into many piecewise linear representations by extracting some points named edge-points that can indicate the trends of time series data, and especially dose not require any prior knowledge of the monitored objects as well as any predefined threshold value related to the time series data. The experiments on real public sensor data series show that the proposed algorithm can compress data effectively and reduce the communication of data obviously. Moreover, compared with some other data compression algorithms, the proposed algorithm appears better compression performance, reconstructed error and stability which allows the algorithm being applied to the collected data series with different fluctuation characteristics. Consequently, it can save the energy of wireless communication of senor nodes and prolong the lifetime of WSNs better. [C72]

"Evaluating the Energy Efficiency of TCP Transmission over a WiMAX Network"

To minimize the power consumption of a mobile device, mobile WiMAX based on IEEE 802.16/802.16e defines three power saving classes for transmitting different types of data traffic. However, the standard specification does not suggest a power saving class for transmitting background TCP traffic, such as a long FTP session. This paper investigates the energy efficiency of TCP transmission over a WiMAX network under different MAC

configurations, wireless and wired traffic conditions. We conduct a number of experiments in a real WiMAX test-bed and obtain power consumption parameters of a WiMAX network interface card (NIC). These parameters are further fed into the network simulator 2 (NS-2) to evaluate the energy consumption of TCP transmission in a large-scale WiMAX network. Experimental and simulation results demonstrate that the IEEE 802.16 bandwidth request mechanism introduces considerable power consumption overhead in TCP transmission. Moreover, the energy consumption of a long TCP transmission session in a WiMAX network can be significantly reduced by applying the power saving class type II and base station-proxy mechanism. [C73]

"Localized energy conservation algorithm"

Energy is one of the most important metric when we talk about Mobile ad-hoc networks. In order to increase the system's life-time, energy consumption has to be minimized. Here we will look at some energy saving algorithms. The initial analysis tells us that LECA conserves more energy that SPAN or any other algorithm. We present a Localized Energy Conservation Algorithm (LECA) [3] for routing in Mobile Ad-hoc Networks (MANETs), to reduce energy consumption while being able to maintain performance levels. In LECA a small subset nodes, called coordinators, is selected to participate in routing while the others are put off to conserve power. The number of coordinators selected is lower than the corresponding number in the existing methods. This makes it possible for the network to attain high performance levels although a sparse set of coordinators are elected to reduce energy consumption to the bare minimum. we proposed a localized algorithm for conservation of energy in MANET's, without compromising the system performance. The algorithm presented here (LECA) selects minimum number of coordinators which constitute a connected backbone. [C74]

"Energy efficient fault-tolerance task allocation scheme for real-time energy harvesting systems"

Fault-tolerance and energy have become important design issues in multiprocessor system-on-chips (SoCs) with the technology scaling and the proliferation of battery-powered multiprocessor SoCs. This paper proposed an energy efficient fault tolerance task allocation scheme for multiprocessor SoCs in real-time energy harvesting systems. The proposed fault-tolerance scheme is based on the principle of the primiary/backup task scheduling, and can tolerate at most one single transient fault. Extensive simulated experiment shows that the proposed scheme can save up to 30% energy consumption and reduce the miss ratio to about 10% in the presence of faults. [C75]

"A simple low power current sensor without using amplifier"

A simple low power current sensor for DC-DC converters is presented in this paper. The proposed current sensor is designed without using amplifier. This greatly reduces the power consumption and significantly saves silicon area. Simulation shows less than 20uA total current consumption can be achieved by using this structure. The performance of this design is robust to temperature variations. The proposed structure can be implemented in both CMOS and bipolar technology. [C76]

"Fault-tolerant and power-aware scheduling algorithm in hard-real-time distributed systems"

Dynamic voltage scaling (DVS) technique is being increasingly used in hard-real-time energy-limited embedded systems as a means to conserve energy and prolong their lifetimes. In this paper, we first analyze the interplay between fault-tolerance and energy-saving as well as their quantitative needs on processor slack resource. Then, we extend the traditional fault-tolerant completion time test (FTCTT) to power-aware fault-tolerant completion time test (PAFTCTT). Based on PAFTCTT, a voltage slowdown factor calculation is proposed. These slowdown factors not only guarantee that all hard tasks can be scheduled within their deadlines despite of any single permanent fault, but also effectively reduce energy consumption. Finally, the simulation experiments reveal that slowdown factor technique can achieve the percents of energy-saving up to 31.3% (with an average of 16.3%). [C77]

"Enhanced discontinuous reception mechanism for power saving in TD-LTE"

The battery volume of mobile terminals is limited and in most case it cannot rely on the supplying of external power. Therefore, discontinuous reception mechanism (DRX), a kind of power saving mechanism in mobile communication is introduced in order to reduce the power consumption of battery. In this paper, we discuss and show DRX parameters and features in TD-LTE. By establishing TD-LTE DRX model to the enhance DRX mechanism. Based on the analytical model, we investigate the DRX parameters and improve the power saving performance. The proper choice of these parameters (short DRX timer, long DRX timer, inactivity timer and On duration timer) allows for reducing power consumption in time and keeping the best User Experience. [C78]

"Service priority based target tracking framework"

Multiple targets tracking is one of the challenging applications in a wireless sensor network due to targets' movement in different directions, targets' speed variations and frequent connectivity failures of low powered sensor nodes. If all the low-powered sensor nodes are kept active in tracking multiple targets' coming from different directions of the network, there is high probability of network failure due to the wastage of power. It would be more realistic, if, according to the priority of service, sensor nodes are classified and are kept active. Then, it is possible to reduce energy consumption. In our paper, we propose a distributed tracking framework incorporating sensor network properties which results into a novel service priority based dynamic tracking framework. We simulate our method by a sensor network simulator OMNeT++. We find that our architecture saves energy significantly. [C79]

"Energy-Optimization Scheduling of Task Dependent Graph on DVS-Enabled Cluster System"

At present, power management in High-Performance Computing (HPC) environment is becoming a hot topic owning to its high operation cost, low reliability and environmental impact. In this paper, we investigate energy minimization scheduling algorithm of data dependent tasks in DVS-Enabled cluster system. Considering the data-intensive characteristics, the proposed EOTD (Energy Optimization scheduling for Task Dependent graph) algorithm adopts task clustering to reduce data transmission time and communication energy consumption. In order to decrease dynamic power of processing elements, it uses one of the power-saving techniques in system level-Dynamic Voltage Scaling while not violating the deadline users specify. Moreover, on the premise that application execution is predictive and exclusive for processing elements, we employ Dynamic Power Management and Binary Search technique to reduce the static power of idle processing elements and last find the optimal number of processing elements. EOTD algorithm not only optimizes the energy consumption of task dependent graph, but also satisfies the QoS requirements service level agreement gives. Compared with VM and LJ-VM algorithm, experimental results demonstrate that EOTD algorithm can achieve larger energy optimization in less optimizing time. [C80]

"Solar food processor"

Cooking is one of the unavoidable activities that consumes huge amount of conventional fuel. If this state continues then all the fuel left will get depleted in about 20-30 years. This problem was identified many years ago and solar cookers were introduced. In different parts of the world solar cookers are made, studied and patented but it is not being used at homes like other conventional cookers. The necessity of the use of solar cookers in order to reduce the consumption of firewood or conventional fuel is well recognized by various National and International Organizations. In spite of various efforts made by those organizations the wide spread use of solar cookers has not become possible. Drawbacks in conventional solar cookers are they are single use based models, i.e. if one buys a cooker one can use it only for cooking but it can't be used for drying, distillation of water etc. and if one buys a solar dryer it can be used only for drying but not for cooking or distillation of water and so on. The reason is that each operation requires a different design, for cooking the cabin should be air tight, but holes should be present for drying (ventilation system) and in the case of distillation of water the glass placed on top of the cooker should be slanting, for the water to drain into the container. Another big drawback is that as one is cooking food in the solar cooker if the climate changes suddenly and if it becomes cloudy then the food will be half cooked. These cookers can't be used at night and during the period lacking sufficient sunshine. They are huge in size making it very inconvenient to use. The above mentioned problems can be overcome using the Solar Food Processor. The Solar Food Processor is a multi-purpose device unlike the conventional solar cooker; it can be used for cooking, heating/pasteurizing water (to inactivate microbes), distillation of a small quantity of water (to remove different minerals) and drying domestic products (fruits, vegetab--les, herbs etc.). All the activities can be performed in a single device called Solar Food Processor (SFP). If SFP is used for cooking only seven months a year and for heating water and drying for another 4 months a year, one can save on the average, 1160kWh of electricity, 650 kg of fire-wood or 205 liters of kerosene (or LPG) per year. SPF can be used during the period lacking sufficient sunshine. Copper tubes filled with water are placed at the bottom of the cooker and thus solar energy will be stored in the water. The heat can be retained for a period of 2 hours and hence when the sunlight is not sufficient the heat stored in the water can be used to warm food. The heat energy is used for cooking but the light energy is wasted hence solar panels that can produce 20W of energy is fitted to the cooker. The energy thus produced is stored in a battery. SFP can be used to cook and warm food even at night using stored solar energy. The energy stored in the battery from the solar panel can be used to power an electric heating plate placed inside the cooker, on which the vessel to be cooked or warmed can be placed. This way SFP can also be used at night and the period lacking sufficient sunshine. If the food is not cooked properly due to the unstable climate, it can be placed on the electric plate powered by the battery and food can be cooked properly. It can also be used as a hot case as it can retain heat for a longer time. Thus the SFP is very efficient, economical and convenient due to reduced size when compared with the conventional solar cookers. [C81]

"Power Saving Design for Servers under Response Time Constraint"

Reducing the power consumption while maintaining the response time constraint has been an important goal in server system design. One of the techniques widely explored in the literature to achieve this goal is Dynamic Voltage Scaling (DVS). However, DVS is not efficient in modern systems where the overall power consumption includes a large portion of static power consumption. In this paper, we aim to reduce the static power consumption by Dynamic Power Management (DPM) with sleep model in addition to DVS. We propose a smart PowerSleep power-saving scheme, where a procrastination technique is adopted to carefully aggregate jobs to reduce the overhead of transitions in and out of the sleep mode. We also observe that PowerSleep might not always be a good choice due to the mode transition overhead when the server utilization is high, where instead we use PowerIdle power-saving scheme with DVS only. By modeling the system with M/G/1/PS queuing model and further extensions, we present how to minimize the mean power consumption of the server under the given mean response time constraint for both power-saving schemes. Simulation results show that our smart PowerSleep scheme significantly outperforms the simple power saving scheme which adopts sleep mode. [C82]

"A new central air-conditioning system control strategy based on prediction model"

The central air-conditioning system has a great delay, and the flow of people changes quickly at large shopping malls, so the traditional control model which is based on the instantaneous change of the parameters has a limited energy-efficiency effect. In order to enhance the operation efficiency of the central air-conditioning system, the control strategy should be changed. Based on the conservation of energy, the model of the people flow and the predicted model of temperature are derived. According to the gray prediction model GM(1,1), the cooling load of the next time can be obtained, and then the cooling load can be predicted and the frequency can be changed in advance, so the flow of chilled water can be changed, and the energy consumption of the air-conditioning can be greatly reduced. Based on the models obtained above, the flow of chilled water can be adjusted half an hour before to save the energy. [C83]

"Development and application of online energy analysis system based on software integration and communications"

An online energy analysis system for paper machine dryer section is developed. The data and information share is realized in different types of database. Supervisory and analysis software plays an important role in the system, such as iFIX of GE and eTMS. the techniques of gathering and analyzing the real time data from the paper machine dryer section and communication between different software are also introduced. The running result of the test shows that the system has a good effect for the paper machine optimizing operation, energy-saving, and consumption-reducing. [C84]

"Overall energy reduction for hard real-time systems based on threshold work-demand analysis"

In this paper, we study the problem of reducing the overall energy consumption for hard real-time systems scheduled by the earliest deadline first (EDF) scheme. To balance the static and dynamic energy consumption, the concept of critical speed was proposed. Moreover, when combined with the processor shutdown strategy, the critical speed was widely used as the lower bound for voltage scaling in literature. In this paper, we show that the critical speed strategy might not always be more energy efficient than the traditional DVS strategy and there is a tradeoff between these two strategies depending on the job workload to be finished within certain interval. To effectively address this issue, we propose a technique that combines these two strategies to achieve better energy saving performance. Our approach determines the energy efficient speed for real-time tasks based on the threshold work-demand in a feasible interval and will reduce the job speed below the critical speed when necessary. Our experimental results demonstrate that the proposed techniques significantly outperformed the previous research in overall energy saving performance. [C85]

"Design of an enhanced energy conserving routing protocol based on route diversity in wireless sensor networks"

This paper presents a new Energy Conserving Routing Protocol (ECRP) that aims to optimize the transmission cost over a path from a source to a defined destination in a Wireless Sensor Network. Energy consumption remains a significant metric related to the service lifetime of a Wireless Sensor Network. This parameter is included in our model in order to generate a set of maximally disjoint paths between each sensor and the sink, so as to avoid or partially reduce the appearance of congestion in the network. We aim to spread the data traffic over non-overlapping paths in order to increase the global network lifetime. Simulations have shown that our ECRP is more efficient than existing protocols in terms of congestion avoidance and energy saving. [C86]

"Low-complexity aggregation of collected images with correlated fields of view in wireless video sensor networks"

Wireless video sensor networks (WVSNs) require video data from sensor nodes to be delivered efficiently. Cameras in adjacent video nodes tend to have correlated fields of view (FoVs) or overlapping part when a sufficient number of video sensors are deployed. This paper proposes a data aggregation technique for WVSNs to remove the spatial redundancy, thereby reducing energy consumption and response time. Our approach exploits the correlation between discrete cosine transform (DCT) coefficients pairs of two intra-coded images from cameras with overlapping FoVs. Experiments show that an intermediate node en route to the base station achieves bit-rate savings up to 18.9%. This scheme is less complicated than other video and image coding techniques that exploit correlated FoV, allowing resource-constrained video sensors to operate more reliably and longer. [C87]

"rCUDA: Reducing the number of GPU-based accelerators in high performance clusters"

The increasing computing requirements for GPUs (Graphics Processing Units) have favoured the design and marketing of commodity devices that nowadays can also be used to accelerate general purpose computing. Therefore, future high performance clusters intended for HPC (High Performance Computing) will likely include such devices. However, high-end GPU-based accelerators used in HPC feature a considerable energy consumption, so that attaching a GPU to every node of a cluster has a strong impact on its overall power consumption. In this paper we detail a framework that enables remote GPU acceleration in HPC clusters, thus allowing a reduction in the number of accelerators installed in the cluster. This leads to energy, acquisition, maintenance, and space savings. [C88]

"On-line Calculation of Critical Characteristics for Cryogenic Storage Vessels"

Cryogenic products, such as Oxygen, Nitrogen or Argon, are commonly delivered to customers by the supplier. To do so, the supplier is responsible for managing the inventory of product at the customer site, in most cases. It is important to have access to an accurate estimation of the quantity of product stored at any time in cryogenic vessels to avoid run-outs for the customer and to optimize the product deliveries, which means saving money and reducing pollution due to trucks fuel consumption. Former studies showed that an accurate mass estimation can be made from differential pressure measures between the bottom and the top of the vessel, the pressure on top, and required vessel characteristics. Differential pressure measurements are installed on cryogenic tanks and the data is available remotely through a remote telemetry unit (RTU). Often, the tank characteristics are unknown or only roughly estimated limiting the accuracy of the mass estimation in the tank. This paper presents an on-line method to estimate the critical required tank characteristics: radius, total height (for vertical tanks), total length (for horizontal tanks), bottom height, and maximum liquid height. This method relies on a physical model describing the vessel during a filling and providing a relationship between the delivered mass of product, the pressure measures and the vessel characteristics. [C89]

"Enhanced distance based broadcasting protocol with reduced energy consumption"

One important challenge for broadcasting in mobile ad hoc networks is the well known broadcast storm problem. Most of existing techniques to prevent it usually lies in reducing the number of forwarding nodes in the process. One of these algorithms (from the state of the art) is the distance based broadcasting algorithm, that tries to minimize this number considering only as candidates of forwarding those nodes far from the source. In this paper, we propose a cross layer design for enhancing the distance based broadcasting protocol in terms of energy consumption. Instead of using the distance, we are considering the reception signal strength. That is more realistic since the theoretical transmission range is not accurate in environments with obstacles. The necessary transmission power to reach an intended device is obtained using the beacons. If the furthest node can be reached using less power than the default value, the transmission power is reduced and thus, we save energy. Different proposals for enhancing the algorithm are proposed, and they not only save energy but also highly reduce the number of collisions. [C90]

"Prioritizing power management and reducing downtime for energy conservation in data centers"

We developed software that performs priority-based power management and downtime reduction for virtual machines running in data centers. The software deals with power management at the processor level. The software automatically performs load distribution among servers in data centers to save power. In addition, it reduces downtimes for critical virtual machines. Our experiments have achieved an energy saving of up to 35%. We therefore confirm that the proposed scheme has significantly decreased energy consumption while maintaining high runtime availability for the mission critical applications. [C91]

"An implementation of energy efficient multi-performance processor for real-time applications"

Multi-performance processor reduces the energy consumption by using lower supply voltage in CPU core and reducing the number of cache ways activated when applications do not need the peak performance of the processor. In this paper, the design results of a multi-performance processor is presented, which has two processing elements, PE-H and PE-M. The design flow of finding minimum VDDfor PE-M is shown. The processor is implemented by commercially available 0.18 μm process technology. PE-H and PE-M are synthesized using cell libraries characterized with 1.8V and 1.0V, respectively. Post-layout simulation is performed to evaluate energy consumption and performance of the processor. The experimental results show that a PE with 1.0V supply voltage takes more than 50% smaller energy consumption and longer execution time compared with those of a PE with 1.8V supply voltage. The experiments also demonstrate that the selective-way instruction cache contributes for saving the energy consumption. The results show that lower associative cache consumes lower energy while takes larger execution time. The energy efficiency of the selective-way cache technology depends on the type of benchmark program. At last, the paper shows the specifications of the processor. The processor with two PEs can save the energy consumption without losing peak performance of the processor. The area overhead for having two PE cores is only 6.88% of the total chip area. [C92]

"A new energy management approach for user-centric applications"

Reducing energy consumption has become an important design problem. Although most of consumer electronic systems are user centric existing energy management methods are device centric. The methods either assume unchangeable operational environment or rely on very simplified policies, which eventually lead to large energy losses. In this paper we present a new energy management approach that allows systems to monitor their users for energy saving. We discuss applications of this novel approach in personal computers, television sets and home automation system and show the results of their experimental evaluation. [C93]

"Application of low power technologies on video codec VLSI designs"

We apply several low power technologies to save both total energy and peak power consumption for video codec VLSI designs. Our technologies include two-layer clock gating, utilization of skip mode, memory hierarchy with memory access units, and internal memory partitioning. We implement a standby mode to reduce both clock power and memory power for saving total energy. We also use a novel technology, called active period rescheduling, to reduce the peak power consumption. Applying these technologies to an H.264/AVC codec, we can achieve 43% and 45% savings in total energy for the encoder and decoder, respectively. Moreover, by applying the peak power reduction technology to the H.264/AVC decoder, we achieve 45% saving. [C94]

"Localized adaptation for energy-aware packet transportation in WDM networks"

Localized adaptation strategy with cooperation of sleeping mechanism and lightpath bypass reconfiguration is proposed for energy-saving transport in dynamic IP-over-WDM networks. Analysis and Simulations indicate that total energy consumption is reduced by the novel strategy. [C95]

"Energy-efficient distributed parameter estimation with partial updates"

This paper presents an innovative approach to distributed estimation which features partial updates of parameter estimations, thereby offering significant reduction in energy consumption in the sensors. The proposed estimation scheme updates only a subset of the parameters at each iteration. This not only reduces data processing complexity, but also reduces the energy required for diffusing the parameter estimates. In distributed parameter estimation, sensor nodes consume energy not only in processing data, but most costly, in communicating and diffusing updated parameter estimates. Reducing the number of parameters to be updated and diffused are thus an effective way to save in energy consumption. As such, the most fruitful outcome in partial updates is saving in energy required to diffuse those updated parameter estimates. The proposed scheme is a viable alternative to conventional set-membership adaptive algorithms that feature data-dependent selective updates of parameter estimates. [C96]

"A low-power double edge-triggered flip-flop with transmission gates and clock gating"

In recent years, energy saving techniques have become critical in hardware designs, especially for mobile devices. This paper has reviewed several previous designs of double edge-triggered flip-flops, and has proposed a transmission-gate-based double edge-triggered flip-flop with a clock-gating function. Comparing to the previous work of double edge-triggered flip-flops, the proposed one saved 33.14% power on average (switching activity factor = 0-0.4) and it can save up to 97.85% power compared to conventional single edg-etriggered flip-flops when the input is idle. In addition, the proposed design also improved performance by reducing Clk-to-Q

latency by 0.21 ns. [C97]

"A low cost and effective implementation of standby mode power reduction"

Considering the energy-saving, the issue of reduction power consumption of standby power of appliances has been considered for decade. In this paper, we present the implementation to reduce the standby power consumption. By the way of detecting the current variation and time pre-setting, we can save the wasting power. The design is easily implemented with low cost, quickly commercialized and consumes 240 mW. This design has had two silver medal award both in iENA Nuremberg and International Invention Show Technomart Taipei 2009. [C98]

"Optical transparency and network energy efficiency"

Summary from only given. Communication networks have been identified as an important enabling technology for realizing dramatic reductions in energy consumption across many sectors of our society, including electric power delivery (smart grids), transportation (tele-presence and traffic management), and building controls. Recent reports indicate that by 2020 information and communication technologies could offset their own carbon footprint by five-fold through savings realized in other areas. This benefit presupposes the sustainable growth of communication networks, even as the Internet continues to expand exponentially. Historically optical networks have benefited from exponential increases in transmission capacity and interface speeds. However, recent studies have demonstrated that spectral efficiencies of optical transmission systems are approaching channel capacity limits, indicating that efficiency improvements through bandwidth increase may be limited. This brings focus to network energy efficiency, measured as the power of the network equipment per unit bandwidth delivered to the user, as an important dimension for continued efficiency improvements. Optical transparency enables efficient use of network resources through optimized wavelength routing and switching. Some of this translates directly into reduced electronic processing and consequently reduced energy consumption. Nevertheless, there are further opportunities for power reductions including re-use of stranded resources through reconfiguration, dynamically varying capacity to follow traffic fluctuations over time, and changing network configuration to take maximum advantage of available renewable energy resources. In this work we build transaction-based network models to examine the relative benefit and potential opportunities for improving overall network energy efficiency. These models include projected traffic growth through 2020 for different network services. The relative impact of optical techno--logy efficiency measures is included to understand benefits to the overall network efficiency. [C99]

"Energy saving effect due to the voltage reduction in industrial electrical networks"

The power consumption is depending on the voltage level at the load bus. For many enterprises, especially for the enterprises making small series of various products the production conditions and, respectively, the power consumption by different consumers can be significantly different from day to day. It is difficult to assess the real effect of optimizing the voltage level over a short-time. The method of the express-estimation of the power reduction effect caused by the reducing of the voltage level is discussed in the paper. A row of LV networks were investigated with the purpose to develop and to verify practical measures for the reduction of power consumption without affecting the production processes in the enterprises. The practical results of the carried out voltage optimization are discussed in the paper. [C100]

"An energy saving criterion for wireless sensor networks with time synchronization requirements"

In Wireless Sensor Networks (WSNs) time synchronization is essential to aggregate and to process data collected by different nodes, both in real-time and off-line. However, time synchronization protocols at the application layer may significantly increase the amount of dissipated power. This paper analyzes this problem and suggests a communication scheme as well as a criterion to reduce the power consumption of WSN nodes, while preserving communication reliability and meeting target synchronization accuracy requirements. [C101]

"Research on ring-based routing for wireless mesh network"

The author puts forward a ring-based routing approach, which reduces the load of the mechanism of the central node in a wireless mesh network. This routing mechanism can evenly allocate the load from the area close to the center of the network to the network perimeter area. This paper analyzes the ring-based routing method from the outlined principles, method descriptions and emulation of the method. Adopting of this time scheduling approach is mainly to save energy, so the network can significantly decrease average power consumption, but the average power consumption reduction is based on the cost of network latency, because the dormant node cannot forward the packet. It cannot continue working until the corresponding super-frame period arrives. [C102]

"GMPLS energy efficiency scheme for Green Photonic Networks"

Since its emergence the internet has been a significant part of today's modern living. Defined by its interconnections and routing policies, it has fuelled increased demands for provisioning of new more advanced services that are able to dynamically react to changes within the network. These services however, lead to enormous energy consumption in contrast to a global drive for a greener environment. Hence the existence of an optical infrastructure that complies with the principles of zero-carbon emission is imperative. Subsequently, in this paper, we present an energy model of Generalized Multi-Protocol Label Switching (GMPLS) network for more power efficient Green Photonic Networks. We are proposing a greener network design based on a novel routing algorithm to deliver power reduction through implementation of so called "Hibernation" approach. The scheme includes network topology such as group the nodes configuration, segmentation of the link/ports, and wavelength provisioning via partitioning. The performance evaluations of these energy saving schemes are investigated by including various challenging issue on "greening the internet" and reduces carbon footprint. In addition, to study the impact of wavelength request, blocking probability and power consumption in relation to network load is taken into account. A trade-off is observed between energy per bit, wavelengths offered (Erlang) and blocking probability as a result of the idling nodes. [C103]

"Current recycling in linear regulators for biomedical implants"

A novel current recycling dual linear regulating power supply is proposed in this paper. In systems, such as biomedical implants, requiring a high actuation supply voltage and a number of lower supply voltages generated by linear regulators, our technique allows the linear regulators to be stacked, effectively reducing the overall current consumption to that of a single regulator. We design a dual linear power supply in a 0.35 μm high-voltage CMOS process and simulated results demonstrate a power saving in load of up to 49.4% compared with a conventional implementation. [C104]

"A quasi-power-gated low-leakage stable SRAM cell"

Leakage power dissipation and stability continues to be a major concern in deep-submicron SRAM cell design. In this paper, a quasi-power-gating approach that reduces the leakage power dissipation in an SRAM cell while maintaining stability is proposed. As compared to a standard 6-transistor SRAM, it consists of four additional NMOS transistors. In the active mode, the cell is activated by enabling two NMOS transistors in the pull-down path of the inverter. In the idle mode, a quasi-power-gating scheme is employed to reduce leakage by utilizing stack effect. It was found that this cell resulted in about 39.54 percent and 30.5 percent leakage power savings at a supply voltage value of 1V and 300mV respectively. A stability increase was also observed when compared to the standard non-power-gated 6-transistor SRAM cell. [C105]

"An op-amp sharing technique for continuous-time ΔΣ modulators"

This paper presents a new operational amplifier sharing technique for a continuous-time ΔΣ analog-to-digital converter (ADC). This technique saves power consumption by reducing the number of active elements in the modulator. Furthermore, the shared amplifier acts both as an adder and integrator in two different clock phases. The proposed technique also can be realized in a noise-coupled delta-sigma ADC. To verify the idea, a 2nd-order continuous-time ΔΣ modulator has been designed and simulated successfully with and without noise-coupling techniques. [C106]

"Energy efficient approach for survivable WDM optical networks"

The traffic volume that needs to be handled by communication networks is growing very fast due to the continuously increasing number of end-users and to the new and emerging services that can be accessed on the Internet. This reflects into a need for increased network capacity, which in turn introduces higher energy consumption of the network infrastructure. In view of the scale of the network of the future, it becomes evident that investigation of technologies, methodologies and approaches that can offer energy savings are of the utmost importance. It is widely accepted that optical network technologies will have a central role in the formation and the support of the network of the future. Therefore, it is important to explore novel solutions with respect to their energy efficiency. Several attempts to reduce power consumption in optical networks can be found in the literature. However, so far, no attention is paid to the impact of resilience in the overall network power consumption. On the other hand, wavelength division multiplexing (WDM) networks consist of very high capacity links and nodes where a single failure may disrupt an enormous number of services. Therefore, backup resources need to be provided for the purpose of survivability. Regardless of the network status, optical amplifiers and switching nodes along the backup paths are always active (i.e. switched on). Moreover, backup paths are typically longer than their respective primary paths, and therefore the total energy consumed by the

spare resources in the network may be relatively high. This paper proposes a novel approach to save energy in survivable optical networks. The approach is based on appropriately handling protection resources, where a trade-off between recovery time and energy consumption is exploited. The proposed idea has been tested through simulations using a Pan-European (COST 239) and Pan-American (NSFNet) network topology. For benchmarking purposes, results for the proposed energy-a--ware approach are compared against a conventional one, based on shortest path routing. With the proposed approach, more than 40% energy saving has been observed in case of the COST 239 network and more than 30% in the NSFNet. To further increase the energy savings in the network, a routing algorithm (specifically tailored for the proposed energy-aware approach) is also presented, showing that an additional 20% in energy reduction is achievable. [C107]

"Trading power savings for blocking probability in dynamically provisioned WDM networks"

In those networking scenarios (e.g., the stationary/mobile wireless paradigm) where limited energy storage capabilities is a limiting factor, power efficiency has been studied extensively for a long time. In the last few years, the steadily growing power consumption figures of ICT along with a recent public awareness of the possible environmental effects, broadened the focus of the research efforts towards more power conscious solutions also for wired networks. One promising solution going in this direction is represented by transparent wavelength division multiplexing (WDM) networks, where all-optical circuits (or lightpaths) carry the network traffic from the source to the destination node in the optical domain, i.e. without any optical-to-electrical (O-E-O) conversion. To further improve network power efficiency, several approaches have been proposed in the literature attempting to reduce the power consumption in transparent WDM networks. Among them, power aware (PA) routing and wavelength assignment (RWA) algorithms are receiving a lot of attention. One possible solution for the PA-RWA problem is to limit the number of devices in the network that need to be powered-on to support the lightpath requests. These methods, however, have an adverse impact on the length of the provisioned lightpaths. In order to efficiently use as much powered-on network resources as possible, the path length is, on average, longer than the one found with traditional (and less power efficient) shortest path solutions. This is in contradiction with the goal of classical RWA algorithms that tend to minimize the resource usage (i.e., wavelengths and fibers) within the network, in order to minimize the blocking probability. When availability of network resources becomes something that cannot be overlooked, a trade off needs to be assessed between power savings and blocking probability. In this talk, a non-conventional solution to the PA-RWA problem is presented. It is based on the intuition--that, in some cases, relaxing the power minimization constraint can have beneficial effects on the overall network performance, i.e., it can contribute to the reduction of resource fragmentation in the network and, in this way, lower the blocking probability. The proposed algorithm leverages on a cost function that considers both the power status of network elements (in this particular case the in-line optical amplifiers on fiber links only) and the information about wavelength usage. The algorithm has been tested using a Pan-European core network (i.e., COST 239). Performance results confirm the presence of a trade-off between energy saving and blocking probability. They also suggest that a "binary" approach using only the powered-on/powered-off information might not always be the best choice. [C108]

"Energy-saving Analysis Based on the Specific Consumption Theory for Large Coal-fired Power Units"

The specific consumption theory is applied to model and analyze the main equipment and steam flow of large coal-fired power unit at different operating loads, based on the First and Second Thermodynamic Laws. A 600MW subcritical coal-fired power generating unit is selected as the research object to analyze the energy consumption distribution at different loads, listing the main equipment of higher energy consumption rates. The results indicate the energy-saving potential of the effects of influencing the energy consumption rates. The research also puts forward the directions of optimizing and reforming to reduce energy consumption. [C109]

"Power Saving in Water Supply System with Pump Operation Optimization"

The optimal model makes use of the latest advances in hybrid genetic algorithm (genetic simulated annealing, GSA) to automatically determine the least-cost pump operation for each pump station in large-scale water supply system while satisfying hydraulic performance requirements. When the simplified model was used instead of the microscopic model, the calculation time of optimal control model was greatly saved, but the precision was basically the same. The results of optimal control model for the water distribution system in city T showed that the simplified model for optimal control had remarkable advantage. Pump optimal operation reduce electricity energy by 6.04 percent compared with empirical operation. [C110]

"Analysis of Energy-Saving Measures in Ports"

This article analyzed the characteristics of the port energy consumption from the loading and unloading

operations, space lighting, office energy consumption and power system loss. According to these characteristics we made some recommendations on how to reduce port energy consumption. [C111]

"Calibration of on-chip thermal sensors using process monitoring circuits"

Remarkable increase in peak power-density values coupled with the hotspot migration caused by workload variance motivates the need for multiple thermal monitoring circuits distributed across the die. The effect of intra-die process-variations on deep sub-micron circuits is significant enough to undermine their robustness. Accordingly, there is change in the response of thermal sensors occupying different process-corners which causes a shift in their calibration-constants. To save on tester cost, modern microprocessors employ a single, 2-point hard calibration model (slope-intercept form). In a multi-sensor environment, a single calibration equation will be rendered ineffective due to sparse sensor distribution that will be afflicted by varying degrees of process-variation. Thus, our aim is to estimate the process-induced drift in the calibration-constants of the thermal sensors. To this end, we propose a novel, supply and temperature independent, process-sensor which offers a high sensitivity of 3.35%/5 mV variation in Vthand a low power consumption of 4-25 nW. The process-estimates obtained are plugged into an analytical model used to describe the process-dependence of a ring-oscillator based thermal sensor and generate the process-shifted calibration constants. HSPICE simulations in 45 nm indicate that in the presence of process-variations having 3-Г‚Вї variability of +/-15% in all process-parameters, the average measurement error of a ring-oscillator-based thermal sensor with process-corrected calibration constants is reduced by >3X for slope and >10X for intercept as compared to one with static constants. [C112]

"Adaptive task allocation for multiprocessor SoCs"

This paper proposes an adaptive energy efficient task allocation scheme for a multiprocessor system-on-a-chip (SoC) in real-time energy harvesting systems. The proposed scheme generates an energy efficient offline task schedule for a multiprocessor SoC energy harvesting system by balancing application workload among multiple processing elements and pushing real-time application towards their deadlines. The off-line task schedule is dynamically extended to adapt to the energy availability in the runtime to improve the probability of a task to be feasibly scheduled. Simulation experiments show that the proposed scheme achieves energy savings of up to 24%, and reduces task deadline miss ratio of up to 10%. [C113]

"Research on the Performance of Solar and Air-Source Heat Pump Combined Heating Systems"

A solar and air-source heat pump combined heating system for experimental research is setup, the efficiency of the solar collectors and the COP of the air-source heat pump is tested by experiments. Hourly simulations during a whole year are conducted based on the performance data obtained from experiments, several conclusions are drawn: (1) The solar and air-source heat pump combined heating system can save electricity up to 50-70% compared to solar system assisted by electrical resistance heater, when located in places with not very cold winter; (2)The solar and air-source heat pump combined systems is more sensitive to supply water temperature and its percentage of electricity saving is reducing with the rising supply water temperature compared to auxiliary heating by electrical resistance. (3) The life-cycle cost of the combined system is not very sensitive to solar fraction when solar fraction ranges from 30% to 70%, and it is lowest when the solar fraction is near 50%. [C114]

"The Utilization and Development Strategies of Smart Grid and New Energy"

From a low-carbon economy perspective, this paper discusses the significance and prospects of the development and integrated use of smart grid and the new energy. It proposes that, for China to develop a smart grid, an overall view should be adopted to enhance the cooperation between the petroleum, the coal, the electricity and other energy industries, raising the proportion of new energy in the whole energy mix and addressing the distributed power generation issue through developing a smart grid, so that an optimal use of smart grid can be achieved, which will ultimately save the energy and reduce emissions for the whole nation. The authors of this paper hold that in today's China, the integrated use of smart grid and new energy should become the mainstream of energy development and one of the best solutions to energy-saving and emissions reduction in the future. In current China, as the electric power industry is the major consumer of the total primary energy and the situation will last for a considerable length of time, the integrated utilization of the smart grid and new energy sources that is in accordance with China's reality can optimize the energy source mix and conduce to the development of a low-carbon power industry. It is a practical way to cut down carbon emissions and shall bring long-term economic and social benefits. [C115]

"Exploring power-performance tradeoffs in database systems"

With the total energy consumption of computing systems increasing in a steep rate, much attention has been

paid to the design of energy-efficient computing systems and applications. So far, database system design has focused on improving performance of query processing. The objective of this study is to experimentally explore the potential of power conservation in relational database management systems. We hypothesize that, by modifying the query optimizer in a DBMS to take the power cost of query plans into consideration, we will be able to reduce the power usage of database servers and control the tradeoffs between power consumption and system performance. We also identify the sources of such savings by investigating the resource consumption features during query processing in DBMSs. To that end, we provide an in-depth anatomy and qualitatively analyze the power profile of typical queries in the TPC benchmarks. We perform extensive experiments on a physical testbed based on the PostgreSQL system using workloads generated from the TPC benchmarks. Our hypothesis is supported by such experimental results: power savings in the range of 11%-22% can be achieved by equipping the DBMS with a query optimizer that selects query plans based on both estimated processing time and power requirements. [C116]

"Development and Application of Test Apparatus with Cyclic Water-mixing Gathering Process Simulation"

The oil & gas gathering and transportation system is a great energy consumer in the oilfield. The energy consumption includes oil-gathering, dehydration, stability treatment, storage and transportation, and oil-gathering part accounts for 60%~80%. Therefore, to face the strategic targets and requirements raised in many countries that unit GDP energy consumption should be reduced effectively in the new situation, the energy-saving task is very severe in the oilfield. Especially, reducing the oil-gathering energy consumption is becoming the key problem. But in the current crude oil gathering and transportation process, the operating parameters are designed and optimized based on the situation that oil arrival temperature is near the freezing point, which restrict the further exploration and potentiality of lowering the temperature. In this paper, the limitations of commonly research methods are focused and the operating conditions, such as the working fluid, soil temperature, the pipeline specifications and flow velocity are considered respectively. We have developed a set of cyclic water-mixing gathering process simulation test apparatus with strong applicability and operability. The design of apparatus provides the new technology and the reliable method for improving energy efficiency, it is significant for improving the oilfield surface engineering test equipment and achieving the energy-saving targets. [C117]

"Study and Application on Removal of Silica by Chemical Coagulation Process from the Oil field Produced Water Reused in Boiler"

The technology of steam injection on the development of heavy oil and low permeability reservoirs has been successfully applied in the worldwide, and one of the key process is the amount of steam injected. The fresh water can be supplied for steam boiler in ground facilities, but it will cause the shortage of fresh water resources. So produced water reuse as the environmental-friendly technology can both make use of waste and avoid the discharge of produced water in the power generation. However, in the development of special oil field, the produced water often contains large amounts of SiO2in the form of ion or colloid, these Silica compound are easy to form dense and rigid Silica scales at high temperature, which is difficult to clean with conventional methods, the heat transfer efficiency and safe operation of the boilers and other process equipment are affected seriously. Accordingly, the reuse of the produced water replace of the fresh water is restricted. So, the removal agent of Silica with main agent of Magnesium Sulfate is developed in this paper. The reaction mechanism, the pH regulation of water, the adsorption, coagulation and precipitation of Silica are considered respectively. The optimum compositions are as follow: CMgSO4:CNaOH:CPAC:CCPAM=12:24:8:3. The agent is applied in the oil field and the results show that the average Silica content from 248.4 mg/L in incoming water to 47.1 mg/L in effluent water, the removal of Silica efficiency is up to 81%, the treated water achieve the quality goal of boiler feed water. The situation of shortage of fresh water resources can be alleviated effectively. Simultaneity, a variety of potential environmental hazards caused by discharged of high-temperature produced water are eliminated. The study is significantly for save energy and reduce consumption, environment-friendly and sustainable development in crude oil industry. [C118]

"The Combustion Situation of Pulverized Coal in Plasma Ignition Burner"

Saving energy and reducing consumption in coal-fired power generation is a very important development in the electric power industry. Therefore, to develop less oil or oil-free direct start-up burner has become a useful way. The application of plasma ignition burner had saved a lot of oil, because it made the technology of ignition and stable combustion combine effectively. It had found the impact of pulverized coal speed on the combustion situation in the first order combustion tube by simulating. And finally by changing the height of concentration block in the first order combustion tube, it has determined the best height of concentration block with the best combustion effect. [C119]

"Models for an Energy-Efficient P2P Delivery Service"

Data and service delivery have been historically based on a "network centric" model, with datacentres being the focal sources. The amount of energy consumed by these datacentres has become an emerging issue for the companies operating them. Thus, many contributions have proposed solutions to improve the energy efficiency of current datacentre architecture and deployments. A recently proposed approach argues for removing the datacentres from the delivery architecture. Their functionalities will instead be distributed at the edge of the network, directly within operator-managed home devices, such as Home Gateways, or Set-Top-Box (STB). This paper presents a study of the overall energy consumption required by such a community of STBs in order to provide the same services as datacentres. This paper also investigates a possible distributed algorithm to further reduce this overall energy consumption. This algorithm will be deployed over a managed peer-to-peer network of STBs. It will make optimized decisions and instruct unused STBs to switch Off to save energy without altering the general Service Level Agreement. We demonstrate the potential benefit of such an algorithm through an off-line scheduling. Finally, we propose a service-delivery model that allows us to integrate the service availability in the energy optimization problem. The combination of these two models is the first step in the development of our energy optimisation distributed algorithm. [C120]

"A 14 bit, 280 kS/s cyclic ADC with 100 dB SFDR"

This paper presents the design of a 14 bit, 280 kS/s cyclic ADC which consumes 1.6 mW power and achieves 100 dB SFDR. The design is optimized with a half-scale residue transfer characteristic (RTC) which lowers swing and slew requirements on the opamp. Further advantages of this RTC are exploited to reduce the number and magnitude of dominant error sources, and the residual error is randomized with dithering. Capacitor scaling and optimized allocation of conversion time to each step add to power savings. The ADC fabricated in a 0.35 Г‚Вїm CMOS process occupies 1.04 mm2silicon area. [C121]

"Behavioral level dual-vth design for reduced leakage power with thermal awareness"

Dual-Vthdesign is an effective leakage power reduction technique at behavioral synthesis level. It allows designers to replace modules on non-critical path with the high-Vthimplementation. However, the existing constructive algorithms fail to find the optimal solution due to the complexity of the problem and do not consider the on-chip temperature variation. In this paper, we propose a two-stage thermal-dependent leakage power minimization algorithm by using dual-Vthlibrary during behavioral synthesis. In the first stage, we quantitatively evaluate the timing impact on other modules caused by replacing certain modules with high Vth. Based on this analysis and the characteristics of the dual-Vthmodule library, we generate a small set of candidate solutions for the module replacement. Then in the second stage, we obtain the on-chip thermal information from thermal-aware floorplanning and thermal analysis to select the final solution from the candidate set. Experimental results show an average of 17.8% saving in leakage power consumption and a slightly shorter runtime compared to the best known work. In most cases, our algorithm can actually find the optimal solutions obtained from a complete solution space exploration. [C122]

"A Novel Energy Consumption Balance Strategy for Wireless Sensor Network"

Aiming at counterbalancing the energy consumption of the nodes in wireless sensor network, and preventing the emerging of energy hole, this paper proposes a balance strategy of energy consumption, which depends on double-deploy of the nodes, namely committing the deploy of sensor nodes in every layers according to their different functions. Compared with single irregular deploy, sensing nodes and switch nodes are independently deployed with interaction, thus cause the node number increased in the loop decrease, and theirs redundant data transmitted to the base station will decrease meanwhile, therefore not only the hardware cost and maintenance cost are saved, but also the transmission load of networks is reduced, and the problem of energy hole is relieved effectively. [C123]

"Cluster-tree based energy efficient protocol for wireless sensor networks"

Wireless sensor networks are conceived to monitor a certain application or physical phenomena and are supposed to function for several years without any human intervention for maintenance. Thus, the main issue in sensor networks is often to extend the lifetime of the network by reducing energy consumption. When the network topology does not change very often, a clustering technique can be used to manage the network activity. Some applications have high priority traffic that needs to be transfered with bounded end-to-end delay. The IEEE 802.15.4 standard defines a MAC protocol that saves energy by putting nodes periodically in sleep mode. The ZigBee protocol defines a hierarchical addressing mechanism by creating cluster-tree based on regrouping the star topology of the IEEE 802.15.4 standard. In this paper, we show how these two standards fail

to guarantee quality of service and energy saving at the same time. We propose a time segmentation approach that saves energy, enables quality of service in terms of guaranteed access to the medium and improves the overall performance of the network. This time segmentation is achieved by synchronizing nodes activity using a tree-based beacon diffusion. The tree-based topology is inspired from the cluster-tree proposed by ZigBee. Our solution guarantees end-to-end delay for high priority traffic. The efficiency of our solution is proven by simulation and implementation. [C124]

"Optimization and Evaluation of an Energy-Efficient MAC Protocol for WASNs"

A Wireless Ad hoc Sensor Network (WASN) is an autonomous collection of low cost devices that communicate over wireless links. This devices are often powered by limited energy resources, and it is expensive and sometimes infeasible to recharge or replace them. Hence, energy efficiency is the main design concern for such a network. In literature, several energy-efficient Medium Access Control (MAC) protocols have been proposed, because the primary sources of energy waste are collision, overhearing, idle listening and overhead. %Nevertheless, most of these works In this paper, we propose a novel adaptive MAC layer protocol, which uses a model-based duty-cycle adaptation strategy based on traffic load predictions. Specifically, a stochastic model is used by a state estimator to predict the network's future conditions. The predicted network conditions are then used by an optimizer to derive an optimal wake-up time schedule which reduces the end-to-end latency while saving energy. The performance of our protocol is then compared to the most widely duty-cycle MAC protocols such are S-MAC and T-MAC. Our experimental results on a simulated WASN reveals that under heavy as well as light traffic conditions our solution results in an improvement in the balance between end-to-end latency and energy consumption. [C125]

"An embedded control and monitor system for SAR using SOPC technology"

In the future, Synthetic Aperture Radar (SAR) requires enhanced capabilities, such as all-weather and better resolving power, more widely used in sciences, etc. New system to improve the control and monitor capability is desired by the development of the carrying-platform and SAR itself. A fast and small control and monitor system has been developed and tested. It employs SOPC (System On Programmable Chip) technology to satisfy the requirements of more advanced vehicle behavior in a small package, high-performance computing, and low power consumption, etc. The system presented in this paper is designed of Xilinx VirtexII p20 chip; a 1553B chip, an A/D chip has a SPI interface, etc. The project use PowerPC 405 embedded in V2P chip as a control computer to save PCB space, reduce total power consumption and enhance the computing capability of the system. This paper focuses on the design aspects of the hardware and the software of the system. Some experiments' results are given in this paper. [C126]

"Energy-Efficient Hardware Prefetching for CMPs Using Heterogeneous Interconnects"

In the last years high performance processor designs have evolved toward Chip-Multiprocessor (CMP) architectures that implement multiple processing cores on a single die. As the number of cores inside a CMP increases, the on-chip interconnection network will have significant impact on both overall performance and power consumption as previous studies have shown. On the other hand, CMP designs are likely to be equipped with latency hiding techniques like hardware prefetching in order to reduce the negative impact on performance that, otherwise, high cache miss rates would lead to. Unfortunately, the extra number of network messages that prefetching entails can drastically increase the amount of power consumed in the interconnect. In this work, we show how to reduce the impact of prefetching techniques in terms of power (and energy) consumption in the context of tiled CMPs. Our proposal is based on the fact that the wires used in the on-chip interconnection network can be designed with varying latency, bandwidth and power characteristics. By using a heterogeneous interconnect, where low-power wires are used for dealing with prefetched lines, significant energy savings can be obtained. Detailed simulations of a 16-core CMP show that our proposal obtains improvements of up to 30% in the power consumed by the interconnect (15-23% on average) with almost negligible cost in terms of execution time (average degradation of 2%). [C127]

"Balancing Task Resource Requirements in Embedded Multithreaded Multicore Processors to Reduce Power Consumption"

Power consumption is a major design issue in modern microprocessors. Hence, power reduction techniques, like dynamic voltage scaling (DVS), are being widely implemented. Unfortunately, they impact on the task execution time so difficulting schedulability of hard real-time applications. To deal with this problem, this paper proposes a power-aware scheduler for coarse-grain embedded multicore processors implementing global DVS. To this end, this work presents two heuristics, namely Balanced Memory and Balanced CPU, which distribute the task set among cores focusing on resource utilization. Results show that with respect to a system not implementing DVS,

two or five DVS levels achieve energy savings by about 35% or 51%, respectively. [C128]

"A Matrix Completion Approach to Reduce Energy Consumption in Wireless Sensor Networks"

This paper proposes a new approach to save energy in a wireless sensor network (WSN) in which sensors lie on a uniform rectangular grid. At each data-acquisition/sampling instant, only a randomly selected subset of all the sensor nodes acquires and transmits the data. This problem can be solved by semi-definite programming, which is based on fixed point continuation with Bregman iterations. [C129]

"A Smart-NIC-Based Power-Proxy Solution for Reduced Power Consumption during Instant Messaging"

The major challenge to achieving efficient power management for local computers that serve as edge devices of the Internet is to achieve long sleeping times while at the same time maintaining network connectivity. By modifying the network interface card (NIC) with a low-weight proxy module that can handle a certain amount of network protocol semantics and hence still keep the local computer alive on the Internet, a longer host sleeping time can be achieved, while keeping many of the components, including CPU, memory, motherboard, hard drive, etc, remain in a very-low-energy mode. In this paper, we pursue a power-proxy solution to the widely-used Instant Messenger (IM) applications. Yahoo!Г‚В®Messenger is selected for a case study to investigate its communication protocol YMSG. Furthermore, the decision on inactivity time-out values is a crucial factor for energy savings, but the random nature of idle periods makes the decision another challenge. We formulate the decision problem into a stochastic program and propose an adaptive algorithm to set up appropriate inactivity time-out values. Simulations show that the proposed power-proxy solution combined with the inactivity time-out setup algorithm can efficiently reduce the power consumption of an edge computer. [C130]

"A Performance Evaluation of Energy Efficient Schemes for Green Office Networks"

Power consumption in office networks has become a major issue due to its running cost. In order to reduce the power consumption, several approaches have been proposed such as Energy Efficient Ethernet (EEE) and Energy Efficient Wireless aggregation (EEW). In this research, we develop an analytical model and apply the model to evaluate and compare performance of the existing technologies. The parameters of interest include the number and the average throughput of clients. Our analysis results show that EEW is more efficient than EEE with a small number of clients or low average throughput. Motivated by this result, we examine the possibility of conserving more power by introducing a combination of EEE and EEW, called EEEW. EEEW can take advantage of both EEE as well as EEW and should be very strong against the varying conditions of the network. We found that when the average throughput of clients is less than 0.5Mbps, the combination can save more than 66% of the power consumed by EEE. We also describe EEEWS, a combination of EEEW and link-sleep techniques which presents a further power saving potential. [C131]

"Tuning servers, storage and database for energy efficient data warehouses"

Undoubtedly, reducing power consumption is at the top of the priority list for system vendors, data center managers who are challenged by customers, analysts, and government agencies to implement green initiatives. Hardware and software vendors have developed an array of power preserving techniques. On-demand-driven clock speeds for processors, energy efficient power supplies, and operating-system-controlled dynamic power modes are just a few hardware examples. Software vendors have contributed to energy efficiency by implementing power efficient coding methods, such as advanced compression and enabling applications to take advantage of large memory caches. However, adoption of these power-preserving technologies in data centers is not straightforward, especially, for large, complex applications such as data warehouses. Data warehouse workloads typically have oscillating resource utilizations, which makes identifying the largest power consumers difficult. Most importantly, while preserving power remains a critical consideration, performance and availability goals must still be met with systems using power-preserving technologies. This paper evaluates the tradeoffs between existing power-saving techniques and their performance impact on data warehouse applications. Our analysis will guide system developers and data center managers in making informed decisions regarding adopting power-preserving techniques. [C132]

"WiMAX-ZigBee management system for green education"

A WiMAX-ZigBee management system for green education has been developed. The developed energy management system brings about an end to the disgusting environmental problems. This paper explores the concept of energy management and introduces an Energy Management System located at campus areas. Analysis shows that 30% energy can be saved from the total energy consumption which saves HK$30 thousand million dollars annually. The projection on the environment reduces 22.4 million tons CO2 emission. [C133]

"Designing a processor from the ground up to allow voltage/reliability tradeoffs"

Current processor designs have a critical operating point that sets a hard limit on voltage scaling. Any scaling beyond the critical voltage results in exceeding the maximum allowable error rate, i.e., there are more timing errors than can be effectively and gainfully detected or corrected by an error-tolerance mechanism. This limits the effectiveness of voltage scaling as a knob for reliability/power tradeoffs. In this paper, we present power-aware slack redistribution, a novel design-level approach to allow voltage/reliability tradeoffs in processors. Techniques based on power-aware slack redistribution reapportion timing slack of the frequently-occurring, near-critical timing paths of a processor in a power- and area-efficient manner, such that we increase the range of voltages over which the incidence of operational (timing) errors is acceptable. This results in soft architectures-designs that fail gracefully, allowing us to perform reliability/power tradeoffs by reducing voltage up to the point that produces maximum allowable errors for our application. The goal of our optimization is to minimize the voltage at which a soft architecture encounters the maximum allowable error rate, thus maximizing the range over which voltage scaling is possible and minimizing power consumption for a given error rate. Our experiments demonstrate 23% power savings over the baseline design at an error rate of 1%. Observed power reductions are 29%, 29%, 19%, and 20% for error rates of 2%, 4%, 8%, and 16% respectively. Benefits are higher in the face of error recovery using Razor. Area overhead of our techniques is up to 2.7%. [C134]

"Exploiting Storage Class Memory to reduce energy consumption in mobile multimedia devices"

Storage Class Memory (SCM) provides a valuable opportunity to merge main memory and secondary storage since it is not only non-volatile but also randomly accessible in byte unit. In this paper, we investigate four system configurations employing SCM and Flash memory storage and evaluate how much energy can be saved from each of them. According to experimental results measured in a real system, the most expensive combination of SDRAM memory and SCM storage increases performance dramatically. Also, the configuration using SCM for both memory and data storage lowers energy consumption to roughly an eighth, but decreases performance of compute intensive jobs to half, compared with the conventional SDRAM memory and Flash memory storage configuration. [C135]

"Power and slew-aware clock network design for through-silicon-via (TSV) based 3D ICs"

In this paper, three effective design techniques are presented to effectively reduce the clock power consumption and slew of the 3D clock distribution network: (1) controlling the bound of through-silicon-vias (TSVs) used in between adjacent dies, (2) controlling the maximum load capacitance of the clock buffer, (3) adjusting the clock source location in the 3D stack. We discuss how these design factors affect the overall wirelength, clock power, slew, skew, and routing congestion in the practical 3D clock network design. SPICE simulation indicates that: (1) a 3D clock tree with multiple TSVs achieves up to 31% power saving, 52% wirelength saving and better slew control as compared with the single-TSV case; (2) by placing the clock source on the middle die in the 3D stack, an additional 7.7% power savings, 9.2% wirelength savings, and 33% TSV savings are obtained compared with the clock source on the topmost die. This work aims at helping designers construct reliable low-power and low-slew 3D clock network by making the right decisions on TSV usage, clock buffer insertion, and clock source placement. [C136]

"Energy efficient joint scheduling and multi-core interconnect design"

Energy efficient and high performance interconnect is critical for multi-core architecture. Interconnect with power saving segmented buses satisfies the tight latency and high volumn data transfer needs of applications with large embeded pallelism. This paper analyzes the major energy consumption factors of interconnect with segmented buses from high level synthesis. It presents a computation and inter-core data transfer scheduling algorithm to minimize the interconnect energy consumption by addressing the analyzed factors while exploring an application's maximum parallelism. This paper jointly considers scheduling and interconnect design. It presents an application specific approach to determine the minimum number of segmented buses required and an optimal inter core data transfer schedule which can be used to configure the switches on the segmented buses to avoid bus contention and minimize interconnect energy consumption with a given application. Experimental results show that the proposed scheduling algorithm can reduce interconnect dynamic about 23% on average compared to the other communication cost conscious scheduling techniques for evaluated high parallelism DSP applications. [C137]

"Delay-Hiding energy management mechanisms for DRAM"

Current trends in data-intensive applications increase the demand for larger physical memory, resulting in the memory subsystem consuming a significant portion of system's energy. Furthermore, data-intensive applications

heavily rely on a large buffer cache that occupies a majority of physical memory. Subsequently, we are focusing on the power management for physical memory dedicated to the buffer cache. Several techniques have been proposed to reduce energy consumption by transitioning DRAM into low-power states. However, transitions between different power states incur delays and may affect whole system performance. We take advantage of the I/O handling routines in the OS kernel to hide the delay incurred by the memory state transition so that performance degradation is minimized while maintaining high memory energy savings. Our evaluation shows that the best of the proposed mechanisms hides almost all transition latencies while only consuming 3% more energy as compared to the existing on-demand mechanism, which can expose significant delays. [C138]

"A 6 bit 800MHz TIADC Based on Successive Approximation in 65nm Standard CMOS Process"

Applications like ultra-wideband radio, optical communication require sampling rates of at least 500 MS/s with low resolution. The potential energy savings of successive approximation based time-interleaved A-D conversion architecture overrides traditional flash architecture. This paper presents a 6-bit 800 MS/s ADC in 65 nm STMicroelectronics standard CMOS process. The ADC uses 8-channel time interleaved SAR topology and achieves 36 dB SNR and 43 dB SFDR with 13.5 mW power consumption from 1.2 V supply. The resulting FOM is 0.3251 pJ/step. The timing mismatch among the channels is reduced by clock-edge reassignment technique. The high speed specification of the system requires the design of low offset comparator. Power consumption and jitter are reduced by using shift register based phase generator. [C139]

"Leakage-Aware Energy Minimization Using Dynamic Voltage Scaling and Cache Reconfiguration in Real-Time Systems"

System optimization techniques are widely used to improve energy efficiency as well as overall performance. Dynamic voltage scaling (DVS) is acknowledged to be successful in reducing processor energy consumption. Due to the increasing significance of the memory subsystem's energy consumption, dynamic cache reconfiguration (DCR) techniques are recently proposed at the aim of saving cache subsystem's energy consumption. As the manufacturing technology scales into the order of nanometers, leakage current, both in the processor and cache subsystem, becomes a significant contributor in the overall power dissipation. In this paper, we efficiently integrate processor voltage scaling and cache reconfiguration together that is aware of leakage power to minimize overall system energy consumption. Experimental results demonstrate that our approach outperforms existing techniques by on average 12-23%. [C140]

"Prognostics-based health management for free air cooling of data centers"

The telecommunication industry has become conscious about its energy consumption and associated the environmental footprint of its operating infrastructure, e.g., data centers. At present, more than one half of the total energy consumption of data centers is for the power and cooling infrastructure. One way to save energy is an approach called Г‚Вїfree air coolingГ‚Вї, where ambient air is used to cool the equipment, thereby reducing the energy consumed in cooling and conditioning the air. Free air cooling is being adopted for data centers that are already in operation where the equipment used are unlikely to have been designed or qualified for free cooling regime. Traditional reliability evaluations depend on industry standards that assume pre-defined environmental conditions and generally perform set of environmental tests that relate to those conditions. Equipment level risk identification and mitigation methods are not practical to apply for the data center as a system. This paper provides an overview of the associated challenges posed by such an operating environment. This paper discusses the reason why traditional reliability methods cannot be used to assess the risks of free air cooling of data centers. Finally, as an alternative approach, prognostics and health management technique that can provide the users of data centers with the ability to identify impacts of free air cooling, estimate remaining useful life of the equipment, and help identify impending intermittent service interruptions and degradations is described. [C141]

"An Energy Efficient Cluster-Head Selection for Wireless Sensor Networks"

Recent advances in wireless sensor networks have led to many new protocols specifically designed for sensor networks where energy awareness is an essential consideration. Clustering is a key routing technique used to reduce energy consumption. Clustering sensors into groups, so that sensors communicate information only to cluster-heads and then the cluster-heads communicate the aggregated information to the base station, saves energy and thus prolonging network lifetime. In this paper, we propose an energy efficient cluster-head selection algorithm for adapting clusters and rotating cluster head positions to evenly distribute the energy load among all the nodes. Our proposed model is extended to the LEACH's stochastic cluster-head selection algorithm by modifying the probability of each node to become cluster-head based on remaining energy level of sensor nodes for transmission. Simulation results show that our proposed model could better implement load balance and

prolong the lifetime of the network. [C142]

"Energy Efficient Lighting System Design for Building"

Lighting contributes the highest amount of electricity usage in a building. Generally, lighting will consume from 20% until 50% of the electricity consumption. The efficient and effective use of lighting can offer major energy and cost saving. This research investigates and analyses the energy management in a building and presents the design of energy efficient lighting systems. The first part propose a design of energy efficient lighting which will help users to determine the ideal number of luminaries needed in certain room without reducing the quality of lighting. The design was develop via Matlab. The second part is an audit and cost study to demonstrate the wastefulness of commercial, industrial, residential and community lighting. Based on the study, the design for improvement of current lighting system called Lamp Replacement had been proposed. The major findings in this project are that the energy-efficient lighting design could still be achieved without sacrificing the visual comfort and quality of lighting and replacement of older fixtures with new luminaries can greatly improve efficiency. [C143]

"A Harmonization Among Power Saving Class in the IEEE 802.16e Systems"

The power saving mechanisms of the current IEEE 802.16e system are designed to take no consideration of the harmonization between power saving classes (PSCs) I and II. Hence, we propose a harmonized power saving mechanism between PSC I and PSC II to increase unavailability interval when a mobile station (MS) uses PSCs. The proposed mechanism adjusts the timing of the sleep window of PSC I to maximize the unavailability interval of the MSs. As a result, the proposed mechanism achieves power saving of the MSs. Through the simulation, we show that the proposed mechanism can reduce the power consumption of the MSs considerably compared with conventional mechanisms. [C144]

"Energy-efficient management of wireless sensor networks"

Managing wireless sensor networks in an energy-efficient manner is no mean feat. Management requests and responses create additional traffic in addition to the data issuing from the network's actual sensing application. Effective management therefore requires balancing the need for detailed oversight of the network against the energy consumption of the management system itself. This paper explores whether sending the management data and the sensing data together rather than separately can reduce the management system's energy footprint. From the results of our experiment using BMAC and DYMO on MICAz motes running on TinyOS, we find that our approach does indeed substantially reduce the communication costs of the management system. We discuss different models for cooperation between the management system and the sensing application and estimate the potential trade-off between the number of packet transmissions and the delay of management data. To put the theoretical results into practice, we present a management framework for monitoring wireless sensor networks that is independent of the actual sensing application. This framework allows fine-grained control over the latency tolerated for management requests for the sake of reduced energy consumption. Measurements based on a prototype implementation of the framework in an experimental setup show that up to 61% of the energy previously needed for management requests can be saved. [C145]

"A Perfect Power demonstration system"

Energy efficiency, power system reliability and the environmental impact of fossil fuel plants are all drivers for more intelligent or smart grids. We discuss a Perfect Power System, a smart micro grid with system redundancy, and implement a test bed to demonstrate smart grid concepts such as demand response, onsite generation, automated lighting system control, and ambient temperature control. We conclude that the integration of Zigbee modules in building control systems will enable greater levels of building energy management, reduce energy consumption and potentially result in significant cost savings. [C146]

"A novel approach for trade-off between computation and communication cost in wireless sensor networks"

Wireless sensor networks consist of nodes with severe energy constraints and thus, they must use energy saving algorithms in different layers. Despite the prior work, the computational cost in a wireless sensor network is usually neglected compared to the communication cost; it may not admit to in which large volumes of data packets are being transmitted, such as those cases in which This packets are video frames captured by video sensor nodes. In this paper, we consider the problem of minimizing the communication needed to send readings from a set of sensors to a single destination with obtaining a trade-off between computation and communication energy. We propose a centralized as well as a distributed algorithm. In the former, the sink node and in the latter, each node endeavors to reduce network energy consumption adaptively, making a trade-off between data

compression at the appropriate level and sending row data. The data compression technique used is dependent on the application type and considers spatial correlation. Comparing the simulation results of our approach with similar work, without consideration of trade-off between computation and comparison, shows significant improvement in energy saving of the network. [C147]

"A Light-Weight Autonomous Power Saving Method for Wireless Sensor Networks"

This paper proposes an autonomous energy saving method that works on wireless sensor networks. Wireless sensor nodes are equipment for gathering information about the user's surrounding environment. An energy-efficient data gathering system is required because each node is battery powered. Our method autonomously reduces the sampling frequency for monitoring environments whose condition may vary rapidly or slowly. Its simple lightweight computation scheme also helps to reduce battery consumption. We conducted experiments using real sensor data and found that our method performed well in terms of both power consumption and quality of sampled data. [C148]

"Sensor networks with secure public-key over GF (2m)"

In Observing and interacting with the real physical world sensor networks now take new opportunities for play the roles in almost everywhere. They are composed of a large number of sensor nodes and each sensor node has capabilities of sensing, processing, and communication, which underpinned by limited energy. Reducing energy consumption was, is and will be a major concern in sensor networks. For the given extremely limited hardware resources on sensor nodes and the inclement deploying environment, the adversary attack becomes a serious security threat toward wireless sensor networks. In this paper a secure public-key based effective and efficient sensor network is to be introduced. A saving time, reducing computing energy, algorithm is carefully investigated. The powerful elliptic curve cryptography (ECC) over GF (2m) is also investigated with hidden generator point. [C149]

"SFRP: A selective flooding-based routing protocol for clustered wireless sensor networks"

Energy efficient routing in sensor networks has been of great interest in the research community. Cluster-based data collection using aggregation and routing is an effective way of improving energy efficiency in sensor networks. However most cluster-based routing protocols assume a CH-to-CH form of multi hop communications. This assumption may not be valid in typical application scenarios due to battery power and transmission range constraints, hence requiring some sort of gateway mechanisms between cluster heads. Incorporating and modifying the underlying concept of flooding in a clustered network implemented in CBRP, we propose a selective flooding-based routing protocol (SFRP) for multi hop routing; SFRP is specifically targeted at environmental monitoring applications, where sensor nodes typically form a spanning-tree structure rooted at a single sink node. Simulations show that the protocol has reduced control overhead thereby saving energy in the route formation phase. [C150]

"Packet Forwarding with Minimum Energy Consumption in Body Area Sensor Networks"

Body area sensor networks (BASNs) are powered by batteries and hence energy is a scarce resource. Thus communication protocols in BASN need to be energy efficient. This paper addresses this problem by proposing a Minimum Energy Packet Forwarding Protocol (MEPF). First, we analyze the tradeoff of energy consumption between lower transmission power and packet retransmission. Then we propose the transmission power control part of MEPF. It transmits a packet using the minimum transmission power that can guarantee a high packet reception rate. Unlike the previous work, we not only need to adjust the power of the forward transmission but also the ACKs, which further reduces the consumption. MEPF outstands from the earlier works by also retransmitting lost packets when a link is good enough. The quality of the link is dynamically judged by a machine learning algorithm which also considers the limited buffer space in a sensor node. By MEPF, the energy consumption to forward a packet is minimized without sacrificing the packet reception ratio. Experimental results show quantitatively that MEPF save significant amounts of energy. [C151]

"IP Prefix Matching with Binary and Ternary CAMs"

Ternary Content Addressable Memories (CAMs) are widely used in high-speed routers. They allow a longest-prefix matching operation to complete within a single clock cycle. However, TCAMs are costly and their power consumption is very high. In this paper, we identify two kinds of redundancy in the usage of TCAMs in IP route lookup, and propose a hybrid scheme which combines Binary CAMs and Ternary CAMs to reduce the total area and power consumption. We also introduce shared memory blocks for further simplification of the lookup circuit. The simulation result shows that our approach can save more than 50% of transistors in CAMs, compared with the traditional way, and that it reduces the critical path in IP route lookup significantly. [C152]

"Distributed clustering approach for wireless sensor network based cellular data placement model"

Requiring all the nodes in a large-scale wireless sensor network to communicate their data to their respective destination will deplete the energy of the nodes quickly due to the long-distance and multi-hop nature of the communication and will also results in network contention. Therefore to increase longevity and support scalability, nodes are often grouped into disjoint and mostly non-overlapping clusters. Clustering saves energy and reduces network contention by enabling locality of communication: nodes communicate their data over shorter distances to their respective cluster-heads. The cluster-heads aggregate these data into a smaller set of meaningful information. Not all nodes, but only the cluster-heads need to communicate far distances to their respective destinations. In this paper, we propose a distributed clustering approach for our proposed real time data placement model for WSNs. It is assumed that the sensor nodes are aware of their locations in their deployment area, and they are time synchronized. For data dissemination and action in the wireless sensor network the usage of Action and Relay Stations (ARS) has been proposed. [C153]

"Adaptive low power receive diversity for LTE"

Long Term Evolution (LTE) is the improvement of the 3G W-CDMA system and offers higher system capacity while being more robust against multipath fading. For this purpose it features several multiple antenna schemes. Receive diversity is a mandatory multiple antenna scheme. This paper proposes an architecture for receive diversity which significantly reduces the power consumption compared to conventional approaches. Depending on the environment it has a similar performance as maximum ratio combining while delivering a power saving of 30% in the radio frontend and allowing even better power reduction on system level. Minor modifications have to be made at the radio frontend. The performance of the proposed architecture is evaluated in multipath fading channels in terms of bit error rates. [C154]

"A disposable polydimethylsiloxane (PDMS) microdevices for DNA amplification with low power consumption"

Polymerase Chain Reaction (PCR) microchip has become an important tool in a molecular biological research. Many researchers have attempt to improve the efficiency of the device in terms of type of materials, fabrication process, temperature control system, design of the device, detection methods, etc. In this study, we demonstrate the disposable polydimethylsiloxane (PDMS) microchip provided for DNA amplification. The devices consists of two mainly parts, first part is PDMS static chamber that casting on Silicon (Si) mold that bonded with thin glass sheet by RF plasma cleaner. The other parts are Pt-microheater and Pt-temperature sensor on SiO2/Si substrate. The thin film Pt-microheater and Pt-temperature sensor (RTD) were fabricated with CMOS compatible process. In the results, with 10 Г‚Вїl of PCR mixture volume, the approximately 700 bp DNA were successfully amplified within 50 minutes by 32 PCR cycles. The amplified products were comparable with conventional method by agarose gel electrophoresis method. With this PCR chip we can save cost by reducing the reagents volume, time consuming and repeatable fabrication. Further information about microchip fabrication and application will be presented. [C155]

"Energy Efficient Resource Management in Virtualized Cloud Data Centers"

Rapid growth of the demand for computational power by scientific, business and web-applications has led to the creation of large-scale data centers consuming enormous amounts of electrical power. We propose an energy efficient resource management system for virtualized Cloud data centers that reduces operational costs and provides required Quality of Service (QoS). Energy savings are achieved by continuous consolidation of VMs according to current utilization of resources, virtual network topologies established between VMs and thermal state of computing nodes. We present first results of simulation-driven evaluation of heuristics for dynamic reallocation of VMs using live migration according to current requirements for CPU performance. The results show that the proposed technique brings substantial energy savings, while ensuring reliable QoS. This justifies further investigation and development of the proposed resource management system. [C156]

"Greenhouse Wireless Sensor Network Monitoring System Design Based on Solar Energy"

This paper puts forward greenhouse wireless sensor network monitoring system design based on solar energy. It transmits data through wireless receiving and sending equipment without setting up electric wiring. The system structure is simple, which saves the manpower and material resources. The monitoring and management center can control the temperature and humidity of the greenhouse, measure the carbon dioxide content, collect the information about intensity of illumination, monitor and control the pictures. In this way, then no manpower will be needed. Compared with ordinary wireless technology, this system design consumes less energy, costs less money and has large internet capacity. The sensor nodes receive the solar energy and supply it to the wireless

sensor network. This system adopts MSP430 MCU with super low energy consumption and network transmitting chip nRF24L01 with low energy consumption to reduce system consumption as much as possible. What's more, this system adopts multilevel energy memory. It combines energy management with energy transfer, which makes the energy collected by solar energy batteries be used reasonably. Therefore, the self-managing energy supply system will be established, and the wireless nodes will receive permanent power supply and the wireless sensor network can be used without limitations. [C157]

"Runtime Energy Adaptation with Low-Impact Instrumented Code in a Power-Scalable Cluster System"

Recently, improving the energy efficiency of high performance PC clusters has become important. In order to reduce the energy consumption of the microprocessor, many high performance microprocessors have a Dynamic Voltage and Frequency Scaling (DVFS) mechanism. This paper proposes a new DVFS method called the Code-Instrumented Runtime (CIRuntime) DVFS method, in which a combination of voltage and frequency, which is called a P-State, is managed in the instrumented code at runtime. The proposed CI-Runtime DVFS method achieves better energy saving than the Interrupt based Runtime DVFS method, since it selects the appropriate P-State in each defined region based on the characteristics of program execution. Moreover, the proposed CI-Runtime DVFS method is more useful than the Static DVFS method, since it does not acquire exhaustive profiles for each P-State. The method consists of two parts. In the first part of the proposed CI-Runtime DVFS method, the instrumented codes are inserted by defining regions that have almost the same characteristics. The instrumented code must be inserted at the appropriate point, because the performance of the application decreases greatly if the instrumented code is called too many times in a short period. A method for automatically defining regions is proposed in this paper. The second part of the proposed method is the energy adaptation algorithm which is used at runtime. Two types of DVFS control algorithms energy adaptation with estimated energy consumption and energy adaptation with only performance information, are compared. The proposed CIRuntime DVFS method was implemented on a power-scalable PC cluster. The results show that the proposed CI-Runtime with energy adaptation using estimated energy consumption could achieve an energy saving of 14.2% which is close to the optimal value, without obtaining exhaustive profiles for every available P-State setting. [C158]

"Efficiency of Distributed Compression and Its Dependence on Sensor Node Deployments"

In this paper we analyze the energy-efficiency of distributed compression and its dependence on the node deployment strategies for Wireless Sensor Networks (WSNs). Reduced energy and bandwidth usage can be achieved by Distributed Source Coding (DSC) which is a lossless compression technique used in, for example, data gathering applications. We evaluate the performance of clustered WSNs applying DSC under various topologies and different cluster head selection schemes. The topologies considered are obtained from three different node deployment models which are fundamentally based on random point processes. Those models cover the extreme deployment cases and allow direct comparison between various scenarios. The evaluation takes into account the packet header costs and the signal processing costs associated with DSC. Additionally, the applied energy model makes use of measurements obtained from real experiments. The simulations results show very good performance in terms of energy-efficiency. Furthermore, significant average energy savings and average lifetime extensions are possible using DSC under different deployment strategies. This study also leads to the identification of the best fitting deployment strategy in relation to the characteristics of different sensed phenomena. Hence, the proposed approach is particularly suited to support the optimization of networks in realistic environments. [C159]

"Power Saving Mechanism in IEEE 802.16m"

Most wireless networks adopt power saving mechanisms in order to extend the battery lifetime of mobile devices. In this paper, we investigate the performance of a power saving mechanism in IEEE 802.16m by using a simulator which models the sleep mode operation with a flexible length of listening window specified in IEEE 802.16m standard. Through simulations, we evaluate the proportion of listening window in a given sleep operation period as a performance measure for power consumption instead of direct estimation of power consumption and measure the power efficiency in various environments. The sleep mode operation in traffic indication messages can reduce the proportion of the listening window by approximately 10% than that without traffic indication messages. [C160]

"OHO: Overhearing on-demand route repair mechanism for Mobile Ad Hoc Networks"

MANETs is mobile networks with no infrastructure. The main characteristic of MANETs is mobility, which causes dynamic changing of topology and link failure. Route repair mechanism, which is initiated after link failure

occurred, broadcasts route request messages to the network to find a new route. Finally, there are only a few nodes selected to be the member of the new active route. That means most of the route request messages squander energy of nodes that are not the member of the new active route as well. In this paper, we propose a novel route repair mechanism that can save energy of nodes in an overall. The key feature is to overhear information from packets traveling around. Therefore the route repair can be successful with less overhead than the conventional routing protocol such as AODV by using overhear information. Simulation results show that our proposed route repair mechanism can improve performance in terms of energy. The average improvement of energy is 24% and reducing the overhead of network about 30% to 50% when comparing to the conventional AODV. [C161]

"Energy-saving set-top box enhancement in BitTorrent networks"

BitTorrent is a leading P2P network system for downloading contents. This trend moves the energy use out of the data center and into the homes of content consumers who are also then content distributors. BitTorrent clients must be fully powered-on at all times so that they are part of the swarm. Energy saving mode of the BitTorrent protocol is a critical issue, whether the goal is to reduce energy consumption of consumers or make your data center's room green. In this paper, we explore how the BitTorrent protocol can be changed so that BitTorrent-based IPTV set-top box can hibernate. [C162]

"A mixed style architecture for low power multipliers based on a bypass technique"

In this paper a new technique for the design of combinational circuits for low power is introduced. The basic idea is to bypass blocks of logic when their function is not required, using low delay and area overhead components (transmission gates). The internal state of these blocks is kept unchanged, so the switching activity of the circuit is minimized, resulting to low dynamic power consumption. While this idea offers great savings mainly to array multipliers, due to their regular interconnection scheme, the reduced area and fast speed of tree multipliers is a real temptation for the designer. Therefore, a mixed style architecture, using a traditional, tree based part, combined with a bypass, array based part, is proposed. Through extensive experimentation it has been found that the bypass technique offers minimum power consumption for all cases while the mixed architecture offers a delay*power product improvement ranging from 1.2x to 6.5x, compared to all other architectures. [C163]

"Power reduction effect of higher room temperature operation in data centers"

Electric power consumption has been of great concern to network carriers and service providers from both economical and environmental viewpoints, as it is predicted to increase exponentially for the foreseeable future. Lots of efforts to save energy at information and communications technology (ICT) related equipment, including routers/switches and servers, have been made to address this issue. Such efforts can be complemented with reducing power consumption at air-conditioning (A/C) systems and power supply systems, since they play significant parts in total power consumption in machine rooms. However, it is often the case that A/C systems are operated in a non-optimal condition in terms of power efficiency, partly because thermal conditions vary with many factors, such as types and layouts of ICT equipment. Against this background, improving energy-efficiency in A/C operation is gathering more attention, and many related works have been reported in recent years. [C164]

"Smart metering by using "Matrix Pencil""

A new method to identify electrical appliances and their consumption is presented in this paper. It is an important aspect to address larger monitoring system called smart grid. It will deliver electricity from suppliers to consumers using two-way digital technology to control appliances at consumers' homes to save energy, reduce cost and increase reliability and transparency. This paper focuses on an innovative function based on "Matrix Pencil" to identify and monitor electrical loads in residential areas. This technique takes advantage from transient and steady state analysis to improve monitoring efficiency. In particular, it allows us to extract active and reactive power for fundamental and harmonic frequencies. This new approach has been integrated into an energy meter with the collaboration of Landis + Gyr. [C165]

"A New Intelligent Remote Control System for Home Automation and Reduce Energy Consumption"

This paper presents the design and implementation of an internet-based smart remote control system for home automation, dedicated to power management that adapts power consumption to available power resources according to user comfort and cost criteria. Sensors and home appliances are connected to the designed and implemented control panel and then they are monitored and controlled from every corner of the world through the Internet cloud. The system is scalable and allows additional appliances to be added to it with no major changes to its core. New communication format is proposed to enable communication between the control panel

and the server as well. To verify the principle operation of the design, some home applications are experimentally tested. Experimental results show the efficiency and accuracy of proposed intelligent control system in terms of energy saving and being user friendly. [C166]

"Memory access reduction method for efficient implementation of fast cosine transform Pruning on DSP"

In this paper, we propose a novel memory access reduction method to minimize the memory accesses due to weighting factors (cosine coefficients in the computation diagram of fast DCT pruning) and input points for implementing fast DCT pruning on DSP processors. The proposed method reduces the number of memory accesses in two steps: 1) Reduce the number of weighting factors and 2) Combine butterflies at two stages in fast DCT pruning diagram to form an efficient butterfly structure in one stage and calculate them. The proposed method is applied to implement Pruning FCT on TI TMSC320C64x DSP. Experimental results show that the proposed method can achieve average of 40% memory access reduction, 48.6% clock cycle reduction and 32.6% memory space saving for weighting factors to compute Pruning FCT on DSP comparing with the conventional implementation. [C167]

"Energy-Efficient Spectrum Sensing for Cognitive Radio Networks"

This paper focuses on the spectrum sensing issues in the unslotted cognitive radio networks with wireless fading channels. To overcome the energy-inefficiency problem of the existing continuous/fixed-schedule spectrum sensing schemes in the cognitive radio networks, we propose an efficient spectrum sensing scheme for secondary users (SUs). The design goal of our proposed scheme is to save the sensing energy consumption while guaranteeing the priority of the PUs and the spectrum opportunity for SUs in terms of available spectrum usage time. In particular, our proposed energy-efficient spectrum sensing scheme adaptively adjusts the spectrum sensing periods and determines between the presence and vacancy of the PU by taking advantage of PU's activity patterns. We also develop a novel two-threshold based sequential sensing policy to reduce the false alarm probability while limiting the missed detection probability. We conduct simulations to validate and evaluate our proposed scheme. [C168]

"Energy Management Mechanism for Ethernet Passive Optical Networks (EPONs)"

In the past few years, Ethernet Passive Optical Networks (EPONs) have rapidly gained large popularity in broadband access networks. However the current standard has no management protocols aiming at reducing power consumption. In this paper, we propose an Energy Management Mechanism (EMM) within the IEEE 802.3ah control scheme. The main idea is to switch Optical Network Units (ONUs) to sleep mode and determine a suitable wakeup time schedule at the Optical Line Terminal (OLT). In the proposed EMM there is a trade-off between maximizing the power saving and guaranteeing the network performance. We compare two types of downstream scheduling schemes, Upstream Centric Scheduling (UCS) and Downstream Centric Scheduling (DCS), which are different in the way they assign 'active' and 'sleep' states to ONUs. Simulation results in terms of energy consumption and queuing delay are shown for the EMM based EPON system. [C169]

"MTSCStack: An effective technique to decrease leakage power in VLSI circuits"

The demands of future computing have led to challenges of very deep submicron (DSM) regime. As a result, leakage power dissipation is rapidly becoming a substantial contributor to the total power dissipation as threshold voltage becomes small, according to the International Technology Roadmap for Semiconductors (ITRS). In this paper a new low leakage power technique, named "MTSCStack" has been proposed. The proposed method is based on reducing leakage power in active mode and standby mode while saving exact logic state during sleep mode. Library designed using 65 nm BSIM 4 model of Berkeley Predictive Technology Model (BPTM) has been used to simulate proposed technique. [C170]

"AI-MAC: An Adaptive, Anycast MAC Protocol for Wireless Sensor Networks"

Energy constraints in wireless sensor nodes necessitate the design and development of energy-efficient MAC protocols to arbitrate access to the shared communication medium. While there exists a plethora of sensor MAC protocols, these protocols do not individually vary the duty-cycle of each sensor according to local connectivity status, to maximize energy savings. In this paper, we propose A^2-MAC-an Adaptive, Anycast MAC protocol for low-powered wireless sensor networks. It utilizes: (i) a random wakeup schedule, such that each node can independently and randomly wakeup in each cycle without coordination and time synchronization; (ii) adaptive duty-cycles based on network topology; and (iii) adaptive anycast forwarders selection, which allows each node to transmit to any member in its forwarding set. There are two key adaptive mechanisms in A^2-MAC: (i) each

node varies its duty-cycle and set of forwarding nodes such that energy consumption can be locally minimized for a given local delay performance objective; and (ii) nodes cooperatively reduce the duty-cycles required of their forwarding nodes, depending on local network connectivity. By allowing nodes to operate with different duty-cycles and forwarding sets, A^2-MAC achieves better energy-latency tradeoffs and extends node lifetime substantially, while providing good end-to-end latency. [C171]

"Energy-Efficient Accelerometer Data Transfer for Human Body Movement Studies"

Wireless sensors with accelerometers are widely used in various studies on human body movements. The most challenging problem in a small body-attachable sensing unit is how to maximize the battery lifetime. Previously, the preferred approach was to reduce the number of transmissions through data compression. Compressed Sensing(C-S) is an emerging alternative approach that aggressively reduces the samples yet permits the reconstruct of the original analog signal. C-S has the great potential to be extremely effective due to the universality and lower complexity of sensor implementation. In this paper, we investigate the nature of various human body movements. We examine the performance of the C-S framework in terms of the energy savings in a real testbed. Our experimental results show that the C-S framework can save up to 40% of energy in the sensing unit, compared with the traditional data compression scheme. [C172]

"Experiences with Active Per-Flow Queuing for Traffic Manager in High Performance Routers"

Per-flow queuing is believed to be an effective approach to guarantee Quality of Service (QoS) in high performance routers. However, its brute-force implementation consumes a huge amount of memory and is not scalable as the number of flows increases. Dynamic Queue Sharing (DQS) mechanism, in which a physical queue is dynamically created on-demand when a new flow comes and released when the flow temporarily paused, is able to achieve per-flow queuing performance with much less memory. In this paper, based on DQS, an active per-flow queuing system is designed, implemented and tested. To evaluate the effectiveness of DQS, we implement two FPGA-based Traffic Manager (TM) prototypes, one with DQS and the other a traditional one. The real chip implementation shows that DQS can not only scale down the required memory for per-flow queuing but also reduce the total number of control logic elements. As a result of reduced control logic, original 3-stage scheduling in naive scheme can be improved to be a single stage while maintaining the same delay performance, thus resulting in a faster speed potential. Besides, the power consumption can also considerably be reduced. Our experiments on a 4Gbps TM prototype using Stratix EP1S80F1508C5 FPGA show a 58.6% decrease in control memory. Meanwhile, the logic cells and LC registers are reduced by 6.8% and 15.0% respectively, and the power consumption is saved by 23% compared with the brute-force per-flow queuing implementation with 8K queues. [C173]

"A mixed style multiplier architecture for low dynamic and leakage power dissipation"

In this paper a new technique for the design of combinational circuits for low power is introduced. The basic idea is to bypass blocks of logic when their function is not required, using low delay and area overhead components (transmission gates). While this technique offers great dynamic power savings mainly in array multipliers, due to their regular interconnection scheme, it misses the reduced area and fast speed advantages of tree multipliers. Therefore, a mixed style architecture, using a traditional, tree based part, combined with a bypass, array based part, is proposed. Through extensive experimentation it has been found that while the bypass technique offers the minimum dynamic power consumption value, the mixed architecture offers a delay*power product improvement ranging from 1.2x to 6.5x, compared to all other architectures. Furthermore, the tree part of the mixed architecture has enough timing slack to be implemented with high Vth low leakage components, offering an extra 20%-30% leakage power saving, which is a considerable value in deep submicron technologies. [C174]

"Research on government responsibility in energy saving and emission reducing"

The theoretical basis for government accountability in energy saving and emission reduction are analyzed from public administration property, requirements of government functions, market externalities and public goods. On this basis, the government's responsibilities on energy saving and emission reduction are defined to six areas, in accordance with the problems in process of exercising the government's responsibilities, and then countermeasures and proposals are put forward, including changing the concept of the government, adjusting the economic structure, formulating policies and laws, promoting technological progress, developing recycling economy, strengthening supervision and evaluation, improving the institutional mechanisms. [C175]

"Energy and thermal aware buffer cache replacement algorithm"

Power consumption is an increasingly impressing concern for data servers as it directly affects running costs and system reliability. Prior studies have shown most memory space on data servers are used for buffer caching and

thus cache replacement becomes critical. Temporally concentrating memory accesses to a smaller set of memory chips increases the chances of free riding through DMA overlapping and also enlarges the opportunities for other ranks to power down. This paper proposes a power and thermal-aware buffer cache replacement algorithm. It conjectures that the memory rank that holds the most amount of cold blocks are very likely to be accessed in the near future. Choosing the victim block from this rank can help reduce the number of memory ranks that are active simultaneously. We use three real-world I/O server traces, including TPC-C, LM-TBF and MSN-BEFS to evaluate our algorithm. Experimental results show that our algorithm can save up to 27% energy than LRU and reduce the temperature of memory up to 5.45°C with little or no performance degradation. [C176]

"An Energy Efficient Sleep Scheduling Considering QoS Diversity for IEEE 802.16e Wireless Networks"

Power management is one of the most important issues in IEEE 802.16e wireless networks. In the standard, it defines three types of power saving classes (PSCs) for flows with different QoS characteristics. It allows a mobile device to turn off its wireless radio when all its PSCs are in sleep states. In this paper, we consider the scheduling of power saving classes of type II in an IEEE 802.16e network with a BS and multiple MSSs (mobile subscriber stations). Previous work proposes to enforce all MSSs to have the same sleep cycle, thus leading to higher energy cost for those MSSs with less strict delay bounds. We observe that if the sleep cycles of MSSs can be assigned according to their delay bounds, MSSs can significantly reduce their duty cycles. We propose an efficient tank-filling algorithm, which is standard-compliant and can allocate resources to MSSs according to their QoS characteristics with the least number of active frames. Simulation results verify that our algorithm incurs less power consumption and leads to higher bandwidth utilization than the previous schemes. [C177]

"Hybrid cooled data center using above ambient liquid cooling"

Customers who operate large data centers are looking for new ways to reduce their energy consumption and improve the ability to support higher compute density. An approach to liquid cooling that uses warm water instead of chilled water to cool system components and eliminate or greatly reduce the need for chillers in the data center is described in this paper. This change would have the dual effect of reducing the energy consumption of the cooling infrastructure by as much as 50% while increasing supported power densities (relative to air cooled solutions). In this paper is a description of the hybrid data center concept. An analytical model is constructed of both the hybrid data center and a baseline data center using heat transfer fundamental calculations and equipment data sheets. Variations in environmental conditions and the percentage of heat removed with liquid are investigated. The overall energy savings for these variations and the estimated cost savings are reported. [C178]

"A novel energy-balanced cross-layer multi-path routing algorithm for wireless Ad hoc networks"

In this paper, we propose an energy-balanced cross-layer multi-path routing algorithm for wireless Ad hoc networks. This algorithm utilizes cross-layer information of the network nodes and can balance the energy consumption of the network nodes in flow distribution under the situation that the network topology is maintained unchanged; moreover, the transmission power can be adjusted in routing process to meet the communications requirements and save limited energy; while the network topology changes at random, this algorithm can adjust multi-path routing, balance the energy consumption of network and prolong network survival time according to the comprehensive information of the network nodes. In this way, the simulation results also show that compared with other multi-path routing algorithms, this one can yield a better effect in aspects of prolonging network survival time, reducing average network delay and enhancing the throughput. [C179]

"Integrated energy-aware cyclic and acyclic scheduling for clustered VLIW processors"

The technological trend towards smaller feature size and related implications of reduced threshold voltage and increased number of transistors pose a power management challenge. Leakage power dominates total processor power in smaller technologies. In VLIW and clustered VLIW architectures, the large number of functional units with relatively simpler issue logic contribute significantly to the overall power consumption. The underutilization of functional units (because of inherent limitations in ILP among others) causes a significant amount of this power to be consumed in the form of leakage power. Architectural schemes proposed in the past suffer from a limited program view thereby compromising a good amount of energy savings in the form of extra transitions to/from low leakage mode. Energy aware scheduling in the context of VLIW architectures has mostly focused on acyclic scheduling. In this paper, we propose a simple and integrated compiler directed scheme that obtains significant energy savings in functional units for VLIW and clustered VLIW and works equally well for both cyclic as well as acyclic scheduled regions. Our compiler directed scheme increases energy savings in functional units up to 9% and 26% in VLIW architecture and clustered VLIW architecture respectively. We provide a preliminary

experimental analysis of our algorithms using the Trimaran 4.0 compiler infrastructure. [C180]

"Performance and energy optimization of concurrent pipelined applications"

In this paper, we study the problem of finding optimal mappings for several independent but concurrent workflow applications, in order to optimize performance-related criteria together with energy consumption. Each application consists in a linear chain graph with several stages, and processes successive data sets in pipeline mode, from the first to the last stage. We study the problem complexity on different target execution platforms, ranking from fully homogeneous platforms to fully heterogeneous ones. The goal is to select an execution speed for each processor, and then to assign stages to processors, with the aim of optimizing several concurrent optimization criteria. There is a clear trade-off to reach, since running faster and/or more processors leads to better performance, but the energy consumption is then very high. Energy savings can be achieved at the price of a lower performance, by reducing processor speeds or enrolling fewer resources. We consider two mapping strategies: in one-to-one mappings, a processor is assigned a single stage, while in interval mappings, a processor may process an interval of consecutive stages of the same application. For both mapping strategies and all platform types, we establish the complexity of several multi-criteria optimization problems, whose objective functions combine period, latency and energy criteria. In particular, we exhibit cases where the problem is NP-hard with concurrent applications, while it can be solved in polynomial time for a single application. Also, we demonstrate the difficulty of performance/energy trade-offs by proving that the tri-criteria problem is NP-hard, even with a single application on a fully homogeneous platform. [C181]

"An Energy Saving Scheme Based on Network Coding in WSN"

Energy efficient communication is a key issue in energy constrained wireless sensor network (WSN). Network coding can reduce transmission times and thus help to save transmission and reception energy in many wireless networks. In this paper, we propose a new scheme which applies network coding to WSN. And we compare the energy performance of our scheme, conventional scheme and cooperative diversity scheme. Results show that network coding scheme has better energy efficiency than other schemes especially when the transmission power is low. [C182]

"Optimization of multiple overlapping queries for energy efficient sensor communication"

Sensor networks can be viewed as a large distributed database that captures the underlying physical environment using the deployed tiny sensors. Data capturing can be requested by declaring queries. Due to energy constraint of sensor nodes, efficient processing of queries, specially when multiple of them run in the network, is a critical issue for network longevity purpose. In this paper, we address an energy sensitive model for processing of multiple queries by taking all query running phases into account. The main goal is to reduce redundant functions caused by query overlaps and increase the network life time. Specifically, we formulate energy consumption in different query running phases which helps to select optimum query plans more precisely. The proposed query processing framework is supported by a hybrid routing infrastructure made by both directed routing and flooding. Our evaluation results indicate that proposed framework leads to an energy saving improvement when multiple queries run in the network. [C183]

"Chopping off peak demand using DLS technique-Formulating an intelligent technique for load identification"

This paper identifies electrical load which are brought under DLS technique in order to use effectively for judicious scheduling of loads for chopping off peak load demand. In general an analysis is made on loads, their type, and to suggest how to schedule these loads for an entire day and thereby chopping the peak load demand. The present paper approaches for a problem formulation which helps in timely decision making for those who will be using this technique for chopping peak load demand. This paper analyses on different loads and thereafter gives a decision for those loads that are to be included for DLS technique application and hence reduce the peak demand on a very short span of time. The entire decision making technique is governed by Artificial Intelligent method. This method helps in reduction of peak demand. [C184]

"Developing a corporate-wide strategic energy management program"

The cement industry is undergoing extreme challenges with respect to energy. Energy costs continue to rise, energy markets are volatile and environmental regulations due to climate change present unprecedented pressures on manufacturing. CalPortland has partnered with EPA's ENERGY STARГ,В®Program to develop a corporate-wide energy strategy that attempts to mitigate many of these energy challenges. This paper will cover CalPortland's commitment to energy management through its organization, employee involvement, energy efficiency initiatives and long term strategies. The paper will explore why CalPortland decided to create a

program, how they did it and what the results were. A step by step approach involving the creation and development of the program will be presented. Topics include: energy team organization, energy saving initiatives, renewable energy/alternative fuels, climate initiatives and value chain outreach. The energy program has saved the company millions of dollars, has significantly reduced process emissions and has created a corporate culture that fosters continuous improvement in the areas of sustainability and energy efficiency. [C185]

"Watchdog: Confident Event Detection in Heterogeneous Sensor Networks"

Many mission-critical applications such as military surveillance, human health monitoring, and obstacle detection in autonomous vehicles impose stringent requirements for event detection accuracy and demand long system lifetimes. Through quantitative study, we show that traditional approaches to event detection have difficulty meeting such requirements. Specifically, they cannot explore the detection capability of a deployed system and choose the right sensors, homogeneous or heterogeneous, to meet user specified detection accuracy. They also cannot dynamically adapt the detection capability to runtime observations to save energy. Therefore, we are motivated to propose Watchdog, a modality-agnostic event detection framework that clusters the right sensors to meet user specified detection accuracy during runtime while significantly reducing energy consumption. Through evaluation with vehicle detection trace data and a building traffic monitoring testbed of IRIS motes, we demonstrate the superior performance of Watchdog over existing solutions in terms of meeting user specified detection accuracy and energy savings. [C186]

"Performance Improvement and Energy Saving Based on Increasing Locality of Persistent Data in Embedded Systems"

The performance of embedded systems often suffers from strict cost/size and power/energy limitations. This is especially important for very small systems that are sold in a high number of items like smart cards and RFID controllers. On one hand, small hardware platforms are developed to minimize cost and power consumption. On the other hand, applications have to fulfill strict performance demands. We introduce a high-level performance optimization for EEPROM-based embedded systems. Writing to persistent memory is known to be very costly in the meaning of time and energy consumption. Our proposal shows how to reduce the number of write operations. We introduce an approach to increase spatial data locality without losing reliability of data that has to be stored persistently. [C187]

"Negotiate power and performance in the reality of RFID systems"

Recent years have witnessed the wide adoption of the RFID technology in many important application domains including logistics, inventory, retailing, public transportation, and security. Though RFID tags (transponders) can be passive, the high power consumption of RFID readers (interrogators) has become a critical issue as handheld and mobile readers are increasingly available in pervasive computing environments. Moreover, high transmission power aggravates interference, complicating the deployment and operation of RFID systems. In this paper, we present an energy-efficient RFID inventory algorithm called Automatic Power Stepping (APS). The design of APS is based on extensive empirical study on passive tags, and takes into consideration several important details such as tag response states and variable slot lengths. APS dynamically estimates the number of tags to be read, incrementally adjusts power level to use sufficient but not excessive power for communication, and consequently reduces both the energy consumption for reading a set of tags and the possibility of collisions. We design APS to be compatible with the current Class-1 Generation-2 RFID standards and hence a reader running APS can interact with existing commercial tags without modification. We have implemented APS both on the NI RFID testing platform and in a high-fidelity simulator. The evaluation shows that APS can save more than 60% energy used by RFID readers. [C188]

"Industrial strategies to help reduce energy consumption: A holistic approach for cement producers"

Cement producers have faced a significant rise in energy costs with the introduction of dry-process kilns, with a record average consumption of 100-200 kwh per ton of cement (The Cement Plant Operations Handbook, 2009*). This complex challenge, coupled with rising fuel and energy costs, has prompted cement manufacturers to implement energy management programs to help reduce costs while maintaining competitiveness and increasing profits. This paper will review how many cement producers have reduced energy costs by adopting innovative sustainability programs. A holistic approach teaches a simple five-step process: audit, monitor; analyze; control and optimize. This practice helps customers to identify cost saving measures and evaluate the tools available which are best suited to their specific plant needs: power and energy management systems; variable frequency drives; model predictive control systems; energy audits; and others. Learn how other cement producers have reduced their energy costs by up to 20 percent by finding and eliminating operating

inefficiencies, modifying equipment, driving energy efficiency in product design and modifying processes. Obtain the tools necessary to expand plant operations to include comprehensive energy management programs that will quickly provide measurable results and remarkable cost savings. [C189]

"НфmEnergy: A system to reduce home energy usage for systems and information design symposium"

American home energy consumers comprise a significant portion of ever-increasing U.S. domestic energy usage, and the rise in home energy rates now exceeds inflation. If this trend continues, rising energy costs will further deplete home energy users' expendable income. The EIA projects electricity consumption in the US to grow by 2.9 percent during 2010, and another 1.2 percent next year. While various energy-saving devices are currently available to consumers, their use is hardly widespread. We are in the process of developing a system whose function combines the technologies of digital power meters and active "cut-off current-limiting devices. The system also offers users real-time energy usage feedback, so that homeowners may adjust their daily routines to save energy. It is our hope that such a system, through its ease of use and cost-effectiveness, will be more appealing to the general consumer, and achieve more widespread use. We are currently completing the development and testing of different individual components of this system. Through the development and testing of this system, we better understand why general consumers do not use existing energy-saving technologies to lessen their projected increase in energy consumption. This paper demonstrates the application of energy-saving preferences into design of cost-effective solutions that can have a transformative impact on home energy use into the near- and long-term future. [C190]

"Energy-Aware, Self-Deploying Approaches for Wireless Sensor Networks"

This paper proposes self-deploying approaches for sensor networks. The gravitational field (GF) and the radioactive decay (RD) are used to model the repulsion forces between sensor nodes. The Received Signal Strength (RSS) is transformed to the repulsion force for computing the next move distance and direction. The GF approach reduces the power consumption on communication overheads while the RD approach reduces the physical move distance to save energy. A mechanism called as distance-force ratio (DFR) is proposed to improve the oscillation moving problem which sensor nodes move back and forth during the deploying progress. Furthermore, a hybrid approach which combines two models to save energy on mobility and communication is proposed. Simulation results show that the proposed approaches can reduce the energy spent on mobility and the communication overheads. The hybrid approach inherits the benefits of both models and has well performance on the effective move ratio, the move attempts, coverage, and the deploying time. [C191]

"Exploiting the character of memory accesses to achieve lower power consumption of the data TLB"

Low-power design is quite necessary for the modern power-sensitive embedded systems. Translation Look-aside Buffers (TLBs) can take up significant on-chip energy while translating page addresses. In this paper, we study the memory access behavior of applications drawn from SPEC benchmark suits. In such study, we define a parameter, page interval, to direct our research on saving the power dissipation of dTLB. After that, we present an optimized low-power design for dTLB by introducing an Access Recording Buffer (ARB). The ARB specifically records the high-order bits of the recently-used logical address and that of the corresponding physical address. To decide the optimal configuration of the ARB, we further study different depths and replacement policies to observe their effects on system performance and energy consumption. By running applications drawn from SPEC benchmark suits, the experiment shows most page address translation can be done in the ARB, thus significantly reducing the need to look up the dTLB. Our experiments show that using the ARB can yield an average on-chip energy saving of 30% for dTLB. [C192]

"Application considerations for gapped silicon-carbide arresters installed on utility high voltage systems part II: Energy consumption"

There has been increased global interest recently in identifying opportunities to conserve energy by reducing consumption, both in the residential and commercial areas. One such energy savings opportunity, in the utility environment, relates to the large number of gapped Station and Intermediate Class silicon-carbide (SiC) arresters still installed on utility high voltage systems. These gapped SiC arresters represented state-of-the-art protection during the 30+ years that they were installed (1950s thru 1980s). Application considerations regarding these gapped SiC arresters versus modern gapless metal oxide (MOV) arresters were presented previously in reference[1], which focused primarily on protection and durability concerns. The intent of this paper is to extend this initial effort and focus on energy consumption issues and energy savings opportunities associated with replacement of these high voltage gapped SiC with MOV arresters. [C193]

"Mobile base station management using fuzzy logic in wireless sensor networks"

Due to resource limitations in wireless sensor networks, prolonging the network lifetime has been of a great interest. The energy of sensor nodes is mostly utilized for data transmission to the base station. In hierarchical routing based on clustering, it is the cluster heads responsibility to do that. Thus, it makes them to deplete their energy much faster. In this paper, a mobile base station approach is used to reduce the energy consumption of cluster heads by enclosing the base station to them while a fuzzy logic is applied to manage the base station move. A Critical Degree is assigned to each cluster head by the fuzzy system based on the input parameters such as, energy, proximity to the base station and size of cluster. Then it makes the base station move toward the cluster head with the most Critical Degree so that it can save much more of its energy. According to the simulation results, the proposed scheme has proved its efficiency in the network lifetime, residual energy of network and load distribution. The proposed scheme also proved to have considerable efficiency in different scenarios. [C194]

"Energy-saving design and application for electrostatic precipitation monitor system"

In order to solve high energy consumption and avoid energy wasted in industry, an energy-saving pulse power supply is used in this paper. According to the principle of electrostatic precipitation, the paper analyzes the reason of anti-corona when higher resistivity powder is removed. Electrostatic precipitation can work with high efficiency and energy-saving by using new technique of power supply to avoid anti-corona. It can also auto-adjust the range and the number of pulse with high energy and low energy as closed-looping according to the running voltage value. As well as it can reduce the thickness of powder by technique rebuilding for the electric control power supply, each electric field is finely controlled with different power supply style. For illustration, there gives a project of technique rebuild for energy-saving and reduction of powder discharged in XiBaiPo Electric Power Plant Corporation HeBei province. Practice has proved it will have widespread application and broad prospect to be implemented. [C195]

"Memory system design and implementation for a multiprocessor"

In the era of multi-core processors, the challenge of designing a high efficient memory system is more severe than before. This paper focuses on the memory hierarchy design and implementation on a multiprocessor system. With the distributed shared memory (DSM) model, some techniques have been presented to improve the performance of traditional memory hierarchy and simplify the complexity of cache coherence logic. Moreover, the proposed memory system is in favor of power-saving by reducing the number of times to access the lower-level memory devices. The structure of the memory system has been implemented with a 0.18μm CMOS process and some experimental results are presented. [C196]

"Modeling and reducing power consumption in large IT systems"

This paper proposes a new energy optimization methodology using the Potluck Problem concept for large and complex IT systems. The proposed methodology involves analyzing the historical time-series data about resource utilization in the IT system, and finding interesting temporal patterns therefrom. Based on the analysis, a system of predictors is constructed wherein each predictor provides an estimate of demand for resources in the IT system for a future time period. These estimates are then used in the Potluck Problem solution strategy to obtain final demand predictions. This approach has been tested for efficacy using data from an actual large IT system. Before-and-after comparison is done for computing energy savings had the resources in the IT system been provisioned in accordance with our approach, in comparison with what actually transpired. Following these calculations, policies are designed with an aim to reduce the aggregate power consumption of the IT system. [C197]

"Optimisation of Energy Consumption of Soft Real-Time Applications by Workload Prediction"

Embedded real-time systems often operate under energy constraints due to a limited battery lifetime. Modern processors provide techniques for dynamic voltage and frequency scaling to reduce energy consumption. However, while the processor possibly operates at a lower clock frequency, the running applications should still meet their deadlines and thus set some limits to the use of scaling techniques. In this paper, we propose auto correlation clustering (ACC) as a technique to predict the workload of single iterations of a periodic soft real-time application. Based on this prediction we adjust the processor performance such that deadlines are exactly met. We compare our technique to the broadly implemented race-to-idle (RTI) and identify situations where ACC can gain higher energy savings than RTI. Additionally, ACC can help saving energy in multithreaded processors where RTI can be applied only with a high overhead if at all. [C198]

"System architecture challenges in the home M2M network"

Wireless home networks are extending beyond phones and computers to include every imaginable type of electronic device from TVs and audio components, to appliances and thermostats. The benefits include distribution of multimedia throughout the home, energy savings through remote or automatic control, and reduced cost through packaged services. Though people are often enamored by the technology that provides very broadband wireless streaming for multimedia, an important new class of low data rate machine-to-machine (M2M) devices are key to this highly connected home. The M2M device class is typically characterized by very low power consumption and little or no human intervention. In many cases, they autonomously communicate with each other or with a central controller. The home of the future will be outfitted with many such devices. Applications, such as home security sensing, lighting control, HVAC systems, appliances that run smart grid applications, medical devices, and entertainment systems, will all need to connect and communicate from within the home. There are many challenges in the design of the home M2M network. Varying security, power, and data rate requirements for M2M devices necessitate that they use different network protocols to communicate. The 802.15.4 (ZigBee/6LoWPAN) protocol is well suited for low power / low data rate applications such as HVAC control and appliances. The 802.11 (Wi-Fi) protocol works well for higher data rate applications such as audio and video streaming. Cellular is the best fit for applications that need to roam into and out of the home network. The Bluetooth protocol is well suited for low data rate communications such as audio connections and file transfer. The home network will require an M2M gateway to facilitate communication among the various devices and to provide a connection to a backhaul that reaches the Internet. The gateway can have many different embodiments; it needs to support one or more of the local network pr--otocols as well as the back haul connection to the Internet. The backhaul connection may be Ethernet, cable, DSL, fiber, or cellular. As M2M gateways become more commonplace, they may be integrated into miniature cellular base stations, or femtocells. Femtocells will allow multiple devices (cellular and non-cellular) to access the Internet through an IP-based backhaul. This paper explores some of the many systems architecture challenges that are associated with the evolving home M2M network. In particular, the focus is on the design of the home M2M gateway and the challenges that arise when building a home network that utilizes multiple network protocols. Several questions need to be addressed. First, what protocols should be supported by the M2M gateway and how can the gateway best handle communication between nodes that use different protocols? Second, what data aggregation and dissemination techniques can the gateway use to assist low power/low duty cycle service requirements? Finally, can technologies, such as software defined radio (SDR), be used to build gateways that allow the user or operator to select what network protocols and air interfaces are supported? [C199]

"A Node-Grade Based AODV Routing Protocol for Wireless Sensor Network"

This paper proposes an improved Ad-hoc On-Demand Distance Vector (AODV) routing protocol based on node-grade to reduce the energy consumption of nodes in wireless sensor networks. The improved AODV called Grade-AODV (G-AODV) assigns a grade to each node according to the hop distance of the node to the sink node. The lower grade a node has, the closer it is to the sink. Each node is restricted to receive the route request (RREQ) packet from the nodes which have larger grade than itself. Therefore, the proposed G-AODV can reduce the energy consumption of nodes from two aspects: 1) the useless broadcast of RREQ can be avoided; 2) each packet uses less network resources because the route paths with less hop distance are set up. The performance of G-AODV is evaluated by simulation through OPNET modeler. The simulation results show that the G-AODV has better performance than AODV in view of the utilization and lifetime of network. [C200]

"Impact of Traffic Patterns and Burst Assembly on Energy Consumption in OBS Networks"

Increasing the attention of Green IT, many researches have been studied to reduce energy consumption occurring in network equipments. To reduce energy consumption in network equipments, sleeping concept has been explored in IEEE 802.3az Task Force Group. In this paper, we study factors that affect the performance of the sleeping mode in Optical Burst Switching (OBS) networks: traffic patterns and burst assembly. To do this, we model a router system that supports sleeping mode by using OPNET modeler. We implement various traffic generators and burst assembly methods. Through the simulation, we evaluate the impact of traffic patterns and burst assembly methods to the performance of sleeping mode by analyzing sleeping time, the number of transitions and packet delay. [C201]

"Power-saving effect of permanent magnet on oscillating electromagnetic linear actuator"

The purpose of this paper is to analyze and design an electromagnetic linear actuator for linear pump. Solenoid linear actuator is widely used because it occupies small space: it has no mechanical energy conversion system. In addition, the energy loss is very low and it makes no noise. Conventional solenoid linear actuator, however, has the critical drawback of high power consumption. In this research, we present an electromagnetic linear

actuator using a permanent magnet in order to reduce power consumption. The enhanced performance of the actuator was verified by finite element analysis. [C202]

"Research on Fuzzy-PID control strategy for AC arc furnace electrode regulator system"

This paper studied the Fuzzy-PID control strategy for AC arc furnace electrode regulator system. Based on the classical PID control, this paper used the basic theories and methods of Fuzzy Mathematics to adjust the PID parameters, realized the Fuzzy-PID control strategy, applied it in electrode regulator system and then made the simulation. The simulation results showed that the control strategy of the electrode regulator discussed in this paper adjusted the position of the electrode accurately, regulated the arc length of the electrode to an expectable value. Therefore, this discussed control strategy could suppress the power grid fluctuations, reduce power consumption and save energy. [C203]

"Advanced Mechanisms for Sleep Mode Optimization of VoIP Traffic over IEEE 802.16m"

Since mobile devices are equipped with limited battery power, it is essential to have efficient power management mechanisms in mobile broadband networks such as mobile WiMAX that enable always on connectivity and provide high throughputs. In recent times Voice over IP (VoIP) has emerged as an important and dominant application in broadband mobile networks such as WiMAX. VoIP traffic is uniquely characterized by small packets sent regularly at periodic intervals and are bound by strict latency requirements for satisfactory user experience. This paper presents novel mechanisms to achieve enhanced power saving during a VoIP session by exploiting unique characteristics of VoIP traffic in next generation mobile WiMAX networks based on IEEE 802.16m standard. The analytical model and simulation results indicate that proposed methods reduce the average power consumption during a VoIP call by up to 70% compared to the existing IEEE 802.16m draft specifications. Moreover, the simulation results closely match our proposed analytical model. [C204]

"A Prediction Based Long-Cycle Time Synchronization Algorithm for Sensor Networks"

Existing time synchronization algorithms and protocols mostly focus on improving the synchronization accuracy. However, they usually require frequent resynchronization to keep designed precision in actual applications, which leads to high energy consumption and heavy traffic load. This paper presents a Prediction based Long-cycle Time Synchronization algorithm (PLTS), which puts emphasis on reducing the resynchronization frequency while guaranteeing a given accuracy. PLTS is a combination of periodic synchronization and prediction synchronization. It makes use of an existing time synchronization protocol to accomplish the periodic synchronization, while during the intervals of periodic synchronization, each node applies a prediction model to calibrate its own logic time according to the crystal oscillator's frequency characteristics. By this means, all nodes can keep synchronization till next periodic synchronization starts. Experiment results show that PLTS can reduce resynchronization frequency remarkably and possesses good merits in saving energy and reducing traffic load. [C205]

"Energy Savings through Dynamic Base Station Switching in Cellular Wireless Access Networks"

Reducing the energy consumption of cellular wireless access networks is not only beneficial for the global environment but also makes commercial sense for telecommunication operators. Since access networks are designed to support peak time traffic, the utilization of base stations can be very inefficient during off-peak time because the traffic profile is time varying. We study the dynamic switching of base stations (BS) to reduce the energy consumption considering the time varying characteristic of the traffic profile. We show via analysis that the mean and variance of traffic profile and the BS density are the dominant factors that determine the amount of energy saving that can be achieved. Simulations using ideal and real traffic profiles are used to quantify the potential savings from dynamic BS switching in a realistic setting. [C206]

"Contention-Limited Access Strategies in IEEE 802.15.4 Beacon-Enabled Networks"

Medium access control (MAC) protocols for wireless sensor networks (WSNs) have been extensively investigated in the last years. Although several different protocols have been proposed, and some have been implemented as proprietary protocols in commercial devices, the IEEE 802.15.4 MAC protocol is widely adopted in today's devices. As a result, energy-saving strategies that can be implemented in compliance with IEEE 802.15.4 can be considered of great relevance. In particular, in beacon-enabled networks much energy can be wasted due to contention among nodes sending data to the coordinator. In this paper, we investigate strategies that can reduce this energy waste by splitting the contention window into multiple contention-limited slots. We consider two different alternatives, and propose efficient algorithms that can be used to assign nodes to these slots based on their traffic conditions. The resulting strategies are evaluated by simulation in terms of energy consumption. Finally, a proof-of-concept is discussed to illustrate the feasibility of our proposal. [C207]

"An Energy Efficient Channel Assignment and Routing Algorithm for Multi-Radio Wireless Mesh Networks"

Endowing mesh routers with multiple radios is a recent solution to improve the performance of wireless mesh networks. The approaches proposed in the literature to solve the problem how to assign channels to radio have mainly focused so far on reducing interference or maximizing the throughput. To the best of our knowledge, none of such approaches attempted to save network resources for the purpose of reducing energy consumption and RF emissions. In this paper, a channel assignment and routing algorithm is presented aiming to turn off as many radio interfaces as possible while providing a required level of performance. Simulation studies show that the proposed algorithm enables to achieve nearly the same performance of traditional algorithms while considerably reducing the number of radio interfaces turned on. [C208]

"ATMA: Advertisement-Based TDMA Protocol for Bursty Traffic in Wireless Sensor Networks"

Energy conservation is one of the primary goals of the majority of MAC protocols designed for wireless sensor networks. In Sensor-MAC (S-MAC), one of the first MAC protocols designed for sensor networks, nodes sleep and wake up periodically to save energy. MAC protocols such as Timeout-MAC (T-MAC) and Advertisement-MAC (ADV-MAC) improved upon S-MAC by introducing support for variable loads and providing further energy savings. In event-driven networks with sources generating bursty traffic or networks with period traffic, we can further reduce the energy consumption and increase node lifetime if we take into account the nature of the traffic. In this paper we propose Advertisement-based Time-division Multiple Access, or ATMA, a distributed TDMA-based MAC protocol for wireless sensor networks that utilizes the bursty or periodic nature of the traffic to prevent energy waste through advertisements and reservations for data slots. We provide detailed comparisons of the ATMA protocol with S-MAC, T-MAC and ADV-MAC through extensive simulations. The simulation results show that in bursty or periodic traffics, ATMA outperforms S-MAC, T-MAC and ADV-MAC in terms of energy consumption with reductions of up to 75%, while faring as well as T-MAC and ADV-MAC in terms of packet delivery ratio and latency. [C209]

"Dimming Cellular Networks"

We propose a novel technique called dimming to improve the energy efficiency of cellular networks by reducing the capacity, services, and energy consumption of cells without turning off the cells. We define three basic methods to dim the network: coverage, frequency, and service dimming. We construct a multi-time period optimization problem to implement frequency dimming and extend it to implement both frequency and service dimming together. We illustrate the ability of dimming techniques to adapt the capacity and network services in proportion to the dynamic spatial and temporal load resulting in significant energy savings through numerical results for a sample network. [C210]

"Energy-Efficient WDM Network Planning with Dedicated Protection Resources in Sleep Mode"

Energy-efficient optical networks are gaining momentum as environmental-friendly solutions with reduced operational costs. Energy-efficiency can be achieved by using devices in sleep mode, i.e., a low-power, inactive state in which devices can be suddenly waken-up upon occurrence of triggering events. This paper advocates a sleep mode option for the optical devices (e.g., amplifiers, optical switches) installed for protection purposes only. These devices can be put in sleep mode to reduce the network power consumption, but they can be promptly waken up (if necessary) upon a failure occurrence. This principle is proposed and applied in Wavelength Division Multiplexing (WDM) networks with dedicated-path protection to ensure survivability against single-link failures. The main contribution of the paper is the definition of the energy-efficient network planning problem for resilient WDM networks where optical devices can be configured in sleep mode. Optimal results of the integer linear programming (ILP) problem show savings of up to 25% in the overall power consumption. [C211]

"Differentiated Energy Savings in Optical Networks with Grooming Capabilities"

This paper investigates the benefits of enabling services with differentiated energy-saving (DiffEnS) in WDM optical networks with traffic grooming capabilities. DiffEnS can reduce the operating cost (OPEX) as more customers gradually join green programs and subscribe to the energy efficient traffic services referred to as the Green. Based on a modular node design with grooming capabilities, two heuristic algorithms are introduced for minimizing energy consumption during provisioning of energy-aware services. Using our previously developed auxiliary graph, we report on performance of these heuristic algorithms. Our results indicate that, thanks to DiffEnS moderate energy saving can be achieved, even when a small percentage of customers switch to Green services. A major trade-off is the possibility of an increased average end-to-end delay experienced by Green

services. [C212]

"Protocol-Agnostic Compression for Resource-Constrained Wireless Networks"

Reducing the time the radio is on in wireless devices results in lower power consumption, so sending the same data in fewer bytes can greatly extend the lifetime of a network. In this paper, we explore the use of protocol-agnostic packet compression, a technique orthogonal to current explicit compaction techniques. Because it functions as a transparent layer inside a communication stack and makes no assumption about the specific protocols used, it is generic enough to be used on multiple technologies. Compression is performed by identifying patterns in recent packets and replacing those patterns with bit flags in the transmitted packet. We present the results of compressing actual packet traces collected from several commercial networks using this algorithm and discuss the resource trade-offs of the algorithm. Results indicate compression ratios between 40% and 80%, yielding predicted energy savings of 30-70% in a typical time- synchronized network. [C213]

"Adaptive Parametric Routing Based on Dynamic Metrics for Wireless Sensor Networks"

Designing a QoS-aware, yet energy-saving routing protocol for WSNs is a notoriously hard problem. However, the outstanding interest for this technology, and the growing number of envisioned applications, motivate the need to introduce the notion of Quality of Service (QoS) in these networks. This paper introduces EDEAR (Energy and Delay Efficient Adaptive Routing), an adaptive routing algorithm based on route exploration and reinforcement learning. We evaluate EDEAR with simulations, under various network mobility conditions. Our results show that EDEAR outperforms any other routing protocol, delivering packets with the shortest delay, while reducing energy consumption. As a result, EDEAR's features allow to increase the network lifetime by 9-18%. [C214]

"Feasibility and Benefits of Passive RFID Wake-Up Radios for Wireless Sensor Networks"

Energy efficiency is one of the crucial design criteria for wireless sensor networks. Idle listening constitutes a major part of energy waste, and thus solutions such as duty cycling and the use of wake-up radios have been proposed to reduce idle listening and save energy. Compared to duty cycling, wake-up radios save more energy by reducing unnecessary wake-ups and collisions. In this paper, we investigate the feasibility and potential benefits of using passive RFID as a wake-up radio. We first introduce a physical implementation of sensor nodes with passive RFID wake-up radios and measure their energy cost and wake-up probability. Then, we compare the performance of our RFID wake-up sensor nodes with duty cycling in a Data MULE scenario through simulations with realistic application parameters. The results show that using a passive RFID wake-up radio offers significant energy efficiency benefits at the expense of delay and the additional low-cost RFID hardware, making RFID wake-up radios beneficial for many delay-tolerant sensor network applications. [C215]

"Control of electric louver based on wireless sensor network"

In intelligent building, both lighting and artificial illumination system are very important. In this paper, a daylight monitoring system has been designed. The distribution of daylight is detected by using the wireless sensor network, according to these data, a prediction model about illumination and state of louver will be established. For reaching the requirement of the indoor's illumination, a control system of louver is used to control the lowering length and leaves angle. The purposes of this design are to improve the comfort degree of the users and to decrease the artificial illumination, so, the energy can be saved and the consumption can be reduced. [C216]

"An optimized parallel and energy-efficient implementation of SNOW 3G for LTE mobile devices"

Multi-core processors are becoming attractive for mobile devices because of the performance speedups and power savings they might attain. In this paper we employ such processors to investigate the SNOW 3G ciphering algorithm in the Long Term Evolution (LTE) protocol stack. In particular, we introduce several software optimizations, and present a novel parallel implementation of the algorithm. The proposed parallel design and its serial counterparts are then benchmarked using a simulated mobile phone platform. Evaluation results show that optimizations applied to the serial implementation saves 57% of energy consumption and shortens the execution time to the half. Moreover, the proposed parallel implementation meets the LTE speed, while reducing the energy consumption by 70%, and improving the energy efficiency by a factor of eight. [C217]

"Designing automatic power saving on virtualization environment"

Currently, the data center is equipped with a huge number of servers, storage and networking devices. Aided by the virtualization technology, the population of servers in the data center can be dramatically reduced, thus

enabling a very significant reduction in the power consumption, reduced operational costs, and also enhanced corporate competitiveness. Built upon the virtualization technology and the resource allocation, therefore, this paper will utilize the pre-defined scenario model to propose the scenario-based APS technology. Meanwhile, this research can also integrate the Linux platform to develop the user interface for the scenario-based APS. Furthermore, the virtual framework of the Open Source Hypervisor was set as the standard to verify the model's accuracy and to practically examine the user interface's feasibility. For scenario-based APS technology, the SAMI can construct the pre-defined scenarios model based on actual applications resource requests. Basically, the APS can set the server without workload to standby mode for power saving. Hence, the APS can automatically execute the power distribution optimization from SAMI. When the supervisor discovers any load changes under virtual environment, the wake-up function of the APS would activate the server and then execute live migration of the virtual machines (VM) by utilizing automatic workload balancer. This can achieve a workload balancing for the server and provide a virtualization environment with guaranteed performance for the network or cloud platform. By analyzing the experimental results, the proposed Scenario-Based APS can achieve a approximately 21% reduction in power consumption. Also, the operational performance of the virtual machine can also be safeguarded under the efficient operation of such power-saving model. [C218]

"Optimizing Energy-Latency Trade-off in Wireless Sensor Networks with Mobile Element"

Recent research shows that significant energy saving can be achieved in wireless sensor networks by using mobile elements (MEs) capable of carrying data mechanically. Though ME can reduce the energy consumption at each sensor node, it increases the latency from the time the data is generated at a node to the time the base station receives it. To address this issue, we proposed a collection-based approach in which a subset of nodes served as the data collection points (CPs) that buffer data originated from sources and transfer to ME when it arrives. CPs shorten the trajectory of ME which can gather a large volume of data at a time, however, they also increase energy consumption of nodes to transmit data to them. There is a trade-off between the energy consumption of network and the length of trajectory of ME which is determined by the number of CPs. In this paper, we introduce a Probabilistic Path Selection (PPS) algorithm to reduce the data collection delay for stochastic event detection scenario. Furthermore, we develop a heuristic algorithm and extend to the more general case of combined ME and CPs selection to enable a flexible trade-off between energy consumption and data delivery latency. Our implementation and simulation results show nearly monotonic decrease of data delivery latency for greater limits on the energy consumption, and which is same on the contrary. [C219]

"Energy Saving of Elevator Group Control Based on Optimal Zoning Strategy with Interfloor Traffic"

In this paper, with interfloor traffic condition, the optimal zoning elevator group control strategy is studied aiming at energy saving. First, the energy consumption data of an elevator is analyzed and the energy consumption model is constructed. Then, the optimal zoning strategy for energy saving is designed and solved by genetic algorithm. In this algorithm, the energy conservation and the variance of round trip time are considered simultaneously. In addition, a simulation platform is developed and, by which, a testing model with tri-elevator and thirteen-floor building is constructed and the effectiveness of the energy saving optimal zoning strategy is tested. The results demonstrate that, compared with the traditional average zoning method, the new strategy can reduce the energy consumption by 10.38% and the average waiting time by 41.55%. [C220]

"Study on the countermeasures of low-carbon transformation of construction industry in China"

Low-carbon construction is the inevitable development direction of the construction field in the process of dealing with the climate change. The essence of low-carbon construction is improving the energy efficiency, reducing the emission of greenhouse gas and then to achieve the purpose of energy saving. Starting with the energy consumption and CO2 emission situation in the construction field of China, this paper proposes the energy conservation and emission reduction paths in the construction field. At the same time, for the emission reduction paths, this paper respectively analyzes the strict construction energy-saving standards and the construction carbon emission reduction potential of the new energy and renewable energy sources. Lastly, according to the actual national conditions of China, this paper presents the technology and policy countermeasures for the development of low carbon construction. [C221]

"Sensor selection for collaborative spectrum sensing using SVD-QR"

Collaborative spectrum sensing enables opportunistic unlicensed access to the unused portions of the licensed spectrum. In this paper, we propose an effective sensor selection scheme for collaborative spectrum sensing over shadow fading channel using SVD-QR decomposition. Since shadow fading is correlated for closely spaced sensors, it is desired to select fewer independent sensors to reduce battery consumption and save bandwidth, while still adopting adequate sensors to make the sensing performance satisfied. The proposed scheme can

reduce the redundancy in cognitive radio networks and does not rely on the position information of sensors. The simulation results illustrate that the SVD-QR algorithm outperforms correlation measure based selection method for spectrum sensing. [C222]

"Computational analysis of daylight harvesting scheme in an office building in Mumbai"

Designing a building with maximum utilization of daylight and use of energy efficient luminaires will reduce the cost of energy use. In the present study, by means of computer simulations using RELUX software, the interaction between natural and artificial light and the related illumination conditions expected in a commercial office building in Mumbai, India have been simulated and analyzed. In this way, it was possible to evaluate the relevant loads for artificial illumination that has been considered not as the principal but a complementary light source. The main goal of this study is to show the potential of drastically reducing the electrical energy consumptions for illumination, by adopting day lighting harvesting solutions. Comparison were done using two different lighting schemes one with Fluorescent Luminaires and without daylight harvesting and other one with LED fixtures with daylight harvesting using combined occupancy and daylight dimming sensors. With the latter scheme a saving of 80% can be achieved on energy and operating costs for a period over 25 years. [C223]

"Energy Efficient Assisted GPS Measurement and Path Reconstruction for People Tracking"

In the use of a wearable GPS and cellular tracker for applications such as elderly tracking, device power consumption is an important consideration. To save power, assisted GPS (AGPS) location fixes should not be performed frequently. On the other hand, we also do not want to lose important information about the user's mobility patterns and routines. To solve this dilemma, in this paper, we present the design of a system that intelligently schedules on-line AGPS location fixes only when necessary based on information extracted from user's historical mobility data, and then reconstruct the user path based on these sparsely taken on-line location fixes. Experimental results show that our on-line algorithm can significantly reduce the number of AGPS fixes needed and the reconstruction method works well without a priori knowledge of a map and streets information. [C224]

"Power reduction by register relabeling for crosstalk-toggling free instruction bus coding"

As process technology moves toward the deep submicron level, crosstalk effects are increasingly important considerations especially when adjacent bus lines switch in opposite directions (so called crosstalk-toggling transitions). Crosstalk-toggling transitions not only increase power consumption but also increase transition delays. While many bus encoding schemes have been proposed to totally avoid crosstalk-toggling transitions thus reducing transition delays in synchronous circuit designs, opportunities exist to additionally reduce power consumption. We propose a register relabeling algorithm to further reduce the instruction bus power consumption based on the existing Selective Shielding method. With no extra hardware requirements and no performance loss, the average energy consumption of our design is 94% compared with an unencoded instruction bus using 90 nm technology with a 14 mm bus length, and 13% less than that of an instruction bus with Selective Shielding coding. Our scheme makes Selective Shielding method save more energy. [C225]

"CRAT: A novel routing algorithm for wireless sensor networks based on cooperative MIMO"

Cooperative MIMO technology can be used to reduce the total energy consumption compared with traditional SISO technology under condition that the transmission distances surpass a threshold in wireless sensor networks. In order to solve the routing optimization problem of multi-hop extensible wireless sensor networks based on cooperative MIMO, a novel cost-based routing algorithm with thresholds (CRAT) is proposed. In the algorithm, the routing paths stretch out unboundedly from monitor node and reach the base station ultimately fixed on thresholds, and the routing structure of the CRAT algorithm is different from other cost-based routing algorithms. The energy consumption and thresholds of the algorithm have been analyzed. After that, we define the cost function of CRAT algorithm according to relevant parameters including energy consumption, residual energy, hops and antennas. Finally, the experiments verify the effectiveness of the CRAT algorithm in saving energy, and the reasonableness of the cost function. [C226]

"Towards green wireless access networks"

As wireless communications experience exponential growth, energy consumption has became a crucial problem in the wireless industry. Energy efficiency of wireless systems has to be significantly improved in order to guarantee the sustainable growth of the wireless industry. Plenty of efforts have been carried on to achieve so called green wireless world. In this paper, focusing on energy saving in wireless access networks, we provide an overview on energy saving studies currently conducted in 3GPP LTE standard body. The aim of the paper is to gain a better understanding on energy consumption problems in wireless access networks and identify key

research problems in this field. Currently most of research focus on base station energy saving with efforts to reduce energy consumed by power amplifiers. Less attention are spent on the network level. We believe a holistic network level solution based on novel architecture and methods, such as relay, user cooperation, as well as cognitive approaches, will be prosing enablers towards green wireless access networks. [C227]

"Router performance with AoI and RoI routing for wireless sensor networks"

In order to achieve the best performance of a Wireless Sensor Network (WSN), it is a must to provide a challengeable routing algorithm, which consumes less power and allows more data collection. In this paper we have considered a WSN with mobile sinks and it is considered that the router follows the basic location update algorithm with traffic awareness. We show the performances of a router under two different scenarios. In the first scenario, all the mobile sinks are allowed to move around the entire area of interest (AoI). In the second scenario, regions of interest (RoI) are defined for all mobile sinks. The performances of router under different scenarios are simulated using matlab simulation. Based on the applications of the wireless sensor network and its requirements, the scenarios can be selected But the results shows that for the energy constraint cases it is better to select the RoI scenario by which lifetime of the network can be saved for a long time with reduced energy spent. [C228]

"On the energy aware deployment strategy in cellular systems"

The rapid evolution of telecoms industry is accompanied by a huge increase of energy consumption of mobile networks, which forces the operators to exploit the potential of new techniques to save energy. In this paper, we propose a novel deployment strategy which is able to adapt itself to the spatial variation of the traffic by enhancing the cell radius in the low traffic areas, while the target quality of service (QoS) is still satisfied. Thus, the number of base stations deployed in the low traffic areas is reduced. Since the base station is the most energy-intensive equipment in cellular networks, this reduction naturally leads to significant energy savings for the entire cellular system. [C229]

"A study on development of ESS installed in DC railway system"

The ESS is considered to be one of the useful devices for energy storing and recycling. The ESS reduces primary energy consumption without affecting transport capacity and punctuality. This paper presents the basic performance tests and charging/discharging test of the 1500 V ESS. Characteristics with/without the ESS are also presented for comparison. The verification test on field focused on stabilizing voltage and energy saving. The catenary voltage with the ESS did not drop and rise within the specific voltage limit. [C230]

"Potential of energy-oriented network optimisation: Switching off over-capacity in off-peak hours"

Mobile communication networks are usually planned to provide some minimum service quality level during peak traffic hours. Consequently, in off-peak hours, when traffic loads are lower, the network is characterised by over-capacity, in the sense that same service quality targets can typically be satisfied with a reduced set of network resources, e.g. sites, carriers, etc. In this paper, we propose a procedure for deriving the potential of energy-oriented network optimisation, and apply this procedure to the case of a UMTS/HSDPA network. Depending on the desired performance target and the energy consumption model, energy savings from energy-oriented network optimisation of up to about 40% are shown to be attainable. [C231]

"Energy-efficient predictive tracking for continuous objects in wireless sensor networks"

Due to the severe resource constraints of sensor hardware, energy efficiency is one of critical factors for monitoring the movement of the large-scale phenomena such as wild fire and hazardous bio-chemical material, denoted by continuous objects. In order to save energy, most of existing research on tracking the continuous objects focuses on finding the ways to minimize the communication cost through the effective data delivery such as data aggregation and reducing the number of reporting nodes, and not much work has been done on sensor state scheduling. Energy efficiency is expected to improve if only sensor nodes near the boundary of continuous object actively participate in tracking process, while other sensor nodes stay on sleep state for energy saving. In this paper, we propose a predictive continuous object tracking scheme, called PRECO, which uses minimum set of active sensing nodes to reduce energy consumption. The proposed scheme predicts the future boundary line, which provides the knowledge for a wake-up mechanism to decide which sleeping nodes need to be activated for future tracking. The proposed algorithm is verified with simulation results that total energy consumption can be dramatically reduced under acceptable boundary detection accuracy. [C232]

"Error-Bounded Data Compression Using Data, Temporal and Spatial Correlations in Wireless

Sensor Networks"

Due to the power is limited on each node of wireless sensor networks (WSNs), a data compression mechanism is required to achieve the purpose of power saving. In this paper, an efficient data compression method is proposed to reduce the size of transmission data under the given error bound. We first apply the observed transmission data to construct a static Huffman codebook which is related to the data correlation of the monitoring environment. Given an error bound, the proposed method determines whether the new sensed data should be sent or not by comparing it with the reference data such as the previous sensed data (for temporal correlation), the neighboring sensed data (for spatial correlation) and the codebook encoded data (for data correlation). Thus, the total size of transmission data can be minimized for power saving. Simulation results show that the proposed method can make WSNs more efficient in energy consumption. Even the error bound is set as a small value (under 0.009), the proposed method can reduce a lot of the transmission data (over 65%) to cut down the total energy consumption. Comparing to DF-TS, our improvement is nearly 70% in the total energy consumed. [C233]

"Application and advantages of PAM multi speed motors in petroleum and chemical industries"

For years, engineers have been looking for economical methods to reduce the initial and operating cost of equipment including motors and controls. Not many options exist that will save money and operating cost using a reliable service of a squirrel cage induction motor. Engineers have developed adjustable speed drives (ASD) used with large induction motors in applications such as pumps, fans, mixers, compressors etc. where the power consumption is reduced at lower operating speeds. However, the initial cost of ASD may have to be evaluated carefully. Meanwhile motor designers have been attempting to design induction motors to run at two different speeds. Many large two speed single winding motors have been installed in the field with two operating speeds without the need of an ASD. However, the speed ratio obtained in such motors is limited to 2:1; for example, 3600/1800 RPM, 1800/900 RPM, 1200/600 RPM, etc. These motors have only one winding and are called consequent pole machines. Other two speed machines exist where two independent windings, one for each desired speed are wound into the stator to accomplish different speeds other than 2:1 ratio of operation. The latter type of motors requires more space in stator to accommodate the dual windings making the machine larger, less efficient and more expensive. Pole Amplitude Modulated (PAM) motor is a two speed single winding machine that can accomplish two speeds at different speed ratio such as 1800/1200 RPM, 1200/900 RPM, 900/720 RPM, 900/600 RPM etc. The PAM motors can also be designed for 3 or 4 speeds. This paper will describe the advantages of using multi-speed PAM motors in applications where power required by the load drops significantly when operated at lower speeds, thus saving operating cost. It will also compare and discuss the total losses of the system using an induction motor driven by ASD versus a single PAM motor for typical petrochemical applications. An understanding of the theory and operating asp--ects of Pole Amplitude Modulation are explained. [C234]

"Study on voltage quality of distribution network with high penetration of DG"

The combination of the grid and DG is considered as a main method which can save investment, reduce fossil energy consumption and improve the reliability and flexibility of the power system. However, the high penetration of DG will severely influence the distribution network. This paper studies a typical structure of distribution network, analyzes the principal theory and sets up the simulation model. The simulation analysis at different cases shows that in mid-voltage or low-voltage distribution network, the energy flow from DG is the essential reason incurring voltage quality problems. Moreover, the voltage quality problem mainly comes from the change of the real power due to the big impedance ratio R/X of the line. The voltage quality problem will be improved by injecting power to regulate voltage with the inverter-based DG. From the result of simulation analysis, this paper provides a method to improve voltage quality with the power electronic inverter of DG. [C235]

"A method for energy saving on context-aware system by sampling control and data complement"

Although various systems use multiple accelerometers to recognize minute motions and states in the research area of context-awareness, a conventional architecture can be optimized from the viewpoint of its energy consumption and accuracy. In this paper, we propose a context-aware system that reduces the energy consumption by controlling the sampling frequency of wearable sensors. Even if the sampling frequency changes, no extra configuration is required because the missing data for the controlled sensors are complemented by our proposed algorithm. The evaluation results confirmed a power-reduction of 34.28% with keeping the accuracy. The energy consumption can be reduced without a large loss in accuracy using our system. [C236]

"PIMA: RFID and USN based personalized indoor microclimate adjuster"

Everyone has physiological preference regarding micro-climate conditions such as temperature, humidity and illumination, therefore, personalized micro-climate control could certainly enhance human comfort level in building interior space. 25% of the total national energy consumption is related with buildings, so reducing building operation energy is also necessary. Consequently, innovative sensing technologies such as RFID (Radio Frequency Identification) and USN (Ubiquitous Sensor Network) are adopted to increase occupants' comfort level and to save energy for controlling both hygrothermal and visual environment in a building. This research explored how sensing technology could support a personalized indoor microclimate control to comfortably adapt physical environment to the identified occupant's preference. As the first step, we designed a simple automated environmental control system with home appliances such as heater, humidifier and lamp along with RFID and USN for sensing both occupants and environment. This RFID and USN based personalized indoor microclimate regulator uses multi-threshold scheme not to give an abrupt start or stop of home appliances and will possess learned preference recommendation capability to evolve its personal preference database according to the user's manual override behaviors observed from the system operations. [C237]

"A latency-tolerant MAC protocol for underwater acoustic sensor networks"

Wireless networks with the shared media require Medium Access Control (MAC) protocol that provides contention resolution mechanism. The design of MAC protocol in underwater sensor networks is a challenging issue because of limited energy source and high propagation delay. The most important goal of the MAC design for underwater sensor networks is to resolve data packet collision efficiently with respect to energy consumption. So, selection of MAC protocol is an important task because it has significant impact on the system efficiency. A suitable MAC protocol must consider some factors such as fairness, energy consumption, latency and throughput based on various applications. The bandwidth in the acoustic links is very low because of the characteristics of underwater environment. To solve these problems, we propose a MAC protocol that is based on reserved time slot. A time slot is allocated to each node for sending data in a way that the data does not collide with another node's data. Our protocol can tolerate latency while providing reasonable throughput with low energy consumption. A synchronization algorithm is employed to synchronize all nodes in a distributed manner. The listen/sleep periodic operation is used for saving energy due to long propagation delay and limited energy. The proposed protocol uses short ranges of underwater acoustic communication links to achieve higher throughput. The simulation results show that the proposed protocol increases the overall throughput of the network and reduces energy consumption. [C238]

"Application of Cleaner Technology and experimental design for the reduction of chemical substance consumption in the hard disk drive arm coil assembly process"

The objective of this research is to apply the Cleaner Technology (CT) and Design of Experiment (DOE) concepts in the hard disk drive arm coil assembly process, in order to reduce chemical substance (i.e. epoxy and Isopropyl Alcohol (IPA)) consumption. In the production process, epoxy is used to fix the arms and coils, whereas IPA is used to clean the arms before they are delivered to the production process. These chemicals are toxic and cause irritation to workers if they are not careful. Furthermore, the ineffective use of these chemicals adversely affects production costs. The research methodology was divided into two main parts. The first part employed the CT concept to analyze the loss during production, as well as the causes of loss. Opportunities to reduce those losses could then be recommended. The next step was to further analyze and evaluate a particular CT opportunity using DOE. In this second part of the research, DOE was used to reduce the chemicals used in the process by finding the optimum amount of chemicals used which does not affect the quality of the product. Full factorial experiment 2k, with two replicates was used for screening the four factors, these being: IPA, work-piece curing, epoxy usage and air pressure. The response variable was the arm coil bonding force. The analysis of variance (ANOVA) was conducted. The results of the study show that the optimal operating conditions are: 1) to clean the arms without using IPA, 2) to cure the work-pieces, 3) the filling of 65 mg of epoxy between the arm and the coil, and that 4) there is no significant impact of the air pressure on the arm coil bonding force. The results of the confirmation test show that the arm coil bonding force is in accordance with customer specifications. The results of the experiment have subsequently been put into practice. Thus, reducing the amount of epoxy wasted in the production process helps save approximately 70,208 Baht per annum, while cleaning without usin--g IPA can save 2,154,240 Baht per annum. In conclusion, applying CT and DOE can help to make overall cost savings of 2,224,448 Baht per annum. [C239]

"Dynamic Time based Burst Assemble scheme to reduce energy consumption in OBS network with Low-Power Idle"

Recently, many approaches for Green-IT have been proposed to reduce energy consumption in network. Low Power Idle(LPI) mode can be used to reduce the energy consumption of network equipments. In OBS network, burst assembly scheme, which aggregates the small size packets into large size burst, is important to improve

the performance of LPI mode. However, the conventional burst assemble algorithms have focused on improving the QoS (Quality of Service) without considering energy consumption. In this paper, we propose Dynamic Time based Burst Assemble (DT-BA) algorithm using appropriate burst assemble time to maximize energy saving while guaranteeing the QoS. The burst assemble time is determined by queue status and traffic tendency. The performance of proposed algorithm is evaluated in terms of energy saving, average packet delay and transition count through OPNET simulation. [C240]

"Energy-efficient gaming on mobile devices using dead reckoning-based power management"

We address the issue of how to reduce energy consumption of the wireless interface during multiplayer gaming sessions on mobile devices. Reducing energy consumed by the wireless interface is achieved by putting it in a low-energy state when it is not used. We leverage the dead reckoning technique used in existing games. In dead reckoning, future locations of objects in a game are estimated based on their current locations and velocities. The difference between the extrapolated and true locations is known as the dead reckoning error. We propose an algorithm that employs the dead reckoning error rate to dynamically control the state of the wireless interface. We implement our algorithm into a dead reckoning simulator that is based on a real open-source game. Our experimental results show that the proposed algorithm can achieve up to 36% energy savings for mobile devices. Our proposed algorithm is practical because it does not require much additional code and it allows easy integration with existing games. [C241]

"Global mechanisms to create Energy Efficient and low-carbon infrastructures: An indian perspective"

The Bureau of Energy Efficiency (BEE) in India has proposed the Perform, Achieve and Trade mechanism to improve industrial energy efficiency. Several European countries and Australia have other energy efficiency schemes. Major developing economies like India and China are also engaged in reducing energy consumption, lowering energy intensity in a manner that would be technically feasible and economically viable. This paper compares some energy efficiency schemes which are being implemented or already implemented in countries.We will draw lessons from these schemes in the design of Perform, Achieve and Trade (PAT) mechanism for India. This paper also discusses design and operational features of white certificate schemes mainly in terms of obliged parties, size of target, eligible customers etc. Most of the schemes discussed are based on quantified energy savings obligations imposed on energy distributors or suppliers, coupled with a certification of the energy savings (via white certificates), and a possibility to trade certificates. These market based instruments help countries to encourage investments in energy efficiency improvement and achieve national energy saving targets. The paper looks at several issues that may arise during/after implementation of PAT mechanism. [C242]

"X-architecture zero-skew clock tree construction with performance and DFM considerations"

As IC fabrication technologies get into nanometer era, clock routing gradually dominates SOC performance indicated by delay, cost, and power consumption. Moreover, the yield losses of clock tree induced by antenna effect and via failures are the critical problems in DFM. Based on X-architecture routing patterns, we propose a system of X-architecture zero-skew clock tree construction with performance and DFM considerations. The system first constructs an X-clock tree and inserts buffers for reducing delay. To fix the antenna violations in clock tree, jumper insertion and layer assignment techniques are applied. Moreover, redundant vias are placed to improve via yield. Experimental results on benchmarks show that our system can outperform the existing works on delay reduction, power saving, via count, antenna violation fixing, and double-via insertion rate. [C243]

"An FPGA architecture supporting dynamically controlled power gating"

Leakage power is an important component of the total power consumption in FPGAs built using 90 nm and smaller technology nodes. Power gating, in which regions of the chip can be powered down, has been shown to be effective at reducing leakage power. However, previous techniques focus on statically-controlled power gating. In this paper, we propose a modification to the fabric of an FPGA that enables dynamically-controlled power gating, in which logic clusters can be selectively powered-down at run-time. For applications containing blocks with large idle times, this could lead to significant leakage power savings. Our architecture utilizes the existing routing fabric and unused input pins of logic clusters to route the power control signals. No modifications to the existing routing algorithms are required to support the new architecture. We study the area and power tradeoffs by varying the basic architecture parameters of an FPGA, and by varying the size of the power gating regions. We also study the leakage energy savings using a model that characterizes an application in terms of its structure and behavior. We show less than 1% of area overhead for a power gating region size of 3X3 logic tiles. Using the application model, we show that up to 40% leakage energy reduction can be achieved using the

proposed architecture for different application parameters, not including power dissipated by the power state controller. [C244]

"Rate-switching unequal error protection for wireless electrocardiogram (ECG) transmission"

Energy efficiency for mobile wireless electrocardiography (ECG) communication is an important issue due to resource constraints in wireless Body Area Sensor Networks (BASNs). Traditional high quality ECG transmission schemes require substantial amounts of energy usage, which may not be available in BASN. Therefore, an adaptive approach is necessary to provide high quality ECG transmission with efficient usage of available energy resources. Related literature mainly focuses on data compression, where transmission energy is saved because the amount of data being transmitted is reduced. However, further reduction of energy consumption based on communication strategy is rarely discussed in literature. In this paper, we analyze the characteristics of compressed ECG data, which show that different parts of the data are unequally important to quality of ECG transmission in BASN. In this work, we propose a new Rate-switching Un-Equal Protection (RUEP) mechanism, which optimizes the distortion reduction of ECG data by adaptively assigning different Rate Compatible Punctured Convolutional (RCPC) codes to protect the different parts of the compressed ECG data. Simulation results demonstrate that our RUEP scheme results in an improved communication energy efficiency by at least 45 percent compared with traditional schemes in the AWGN channel. [C245]

"Adaptive resource provisioning using traffic forecasting for energy efficient networks"

A traffic forecast model for a multilane sleep/wake link is investigated where energy consumption can be significantly reduced. A Box-Jenkins ARIMA forecast model is investigated and applied for traffic forecast. The relations among forecasting confidential interval, energy saving performance, buffer size requirement for lossless network are investigated. [C246]

"Research on wind and grid power intelligent complementary system in oilfield"

With the rising of energy prices and greenhouse gas emissions, new and renewable energy demand is increasingly urgent. The development of wind power is the fastest new and renewable energy area. Large-scale application and natural characteristics of wind power have directed that wind power market must take a diverse development path. Non-grid connected wind power system development is the diversified exploration and practice of wind power development. According to the theory of non-grid connected wind power, it can be directly applied to a series of high-energy consumption and pollution-free green industries that can be suited to the wind power characteristics. Oil fields are large energy consumers, and in order to achieve energy reduction targets, non-grid connected wind power should be used in petroleum production, which is an important theoretical and practical innovation. Africa has rich wind resources, and broad market prospects for wind power exploitation; Africa also has rich petroleum resources, is one of the world's eight major petroleum producing areas, and has 20 petroleum producing countries. This non-grid connected wind power system can be directly applied to petroleum machine production system by building interactive intelligent electricity supply systems, making wind power and grid power complementary. The use of local wind energy can have strategic importance to reduce the cost of African petroleum companies, and improve production efficiency and energy savings. [C247]

"Modeling and analysis for the coexistence of PSC I and PSC II in the IEEE 802.16e system"

In wireless communication system, power saving mechanism is a key issue since a mobile station operates depending on limited power. Hence, the IEEE 802.16e system provides three types of power saving classes (PSC I, PSC II and PSC III) for the mobile station (MS) to reduce power consumption. Many models have been made to analyze the performance of power saving mechanism (PSM) of the IEEE 802.16e system. Although many researches have been studied about the PSC I and PSC II, no work has conducted the performance of PSM considering the coexistence of the PSC I and PSC II. Hence, in this paper, when the PSC I and PSC II are used simultaneously, we model the power saving mechanism (PSM) using a discrete-time Markov chain (DTMC) technique. We develop an analytical model considering the characteristics of the PSC I and PSC II. Using the model, we analyze the performance of the PSM by using several metrics such as power consumption and response delay. Then, by comparing numerical analysis with simulation results, we validate a proposed model. [C248]

"Header Compression Mechanism in MPEG2 TS over IEEE 802.15.4"

The IEEE 802.15.4 protocol is a well accepted standard for wireless sensor network (WSN). To deliver the video data in WSN, MPEG2 TS over IEEE 802.15.4 networks is constructed. For lower energy consumption, the MPEG2 TS header compression mechanism is proposed. The simulation shows that the proposed mechanism reduces the length of MPEG2 TS packet around 4-5%. The proposed mechanism can save the energy and

increase the video quality in low-rate WSN. [C249]

"A New Virtual-Address-Mapping Mechanism for Low-Energy I-Cache"

WPSA (Way-predicting set-associative) cache is a well-known approach to reduce the set-associative I-cache's energy consumption. However, an extra cycle is needed if a prediction miss occurs. This may actually degrade the performance. This paper proposes a new virtual-address-mapping mechanism to aim at only accessing one way in I-cache within one cycle by adding a virtual address matching table which is implemented parallel to the TLB's address translating. This approach reduces the energy consumption while maintaining the performance. Simulation-based evaluation shows that in contrast with the conventional set-associative I-cache, the approach we proposed can reduce about 63%~66% energy consumption and improve nearly 10% performance versus way-predicting access. Even though there are still energy costs, the method still saves a lot of energy. [C250]

"Sequential and Cooperative Distributed SA-Type Algorithms for Energy Optimization in Embedded Systems"

Reducing memory energy consumption in embedded systems is crucial. In this paper, we propose new sequential and distributed algorithms based on Simulated Annealing (SA) in order to reduce memory energy consumption in embedded systems. Our algorithms outperform the Tabu Search (TS) approach. In fact, our algorithms manage to consume nearly from 76% up to 98% less memory energy than TS. Execution time savings for the distributed SA version (from 65.63% up to 75.34% for a cluster of 6 PCs) are also recorded. [C251]

"Adaptive self-triggered control over IEEE 802.15.4 networks"

The communication protocol IEEE 802.15.4 is becoming pervasive for low power and low data rate wireless sensor networks (WSNs) applications, including control and automation. Nevertheless, there is not yet any adequate study about control systems networked by this protocol. In this paper, the stability of IEEE 802.15.4 networked control systems (NCSs) is addressed. While in recent works fundamental results are developed for networks that are abstracted only in terms of packet loss and time delays, here the constraints imposed by the protocol to the feedback channel and the network energy consumption are explicitly considered. A general analysis for linear systems with parameter uncertainty and external bounded disturbances with control loops closed over IEEE 802.15.4 networks is proposed. To reduce the number of transmissions and thus save energy, a self-triggered control strategy is used. A sufficient stability condition is given as function of both the protocol and control parameters. A decentralized algorithm to adapt jointly the self-triggered control and the protocol parameters is proposed. It is concluded that stability is not always guaranteed unless protocol parameters are appropriately tuned, and that event-triggered control strategies may be difficult to use with the current version of IEEE 802.15.4. [C252]

"Power saving clusters for energy-efficient design of fiber-wireless access networks"

Wireless and optical broadband access technologies are foreseen to converge by combining the high transmission capacity of the optical communications with the flexibility and the ubiquitous nature of the wireless communications in order to satisfy the growing end-user demand for bandwidth. This hybrid technology eliminates the cost of running fiber to the destination by allowing the fiber deployment until a certain point from where wireless base stations take over to provide service to the end-user. Despite handling the growing end-user demand, new telecommunication technologies are required to be energy efficient. Recently, there is an increasing interest to reduce the energy consumption of the Information and Communications Technology (ICT) sector and the ICT related CO2emissions. In this paper, we propose an energy efficient design scheme for a fiber-wireless network consisting of a WDM-PON in the optical back-end and a 4G broadband access technology-enabled wireless front-end, e.g. Long-Term Evolution (LTE) or WIMAX. The proposed design scheme uses the average load profiles on the WDM-PON segments and attempts to form power saving clusters (PSCs) which are fiber rings interconnecting several hybrid (fiber-wireless) access networks. Each PSC enables one or more OLTs to sleep and distributes the backlogged traffic among the active segments in the ring. The proposed scheme aims to maximize the number of sleeping segments, and consequently maximize the power saving. Through simulations, we show that the proposed scheme leads to a power saving between 20% and 45% with a maximum of 3.5% increase in the fiber deployment cost by running the interconnection fibers to form PSCs. [C253]

"TopCoF: A Topology Control Framework for Wireless Ad Hoc Networks"

Topology Control (TC) is a well known technique used in wireless ad hoc and sensor networks to reduce energy consumption. This technique coordinates the decisions of network nodes about their transmission power to save

energy, prolong network lifetime, and mitigate MAC-level medium contention, while maintaining network connectivity. In order to ease the implementation and the study in systematic way of proposed TC protocols, in terms of energy usage and network graph properties, we propose a new framework based on NS-2 simulator. The framework is named TopCoF and composed of two main parts. The first one consists of a set of NS-2 extensions to support TC, while the second is a graphical user interface for statistical analysis and visualization of simulation results traced by the first part. TopCoF is modular and generic since it implements a set of basic components used by TC protocols. [C254]

"Power-performance optimization using fuzzy control of simultaneous supply voltage and body biasing scaling"

Adaptive voltage scaling (AVS) leads to considerable power consumption savings in processors when maximum performance is not necessary. Simultaneous use of body biasing techniques and AVS can be used to reduce power in high performance processors without performance penalty. We present a new strategy for employing simultaneous AVS and forward body biasing (FBB) in determining the optimal trade-off between supply voltage and body bias voltage such that power consumption at a particular performance is minimized. For this purpose, an adaptive fuzzy logic controller is designed to make decision for optimal pair of supply and body bias voltage without sacrificing circuit performance. We evaluate usefulness of the method by applying it on real-time monitoring of a processor's supply current when it executes an MPEG 2-decoding application. We achieved an average of 10.03% power reduction without performance penalty and 20.13% power saving at less than 5% performance penalty using proposed simultaneous AVS and FBB compare to fixed supply and body bias voltage. [C255]

"Voltage island design in multi-core SIMD processors"

Today, power management is a key design objective in chip fabrication. In this paper, we present a novel approach to reduce power consumption in SIMD based multi-core architectures. Voltage scaling technique is used, by implementing voltage islands, to optimize power and performance tradeoff for the cores. The number of islands and their respective voltage are selected based on the power-delay characteristics of each instruction: slow instructions run at the nominal voltage while fast instructions run at a lower voltage to save power. An image compression algorithm is mapped into the hardware to demonstrate the power reduction. The results show energy savings of 2.0X for the specified application. [C256]

"A cross-layer approach to save energy in 3GPP-LTE terminals"

Reducing the energy consumption is one of the most demanding design targets for mobile devices. To this end, we develop a 3GPP-LTE cross-layer design that combines the functionality of Media Access Control (MAC) and Physical (PHY) layers with the power consumption of the hardware platform components to achieve an optimized solution in terms of energy consumption. Models for the baseband, the hardware, and the MAC are merged such that tuning their parameters leads to an optimal solution for a given path loss and data rate. Energy gains larger than 50% are obtained with this approach compared to two state-of-the-art approaches. [C257]

"Relay assisted cellular system for energy minimization"

Relay assisted cellular system is a promising infrastructure redesign to enhance the performance of wireless systems. The use of intermediate nodes to relay information from source to destination can be efficient in eliminating black spots, extending coverage region, improving fairness in terms of capacity spread over the cell, saving power by reducing overall transmission and prolonging battery lifetime of user. This paper investigates the power saving potential of Fixed Relay Station (FRS). The basic essence of utilizing a FRS is to reduce the transmit power requirement of mobile station (MS). We assume that each wireless route includes at most one FRS. Results of theoretical analysis and computer simulation of relay assisted cellular network show more than 50% (4 to 5dB) saving in energy consumption for pathloss index of 4. Further the effects of intercell interference in a twohop cellular network is investigated in this paper. Simulation results of Long Term Evolution-Advanced (LTE-A) Urban Macro scenario with inband relays show that even after energy minimization the Signal to Interference noise ratio (SINR) of a twohop cellular network is comparable to that of a traditional cellular network. [C258]

"Optimizing the parameters of active sensor selection and using GA to decrease energy consumption in point coverage wireless sensor networks"

Energy and lifetime are the most important design objectives in many wireless sensor network applications. In asymmetrical sensor networks, different sensors with various abilities are used. It is crucial to select the

parameters of fit function and monitoring sensors optimally in a point coverage network. In this paper, our approach uses genetic algorithm to optimize the parameters of monitoring sensor selection for each round in a point coverage network. Optimal selection of covering nodes for point coverage is done by effective deletion of redundant nodes, considering data transmission cost and heeding the energy of relay nodes for the whole previous lifetime of the network. Reducing the number of active sensors, in a covering set, saves more energy and consequently increases lifetime. Simulation results demonstrate that our algorithm to optimize selection parameters is effective in lifetime prolonging and energy consumption reduction for each round or the whole time of network activity. [C259]

"Development of the grooming techniques for reducing network traffic in sensor networks"

Sensor networks are widely used in environmental exploration, military systems, and factory production monitoring. They usually have limited battery source and link bandwidth. Many algorithms have been proposed till now that considered three functional components namely data gathering (sensing and acquisition), data transport and data analysis (processing). In general power is consumed whenever a bit is generated, transmitted or processed. So, various network architectures and different protocols have been proposed for saving energy consumption and extending the life time of sensor node. Our aim, therefore, is to reduce the number of bits to be transported to achieve energy efficiency. This can be done by recognizing the type of stream data, compression based on the source and grooming/aggregation of the traffic. So, we have developed a compression algorithm which is based on identified distribution of sensed stream data of source which aims to reduce network traffic in order to save power by combining both compression algorithm and state model. [C260]

"A Dynamic Dual-Rate Beacon Scheduling Method of ZigBee/IEEE 802.15.4 for Target Tracking"

ZigBee/IEEE 802.15.4 beacon-enabled mode allows low duty-cycle operation with high energy saving in the wireless sensor network. However, low duty cycles introduce higher end-to-end delay in event propagation and generally lower reactivity of the network with respect to the actual sensing. In target tracking systems, both qualities should be satisfied, namely, low energy consumption while no target is being tracked and low end-to-end delay in target tracking mode. Hence, we need to define a trade-off between the energy consumption and the end-to-end delay. In this paper, we propose a dynamic dual-rate beacon scheduling method with two rate switching schemes modifying ZigBee/IEEE 802.15.4 to enhance its real-time property but still maintain the advantage of low energy consumption. We evaluate our scheme through a simulation using the OPNET simulator. The results show that our scheme exhibits low energy consumption while presenting reduced end-to-end delay, outperforming usual single rate working modes. [C261]

"Energy efficient technologies and contribution of industries"

The revolution in the field of science led to proliferation of Industries and these industries play a key role in the economic development of the society but the impact on the environment is a devastating one. Release of toxic gases into the atmosphere, soil degradation, and water pollution created global warming and unpredictable climatic changes. The energy, in the form of raw materials, power and other utilities, are consumed without taking into consideration of their importance and in this scenario, conservation of energy becomes significant to protect the environment. To achieve this, industries should adopt the energy efficient technologies to reduce the specific energy consumption and also to act as environment friendly. Such energy efficient technologies have been adopted in a fertilizer industry at Chennai that have a remarkable impact on the protection of environment and lowest energy level among the naphtha based fertilizer industries in India. This study focuses on the various technologies adopted by this industry to reduce energy levels and protection of the environment. CO2 absorption system: Carbon-di-oxide emission to atmosphere is avoided, saving the environment. Hydraulic turbine resulted in energy savings of 0.071Gcal/MT of ammonia. Low temperature super methanation catalyst resulted in energy savings of 0.047Gcal/MT of ammonia. Total heat recovery system in Urea process resulted in the reduction of energy level to 7.9Gcal/MT from 9.9Gcal/MT. York Compressor reduces the ammonia emission to atmosphere. Vaporized naphtha burners for firing system resulted in the energy savings of 2-2.5Gcal/MT of Ammonia and saving the environment. Process air compressor resulting in energy savings of 0.02Gcal/MT of ammonia. [C262]

"Energy consumption assessment in LTE baseband of eNodeB and guidelines for green baseband subsystems"

Energy consumption is an issue in general in information and communication technologies (ICT), but also cellular communications in particular. Base station sites are the main energy consumers in a mobile network. Their energy consumption significantly contributes to green house gas (CO2) emissions. Hence, service providers are looking for energy saving solutions in their existing and future deployments which in turn reduces the CO2foot print and operational costs. There is a little study in assessing energy requirements of baseband

functions of base station (e-nodeb) due to its energy consumption contribution is significantly low when compared to other more energy hungry components such as power amplifiers, analog frontend and protocols. In this paper, we have assessed energy consumption in MIMO-OFDM baseband functions of LTE eNodeB on a typical multi-core processor. In particular, implementing such computationally complex algorithms energy efficiently pose certain challenges such as less complex algorithm selection, architecture selection, algorithm architecture mapping, and energy management strategies. We have given the guide lines for addressing these challenges. [C263]

"A New Power-Aware Scheduling Algorithm for Distributed System"

By dynamically adjusting CPU speed and voltage with DVS technique, it is possible to save significant amounts of energy with no or little performance loss. There are numerous algorithms published with this goal, most of which concern the power-aware management in real-time system, embedded system, wireless sensor work etc. In this paper, we present a heuristic algorithm, applying the DVS technique in distributed system, where we place high importance on communication time between processors. At the same time, we concentrate on a large number of tasks. In this situation, we could divide a dependent task into many subtasks, which could be concurrently executed on processors in distributed system. After a shortest deadline has been made, our power-aware scheduling algorithm will reduce the energy consumption without affecting its performance. The experimental results show that our algorithm can reduce the CPU energy consumption by up to 40 percents, or even more, with an average of nearly 36 percents. [C264]

"A Structural Customization Approach for Low Power Embedded Systems Design"

Power consumption is a critical design issue in embedded systems. This paper presents a structural customization approach, targeting two basic design structures for a multiple choice function that is common in an embedded system: tree structure and chain structure. A theoretical comparison between these two structures is performed. We find that the chain structure has a lower area cost and offers more customization opportunities, for improving performance and power efficiency, than the tree structure. We then propose two algorithms to reduce power consumption of the chain design for different performance constraints. A case study on ALU (Arithmetic and Logic Unit) customization has been carried out, Our experiments show that up to 50 percent of ALU power consumption can be saved with our customization approach. [C265]

"Energy-Aware Loop Parallelism Maximization for Multi-core DSP Architectures"

With the advance of semiconductor, multi-core architecture is inevitable in today's embedded system design. Nested loops are usually the most critical part in multimedia and high performance DSP (Digital Signal Processing) systems. Hence, maximizing loop parallelism is an important issue to improve the performance of a modern compiler. This paper studies how to maximize the system performance with the consideration of energy reduction for applications with multidimensional nested loops on multi-core DSP architectures. An algorithm, EALPM (Energy-Aware Loop Parallelism Maximization), is proposed in this paper. We implemented a two phase strategy. First, the strategy uses retiming and loop transformation to parallelize nested loops. Then the strategy employs a novel voltage assignment algorithm to reduce total energy consumption. The experimental results show that on average, both performance and energy-saving can be significantly improved using the EALPM algorithm. [C266]

"A novel cooperative image transmission scheme in Wireless Sensor Networks"

Reducing transmission energy consumption is one of the most critical research issues in the area of Wireless Sensor Networks (WSNs). In this paper, we present our scheme for employing collaborative signal enhancement to achieve energy efficient image transmissions in WSNs. A collaborative signal enhancement approach is compelling due to its capability of saving individual energy consumption by spreading total transmission consumption over multiple sensors. Individual packets describing an embedded wavelet-encoded image exhibit a significantly unequal contribution towards image quality. By leveraging this fact we develop a strategy of appropriately selecting the number of collaborative sensors for each packet transmission in order to achieve the highest possible image quality given a restricted transmission energy consumption budget. Experimental results show that our proposed approach can provide about 2dB higher image quality under the same energy budget compared with the state-of-the-art collaborative transmission scheme in WSN literature. [C267]

"Energy Savings Modeling and Performance Analysis in Multi-Power-State Base Station Systems"

Continuously growing energy consumption in cellular networks motivates the research towards energy saving approaches. Among previous work, many studies suggest different base station shutdown strategies to reduce the transmission power in case of low or no traffic. Besides the strategy that shutdown base stations completely,

our work suggests and evaluates the usage of partial shutdown strategy for multi-antenna base station systems, which allows a better adaptation of power to the network traffic which required by the users. We use Markov Chain to model user traffic and select appropriate state between different power-states of the multi-antenna base station. We evaluate the dependency of the energy saving on the number of antennas and the radius of cells, preserving the coverage of a certain region. The results show that systems with higher number of antennas can better adapt the power to the user traffic requirements. Further, we search for optimal cell radius, showing that it has more important role in case of higher user traffic. [C268]

"Dynamic File System Migration for Energy Efficient Storage Management"

Existing computer systems do not allow the user to access the system when turning off the disk containing the OS for saving energy. Thus existing studies have focused on devising effective disk spin up/down schemes. This paper proposes the scheme to keep on providing limited services as well as to improve the energy consumption in computer system. To do so, we employ the method that moves the root file system of the HDD to a RAM disk, in order to be able to access the system even in the case of a power-down of the disk containing the OS. Also, we realize the autonomic system migration by judging the system activity -- the CPU and user activity. By doing so the power management system can reduce the power more remarkably than in existing systems, and in experimental evaluation we could save power consumption of 8.1-14.4%. [C269]

"Energy Source Aware Target Cell Selection and Coverage Optimization for Power Saving in Cellular Networks"

The spread of mobile connectivity is generating major social and economic benefits around the world, while along with the rapid growth of new telecommunication technologies like mobile broadband communication and M2M (Machine-to-Machine) networks, larger number of various base stations will be employed into the network, which will greatly increase the power expense and CO2emission. In order to degrade the system power expense, variety of researches on new energy and novel transmission technology are put in agenda. In this paper, instead of reducing the absolute power expense, the research focuses on guiding more power consumption into green source energy, which implying that the UEs (User Equipment), especially the cell edge UEs, will have preferential access to the BSs (Base Station) with natural energy supply. To realize the tendentious connection, two detailed approaches are proposed, the HO (Hand Over) parameter tuning for target cell selection and power control for coverage optimization. The system evaluation shows that, by proper setting of parameters in HO and power control, both of the two approaches can achieve good balance between energy saving effect and system throughput impact. [C270]

"An ultra low power 9-bit 1-MS/s pipelined SAR ADC for bio-medical applications"

This paper presents a pipelined successive approximation register analog-to-digital converter (SAR ADC) for bio-medical applications based on 65 nm CMOS technology. Without using op-amp, the proposed 9-bit pipelined SAR ADC can reduce the capacitance from 512C to 64C. The pipelined architecture can enhance the operation efficiency of the ADC and also save the digital power consumption in the SAR. The simulation results show that the total power of the ADC is 10.26 μW only, and the figure of merit (FOM) of the ADC is 28.3 fJ/conversion-step. [C271]

"Genetic algorithm based variable ordering of BDDs for multi-level logic optimization with area-power trade-offs"

Boolean logics when implemented as BDDs can be graphically manipulated to reduce the number of nodes and hence the area. Ordering of BDD nodes play a significant role in this context. Most of the algorithms for input variable ordering for OBDD focus primarily on area minimization. However, suitable input variable ordering helps in minimizing the power consumption also. In this particular work, we have adopted a genetic algorithm based technique to find an optimal input variable order, while node reordering is taken care by the standard BDD package. Experimental results show a substantial saving in area and power. We have also compared our technique with other standard methods of variable ordering for OBDDs and found to produce superior results. [C272]

"PCFS: Power Credit Based Fair Scheduler Under DVFS for Muliticore Virtualization Platform"

In the area of system architecture, there are two most significant trends: multi-core and system virtualization technology. Both of them have quite close relationship with energy efficient computing. Industry turns to integrate more cores on a single chip instead of increasing frequency to solve the heat problem. Meanwhile system virtualization could decrease the total power consumption by sharing the same platform among different

operating systems. So the necessity of power management on the multi-core virtualization platform has become increasingly evident. However, traditional virtual machine monitor schedulers could not make efficient use of DVFS, and thus could not take it into considering that the guest OSes may run at different frequency. In order to address this problem, this paper designs a power efficient scheduler which uses the load and the power level of the guest OSes as feedback, and implements a prototype based on Xen virtual machine monitor. This scheduler allocates power credit to VCPU of each guest OS, accounts the power consumption of VCPU sat different speed levels and makes scheduler decision by integrating it to the credit oriented to CPU time slice sharing. It also uses utilization of processors as feedback and sets frequency according to the load change trends instead of the simple static relationship between load and frequency policies, so as to decrease the speed steps required by response to burst load change. Experiment results show that the scheduling fairness of guest OS improved when using DVFS as main power saving method, and the power consumption of the whole system can be reduced by 5 percent-30 percent. Therefore, this framework for feedback scheduling could make efficient use of varieties of power saving methods and maintain ideal balance between overall system power saving and single core over heat. [C273]

"Snooze: A Scalable, Fault-Tolerant and Distributed Consolidation Manager for Large-Scale Clusters"

Intelligent workload consolidation and dynamic cluster adaptation offer a great opportunity for energy savings in current large-scale clusters. Because of the heterogeneous nature of these environments, scalable, fault-tolerant and distributed consolidation managers are necessary in order to efficiently manage their workload and thus conserve energy and reduce the operating costs. However, most of the consolidation managers available nowadays do not fulfill these requirements. Hence, they are mostly centralized and solely designed to be operated in virtualized environments. In this work, we present the architecture of a novel scalable, fault-tolerant and distributed consolidation manager called Snooze that is able to dynamically consolidate the workload of a software and hardware heterogeneous large-scale cluster composed out of resources using the virtualization and Single System Image (SSI)technologies. Therefore, a common cluster monitoring and management API is introduced, which provides a uniform and transparent access to the features of the underlying platforms. Our architecture is open to support any future technologies and can be easily extended with monitoring metrics and algorithms. Finally, a comprehensive use case study demonstrates the feasibility of our approach to manage the energy consumption of a large-scale cluster. [C274]

"Intelligent Power Management Over Large Clusters"

There is a growing tension within large organisations such as universities between the desire to perform vast amounts of computational processing and the desire to reduce power consumption by switching off computers. This situation will only worsen as computational problems get larger and the desire to save energy escalates. Through careful management of computing resources it is possible to maximise effective computer usage whilst minimising power consumption though this can be costly in terms of human effort. We present our work with the Agility Cloud Computing Platform to provide intelligent control over a University-wide Condor system, which works to reduce power consumption without adversely affecting the Condor users. This system also provides auditing of the power usage, which can be used to determine the power efficiency of the Condor system. [C275]

"Green spectrum management for mobile operators"

This paper proposes intra-operator dynamic spectrum access, i.e., dynamic spectrum access by an operator's networks of its available spectrum bands, as a means to improve power efficiency. It is based around four areas of interest: (i) dynamically moving users into particularly active bands from other bands to allow radio network equipment in those other bands to be switched off when possible, (ii) the dynamic sharing of spectrum in order to take advantage of better propagation bands and reduce necessary transmission power, (iii) the sharing of spectrum to allow channel bandwidths to be increased thus allowing transmission power to be significantly decreased, and (iv) the better hierarchical management of spectrum in cases where different types of cells coexist. Numerical results show a significant potential for such spectrum management solutions to reduce power consumption for the operator by some 50% or more, with further potential saving if there is a lower correlation in traffic loads among the operator's networks/frequencies. It is noted that although the main objective of this paper is power saving, the concepts presented can also be used for other purposes, such as to increase achievable capacity. [C276]

"Dynamic transmission capacity control schemes for power saving using a mixture of the history and the latest information"

Power saving technology for the Internet has become a vital issue because of the growing energy consumption,

caused by the increasing traffic demand. Thus, we have proposed a scheme to dynamically control the transmission capacity between switches in order to reduce the power consumption on the basis of the change in traffic volume. In this paper, the transmission capacity is better estimated by taking into account the history information of the amount of arriving traffic. We propose two types of schemes, which slightly differ in their use of a mixture of the history information and the latest information. Using simulation studies including an evaluation with real traffic, we show that the proposed schemes can achieve high power saving capability as well as sufficient communication quality. [C277]

"Power-aware routing with rate-adaptive network elements"

Current Internet service-provider networks are typically over-provisioned, with the actual traffic through a network element often being much less than the capacity of the network element. However, current network element power consumption is largely independent of actual traffic. This presents an opportunity to reduce network power usage. Such an opportunity may be exploited locally, by redesigning individual network elements to make them rate-adaptive, or globally, by power-aware traffic routing. Instantiating either approach requires significant engineering effort. We attempt to quantify, as realistically as possible, the power-savings opportunity that can be obtained using these two approaches, in isolation or together. In particular, we investigate whether power-aware routing provides any additional benefit if network elements are rate-adaptive. We adopt a fairly simple model of network power use, where power consumption is attributed to links. A link may be turned off, in which case its power usage is zero. Otherwise, a link that is turned on consumes no less than a certain amount of power, called base power, and power use increases further with traffic. A significant parameter of the model is the ratio of base power over full-capacity power. Since it is difficult to estimate feasible values for this ratio, we investigate multiple scenarios in which its value ranges from 0 to 100%. We demonstrate that the combination of rate-adaptivity and power-aware routing saves a significant fraction of network power consumption, for a wide variety of network topologies, traffic loads, and base power ratios. More specifically, if the base power ratio is 50% or more, then power-aware routing appears to be of significant additional benefit over rate adaptivity alone; if the ratio is 25% or less, then power-aware routing offers a relatively small additional benefit. [C278]

"Energy-efficient incremental integrity for securing storage in mobile cloud computing"

We present an energy-efficient protocol for ensuring the integrity of storage services in mobile cloud computing. The proposed protocol applies the concepts of incremental cryptography and trusted computing to design secure integrity data structures that protect the customer data while highly reducing the mobile client energy consumption and efficiently supporting dynamic data operations. The system design is analytically analyzed and experimentally implemented to demonstrate the energy savings it provides on mobile clients. [C279]

"Energy Saving Bottleneck Analysis in Iron and Steel Plant Based on Decomposition Model of Energy Consumption Index"

This paper applied the decomposition model of energy consumption index on the four-grade structure, from main-process stream to equipment, of a Chinese iron and steel plant (here after refers to plant A). Based on the data of energy consumption of plant A of resent years, the change of energy consumption per ton steel was decomposed into production factor and energy intensity factor, to analyze the two factors' influence on the total index. The model analysis showed that, the production structure of 1750m3blast furnaces was the bottleneck of energy saving. Thus decreasing steel-iron ratio will be most effective to reduce the energy consumption of plant A. The further analysis shows that the energy consumption per ton steel would be decreased by 35kgce/t if the steel-iron ratio reduced from 0.98 to 0.90. [C280]

"Active-mode power optimization in OFDMA-based wireless networks"

Energy efficiency is increasingly important for wireless cellular systems due to the limited battery resources of mobile clients. While modern cellular standards emphasize low client battery consumption, existing techniques do not explicitly focus on reducing power that is consumed when a client is actively communicating with the network. Based on high data rate demands of modern multimedia applications, active-mode power consumption should also be an important consideration for wireless system design and standards development. Recent work in this area shows that radio resource management schemes optimizing energy efficient metrics can provide considerable reduction in client power consumption. In this paper, we evaluate the performance of such techniques using realistic cellular system simulation model. Specifically, we focus on the emerging fourth generation IEEE 802.16m standard. Our simulation results indicate that energy efficient techniques continue to provide considerable power savings, even when accounting for realistic system parameters and channel environments. [C281]

"Sustainable development design of electrical systems "A case study of Asiaflex Products""

Sustainable Development (SD) is a simple way of ensuring a better quality of life for everyone, now and for generation to come. It refers to a perspective that considers all three aspects which are social, economic and the environment. Designing an electrical system with sustainability refers to an approach that considers the use of renewable energy, energy efficiency, conservation and minimising usage of natural resources. SD implementations can be grouped into four main areas, namely supplementing consumption with renewable energy, use of high energy efficiency equipments, by design and also instilling SD awareness among employees. Asiaflex Products is taken as the case study for this project. This paper highlights the electrical system designs based on SD concept, equipments used and the comparisons between SD model and the conventional model. Comparisons are also done based on the energy consumptions, energy savings, costs and its return of investment. [C282]

"Energy efficient, architectural reconfiguring DCT implementation of JPEG images using vector scaling"

This paper presents the DCT implementation of JPEG images using discrete cosine transform (DCT). The proposed method aims at reducing the power consumption which by application of vector scaling on DCT. This will be very useful for image compression and transmission applications. Using the character of energy distribution of DCT matrix after 2D-DCT operation, the best DCT basis functions are selected which is capable of achieving considerable power reduction with minimum image quality degradation. The proposed method can efficiently trade-off image quality and power consumption. An algorithm with vector scaled values for DCT coefficients, is also proposed which reduces the computational energy based on the sensitivity differences of 64 DCT coefficients. [C283]

"Challenges & solution in determination of agriculture consumption"

The agricultural sector consumes about 23 percent of India's electricity and 90 percent of its ground water. Although a number of initiatives have demonstrated that more efficient irrigation pump sets could save 30 to 70 percent of the sector's electricity use, stakeholders have been unwilling to bear the costs and risks of replacing the country's inefficient pump sets. To address this problem, the United States Agency for International Development India(USAID) has launched a pilot project to replace about 600 irrigation pump sets in India's Karnataka State under "Water Energy Nexus" (WENEXA) project. This pilot demonstrated the first market-driven public-private partnership between Bangalore Electricity Supply Company (BESCOM) and an Energy Service Company (ESCo) for agricultural demand-side management. If implemented nationwide, India could reduce its electricity supply/ demand gap from 11 to 3 percent and its annual agricultural tariff subsidy by $2400 million a year, among other socio-economic benefits. To measure the saved energy, "Electrical Research and Development Association" Vadodara (ERDA) has been involved as technical and third party independent organization for the field parameters measurement and establishment of the baseline consumption of existing Irrigation Pump sets (IP set). The agriculture electricity tariff in India is highly subsidized and is either zero, flat rate or consumption based. About 95% of the IP sets fall under the category of flat rate tariff. The flat rate is a highly subsidized tariff and lead to use of higher capacity pumps with lower contract load with utility and use of agriculture supply for purpose other than agriculture such as domestic, commercial etc. Due to demand supply shortage, three phase supply is provided to farmers for about eight hours for agriculture purpose and single phase supply for about twelve hours for purposes other than agriculture. Farmers run IP sets during single phase supply availability also by-- using capacitors. All these ground realities posed challenge for establishment of creditable base line of IP set consumption only. The paper describes a methodology which addresses these challenges. The methodology has been accepted by the stakeholders with varied and opposite interests. It is hoped that this methodology would serve as a base document for other agriculture demand side management projects expected to be implemented on large scale in South Asia in coming years. [C284]

"An analytical model for designing and controlling new-generation green devices"

In this paper, we focus on energy-aware devices able to reduce their energy requirements by adapting their performance. We consider the device to be able to save energy through two main energy-aware primitives, namely, low power idle and power scaling. In such an environment, we propose a novel and original model for accurately representing how the joint usage of the previously cited primitives can impact on both energy consumption and network performance. As shown by the results achieved, the proposed model can be effectively applied in order to design and control energy-aware hardware of next-generation network devices. [C285]

"Practical active compensation techniques for ATE power supply response for testing of mixed

signal data storage SOCs"

We will demonstrate the effectiveness of power supply active compensation techniques in mixed signal device performance testing. Read channel speed sorting for data storage SOCs is used to illustrate how we minimize the power transient effect in ATE test, where read-channel current draw varies drastically between different mission-modes and power-saving-modes. These active compensation ideas are critical when decoupling improvement alone cannot reduce the transients to acceptable levels. Compared to other publications, we are focusing on minimizing large device functionality-induced transients; instead of peak power consumption with ATPG generated tests. [C286]

"On the impact of energy-saving strategies in opportunistic grids"

Opportunistic grids are distributed computing infrastructures that harvest the idle computing cycles of computing resources geographically distributed. In these grids, the demand for resources is typically bursty. During bursts of resource demand, many grid resources are required, but on other times they remain idle for long periods. If the resources are kept powered on even when they are neither processing their owners workload nor grid jobs, their exploitation is not efficient in terms of energy consumption. One way to reduce the energy consumed in these idleness periods is to place the computers that form the grid in a "sleeping" mode which consumes less energy. We evaluated two sleeping strategies, denoted: standby and hibernate. Resources that comprise an opportunistic grid are normally very heterogeneous, and differ enormously on their processing power and energy consumption. It opens the possibility of implementing scheduling strategies that take energy-efficiency into account. We consider scheduling in two different levels. Firstly, how to choose which machine should be woken up, if several options are available. Secondly, how to decide which tasks to schedule to the available machines. In summary, our results presented a significant reduction in energy consumption, surpassing 80% in a scenario when the amount of resources in the grid was high. Moreover, this comes with limited impact on the response time of the applications. [C287]

"The Improved Method of Adaptive Frequency for Multi-sink Queries in Wireless Sensor Networks"

One of the important applications of wireless sensor networks is in supervision systems in which the information of locations under the supervision of sensors is sent continuously to applicants. Due to the limitation of energy source in sensor nodes, designing the methods based on optimal consumption of energy in wireless sensor networks is of great importance. In this paper, based on query shared source, an improved method is proposed which is called IQSS (Improved Query Shared Source) to support more complex queries regarding the response message frequency. In addition, we have tried to balance the message dispatch overloading on shared nodes to increase the time of network connection, the aim of which is to prevent redundancy of data and reduce repetitive messages to increase the lifetime of wireless sensor networks. Simulations show that our method can save energy up to 18% compared with those previously applied when the queries have different frequencies. [C288]

"Energy-aware reliability-oriented scheme to deliver time-sensitive data in sensor networks"

Reliable data delivery in distributed sensor networks can be achieved by selecting error free links, prompt recovery from packet losses, and avoidance of congested gateways. Since link failures and packet losses are unavoidable in resource-constrained sensor networks, it might be necessary to tolerate a certain level of reliability without significantly affecting packets delivery performance in favor of real-time packet delivery and efficient energy consumption. This paper presents an effective cross-layer approach that improves packet delivery, maintains low packet error ratio, minimizes computation overhead, and adaptively reduces control traffic in favor of high success reception ratios of representative data packets. Based on this approach, the proposed routing scheme achieves a moderate energy consumption and high packet delivery ratio even in environments featuring high link failure rates. The effectiveness of the proposed routing scheme is experimentally investigated using a mote-based testbed as well as simulation. It is shown to be more robust and energy efficient than the network layer of TinyOS2.x. The results show that the scheme maintains higher than 95% connectivity in interference-prone channels while achieving an average of over 35% energy savings. [C289]

"A novel energy efficient chain based hierarchical routing protocol for wireless sensor networks"

The nodes in a sensor network are severely constrained by energy. Reducing the energy consumption of the nodes to prolong the network lifetime is considered a critical challenge while designing a new routing protocol. In this paper we propose a new power-aware, adaptive, hierarchical and chain based protocol-CCPAR (Clustered Chain based Power Aware Routing) that utilizes the periodic assignments of the cluster head role to different nodes based on the highest residual battery capacity for ensuring the even dissipation of power by all the nodes. Transmission from a single cluster head to the base station in each round and the distribution of the data aggregation workload among all the nodes, save the cluster heads from early exhaustion. The use of data

aggregation also reduces the amount of information to be transmitted to the base station. By chaining the nodes in each cluster and using a separate chain for the cluster heads, CCPAR offers the advantage of small transmit distances for most of the nodes and thus helps them to be operational for a longer period of time by conserving their limited energy. The simultaneous construction of multiple chains in different clusters reduces the time for chain construction as well as the length of each of the chains. These shorter length chains solve the problem of excessive delay in transmission for the distant nodes. Use of a fresh set of parameter values in each round provides the users the flexibility to change these values in a way to control the power consumption. The introduction of MAX threshold enables CCPAR to be quickly responsive and thus highly suitable for time critical applications. From the performance evaluation we observe that CCPAR outperforms other protocols in terms of energy saving and longevity of the network. [C290]

"Another approach to save energy in OFDM systems"

In this paper, we propose an energy-efficient error correction scheme to lower the power consumption of the ADCs in the OFDM system. The proposed opportunistic error correction scheme is based on resolution adaptive ADCs and fountain codes. The key idea is to reduce the dynamic range of the channel by discarding part of the channel in deep fading. Correspondingly, the power consumption in ADCs can be decreased. In our approach, each sub-carrier transports a fountain-encoded packet. The receiver only decodes fountain-encoded packets with high SNR. Others are discarded. To compensate for the discarded packets, a high order modulation is used. The new error correction layer does not require perfect channel knowledge, so it can be applied in a real system. With our approach and 16-QAM, the energy consumption in ADCs is reduced by around 73% with non-perfect channel estimation comparing to the traditional IEEE 802.11a system under the same channel conditions and throughput. [C291]

"A New Routing Protocol of Ad Hoc Based on NS2"

In recent years, improving network model and enhancing the network performance have received people's attention gradually. The peer-to-peer network model has been used in Ad Hoc networks to increase the data output rate, to reduce the transmission power, to increase network capacity and the better load balance. However, the network analysis topology computation, the routing and the energy supply have become a bottleneck. In this paper, We provide a new type of mobile ad hoc network routing protocol based on NS2, which can better integrate with existing cellular networks and achieve users' smooth transition. It can not only save the energy effectively, but also avoid the massive routing search and the computation, solute the problem of load-balancing. At the same time, simulation results show that hybrid network model using peer-to-peer technology can effectively reduce energy consumption and increase network capacity. [C292]

"Dynamic Cluster Based Object Tracking Algorithm in WSN"

In wireless sensor network, saving energy of sensor node for long circle life is important. In this paper, dynamic cluster based algorithm was proposed. The algorithm wake up or slept the sensing nodes though predicting the moving track of the target, reduce the number of tracking nodes to minimize network energy consumption. Selecting the optimal nodes to conduct the tracking task along the predicted moving track though the energy consumption of communication function, which guarantee load balancing and extend the network lifetime. [C293]

"Energy and Water Saving Possibilities in Public Facilities in Albania"

Public facilities in Albanian do not fulfill the National Energy Building Code conditions resulting with great electrical energy losses. High losses are evident in water networks as well. In this paper we present an approach to control energy and water consumption in these facilities using a remote metering, monitoring and intelligent managing system. The structure and tasks of the system are presented. The strategy for keeping the system secure is defined. Cost and savings evaluations for 200 target facilities show that the system is cost-effective (including investment and running costs). The system is expected to change the existing management culture in public facilities increasing electrical energy and water consumption efficiency by reducing electrical energy losses at least 10%, detecting water losses due to illegal connections as well as reduce drastically the existing water consumption rates. [C294]

"Selection of cognitive radios for cooperative sensing"

Cooperative spectrum sensing for cognitive radio (CR) networks has been widely studied to increase the reliability of the primary user detection. However, when there are a large number of cooperating CRs, this typically leads to an increase in overhead in sensing reporting as well as in sensing report combining. A large number of CRs participating in cooperative spectrum sensing also increases the overall energy consumption of the CR network. One recent line of research has examined sensor selection techniques, in which a subset of the

CRs is selected to perform the cooperative spectrum sensing in order to reduce overhead and save network energy. However, selection of such a subset is challenging as we do not know a priori which of the CRs have the best detection performance. We present a literature review of CR selection techniques for hard decision cooperative sensing and also perform novel analysis for simple counting (SC) CR selection method. [C295]

"Power implications of high resolution timer tick settings"

Extending the battery life by reducing the power impact of software applications is becoming increasingly important in mobile computing systems. Several power estimation tools are being developed for software applications, but a gap exists in using them to instrument software applications for better power footprint. In this paper, we analyze idle and active power management scenarios of software applications and target minimizing OS-application interaction as our goal for obtaining power savings. A timer tick varying strategy is shown to reduce power consumption by 3 Watts for multimedia playback software. [C296]

"A novel P2P traffic optimization method"

P2P applications generate a large amount of unnecessary traffic because they know little underlying network information. To optimize P2P traffic, we propose an identifier (called Code-ID, CID for short in the following) construct and distribute method. Each peer has a CID, in our proposal. The distance between two peers can be calculated from their CIDs. Choosing closer peers can not only save network resource, but also improves P2P application's performance in P2P paradigm. Using the CID, network provider (NP) and internet service provider (ISP) can provide ID query service (IDQ) to help P2P application select peers; ISP can perform traffic engineering by influencing the peer selection decisions. To evaluate our method and CID-construct algorithm, we conducted simulations in several different scenarios. The simulations show that our proposal can significantly reduce network consumption and improve P2P download speed; also, it has more scalability compared with other ISP-P2P cooperation traffic optimization method, such as P4P. [C297]

"Energy-Efficient Task Clustering Scheduling on Homogeneous Clusters"

Clusters provide powerful computing performance is at cost of huge energy consumption. Scheduling a parallel application with a set of precedence-constrained tasks on cluster is challenging because of high communication cost. Although task duplication based scheduling algorithm is applied to minimize communication overhead, most of them only consider scheduling lengths, however completely ignoring energy consumption of cluster. Based on this consideration, we propose a novel Energy-Performance Balanced Task Duplication based Clustering Scheduling algorithm (EPBTDCS for short) in homogenous clusters which can significantly saving energy by judiciously shrinking communication energy consumption when assigning parallel tasks to computing nodes. This algorithm not only reduces energy dissipation in cluster without significantly degrading system performance, but also gets an optimal scheduling with a simple and loose condition. We conducted extensive experiments based on real-world SPEC fpppp and Sparse Matrix Solver parallel tasks applications running on a simulated cluster. By comparing with task duplication-based scheduling (TDS for short) and non-duplication-based scheduling (MCP for short) algorithms to prove our algorithm can save energy consumption greatly. [C298]

"A Profile Based Energy Management System for Domestic Electrical Appliances"

Climate change is one of the driving forces behind a new wave of energy management systems. Most of the currently available energy management systems in domestic environment are concerned with real-time energy consumption monitoring, and display of statistical and real time data of energy consumption. Although these systems play a crucial role in providing a detailed picture of energy consumption in home environment and contribute towards influencing the energy consumption behavior of household, they all leave it to households to take appropriate measures to reduce their energy consumption. Some energy management systems do provide general energy saving tips but they do not consider the household profiles and energy consumption profiles of home appliances. The proposed system attempts to address this issue by taking into account household profiles and energy consumption profiles of electrical appliances. The motivation behind this approach is to provide households effective advice on their energy consumption by enabling them to take focused and effective actions towards efficient energy use. [C299]

"Efficient recovery of braking energy through a reversible dc substation"

The full regeneration of the braking energy is one of the most promising sources of energy savings to transport system operators. This paper presents the outcome of a RailEnergy cooperative research program focusing on reduction of energy consumption in transport systems. Today, urban transportation systems are generally fed at 750 Vdc or 1,500Vdc via rectifier bridges and trains are equipped with modern 3-phase ac traction packages. This allow for easier and more effective implementation of dynamic braking over a wider range of speed and

voltage with the possibility of feeding back some of the energy via the 3rdrail or OCS to adjacent trains. The target of this project is to improve the line receptivity of dc power systems by transferring the excess energy to the ac side and thus regenerate it, via the transformer, to the ac medium voltage distribution network that is naturally receptive. This concept transforms the traditional unidirectional dc traction into a reversible one. It is suitable to all known types of dc traction power supply systems from 600Vdc up to 3,000Vdc. The key benefits expected from reversible dc traction substations are: Regeneration of 99% of the braking energy at all time, while maintaining priority to natural exchange of energy between trains; this will allow eliminating the braking resistors, and thus reduce the train mass and heat release; Regulation of its output voltage in traction and regeneration modes to reduce losses, and increase the pick-up of energy from distant trains, and Reducing the level of harmonics and improvement of the power factor on the ac side. Under an Alstom funded internal R&D programme two 750 Vdc prototypes dc reversible substations were built and tested on a dedicated tramway test-track at the Alstom plant in La Rochelle France. To reduce development time & costs the prototypes were built using state-of-the-art industrial variable speed drive converters, active harmonic filters, high power--semiconductors modules, modern controls and protections, modularity, high integration while taking into account the specific requirements of the railway industry. The test results confirmed the theoretical findings and demonstrated that the reversible substations allowed regenerating all of the excess available kinetic energy of the tramway. [C300]

"Heterogeneous Mini-rank: Adaptive, Power-Efficient Memory Architecture"

Memory power consumption has become a big concern in server platforms. A recently proposed mini-rank architecture reduces the memory power consumption by breaking each DRAM rank into multiple narrow mini-ranks and activating fewer devices for each request. However, its fixed and uniform configuration may degrade performance significantly or lose power saving opportunities on some workloads. We propose a heterogeneous mini-rank design that sets the near-optimal configuration for each workload based on its memory access behavior and its memory bandwidth requirement. Compared with the original, homogeneous mini-rank design, the heterogeneous mini-rank design can balance between the performance and power saving and avoid large performance loss. For instance, for multiprogramming workloads with SPEC2000 application running on a quad-core system with two-channel DDR3-1066 memory, on average, the heterogeneous mini-rank can reduce the memory power by 53.1% (up to 60.8%) with the performance loss of 4.6% (up to 11.1%), compared with a conventional memory system. In comparison, the Ч32 homogeneous mini-rank can only save memory power by up to 29.8%; and the Ч8 homogeneous mini-rank will cause performance loss by up to 22.8%. Compared with Ч16 homogeneous mini-rank configuration, it can further reduce the EDP (energy-delay product) by up to 15.5% (10.0% on average). [C301]

"Power Optimization with Performance Assurance for Multi-tier Applications in Virtualized Data Centers"

Modern data centers must provide performance assurance for complex system software such as multi-tier web applications. In addition, the power consumption of data centers needs to be minimized to reduce operating costs and avoid system overheating. Various power-efficient performance management strategies have been proposed based on dynamic voltage and frequency scaling (DVFS). Virtualization technologies have also made it possible to consolidate multiple virtual machines (VMs) onto a smaller number of active physical servers for even greater power savings, but at the cost of a higher overhead. This paper proposes a performance-controlled power optimization solution for virtualized data centers with multi-tier applications. While existing work relies on either DVFS or server consolidation in a separate manner, our solution utilizes both strategies for maximized power savings by integrating feedback control with optimization strategies. At the application level, a multi-input-multi-output controller is designed to achieve the desired performance for applications spanning multiple VMs, on a short time scale, by reallocating the CPU resources and DVFS. At the data center level, a power optimizer is proposed to incrementally consolidate VMs onto the most power-efficient servers on a longer time scale. Empirical results on a hardware testbed demonstrate that our solution can effectively achieve performance-assured power savings. Extensive simulation results, based on a trace file of 5,415 real servers, demonstrate the efficacy of our solution in large-scale data centers. [C302]

"Rank-aware cache replacement and write buffering to improve DRAM energy efficiency"

DRAM power and energy efficiency considerations are becoming increasingly important for low-power and mobile systems. Using lower power modes provided by commodity DRAM chips reduces power consumption but comes at a performance penalty to return to full power for servicing requests. We propose a novel cache replacement policy and write buffer that prevents cache blocks going to certain DRAM chips from being replaced, resulting in less requests going to these chips, and allowing them to remain idle for longer periods of time. Our proposed modifications improve DRAM energy efficiency by 10% on average (up to 30%) compared to a base

case that utilizes low power modes, and by 76% compared to a base case that does not utilize power saving modes. [C303]

"A Camera Angle Based Image Background Subtraction Strategy for WMSNs Target Tracking"

A novel node management strategy is proposed in this paper to solve the target tracking problem for wireless image sensor networks. The node management server is responsible for forecasting the target position, selecting the node to collect image data, and broadcasting control messages to all nodes. After the node sensor receives the messages sent from the server, the node sensor will start the camera, then collect, subtract, and transmit the image data according to the messages. The camera angle is introduced in the node selection algorithm. In order to perform image background subtraction and save energy consumption on traffic, we utilize the camera angle to subtract the redundant image data in the background. The simulation results show that the mechanism can greatly reduce energy cost, especially with the appropriate camera parameters. [C304]

"An Energy-Efficient Cluster-Based Data Gathering Protocol for Wireless Sensor Networks"

Since the nodes in wireless sensor networks operate on limited power, it is an important issue to design efficient data gathering scheme that can save energy while meeting the needs of application. In this paper, we propose an energy-efficient cluster-based data gathering protocol (ECDGP). ECDGP uses a new clustering algorithm based on belief degree for clusterhead election. Furthermore, ECDGP selects the active nodes according to the demand of network coverage. By controlling the number of active nodes in a cluster, ECDGP reduces energy consumption and prolongs the network lifetime. Simulation results show that ECDGP significantly outperforms the traditional clustering routing algorithms in terms of energy consumption and network lifetime. [C305]

"Low-power techniques for flexible channel decoders"

This paper proposes a framework for a low-power design of flexible multi-standard channel decoders which are the most computational demanding blocks of modern communication systems. A power-efficient design envisages hardware level techniques to reduce static power consumption and algorithmic level technique to early stop the iterative decoding when the received information is estimated to be correct. Particularly, the paper focuses on two different stopping rules for Turbo codes which are well-suited for a multi-standard scenario. Simulation results indeed show an achievable power saving ranging from 50% to 80%. [C306]

"Towards integrated circuit thermal profiling for reduced power consumption: Evaluation of distributed sensing techniques"

Reducing the power consumption in integrated circuits will require the use of several techniques, many of which depends on accurate on-chip temperature measurement. Simultaneously, power consumption can be reduced by using smaller integration scales of System-on-Chip (SoC). This will require a comprehensive solution to the ensuing more frequent problems of reliability-related events. This paper introduces the use of an on-chip sensor network to monitor reliability-related parameter and to adapt local chip components to ensure continuing efficient operation with reduced power consumption. The sensor network design is constrained to present a negligible footprint in terms of the chip internal bandwidth use, power consumption and number and area of integrated components. In this context, this paper considers the problem of monitoring the time evolution of the complete chip thermal profile. Different distributed sensing and source compression schemes that leverage on the physical properties of heat propagation and networking of sensors are evaluated in terms of bandwidth and power consumption saving potential. Simulation results show the potential for these techniques to provide useful savings in on-chip communication bandwidth. Considering strict implementation complexity constraints, distributed source coding through binning is the evaluated technique that shows best performance. [C307]

"Improved Architectures for Range Encoding in Packet Classification System"

Packet classification is an important aspect of modern network systems. Packet classification systems have traditionally been built utilizing Ternary Content Addressable Memory (TCAM) due to the high throughput needed. However, TCAMs are expensive in terms of area and power consumption. An alternative to TCAM based systems using SRAM and a novel rule encoding method has been proposed to match multiple packets simultaneously (using multiple store_compare_units). This alternative achieves similar or better throughput than the traditional TCAM approach while occupying smaller space and consuming less energy. This paper revamps the existing SRAM-based architecture to reduce area and power consumption without threatening throughput. Two methods are shown. The first method allows for range encoding SRAMs to be shared between store_compare_units (SCUs) to lower area and power consumption with minor effect on throughput. The second method discusses a hybrid system allowing rules with prefixes (single rules) and ranges (rules which match a range of addresses, usually translated to many prefixes) to exist in parallel for the same domain. This allows for

lower power consumption than utilizing fixed range encoding due to optimization of the ruleset. Results show that this hybrid architecture saves more than 20% of power/field if half of the TCP ports contain ranges (and the other half contains prefixes). The new extensions have been tested in over ten benchmarks (including the SNORT ruleset) to verify the claimed improvements. [C308]

"Distributed Clustering Algorithms for Lossy Wireless Sensor Networks"

Recent experimental studies have revealed that a large percentage of wireless links are lossy and unreliable for data delivery in wireless sensor networks (WSNs). Such findings raise new challenges for the design of clustering algorithms in WSNs in terms of data reliability and energy efficiency. In this paper, we propose distributed clustering algorithms for WSNs by taking into account of the lossy nature of wireless links. We first formulate the one-hop clustering problem that maintains reliability as well as saves energy into an integer program and prove its NP-hardness. We then propose a metric-based distributed clustering algorithm to solve the problem. We adopt a metric called selection weight for each sensor node that can indicate both link qualities around the node and its capability of being a cluster head. We further extend the algorithm to multi-hop clustering to achieve better scalability. Extensive simulations have been conducted under a realistic link model and the results demonstrate that the proposed clustering algorithm can reduce the total energy consumption in the network and prolong network lifetime significantly compared to a typical distributed clustering algorithm, HEED, that does not consider lossy links. [C309]

"Avoiding energy wastage in parallel applications"

We propose a methodology to analyze algorithms in order to reduce energy waste in executing applications. Our methodology is based on three observations. First, the relation between power and frequency of a single core is approximately cubic. Thus it may be possible to run an application slower on a core in order to save energy. In the case of a parallel architecture, one has to also factor the effect (on performance and energy consumption) of the interaction between cores. Second, multicore architectures which aggressively manage power consumption by allowing cores to be operated at reduced frequencies are being developed. This means that parallel applications on a multicore architecture can be executed using a variable number of cores running at different frequencies-affecting both the performance of the application and the energy required to execute it. Lastly, there is a certain benefit (positive utility) in running an application faster and a cost (negative utility) in terms of the energy consumed. Expending energy that does not contribute to the overall utility wastes the energy. The precise trade-off between performance and energy consumption depends on the structure of a parallel algorithm and the associated utilities. We describe a methodology to do this trade-off and illustrate it with several parallel algorithms. [C310]

"A light-weight approach to reducing energy management delays in disks"

Today's enterprise computing systems routinely employ a large number of computers for tasks ranging from supporting daily business operations to mission-critical back-end applications. These computers consume a lot of energy whose monetary cost accounts for a significant portion of an enterprise's operating budget. Consequently, enterprises employ energy saving techniques such as turning machines off overnight and dynamic energy management during the business hours. Unfortunately, dynamic energy management, especially that for disks, introduces delays when an accessed disk is in a low power state and needs to be brought into an active state. Existing techniques mainly focus on reducing energy consumption and do not take advantage of enterprise-wide resources to mitigate the associated delays. Thus, systems designers are faced with a critical trade-off: saving energy reduces operating costs but may increase the delays exposed to the users, conversely, reducing access latencies and making the system more responsive may preclude energy management techniques. In this paper, we propose System-wide Alternative Retrieval of Data (SARD) that exploits the large number of machines in an enterprise environment to transparently retrieve binaries from other nodes, thus avoiding access delays when the local disk is in a low power mode. SARD uses a software-based approach to reduce spin-up delays while eliminating the need for major operating system changes, custom buffering, or shared memory infrastructure. The main goal of SARD is not to increase energy savings, rather reduce delays associated with energy management techniques, which will encourage users to utilize energy management techniques more frequently and realize the energy savings. Our evaluation of SARD using trace-driven simulations as well as an actual implementation in a real system shows over 71% average reduction in delays associated with energy management. Moreover, SARD achieves an additional 5.1% average redu--ction in energy consumption for typical desktop applications compared to the widely-used timeout-based disk energy management. [C311]

"Investigation on the power efficiency of multi-core and GPU Processing Element in large scale SIMD computation with CUDA"

CPU-GPU Processing Element (PE) has become a very popular architecture to construct modern multiprocessing system because of its high performance on massively parallel processing and vector computations. Power dissipation is one of the important factors influencing design development of High Performance Computing (HPC) as a large scale scientific computation may use thousands of processors and hundreds hours of continuous execution that will result enormous energy predicament. Enhancing the utilizations of an individual PE to reach its best computation capability and power efficiency is valuable for saving the overall power cost of large multi-processing systems. Power performance of a CUDA PE is dependent on electrical features of the inside hardware components and their interconnections; also high level applications and the parallel algorithms performed on it. Based on measurements and experimental evaluations, in this work we provide a load sharing method to adjust the workload assignment within the CPU and GPU components inside a CUDA PE in order to optimize the overall power efficiency. The improvement on computation time and power consumption has been validated by examining the program executions when above method is applied on real systems. [C312]

"A digitally calibrated 5-mW 2-MS/s 4th -order ΔΣ ADC in 0.25-μm CMOS with 94 dB SFDR"

A digital calibration scheme is proposed to reduce the power consumption in a switched-capacitor (SC) ΔΣ ADC. When opamp bias current is reduced in the integrators, nonlinear settling errors dominate the output spectrum, causing harmonic distortion. The errors are detected using a parallel structure, and their effect is reduced by passing the post-filtered digital output through an inverse nonlinearity. With calibration, experimental results over a signal bandwidth of 1 MHz yield a peak signal-to-noise-and-distortion ratio (SNDR) of 75 dB, a total harmonic distortion (THD) of -90 dB and a spurious-free dynamic range (SFDR) of 94 dB. The power dissipation of the calibrated modulator is 5 mW, a savings of 38% over a similarly performing uncalibrated ADC. The active area is 0.39 mm2in 0.25-μm CMOS. [C313]

"An energy-recyclable burn-in technology for electronic ballasts for HID lamps"

Eco-friendly electronic products can help save the environment by using less electricity. However, saving energy is not only about reducing the electricity consumption of a product; it should also encompass the electricity consumed in the production process. After a product is assembled, it has to go through a burn-in process for weeding out infant mortalities and thus improving the product reliability. The use of energy-recycling in the burn-in process is popular nowadays in the power supply industry. Existing burn-in process for electronic ballasts is conducted by connecting lamps or resistors at their output. All electrical energy is converted into heat and light. Not only does this method waste electricity, it also raises room temperatures in the factory, which results in installing ventilation systems to release the excessive heat. This paper presents an energy-recyclable burn-in technology for electronic ballast for HPS lamps. The device can emulate the lamp characteristics, process high-frequency ballast output power and recycle the power back into the grid. An experimental prototype for a 400W high-pressure sodium (HPS) electronic ballast is built and evaluated. [C314]

"Reducing Power Consumption of Subscriber Stations in WiMAX Networks"

WiMAX (IEEE 802.16e) is a broadband wireless technology for fixed and mobile wireless connectivity and has potential applications in public safety networks. In this paper, we study such a network in which speed-violation cameras use WiMAX technology to upload images of the violators. The speed-violation cameras are solar powered but use batteries for supplemental power. Extending the battery life of such devices by minimizing power consumption is often an important requirement. The WiMAX standard offers two approaches that can be employed to reduce power consumption: the use of power saving features and the use of relay stations (IEEE 802.16j). In this paper, we evaluate and compare the two approaches for reducing subscriber station power consumption in mobile WiMAX networks using the modeling and simulation environment in OPNET Modeler® Wireless Suite. Power consumed due to packet transmission and device operation can be independently impacted while using different WiMAX features. This paper compares results across different design configurations exhibiting different levels of power consumption while using power saving mode, relay stations, and combination of both. [C315]

"Low power scheduling for periodic real-time systems with Dynamic Voltage Scaling processor"

Energy-efficient task scheduling for periodic real-time systems has been extensively explored in past decades. Dynamic Voltage Scaling (DVS) techniques, known as an attractive method to trade the performance for reduced energy consumption, have been adopted by many previous studies to slow down the system when the workload is low. Most such studies utilize static off-line schemes with the assumption of worst-case execution workload for each task. Dynamic schemes have been developed to reclaim the slacks left by the earlier completion of tasks than their worst-case estimations. However, these algorithms used Earliest-Deadline-First (EDF)

scheduling to guarantee the real-time requirement and seemed to be inefficient in reclaiming the slacks produced by the low-priority tasks. This paper presents a novel power-aware scheduling algorithm to reclaim more slacks and save more energy. It is shown by the experiment that the proposed algorithm can lead to more energy savings of up to 13% compared to EDF policy. [C316]

"Ultra low power RC oscillator for system wake-up using highly precise auto-calibration technique"

An ultra low power RC oscillator for system wake-up is implemented using 0.18um CMOS process. The modern mobile systems need system clock which consumes low power and thus saves limited battery power in order to wake up from sleep-mode. A RC oscillator operates in the subthreshold region to reduce current consumption. The output frequency of RC oscillator is very weakly dependent on process and temperature variation using auto-calibration. This RC oscillator is featured as follows: the current consumption is 0.2 μA the supply voltage is 1.8V; the output frequency is 31.25 KHz with 1.52(Relative 3σ)% accuracy after calibration; it has only 0.4%/°C temperature coefficient; its size is 190 um } 80 um exclude bonding pad. [C317]

"Using solar power as an alternative source of electrical energy for street lighting in Ghana"

Streetlights in Ghana receive electrical energy from the national grid. To pay for the energy consumed, residential consumers on the grid are levied 0.0001 of their total monthly consumption. Unfortunately, these levies are inadequate to defray the cost. There is therefore the need to look at other alternative sources of electrical power, which do not depend on the national grid to light the streetlights. The findings show that most streetlights in Ghana are not metered, thus making it impossible to bill the respective District Assemblies. Again, the socio-political climate in the country complicates the design process by not allowing for ample time for a thorough design work to be done before incorporating streetlights onto the national grid. This paper discusses the use of solar power as an alternative source of electrical energy for street lighting in Ghana. It proposes the use of LED-based lighting systems that receive energy from lead-acid batteries, charged by the solar panels. The design has an auto turn-on and turn-off for the streetlights and for charging the back-up batteries. The expectation is that changing to the LED-based street lighting system will lead to an increased initial installation cost but the savings made due to the reduced maintenance cost is enormous. [C318]

"Smart Camp"

Seamlessly integrating energy saving with the habits of daily life is an ambitious goal. It becomes even a bigger challenge in a remote area, like the Western-Australian Outback. Harsh environment, high temperatures and hard working conditions demand great exertion from humans and make one's well-being an integral part of life. To bring both together-environmental sustainability and life quality-is a new interdisciplinary approach in the field of computer science. A "Smart Camp" is a new low rate wireless personal area network (LR-WPAN)-based solution, which provides accommodations in a remote mining site with a smart automation and information system to contribute to environmental sustainability and to provide amenities for its inhabitants. The Smart Camp intends to monitor and control household appliances with the aim to reduce the overall energy consumption. Additionally, multi-media components will be implemented, which aim to make the occupants life more pleasant by adding value to their habitat. [C319]

"Synchronous and contouring control for gantry-type feed drive systems"

This paper presents a controller design to reduce consumed energy for gantry-type feed drive systems which consist of two linear actuators placed in parallel and one linear actuator placed perpendicular to the two parallel actuators. Synchronous controller design has been widely studied for two parallel actuators because positional (synchronous) error between them causes not only control performance deterioration but also significant mechanical damage to the feed drive system. Although the existing synchronous controller design aims to reduce the synchronous error, this paper first presents a new design that is effective to reduce consumed electric energy while maintaining the synchronous control performance. Contouring controller for multi-axis feed drives is also widely studied thus far, which aims to reduce contouring error in machining and coordinate measurement. This paper next presents a combined synchronous and contouring controller that aims to reduce consumed electric energy while maintaining the contouring control performance in gantry-type feed drive systems. Experimental results show the effectiveness of the proposed controller by which consumed electric energy is reduced by about 7%. [C320]

"A New Vehicle Network Routing Technology Based on Power Control"

The dynamic setting of the node's power value is not involved in the traditional VANET protocol. Thus, the node energy could not be effectively saved, and the channel interference between nodes is likely to be caused. This paper proposes a new vehicle network routing technology based on power control--- PAODV, PAODV mainly

uses the power control on link layer, and it is realized through MAC protocol. The transmission power is dynamically adjusted according to the conditions such as the distance to the node of the next hop and channel status. After using PAODV, node's energy consumption is lowered and channel interference between different nodes is reduced. This further ensures the reliability of the routing algorithm. We compare the performance of PAODV and AODV using network simulator NS-2 with the actual node movement model. The simulation results show that this algorithm can significantly reduce nodes' energy consumption. [C321]

"Reducing Specific Energy to Shrink the Carbon Footprint in a Copper Electrowinning Facility"

Various technologies and strategies to reduce specific energy consumption are examined. Results include 16 harvest cycles for 30 cells totalling 62,400 cathodes with a weight of 2,500 Tons. The industrial site was Zaldivar, a Barrick mining operation located at 175 km Southeast from Antofagasta, Chile. The production averages 140,000 Ton/year of copper cathodes. With the technologies tested in this work, 14 thousand Megawatt-hour and corresponding 14 thousand tons of CO2will be saved per year. [C322]

"Combination of Relative Neighborhood Graph and Forbidden Set in the Design of Distributed Broadcast Algorithms for Wireless Ad Hoc Networks"

A wireless ad hoc network typically comprises of nodes with energy supplied by batteries. Hence, energy conservation is crucial to extending the lifetimes of individual nodes and the network as a whole. In topology control type of broadcast algorithms, the distance between neighbors is used to adjust the transmission power to reduce energy consumption. One such example is based on relative neighborhood graph (RNG). In RNG each node maintains a list of relative neighbors and the information is employed to construct a broadcast path. In this paper, distributed broadcast algorithms are proposed that incorporate the notion of forbidden set in RNG to improve the performance. The key idea of forbidden set is to prohibit nodes with low remaining battery capacity from serving as rebroadcast nodes. Via this selection criterion, we can avoid the disruption of the broadcast path due to energy depletion at nodes with low energy capacity, thereby achieving the goal of elongating the lifetime of the broadcast path. Further power saving can be achieved by getting rid of redundant rebroadcasts. The procedure is described with illustrations. In particular, the removal of such redundancy is dependent on the source node. Simulation results confirm the improvement furnished by the proposed algorithms. [C323]

"An Objective-Flexible Clustering Algorithm for task mapping and scheduling on cluster-based NoC"

An Objective-Flexible Clustering Algorithm (OFCA), which is applicable to multiple design objectives and targets high performance and low energy task mapping and scheduling on homogenous cluster-based NoC, is presented. OFCA employs a lineal clustering to group tasks into clusters, and utilizes an efficient heuristic task mapping process to allocate ready clusters onto the platform. Then a low latency pipeline-based static task scheduling stage is proposed to arrange task sequence in IP cores. Finally a best hardware resource demand for the application could be predicted for reference. OFCA can fully exploit the parallel characteristics within task graphs to minimize inter-cluster communication and limit copying tasks when clustering to reduce extra execution energy. It also controls the use of task-duplication-technique (TDT) by setting different parameters for flexible goals to make a compromise between energy and latency. Experiments show that objectives can be adjusted via different parameter ratios performing OFCA and 57% energy savings on average can be achieved compared to CM Algorithm when employed to streaming applications of 18, 36, and 40 tasks. [C324]

"Dynamic Workload Prediction for Soft Real-Time Applications"

Energy consumption is often a hard constraint of embedded real-time systems. Modern processors provide techniques for dynamic voltage and frequency scaling to reduce energy consumption. However, while the processor possibly operates at a lower clock frequency, the running applications should still meet their deadlines and thus set some limits to the use of scaling techniques. In this paper, we propose AutoCorrelation Clustering as a technique to predict the workload of each single iteration of a periodic soft real-time application. Based on this prediction we adjust the processor performance such that all deadlines are met as exactly as possible. We compare our technique to the broadly implemented race-to-idle and identify situations where autocorrelation clustering can gain higher energy savings than race-to-idle. Additionally, autocorrelation clustering can help saving energy in multithreaded processors where race-to-idle can be applied only with a high overhead if at all. We evaluated our approach by simulating the execution of a MPEG decoder on the multithreaded CarCore processor model. [C325]

"Application of Environmental Management on Energy Saving and Green House Gas Reduction in Beijing"

Green house gas (GHG) emission has been one of hot topics for international society because of its close relationship with economic growth, China has ranked first on GHG emission in the world for its numerous population and rapid growth of industry. As the capital of China, Beijing's government pay great attention to energy saving and GHG reduction which already acts as paragon in China. GHG emission mainly comes from energy consumption, this paper takes CO2 as the research object and analyzes the current energy consumption and GHG emission in Beijing. The application of environmental management in this field can promote the emission-reducing effect which can be proven from five aspects of economy, technology, law, policy and education combining with the projects on industry, traffic, building, green energy and forest. [C326]

"The Research of Distribution Center Optimization Addressing Based on Energy Saving and Emission Reducing Confine Factors"

Energy saving and emission reducing of logistics system is an important research area in low carbon society. Factors of energy saving and emission reducing, such as vehicle exhaust emission confine, energy consume confine is treated as confine factors to construct the optimization model of logistics distribution center addressing. GA is used settle the models, and a practical distribution centers addressing experiment is done to test the model effect. [C327]

"The design of energy-saving filtering mechanism for sensor networks"

The transmission of massive highly related data could generally exist in gathering scenario of sensor networks and lead to the depletion of valuable energy resource. According to the above energy waste problem, an effective filtering mechanism is proposed in the paper to enhance the energy-efficiency of data-gathering. Many current researches adopt clustering method and aggregation technology to lower energy cost during the process in data transmission, while our proposed filtering framework mainly puts emphasis on inhibiting the production of redundant loads at the gathering source to greatly reduce energy cost using self-adaptive filtering scheme, which is constructed by prediction module for mining the time domain association, self-learning module for modifying model and driving module for executing filtering operation. We can prove the above filter components combined with the running of error-driving rule and threshold-distributing rule can effectively decrease the quantity of data transmission in networks based on QoS requirement. Finally, the simulation results show that the proposed filtering mechanism can do better than some classical data gathering approaches on the aspect of energy-saving effect. [C328]

"Improvement on LEACH by combining Adaptive Cluster Head Election and Two-hop transmission"

LEACH is a popular hierarchical routing protocol which efficiently maintains the energy storage of nodes in Wireless Sensor Network (WSN). The nodes using LEACH are divided into clusters. The randomized rotation of cluster head in each cluster can save the energy consumption of nodes. However, the random election of cluster heads without considering nodes' residual energy may reduce and oscillate the lifespan of network. In this paper, we have proposed the Adaptive Cluster Head Election and Two-hop LEACH protocol (ACHTH-LEACH) to prolong the lifespan of network. It improves LEACH by using an adaptive algorithm of cluster head election and allowing multi-top transmission among cluster heads and Base Station (BS). Nodes are tagged as near nodes or far nodes according to the distances to the BS. The near nodes belong to one cluster while the far nodes are divided into different clusters by the Greedy K-means algorithm. The cluster head is shifted and the node with the maximal residual energy in each cluster is elected. During the data transmission phase, the far cluster heads may select the cluster head in the near area as the next hop or communicate directly to the BS. The simulation results have shown that ACHTH-LEACH outperforms several existing protocols in terms of network's lifespan. Especially, ACHTH-LEACH can achieve more than 2 times longer lifespan than LEACH and build a more stable routing environment. [C329]

"An Efficient Power-Aware Optimization for Task Scheduling on NoC-based Many-core System"

With the development of the semiconductor industry, more processors can be integrated onto a single chip. Network-on-Chip (NoC) is an efficient solution for the interconnections on chip for many-core system with many processor cores on chip. However, enhancing performance with lower power consumption is still a challenge. The core issue is the mapping of applications to NoC. A common method is to find processes with high communication with each other and map them to neighborhoods. Thus, they can reduce the communication distance and avoid unnecessary energy cost. This work proposed an online scheduling method, which aims at the optimization of task scheduling algorithm with low communication energy consumption. The communication status of applications at run time is analyzed first. Then, the algorithm will compute the mapping method dynamically and implement the real-time scheduling online. Experimental results based on simulation show that the algorithm proposed in this review can achieve more than 30% communication energy saving with low

complexity. [C330]

"System design and testing research of minimal-oil ignition burner on pulverized coal fired boilers"

In terms of the retrofit of minimal-oil ignition technology in the 600 MW unit of Tianjin Datang International Panshan Power Generation Co., Ltd., the working principal, retrofit scheme and system components of the minimal-oil ignition technology are introduced in this paper. The concretely adopted scheme involves that the small gasified oil gun is adopted to replace the starting-up oil gun, and the concentration device is arranged to realize the concentration-staged combustion of pulverized coal, without any influence to the boiler's performance. The experiment results indicate that the minimal-oil ignition technology can be applied in startup, stopping and aided combustion in low load condition of pulverized coal fired boilers. The average fuel oil consumption after retrofit is reduced by over 90%. The minimal-oil ignition system is simple, operation convenient and little maintenance is needed. Its extensive application can bring prominent economic and environmental advantages. [C331]

"Study on Digital Management of Industrial Water System in Steel Industry"

At present, the shortage of water resources has restricted the development of steel industry. Industrial water minimization is the inevitable choice that break through the bottleneck and reduce energy consumption in enterprises. To solve problems of more extensive operating mode, lower water recycle rate and higher wastewater discharge, life cycle and digital management is very important to joint enterprises. Firstly, the accurate base data was accessed by water balance testing. Then, online monitoring, diagnosis, early warning and the use of dynamic cascade control system was established. This system can realize dosing process control and the reasonable dynamic cascade of wastewater. The model of intensive and digital management would tap maximum energy saving, water-saving potential. [C332]

"A Lossy Image Coding for Wireless Multimedia Sensor Networks"

A simple, high-efficient and energy saving image coding scheme is proposed in this paper, which is suitable for wireless multimedia sensor networks. The scheme is based on lifting wavelet transform and SPIHT algorithm. To solve the very low executing efficiency problem of the combined algorithm, we make improvements in the two aspects. Firstly, by eliminating the computation and coding of the outmost high-pass coefficients, the energy consumption of the transform was reduced and the execution was speed up. Secondly, by using optimized quantization truncation pretreatment with high-pass subband coefficients, coding mass of small value coefficients of the high-pass subband was avoided, which further improves the executing efficiency. The simulation results show up to 90% reduction in the executing time was achieved by choosing the optimized truncation threshold, with the guarantee for the image quality of 34.5dB. [C333]

"Design and Implementation of a Critical Speed-Based DVFS Mechanism for the Android Operating System"

DVFS is an efficient energy saving technique for processors during program execution time. In this paper, a critical speed-based DVFS mechanism that we have implemented on the Android operating system is introduced. Our studies indicate that due to memory accesses, decreasing the frequency may not always reduce the energy consumption. A critical speed is thus defined as the CPU frequency with which the energy consumption can be minimized. In our mechanism, a prediction equation based on the correlation of the memory access rate and the critical speed was constructed and used to choose a suitable frequency and voltage dynamically at run time. Our initial experiment results show that for real applications running on Android, the energy consumption can be effectively reduced. [C334]

"Leakage-Aware Reallocation for Periodic Real-Time Tasks on Multicore Processors"

It is an increasingly important issue to reduce the energy consumption of computing systems. In this paper, we consider partition based energy-aware scheduling of periodic real-time tasks on multicore processors. The scheduling exploits dynamic voltage scaling (DVS) and core sleep scheduling to reduce both dynamic and leakage energy consumption. If the overhead of core state switching is non-negligible, however, the performance of this scheduling strategy in terms of energy efficiency might degrade. To achieve further energy saving, we extend the static task scheduling with run-time task reallocation. The basic idea is to aggregate idle time among cores so that as many cores as possible could be put into sleep in a way that the overall energy consumption is reduced. Simulation results show that the proposed approach results in up to 20% energy saving over traditional leakage-aware DVS. [C335]

"Reducing Energy Consumption in China's Railway Freight Transportation"

Based on the present situation of transportation energy consumption in China and the energy saving advantages of railway transport, it can be seen that there are some space to save energy for China's railway freight transportation. Through analyzing the procedure of railway transport energy consumption, this paper discusses the relationship between the energy consumption influencing factors, and presents several organization optimization measures associated with rebuilding and reforming railway infrastructures and transportation mobile devices. [C336]

"Enablers for Energy Efficient Wireless Networks"

Mobile communications are increasingly contributing to global energy consumption. The EARTH (Energy Aware Radio and neTworking tecHnologies) project tackles the important issue of reducing CO2emissions by enhancing the energy efficiency of cellular mobile networks. EARTH is a holistic approach to develop a new generation of energy efficient products, components, deployment strategies and energy-aware network management solutions. In this paper the holistic EARTH approach to energy efficient mobile communication systems is introduced. Performance metrics are studied so to assess the theoretical bounds of energy efficiency and the practical achievable limits. Moreover, various deployment strategies focusing on their potential to reduce energy consumption are studied, whilst providing uncompromised coverage and user experience. This includes heterogeneous networks with a sophisticated mix of different cell sizes, which may be further enhanced by energy efficient relaying and base station cooperation technologies. Finally, scenarios leveraging the capability of advanced terminals to operate on multiple radio access technologies (RAT) are discussed with respect to their energy savings potential. [C337]

"Inter-Cell Interference Reduction via Store Carry and Forward Relaying"

The integration of mobile relays in cellular networks has been recently envisioned as a way of increasing system capacity, coverage and reducing communication energy consumption. In we studied how store carry and forward (SCF) relaying within the cell can be utilized as an underlay message forwarding mechanism to achieve system wide energy savings. In this paper, by deriving optimal routing policies to reduce either the total energy consumption or the total transmit power, we show that the SCF relaying scheme reduces considerably inter-cell interference. We detail the factors affecting the maximum interference reductions, including the delay tolerance of elastic data traffic and flow characteristics of vehicles in the road network which in this case are used as mobile relay nodes. [C338]

"An evaluation of energy-saving technologies for residential purposes"

Energy-saving technologies have become more readily available for residential purposes. Such technologies can be classified into two broad categories: energy generation systems and consumption reduction solutions. In the first half of this paper, we analyze the feasibility of renewable energy generation systems at home. Our results indicate that although renewable energy can possibly fulfill a significant portion of a household's electricity demand, the costs involved will be a strong barrier to their adoption. Typically, it would take upwards of 10 years to realize a return on the initial investment in installing such systems. This strengthens the argument for government subsidies until manufacturing processes become mature enough to enable cheaper solutions. A more direct method of reducing home electricity costs would be to reduce consumption. In the second half of this paper, we analyze a simple means towards consumption reduction-switching to energy-efficient light bulbs. Our calculations indicate that compact fluorescent lamps (CFLs) are four times less expensive to run than incandescent light bulbs. This takes into account both the unit cost and the runtime cost of the light bulbs. The use of CFLs, coupled with a smart lighting system that automatically shuts off when not in use, may allow up to 83% reduction of household electricity consumption on lighting (or around 7% reduction of total electricity consumption at home). [C339]

"Agents based approach for smart eco-home environments"

This paper proposes an agent based approach to deal with the world wide concerned eco problems, i.e., saving energy consumption and reducing CO2emission. This paper demonstrates a simulated home with the facilities of calculation the average energy consumption and CO2emmision of possible devices or appliances. Various agents for the support of reducing energy consumption and CO2emission at home are designed and deployed in a multi-agent framework. They are working in a collaboration way in the terms of sharing their knowledge resources and working together toward a same goal. It is challenge to make influence on people towards energy saving and CO2reducing life habit and style. This issue is to be discussed in this paper as well. [C340]

"A Novel Continuous Object Tracking Scheme for Energy-Constrained Wireless Sensor Networks"

In order to monitor continuously moving phenomena such as wile fire and hazardous bio-chemical material in wireless sensor network, boundary tracking approach has been widely used by reason of its huge scale and extensive diffusion property. With the boundary tracking scheme, the energy efficiency is expected to improve if only sensor nodes near the boundary of continuous object actively participate in tracking process, while other sensor nodes stay in sleep mode for energy saving. In this paper, we propose a predictive continuous object tracking scheme, which uses minimum set of active sensing nodes to reduce energy consumption. The proposed scheme predicts the future boundary line, which provides the knowledge for a wake-up mechanism to decide which sleeping nodes need to be activated for future tracking. The proposed algorithm is verified with simulation results that total energy consumption can be dramatically reduced under acceptable boundary detection accuracy. [C341]

"Opportunistic Relay Selection in Future Green Multihop Cellular Networks"

Continuous growth of cellular subscribers as well as demands for high-speed and high-quality multimedia services have made it necessary to increase system capacity and data rate. On the other hand, the energy consumed goes up accordingly as the data rates increases. Therefore, designing an efficient resources allocation scheme and architecture to improve the output performance and reduce energy consumption will be the focus for future research. In this paper, we propose an opportunistic relay selection technique to save energy consumption for future Green multihop cellular networks. Then, we developed a comprehensive simulation model with consideration of path loss, shadowing, inter-cell and intra-cell interference and other service requests for both single hop and multi-hop TDD-CDMA based cellular system to conduct a deep investigation of energy consumption including the hardware energy for different RS selection under various time slot allocation schemes. [C342]

"Energy saving control in low cost pneumatic positioning systems"

The paper presents a novel approach to a problem of control in pneumatic positioning systems that is based on open loop control with specially created control strategy. This strategy is focused on low compressed air consumption and reduction of control time at positioning. The resulting transients while positioning did not induce overshoot but yields some errors at initial strokes. This error is reduced in an adaptive way very effectively to a margin that is acceptable in different industrial applications. Simulation results have been confirmed by extended program of testing performed on laboratory stand. The proposed approach can be a basis for development of efficient, low cost, industrial pneumatic positioning devices. [C343]

"Energy optimization policies for server clusters"

We construct energy optimization policies for a server cluster, using statistical data analyses and demand prediction methodologies, with an aim to reduce the power consumption of the server cluster. In doing so, we monitor and analyze the historical time-series utilization data of a server cluster. Based on the analyses results, we develop predictions about utilization of servers for future time periods. Using this predictive analysis, we formulate energy optimization rules or policies for the server cluster. These policies are then evaluated to determine if they result in energy savings in the server cluster. High-level implementation of this entire mechanism is provided and a strategy for inclusion of this mechanism in existing data center automation products is discussed. [C344]

"Enabling GPU and Many-Core Systems in Heterogeneous HPC Environments Using Memory Considerations"

Increasing the utilization of many-core systems has been one of the forefront topics these last years. Although many-cores architectures were merely theoretical models few years ago, they have become an important part of the high performance computing market. The semiconductor industry has developed Graphical Processing Units (GPU) systems that provide access to many cores (i.e: Larrabee, Fermi or Tesla) that can be used for General Purpose (GP) computing. In this paper, we propose and evaluate a scheduling strategy for GPU and many-core architectures for HPC environments. Specifically, our strategy is a variant of the backfilling scheduling policy with resource sharing considerations. We propose a scheduling strategy that considers the differences between GP processors and GPU computing elements in terms of computational capacity and memory bandwidth. To do this, our approach uses a resource model that predicts how shared resources are used in both GP and GPU/many-core elements. Furthermore, it considers the differences between these elements in terms of performance. First, it models their differences in terms of computational power and how they share the access to the node's memory bandwidth. Second, it characterizes how the processes are allocated to the GPU. Using this resource model, we design the Power Aware resource selection policy, which we combine with the LessConsume scheduling policy. Our strategy tries to allocate jobs aiming at reducing the memory contention and the energy consumption.

Results show that the scheduling strategies proposed in this work are able to save over 40% of energy and improve the system performance up to 30% with respect to traditional backfilling strategies. [C345]

"GreenSim: An open source tool for evaluating the energy savings through resource dynamic adaptation"

Due to the continuous growth of customer population, the spreading of broadband access, the increase in energy price, and the expanding number of services being offered by telecoms and providers, energy efficiency issue has become a high-priority objective for wired networks and services infrastructures. Current network devices are well-known to be over-dimensioned for rush-hour traffic loads, and to have flat energy requirements with respect to their real utilization. Recent studies suggested to reduce the energy consumption of networks and networked devices through the introduction of adaptive capabilities, which allow to modulate energy requirements according to network-aware performance (i.e., delays, packet losses, etc.). However, at the today's state of the art, the real impact of these power management techniques is not clear, and requires further studies and researches. Based on this context, we focus on development of a new simulator called "GreenSim", that aims at analyzing and evaluating the impact of adaptive energy saving techniques both on network- and energy-sides in the presence of real traffic traces and data. The results achieved with the proposed simulator demonstrate that these green technologies, when applied to packet processing engines inside network devices, can save up more that 40% of energy consumption in the presence of real Internet traffic profiles, while maintaining an acceptable network performance level. [C346]

"A energy evaluation of E-TDMA vs IEEE 802.11 in wireless ad hoc networks"

This paper presents a deep simulation analysis of contention-based and collision-free MAC protocols in MANET environment. In particular, IEEE 802.11 and Evolutionary TDMA (E-TDMA) have been considered from an energetic point of view. Contention based MAC protocols such as IEEE 802.11 are often applied in the context of wireless ad hoc networks for their easy deployment and reduced control structure that is typical of more complex medium access techniques based on the time-slot reservation or code selection. However, when traffic load is heavy, TDMA based protocol can be essential not only in terms of higher throughput offered in the network but also for a reduction in the energy dissipation due to the capability of lowering the data packet collision. A energy specific evaluation has been led out and many parameters have been considered in order to show the effectiveness and the drawbacks of TDMA based MAC protocols vs contention-based (CSMA) MAC protocols. This contribution is a starting point to develop specific energy saving techniques to apply in the context of MANET at MAC layer. [C347]

"Network power saving topology calculation method by powering off links considering QoS"

In order to reduce the energy consumption of the network, we introduce a concept that realizes a low power consumption network by aggregating traffic on specific numbers of links and powering off link ports of routers that are not used. In this paper, we proposed a practical calculation method that can derive a low power consumption network considering QoS requirements. By iterating the process of powering off arbitrary numbers of links in a heuristic manner, a power-saving network topology is reconfigured. By computer simulation, it is shown that our proposed scheme can reduce the used links of network calculated within a reasonable time. [C348]

"PoliSave: Efficient power management of Campus PCs"

In this paper we study the power consumption of networked devices in a large Campus network, focusing mainly on PC usage. We first define a methodology to monitor host power state, which we then apply to our Campus network. Results show that typically people refrain from turning off their PC during non-working hours so that more than 1500 PCs are always powered on, causing a large energy waste. We then design PoliSave, a simple web-based architecture which allows users to schedule power state of their PCs, avoiding the frustration of wasting long power-down and bootstrap times of today PCs. By exploiting already available technologies like Wake-On-Lan, Hibernation and Web services, PoliSave reduces the average PC uptime from 15.9h to 9.7h during working days, generating an energy saving of 0.6kW/h per PC per day, or a saving of more than 250,000 Euros per year considering our Campus University. [C349]

"Thermal-aware scratchpad memory design and allocation"

Scratchpad memories (SPMs) have become a promising on-chip storage solution for embedded systems from an energy, performance and predictability perspective. The thermal behavior of these types of memories has not been considered in detail. This thermal behavior plays an important role in the reliability of silicon devices and in their static (leakage) power consumption. In this paper, we propose two different techniques to improve the thermal behavior of SPMs. First, we propose a hardware-based, thermal-aware address translation technique

that physically distributes memory accesses to consecutive addresses evenly over the whole memory area. Second, we propose a software-based, thermal-aware address generation technique. This technique tries to distribute the variables that are allocated to the SPM in such a way that an even thermal distribution is achieved. The first technique works particularly well for applications with a regular access pattern, whereas the second technique can also improve the behavior of applications with irregular access patterns. The two techniques thus complement each other and work well together. Using the first technique we show that the peak temperature of an SPM in 65nm technology, when running a typical streaming application, is decreased by up-to 10.0°C. Temperature cycling is reduced from up-to 14.8°C to almost zero in comparison with a non-thermal-aware solution. For our benchmark applications with an irregular access pattern, the second technique is able to reduce the peak temperature by up-to 3.5°C. These savings for both techniques are obtained without any performance degradation or extra silicon area. [C350]

"Energy efficient routing based on random walk in ad hoc sensor network"

Energy consumption is a vital factor in the successful deployment of ad hoc sensor networks because sensor nodes are powered by on board battery which are extremely difficult to be recharged. In this article we have proposed a new routing technique based on the idea of random walk with the objective of saving energy. Our approach is inspired by an existing TDMA like routing protocol. We have given a detailed description of our algorithm taking help of a small size network and performed simulations on large network to draw a comparative analysis with the existing algorithm. The simulation results show that our approach significantly reduces number of transmissions hence conserving energy. [C351]

"Fine-grained adaptive CMP cache sharing through access history exploitation"

Advances in semiconductor technologies have enabled the integration of multiple processor cores as well as varying sizes of L1 and L2 caches on a single chip. The ever growing complexity and diversity of the associated workloads impose a crucial challenge on the organization and management of the on-chip cache resources. As each core generates a varying amount of accesses to each cache line during execution, sharing a single L2 cache among all the cores can minimize off-chip misses. However, each access to a shared L2 cache imposes significant performance and power overhead, as the tags of all the blocks on a cache line need to be compared in parallel. To efficiently utilize cache resources while saving power, we present in this paper a fine-grained L2 cache management technique with minimum hardware overhead. Each core is allowed to set an ownership bit in an L2 cache block to directly signify the necessity of tag checking, thus reducing the latency and power consumption of each cache access. Joint block ownership approaches provide shareability, thus precluding costly data replication from which private L2 caches typically suffer. Meanwhile, through monitoring line-based access histories, a core that produces a large amount of misses is precluded from replacing blocks belonging to other cores, thus efficiently attaining fine-grained cache partitioning. Experimental results confirm that the proposed technique can effectively reduce the access latency and power consumption of traditional shared L2 caches, accompanied by additionally a slight reduction in the miss rate. [C352]

"Unified theory of real-time task scheduling and dynamic voltage/frequency Scaling on MPSoCs"

Dynamic voltage/frequency scaling (DVFS) and adaptive body biasing (ABB) have shown to effectively reduce dynamic and leakage energy consumption in real-time embedded systems. Although these techniques exploit the slack time on a given task ordering, the task ordering may not provide a slack time distribution that DVFS/ABB can benefit from and this can limit the potential energy saving such techniques can provide. In this paper, we present an optimal network flow based solution for simultaneous static real-time scheduling and energy minimization (DVFS and ABB) on multiprocessors. Results show that our optimal solution reduces the energy dissipation by 47.84%, 26.21% and 17.46%, on average, in comparison with no-DVFS execution, voltage scaling algorithm with virtual continuous speed and an optimal energy minimization algorithm without task re-ordering, respectively. [C353]

"Memory access aware on-line voltage control for performance and energy optimization"

This paper describes an off-chip memory access-aware runtime DVFS control technique that minimizes energy consumption subject to constraints on application execution times. We consider application phases and the implications of changing cache miss rates on the ideal power control state. We first propose a two-stage DVFS algorithm based on formulating the throughput-constrained energy minimization problem as a multiple-choice knapsack problem (MCKP). This algorithm uses a power model that adapts to application phase changes by observing processor hardware performance counter values. The solutions it produces provide upper bounds on the energy savings achievable under a performance constraint. However, this algorithm assumes a priori (oracle or profiling-based) knowledge of application phase change behavior. To relax this assumption, we propose P-

DVFS, an predictive DVFS algorithm for on-line minimization of energy consumption under a performance constraint without requiring a priori knowledge of an application's behavior. P-DVFS uses hardware performance counter based performance and power models. It predicts remaining execution time online in order to control voltage and frequency settings to optimize energy consumption and performance. The P-DVFS problem is formulated as a multiple-choice knapsack problem, which can be efficiently and optimally solved online. We evaluated P-DVFS using direct measurement of a real DVFS-equipped system. When bounding performance loss to at most 20% of that at the maximum frequency and voltage, P-DVFS leads to energy consumptions within 1.83% of the optimal solution for our problem instances on average with a maximum deviation of 4.83%. In addition to producing results approaching those of an oracle formulation, P-DVFS reduces power consumption for our problem instances by 9.93% on average, and up to 25.64%, compared with the most advanced related work. [C354]

"Package-Aware Scheduling of embedded workloads for temperature and Energy management on heterogeneous MPSoCs"

In this paper, we present PASTEMP, a solution for Package Aware Scheduling for Thermal and Energy management using Multi- Parametric programming in heterogeneous embedded multiprocessor SoCs (MPSoCs). Based on the current thermal state of the system and current performance requirements of the workload, PASTEMP finds thermally safe and energy efficient voltage/frequency configurations for the cores on a MPSoC. The tasks are assigned to the cores depending on their performance demand and the current voltage/frequency of the core. The voltage/frequency settings of the cores are chosen through an optimization process which is based on the instantaneous thermal model we introduce to decouple the effect of package temperature from the temperature changes caused by the power consumption of the cores. To be able to find the best voltage/frequency settings at runtime, we use multi-parametric programming to separate the optimization into offline and online phases. According to our experimental results, compared to similar DTM techniques, PASTEMP results in up to 23% energy saving and 26% throughput improvement and reduces the deadline misses to more than a half while meeting all thermal constraints. [C355]

"Performance optimization of LUT of subthreshold FPGA in deep submicron"

Field programmable gate array (FPGA) consumes significant dynamic and static power consumption due to the presence of additional logic for flexibility compared to application specific integrated circuits (ASICs). The cost of ASICs is rising exponentially in deep submicron and hence it is important to investigate ways of reducing FPGA power consumption so that they can also be employed in place of ASICs in portable energy constrained applications. It is also important to investigate the possibility of extending the use of FPGA even in subthreshold region for ultra low power applications. At the same frequency, subthreshold circuits show orders of magnitude power saving over super-threshold circuits for low throughput applications. This paper explores the subthreshold performance of a basic FPGA building block-a Look up Table (LUT). It presents comparative analysis of different topologies of three input LUT in deep submicron (DSM) for delay, power dissipation and switching energy. The proposed cross-coupled PMOS (CCP) encoded LUT shows 36% improvement in delay and 31% in switching energy at the cost of 4% increase in static power dissipation over conventional one. However, the increase in static power consumption is negligible compared to the improvement in switching energy. Thereafter, this paper investigates the potential of carbon nanotube field effect transistor (CNFET) based LUT in the subthreshold region. [C356]

"An improved low-power clock-gating pulse-triggered JK flip-flop"

In this paper, an improved clock-gating pulse-triggered JK Flip-flop (CG-PT-JKFF) for low-power requirements is presented. It is based on clock-gating technique, and power consumption is reduced because redundant internal switching activities are eliminated. When probability of activities of the flip-flop is 25%, the improved flip-flop can save up to 41% of the Power. [C357]

"A High-Performance Multi-user Service System for Financial Analytics Based on Web Service and GPU Computation"

In finance, securities, such as stocks, funds, warrants and bonds, are actively traded in financial markets. Abundance of market data and accurate pricing of a security can help the practitioners arbitrage or hedge their position. It can also help researhers and traders design better trading strategies. In this work, we develop a pricing and data/information service system for financial analytics with the following goals: (1) supporting fast pricing and data/information services for massive multiple users, (2) saving cost in hardware equipments and reducing energy consumption, and (3) easy maintenance and service expansion of the system. To achieve the first two goals, we use one traditional server paired with one Tesla C1060 and a set of PCs each paired with an

Nvidia x275, and enhance GPU performance using a set of simple yet very effective optimization techniques. For the third goal, we develop our service system based on Web Service and the Service-Oriented-Architecture design principles. Our initial experiment results show that our GPU-based service system can deliver 4.8 tera flops computing speed, which achieves over 6000% performance increase compared to a cluster of eight Intel i7 quad-core servers. Cost-wise, the GPU-based service system costs 40% of the i7 server cluster, and consumes 50% of energy that is required by the i7 cluster. We also gives an overview of our system architecture and describe the workflow for processing pricing and information service requests. [C358]

"Low complexity montgomery multiplication architecture for elliptic curve cryptography over GF(pm)"

In this paper, a scalable VLSI multiplication architecture based on Montgomery multiplication (MM) algorithm for elliptic curve cryptography (ECC) over GF(pm), where p is a positive prime and m is the degree of extension of the base field GF(p), is presented. The elements of the GF(pm) are in polynomial basis (PB) representation. The coefficients of the polynomials are represented in Montgomery residue format to simplify the multiplications over GF(p). The proposed algorithm of MM over GF(pm) requires m(m+1) MMs and m2additions over GF(p). However, the proposed architecture takes {m(m+1)Nmm+Nadd+1} cycles to compute MM over GF(pm), where Nmm> Nadd= 2, and Nmmand Naddare the numbers of cycles to complete an MM and an addition over GF(p), respectively. The security of an ECC scheme depends on the number of elements in GF(pm). Hence, for a p with nominal bit length (p 2), the value of m can be small, but the GF(pm) still contains almost equal number of elements to a GF(2k), where k is positive integer. The complexity of the MM architecture over GF(p) is reduced by using carry-save-adder (CSA) based implementation, where NPEis the depth of the CSA. Analysis shows that the area complexity of the proposed architecture is significantly less. Implementation in AMS-0.35um technology, with L=30 (for p=536872717), m=23 and NPE=8, yields a clock frequency of 20.885 MHz, throughput of 6243.68 multiplications per second and power consumption of 86.8 mW (at 20 MHz). [C359]

"Order is power: Selective Packet Interleaving for energy efficient Networks-on-Chip"

Network-on-Chip (NoC) links consume a significant fraction of the total NoC power. We present Selective Packet Interleaving (SPI), a flit transmission scheme that reduces power consumption in NoC links. SPI decreases the number of bit transitions in the links by exploiting the multiplicity of virtual channels in a NoC router. SPI multiplexes flits to the router's output link so as to minimize the number of bit transitions from the previously transmitted flit. Analysis and simulations demonstrate a reduction of up to 55% in the number of bit transitions and up to 40% savings in power consumed on the link. SPI benefits grow with the number of virtual channels. SPI works better for links with a small number of bits in parallel. While SPI compares favorably against bus inversion, combining both schemes helps to further reduce bit transitions. [C360]

"Design procedure to minimize power consumption and delays in WSAN"

Current trends in the development of industrial applications enforce the use of wireless networks to communicate the system nodes mainly to increase flexibility and reliability of these applications and to reduce the implementation cost. However, in control applications, as consequence of the latency and jitter generated by the network, not always the results achieved by the experimental results and desired performance are coherent. This is due to the imprecise models for system analysis and design used and the non appropriated validation methods and platforms to support these models. Therefore this paper presents a method to achieve an optimal system configuration in order to fulfil the desired performance in control applications with a significant energy saving and minimum delay. [C361]

"Power saving route algorithm on underground Wireless Sensor Networks"

The routing protocol which can meet the requirement of underground wireless sensor network had a decisive role on the monitoring quality and the survival time of network. By combining the beacon nodes chain deployment of tunnel Wireless Sensor Networks, the Minimum Energy Relay Routing (DMERR) algorithm which is based on dynamic path loss parameter is proposed, this algorithm can save the energy of communication by obtain the exact path loss parameter of each place in roadways and calculation the optimum communication distance accurately. The simulation results show that this routing algorithm can meet the requirements of the underground linear wireless sensor networks and reduce the routing energy consumption effectively. [C362]

"The Optimized Reinforcement Learning Approach to Run-Time Scheduling in Data Center"

Warehouse data center is very large scale and complex, which constains tens of thousands servers and accomodates various applications. What's more important, energy consumption has risen to a critical point. Scheduling needs to maintain performance and reduce energy consumption as much as possible. Previous

researches have proposed RL (reinforcement learning) as a solution. These approaches have reduced energy consumption in IT equipment to the extent of "improved operation" while maintain SLA (Service Level Agreement) and throughput. However, with consideration of the special condition of data center, more optimization of RL could be discovered. We find through careful optimization of RL, we could save much more energy in IT equipment (about 12%) while maintain performance. When we consider 110 billion kWh/year energy consumption in 2011, 12% saving of energy in IT equipment would make a dramatic difference in operation cost or even feasibility. Our approach sets up ideal state which would maintain performance and reduce energy consumption. When some machines deviate from that ideal state, the schedulers in the data center compute the gains and costs of VM migrations to determine whether operations such as consolidation or ban lancing would be carried. In this way, we apply long range value estimation, exploration elimination, combining of planning and learning to optimize RL. The simulation of real internet workload trace shows our design saves much more energy in IT equipment and maintains performance with much less VM migration. [C363]

"A New Cluster Routing Strategy Based on ZigBee"

Zigbee is a wireless technology as an open global standard used in many applications such as interconnecting sensors, monitoring and automating home, medical, industrial, and agricultural systems where low power consumption are needed. Based on the ZigBee network, a good routing protocol has to be scalable and adaptive to the changes in the network topology. Thus protocols must perform well as the network grows larger or as the workload increases. In this paper we improved a new cluster routing protocol(called AODV Cluster). Fistly, AODV Cluster divides the ZigBee network topology into one or more logical clusters, A cluster label uses the ZigBee address allocation, the one cluster can share a new routing, which saved on energy of the network and reduced communication quantity. Simulation results shows that this protocol not only keep the AODV merit, but also advanced the scalability. Especially in dense network, performance is superior than AODV. [C364]

"The Research on Sustainable Circular Economy Mode of Chlor-Alkali Industry in China"

Nowadays, insufficient resources, energy shortage, environmental pollution have become serious obstacles in the process of sustainable economic development, when the process of industrialization is in the rush hour of consumption of resources. Chlor-alkali trade is one of the most important Chemicals Industry, which is characteristic of serious pollution, and noted for resource conversion. The product mix in many chlor-alkali enterprises is attributed to extensive mode, just oriented by primary products with low level of science content Added Value of products. If we can design a "raw material-reactants-products + products-raw materials" product production chain, then the enterprise will not only realize high yield, but also greatly save resources and decrease consumption of transport, reduce environmental risks, to carry out non-pollution manufacture and sustainable development. The enterprises of chlor-alkali industry should take the initiative to develop new products associated with the chlor-alkali industry, to optimize and upgrade of industrial structure at the enterprise level, to expand and extend the industrial chain. To take full advantage of the above-mentioned by-product gases, and further deep and finish process, make fine chemicals stronger and larger, recycling economy development model should provide the guides; moreover the ideas of development of the industry are provided for the purpose that an integrated chlor-alkali industry groups should be established. [C365]

"COTE: A Clustering Scheme with Optimal Tiers and Energy Efficiency in Wireless Sensor Networks"

In wireless sensor networks (WSNs), Energy consumption will be reduced by grouping all the sensor nodes into clusters and letting the data be aggregated at cluster heads(CHs). In this paper, we address the issue of how many tiers in a given clustering scheme are optimal in saving energy. We present a method to calculate the optimal tier number with consideration to the energy consumption both in data transmission and control overhead. We propose a clustering scheme with optimal tiers and energy efficiency for wireless sensor networks, which we term COTE for short. We theoretically analyze the energy consumption, computing complexity and network latency of COTE. COTE not only minimizes the energy consumption by hierarchically organizing clusters with an optimal tier but also has a low message overhead and preferable network lifetime. Simulation results demonstrate that COTE has less energy consumption and longer lifetime with comparison to the existing scheme. [C366]

"A Statistical Method of Energy Consumption Based on Energy-Tree"

Combined with the national energy policy and the actual project requirements, the author studies a statistical method of energy consumption based on energy-tree, in order to reduce corporate energy consumption, improve enterprise efficiency and optimize enterprise direction. Firstly, the author establishes energy-tree model that includes an entity tree that solid parent-child relationship between entities and a table that solid many-to-many

relationship between entities and energies. Secondly, the author studies energy-tree recursive statistics. Finally, the author applies the research result to actual projects. Practice shows that the statistical method of energy consumption based on energy-tree is an efficient and reliable method of energy consumption. [C367]

"An Investigation into Energy Efficiency of Data Centre Virtualisation"

This paper presents a critical comparison of a virtualised data centre infrastructure and an infrastructure that consists of physical servers. Our investigation shows how virtualisation can better utilise the hardware and consequently reduce the power consumption and carbon emissions. The case study reports an extensive research phase to identify main reasons for data centre virtualisation. The data centre is then modelled, based on server information from one of the data centres at the University of Greenwich. We emulate a virtualised infrastructure to contrast against the physical infrastructure. These two models are then critically compared and the potential carbon emission reductions and savings are analysed. Our results show that a virtualised data centre infrastructure can potentially reduce carbon emissions by approximately 30%. [C368]

"Applying Sustainable Economizing Technology to the Low-Carbon Building"

The economizing technology is important to the low-carbon building. Sustainable low-carbon building needs the sustainable technology. This article combines natural technology with building to create a kind of sustainable low-carbon building that is cheap and convenient to use. Therefore this building conforms to the situation in china. In addition, the lifestyle in the building is very important. The sustainable life must be saving energy, environmentally friendly and is good for the health at the same time. The life can exist by sustainable low-carbon building. The new design idea that pursues the sustainable economizing technology and life is different from the design idea of the low-carbon building that pursues high technology and complex systems. It emphasizes the effect of using. This low-carbon building design idea can exert positive effects on reducing CO2emission for buildings. [C369]

"Power saving mechanism and performance analysis for 10 Gigabit-class passive optical network systems"

In this paper, we characterize the energy-saving scheme for the 10 Gigabit-class PON systems discussed in FSAN/ITU-T and IEEE 802.3av. Sleep mode is used to reduce the power consumption in the PON system. An optical network unit (ONU) goes to sleep mode after negations with optical line terminal (OLT) and wakes up when the sleep duration is up. The OLT decides the ONU's next work mode depending on the downstream traffic condition. An analytical model is performed to study the specified sleep mode under the assumption of downstream traffic. The performance metrics are derived with respect to energy consumption and packet delay to evaluate the proper sleep parameters. [C370]

"BFDREAM: A new routing protocol for deep sea acoustic network"

The directed routing protocol ends in failure when it faces the situation of the destination node with a very low velocity in a sparse ad hoc network because none of nodes exists in its forwarding zone. Although the situation is handled by its recovery procedure, continual retransmission will lead to a terrible waste of network resource and a great delay in packets transmission. On the basis of physical characteristics of acoustic network in deep sea, this paper proposed a novelty routing protocol: BFDREAM (Boundary Forwarding DREAM). The protocol absorbs the essence of directing flooding and boundary forwarding, and reduces quantities of the non-effect information created in data transmission. Simulation results show that our protocol achieves much higher performance in energy saving and propagation delay decreasing compared with DREAM. It has a bright application prospect in underwater acoustic networks. [C371]

"Analysis of Carbon Emissions from China's Petrochemical Industries Using the LMDI Method"

Based on time series decomposition of the Logarithmic Mean Divisia Index (LMDI), this paper analyzes the contribution that economic activity, industrial structure and carbon emissions intensity, namely economic activity effects, structural effects and technical effects, make to the change of carbon emissions quantitatively from China's petrochemical industries over the period 1998-2007. The results shows that economic activity is the most important factor to drive carbon emission growth in China's petrochemical industries, however, it is not economic activity that will inevitably lead to carbon emissions growth, structural effects has certain decrement effect to carbon emissions, and technical effects is negative overall, but its volatility is large and without showing any clear decrement effect trend. This study will promote understanding about the relationship between economic development and carbon emissions in China's petrochemical industries, and possess valuable reference for making policies about energy saving and emissions reducing. [C372]

"Life Cycle Assessment of Road Surface Paving with Warm Mix Asphalt (WMA) Replacing Hot Mix Asphalt (HMA)"

Based on a testing road construction project, where warm mix asphalt (WMA) replaced Hot Mix Asphalt (HMA) to be used on road surface paving, investigation was carried out to collect data on energy consumption and air emissions for all the steps including production of raw materials(HMA and WMA), transportation, paving and road surface rolling. Then life cycle assessment was performed to compare the environment impacts of road surface paving with WMA and with HMA based on the data collected above. The life cycle assessment inventory was obtained and assessment results showed that when using WMA and HMA as road surface paver, energy consumption in the full process was reduced by around 22.4%; and environment load was released by saving impact potentials of many impact categories: due to the reduced air emissions from WMA producing and paving, more than 70% of photochemical ozone formation (POF) potentials was saved when compared to HMA paving; above 55% of impact potentials was saved for three impact categories: Global warming100 years (GW100), Acidification (AC) and Human Toxicity via air (HTa), respectively. In conclusion, by using WMA substituting HMA as road surface paving course material, positive effects on energy conservation and environmental load release can be achieved. [C373]

"The Analysis of Energy Conservation on External Sunshade of Bay Window in Nanjing"

This paper, basing the climate parameters of Nanjing, taked a south bay window of PVC casement hollow glass windows as the subject and calculated energy consumption of the bay window using MATLAB when the window had no external sunshade and different external sunshade ways were applicated. Then energy conservation character was analysed The results show that energy-saving effect of the whole bay window using rolling shutter movable external sunshade is the most obvious, the annual energy consumption reducing by about 45% compared with that of non-sunshade. Energy saving effect of middle window of the bay window using rolling shutter movable external sunshade and other two sides utilizing extension of cantilever slab length as level fixed external sunshade and extension of cantilever slab width as level fixed external sunshade of middle window and other sides using rolling shutter movable external sunshade is more obvious and they save energy respectively about 18.23% and 15.54%. The whole bay window utilizing the extension of cantilever slab width and length as level fixed external sunshade makes the annual energy consumption of the bay window increases by about 9.76% compared with that of no sunshade. [C374]

"A Power-Saving and Robust Point Coordination Function for the Transmission of VoIP over 802.11"

Group-polling based schemes for the enhancement of the Point Coordination Function (PCF) in the 802.11 have been supposed to be the most efficient scheme for the transmission of VoIP frame. However, most of the group-polling schemes are not energy-efficient at all due to the fact that all the stations in this list must listen to the channel during all the transmissions belonging to this polling list. Furthermore, if some stations loss this group-polling frame, it will result in many empty group slots leading to unstable system states. In this article, we propose a Power-Saving and Robust Point Coordination function (PSR-PCF) for the transmission of VoIP over 802.11. Any stations can set its wakeup timer and fall asleep according to the schedule information of the received group polling frame. In order to make this system more robust, we propose a chained-scheme, that is, the MAC address of next active station is piggybacked in the frame header of the uplink data frame to the AP with no additional overheads. Analysis shows that the energy consumption can be reduced by over 93.2% compared with that of ICF [20]. The number of active VoIP stations sustained can be up to about 260 without any data loss under the 802.11a with 54Mbps data rate. Whereas, in the same parameters of 802.11a, the PCF with the Round-Robin (RR) scheduler will have more than 10% data losses if the number of active VoIP stations is larger than 60. [C375]

"Power quality in public lighting systems"

The governments are interested in applying energy saving policies. From this point of view, the energy consumption for lighting can catch up 15% of the total electrical energy country bill. As a matter of fact, the lights are often inefficient, they are used when is not necessary and they are also generator of a considerable amount of distortion. A possible method to reduce the energy consumption and to increase the Power Quality (PQ) level can be represented by the substitution of the old lamps and by using new ballast and control systems. The aim of this paper is, with reference to public lighting, to illustrate as the electronic control gear for traditional High Pressure Sodium (HPS) lamp makes possible not only energy saving but also a wide PQ improvement. [C376]

"Enhancing the sustainability of additive manufacturing"

Additive Manufacturing (AM) produces three dimensional objects directly from a digital model by the successive addition of material(s), without the use of a specialized tooling. AM allows the rapid development of sustainable products and has been increasingly used to produce lightweight components to save materials and costs. This particularly helps to save a considerable amount of material, energy and cost for the production of one-off or small volume products. In addition, the non-processed raw materials can be recycled and re-used by AM to reduce material waste drastically. AM is therefore considered as a sustainable manufacturing approach driving the rapid development of new products. The paper will present and review the research activities performed in the University of Exeter to enhance the sustainability of AM. These research activities include: 1) sustainable product design by optimising internal lightweight structures; 2) improvement of process efficiency by optimising AM process parameters; 3) reduction of energy consumption by in situ thermite material reaction; 4) sustainable production of personalised chocolates. [C377]

"The Impact of Using Chilled Water Storage Systems on the Performance of Air Cooled Chillers"

In the air conditioning (AC) industry chilled water storage (CWS) systems are one form of cool thermal storage technology that can be used to time shift the electrical load of the system from the peak day periods to off peak night time periods. In this paper the data for the actual exported and generated electrical energy obtained for the power stations has been used to estimate the electrical energy consumption and the peak electrical load of AC systems. Since the chiller in an air cooled AC system represent more than 75% of the total electrical power consumed by an AC system during the peak demand period, the impact of using CWS systems with alternative operating strategies including partial (load leveling), partial (demand limiting) and full load has been investigated. In our conclusions we estimate that approximately 45% of the total annual exported electrical energy is consumed solely by AC systems as a result of the very high ambient temperatures. Furthermore, it is estimated AC systems represent about 62% of the peak electrical load. The results demonstrate that CWS can reduce the peak electrical load of a chiller in an air cooled AC system by up to 100% and reduce the nominal chiller size by up to 33% depending up on the operating strategy adopted. This is achieved with only a 4% increase in power consumption of the chiller for all CWS strategies except for full storage where the energy consumption actually decreases by approximately 4%. [C378]

"Discussion of Thermal Environment of Effective Utilization of Nature Source in Large Space Building"

In transitional season, using mechanical ventilation can significantly reduce the air-conditioning energy consumption in large space building. In this paper, based on heat balance calculation, a nomograph about lowering switch point of a hall was drawn under different conditions such as different load factor, different outdoor and indoor temperature, and different ventilation rate. Under the load factor of 80%, switch points was 1.9□ and 17.9□, the minimum ventilation rate was 45% of design condition; Numerical simulation was carried out to calculate temperature and velocity filed, under small velocity case, the indoor thermal comfort was affected by load distribution, and the air flow organization of low-side wall return air was positive to good wind environment in occupant zone. [C379]

"Design of Solar Preheating System for Boiled Water"

Based on the current situation of energy and disadvantage of present solar heating water methods, a high-efficiency and secure hot water service system indirectly utilizing solar power has been introduced. The hot water preheating process is added to this system. It can make full use of solar-energy, shorten the time for heating, reduce energy consumption, cut the cost without polluting the drinking water. This system is applicable to population concentrating and large boiled water demanding areas. [C380]

"Evaluation of harmonic current reduction for the purpose of energy savings-A case study"

This article evaluates the method of reducing power loss due to 3rdharmonic currents in a building that contains a significant level of electronic loads, by placing a passive filter in the neutral path. The initial power loss is obtained through current measurements in the phase and neutral conductors and knowledge of the resistance of these conductors and that of the transformer serving the facility. PSpice simulations are performed to determine the most suitable RL-C filter to minimize this loss. The losses are found to be not that significant due to existing reinforcements in the distribution circuit. The effect of filter placement on voltage distortion and capacitor resonance with the transformer leakage inductance are addressed. [C381]

"Power Generation Exchange Optimization Model under Constrains of Energy-Saving and Emission-Reducing Among Regions"

Energy-saving and emission -reducing has become the strategic focus of China's economic development. Power generation industry, with characteristics of high energy consumption and high pollution, has great potential in energy-saving and emission- reducing field. Several methods can be used in energy saving and emission-reducing of power generating side, such as adjusting the power structure, establishing dispatch and trade mechanisms, as well as tax lever strategies, etc.. In this article, the trading results under the energy-saving goal were studied from the dispatch and trade mechanism perspective. Further, following models were established: trading results comparison model with emission reduction constraints and energy-saving goal; energy trading optimization model between two regions and among multiple regions, both considering constrains of energy-saving and emission- reducing. [C382]

"Sustainable development of ice landscape in Harbin"

The paper analyses the practice to realize the sustainable development of ice landscape in Harbin. The specific measures include ice landscape layout, the use of energy saving light source, ice recovery. The study methods are investigation and illumination tests around the ice lanterns on-site. All of Large-scale ice landscapes are built near the Songhua River which across the city so that we can get the free and pure ice from the river quickly. LED technique was applied to ice landscape lighting to reduce the power consumption in 2008. LED light isn't fragile and contains no toxic substances. More and more people are interested in ice landscape, and they become the internal impetus to the ice landscape development. The study also finds out some problems. The collection and reuse of ice lack feasible measures, and about 120,000 cubic meters ice aren't recycled every year. The higher price of LED source has affected its popularity, and the excessive lighting of ice landscape can lead to light pollution. Some factors decide the ice landscape sustainable development such as ice recovery, energy saving, environmental protection and related cultivation of professionals. [C383]

"Research of the Crane System Based on Technology of Storing-Energy with Super-capacitor"

Saving energy, lowering energy consumption and reducing pollutants discharge was an important factor of effecting economic development. This is a new research direction to use super capacity to crane system. In this paper, the character of the super capacitor was firstly introduced and analyzed. Secondly, the DC-DC converter used in crane system based on mix power was designed. And the technology of soft switch was discussed. Then the calculating method of super capacitor was described. [C384]

"An energy efficient MAC protocol for cluster based event driven WSN applications"

Energy efficiency is one of the most important design criteria for long lasting WSN applications. There are many interesting works related to Medium Access Control (MAC) protocols proposed for low energy consumption and high system performance in the literature. TDMA based MAC protocols are more energy-efficient than their traditional contention based counterparts. However, conventional TDMA based MAC protocols are not well suited to the event driven WSN applications. There are some MAC protocols allocating time slots to only source nodes. The distinctive feature of our proposed MAC protocol is that it assigns a time slot to only one of the source nodes all with the same data sensed and to be sent. Thus it reduces data transmission redundancy and achieves energy savings. The analytical performance metrics and expressions are obtained for the proposed MAC protocol and its performance is compared to the conventional TDMA, E-TDMA, BMA and EA-TDMA protocols. [C385]

"Source coding technique for energy efficient IEEE 802.15.4 wireless sensor networks"

One of the main issues in wireless sensor networks is energy efficiency. Most of the energy is used for wireless transmission. To reduce an amount of data being sent, if a particular compression algorithm is used, than it can significantly reduce a power consumption and increase node's operating lifetime. Presented in this paper is a research, in which the possibility of use of IEEE 802.15.4 wireless sensor networks in electrocardiogram (ECG) monitoring applications is analyzed. ECG signal, measured from a patient heart, is in the first step compressed that uses Autoregressive (AR) predictive coding and then again, using Huffman's entropy coding. It has been studied, through the use of simulations, how reduction in data rate of compressed data will affect node's average power consumption. The results obtained from data compression of ECG signal show that sufficient energy saving can be achieved. [C386]

"Optimisation of quality and energy consumption for additive layer manufacturing processes"

Additive Layer Manufacturing (ALM) has great potential to be a viable automated direct manufacturing process for the aerospace, automotive and medical industries. By using layer-by-layer consolidation of raw materials to build three-dimensional near net or net shape objects, ALM enables the recycling of the non-consolidated powder materials and manufacturing of light weight parts, allowing energy and materials saving. One of the main

challenges in various ALM processes is to reduce the energy required for the part building process and at the same time maintain the surface quality of the parts, affected by the "stair stepping" effect, as this has aesthetic and functional importance for industrial applications. These objectives are competing criteria and significantly influenced by the build orientation of the ALM parts. This study investigates a computational technology for the identification of optimal part orientations for the minimization of surface roughness and simultaneously energy consumption in the manufacturing process. The computational model based on a multi-objective optimization technique has been developed to predict and optimise the energy consumption and surface quality objectives. The output of the computational optimisation includes the complete set of Pareto solutions, which define the set of best compromises between the chosen objectives. [C387]

"Feedback based relaying in long term evolution systems"

The last ten years have witnessed explosive growth in the number of subscribers for mobile telephony and data services. However, the recent development of mobile broadband technology comes at a significant energy cost. As subscriber levels saturate, the operating costs of such a network need to be reduced significantly to maintain competitiveness. The carbon footprint will become an increasingly important constraint in future system design. The objective of the recently started Mobile VCE Core 5 Green Radio programme is to study in depth the energy consumption issues for wireless networks. The project considers two main themes, tackling both the top level design of future wireless networks and how to optimise the constituent elements of wireless devices. This paper considers new transmission protocols that maximize the lifetime of a network under a Quality-of-Service (QoS) constraint. The proposed schemes incorporate a Decode-and-Forward relaying strategy with instantaneous channel feedback in order to save energy and therefore prolong the network lifetime. We provide examples of the savings offered by the proposed techniques in significantly increase the lifetime of the network without affecting the considered QoS and delay constraints. The methods seem to be promising solutions for Green Radio technology. [C388]

"Reducing instruction memory energy consumption by using Instruction Buffer and after scheduling analysis"

Use of Instruction Buffers (also named Repeat Buffers), and caches is common way to avoid memory speed bottleneck in presence of memory hierarchies. Once the instruction resides in a cache or a buffer, repeated execution of the same instruction does not require separate memory access and possible cache miss. Use of the instruction buffers offer also an advantage when low energy consumption is an issue. Reading instruction from the buffer requires order of magnitude less energy then fetch from instruction memory. Keeping memories in the deselect mode and fetching data from the buffer takes roughly half of the power compared to the reading from the memory. In this work, we analyze effects of adding instruction buffer to an existing ASIP architecture. We analyze already generated code of an application, to find the often executed loops, and augment instructions with instruction buffer control information. We show, that for many of embedded applications, storing kernels of execution in the instruction buffer saves between 60 to 87% of instruction memory, even with most trivial loops. This savings can translate to up to 47% reduction of memory energy. [C389]

"A new system design of the multi-view Micro-Ball endoscopy system"

While the wireless endoscopic capsule examining human's large gastrointestinal (GI) cavity, such as stomach and large intestine, many interested spots are omitted by only one or two cameras due to its limited field of view. This paper proposes the new system architecture of the Micro-Ball for medical endoscopy application. Six cameras are embedded in the Micro-Ball for multiple fields of view, which can reduce endoscopic miss rate greatly. Based on this system architecture, a new working mode is proposed. The captured image data are saved in the Flash memory instead of being transmitted outside human body wirelessly. Only less than 6mJ is consumed when the Micro-Ball captures a frame of 480Ч480 image and writes the image data into the Flash memory. The endoscopic Micro-Ball can work in human's GI tract for 10 hours when the image frame rate is 2 fps. The Micro-Ball endoscopy system is verified on the FPGA-based demonstration system. [C390]

"Diagnosis of Energy-Saving Potential and Optimized Measures for 600MW Supercritical Coal-Fired Power Units"

Significant progress has been made in energy conservation and consumption reduction since the 11th Five-year Plan. 600MW-class thermal power units have become the main force in China's power mix. It is crucial to study the energy-saving potential, improve the economic operation and overall competitiveness of 600MW power units. Taking a 600MW power unit of certain power corporation for instance, the energy-loss analysis method was introduced to analyze the energy efficiency and energy-saving potential of 600MW power unit. Based on this, several optimized solutions were performed, focusing on the combustion optimization, slide-pressure operation

optimization, sequence valve control optimization and gland seal retrofit etc.. This made favorable energy-saving effects, reducing the coal consumption greatly. [C391]

"IDC: An Energy Efficient Communication Scheme for Connected Mobile Platforms"

Mobile platforms (e.g. laptops) offer ubiquitous network connectivity through its wireless communication interfaces, with most of usage models driven by always-on communication activities. However this in turn creates significant power challenges as the battery life is a critical resource for all mobile platforms. While the communication device itself consumes a relatively small portion of the total power, the impact of communication on the overall platform power is significant, due to the non-deterministic nature of the network traffic, which tends to keep the platform busy more than necessary. In this paper, we extensively investigate characteristics of various real- world network-centric workloads, e.g., VoIP, web browsing, etc., and their impact on the mobile platform in terms of power consumption and energy. Based on the understandings, we propose, implement and evaluate an Interrupt /DMA (Direct Memory Access) Coalescing (IDC) scheme at the wireless network interface card (NIC). This scheme effectively reduces platform wakeups due to incoming network traffic, Another advantage of the scheme is that it requires only NIC modification at the receiving node, and is transparent to the user and the network. Using a commercial NIC with a laptop testing platform, we evaluate the power savings and performance impact of our proposed scheme. The measurements show that our scheme achieves significant platform power saving, around 25% of platform components, without impacting user experience. [C392]

"Green DSL: Energy-Efficient DSM"

Dynamic spectrum management (DSM) has been recognized as a key technology for tackling multi-user crosstalk interference for DSL broadband access. Up to now, DSM design has mainly been focusing on maximization of data rates. However, recently, reducing the total power has become a main target, as IT power consumption has been identified as a significant contributor to global warming. In this paper we extend traditional DSM design towards a much wider energy-efficient scope and show how to tackle the corresponding optimization problems. The impact of this 'green DSL' approach is evaluated for practice with some surprisingly good numerical results. Furthermore bounds are provided on the trade-off between data rate performance and power saving. [C393]

"Energy Savings for Wireless Terminals through Smart Vertical Handover"

This paper optimizes handover decisions between WLAN (802.11) and WiMAX (802.16e) standards, for both uplink and downlink data transmission. The handover becomes part of a cross-layer approach controlling several knobs (air interface parameters or platform settings) in order to reduce the terminal power consumption. The first step is to derive detailed power and performance models for both standards, in order to correctly evaluate the opportunity of a handover. This includes channel fading fluctuations, extraction of MAC-level behavior and packet error rates, and overall power consumption from the wireless platform. Such models enable first optimal single-standard power-throughput trade-offs, that will be used as reference points before adding the handover possibility in order to assess its specific gain. The second step is the design of a handover controller that selects the network with the lowest expected power for the required rate. The proposed mechanism is based on regular scanning of both networks. It computes the expected energy in order to send a given amount of data over each network, taking handover cost into account, and selects the most appropriate one. Based on a software-defined radio platform and a typical channel coherence time of one second, simulations demonstrate a power saving factor up to 2.5 as a function of the scenario, compared to a single-standard system that is already cross-layer optimized. This illustrates the large gain that is available, besides the handover advantage in terms of improved connectivity. [C394]

"Distributed and Power Efficient Routing in Wireless Cooperative Networks"

Most ad hoc mobile devices in wireless networks operate on batteries and power consumption is therefore an important issue for wireless network design. In this paper, we propose and investigate a new distributed cooperative routing algorithm that realizes minimum power transmission for each composed cooperative link, given the link BER (bit error rate) constrained at a certain target level. The key contribution of the proposed scheme is to bring the performance gain of cooperative diversity from the physical layer up to the networking layer. Specifically, the proposed algorithm selects the best relays with minimum power consumption in distributed manner, and then forms cooperative links for establishing a route with appropriate error performance from a source to a destination node. Analytical results are developed to show that our cooperative transmission strategy (MPSDF) achieves average energy saving of 82.43% compared to direct transmission, and of 21.22% compared to the existing minimum power cooperation strategy. Furthermore, the proposed power efficient routing algorithm can also reduce the total power consumption by a couple dB compared to existing cooperative routing

algorithms. Monte-Carlo simulation results are also provided for performance evaluation. [C395]

"Power-Saving Geographic Routing in the Presence of Location Errors"

Existing power efficient geographic routing algorithms have been shown to be able to reduce power consumption and hence prolong the lifetime of multi-hop wireless networks. However, in practical deployment scenarios where location errors inevitably exist, these algorithms are vulnerable to a substantial performance degradation in terms of energy consumption. Since location errors always exist no matter which localization technique is used, there is the need of a geographic routing protocol which can tolerate location errors and achieve reduced energy consumption. In this paper, we study the optimal distance of existing power-saving geographic routing algorithms. Through incorporating location errors into an objective function, we propose a novel geographic routing algorithm. Extensive performance evaluations show that our proposal is robust to location errors, thus statistically minimizing consumed transmit power as a packet is relayed from source to destination. [C396]

"I-Cache Tag Reduction for Low Power Chip Multiprocessor"

Energy consumption is a major consideration in microprocessor optimization. This paper presents a tag-reduction based approach for energy saving in L1 i-cache (instruction cache) of chip multiprocessors (CMP). To our best knowledge, this is the first work that extends the tag reduction technique to the CMP. We formulate our approach to an equivalent problem which is to find an assignment of the whole instruction pages in the physical memory to a set of cores such that the tag reduction conflicts for each core can be mostly avoided or reduced. We then propose three algorithms using different heuristics for this assignment problem. The experimental results show that our proposed algorithms can save the total power up to 45.33% in average compared to the one that the tag reduction is not used. They outperform significantly the tag reduction based algorithm on single core processor as well. [C397]

"Ground bouncing noise suppression techniques for MTCMOS circuits"

Ground bouncing noise produced during the sleep to active mode transitions is an important challenge in multithreshold CMOS (MTCMOS) circuits. The effectiveness of different noise-aware MTCMOS circuit techniques to deal with the ground bouncing noise phenomenon is evaluated in this paper. An intermediate relaxation mode is investigated to gradually dump the charge stored on the virtual ground line to the real ground distribution network during the sleep to active mode transitions. The peak amplitude of the ground bouncing noise is reduced by up to 69.17% with the noise-aware MTCMOS circuits without sacrificing the savings in leakage power consumption as compared to the standard MTCMOS circuits in a 90 nm CMOS technology. [C398]

"A programmable compact control mechanism for ultra-Low power Current-Mediated CMOS Imager"

A novel ultra-low power control mechanism is presented for Mega-pixels current-mediated CMOS imagers. Within the proposed technique, the operating read-out pixel and reset pixel are located in the same column, controlled by only 2-bit lines/pixel compared with 4-bit in previous reported design. The number of transistors for each pixel is reduced from the standard 6 transistors to 4 in the current design. Because the read-out and reset modes are separated into two phases in series for the proposed mechanism, only one reference current source is used, by which the power consumption can further be saved and also the chip area would be shrunk. Minimum wiring overhead is required in the proposed pixel as two control lines are removed. Furthermore, a programmable electronic shutter is adopted to adjust the integration time. The proposed design is simulated using TSMC 0.18 um technology, with more than 80% fill factor for a 17 times 17 um2pixel dimension. [C399]

"Optimal Energy Savings in Cellular Access Networks"

In this paper we study with simple analytical models the energy-aware management of cellular access networks, trying to characterize the amount of energy that can be saved by reducing the number of active cells during the periods when they are not necessary because traffic is low. When some cells are switched off, radio coverage and service provisioning are taken care of by the cells that remain active, so as to guarantee that service is available over the whole area. We show how to optimize the energy saving, first assuming that any fraction of cells can be turned off, and then accounting for the constraints resulting from the cell layout. [C400]

"Energy Profile Aware Routing"

Energy efficient communication devices are essential to minimize the operational cost of future networks and to reduce the negative effects of global warming. In this paper we propose a novel energy reduction approach on network level that takes load-dependent energy consumption information of communication equipment into

account. Case study calculation results show that energy savings of more than 35% and with it operational cost can be saved by applying energy profile aware routing. [C401]

"Power Efficient Approach and Performance Control for Routers"

We introduce two approaches for power saving routers, which are the power efficient designing and the power saving designing. Power efficient designing enables a high performance router at low power consumption. As a part of power efficient designing, we have integrated ASICs/FPGAs of routers and developed a scalable central architecture. Additionally, we used new high speed memories and high speed interfaces such as a SerDes. As a result, the whole power consumption of our router adopting power efficient designing was reduced over 50% compared to conventional routers. Power saving designing is an approach to cut down wasted power consumption. Two major aspects belong to power saving designing, which are static performance control and dynamic performance control. We have been studying on static performance control, such as power cutting technology per port or module, and power saving mode by frequency switching. We were successful in saving 10-20% of power compared to conventional routers using this power saving mode by frequency switching. Furthermore, we introduce the dynamic performance control as a promising power saving approach for next generation routers. The router controls its performance dynamically according to the amount of received traffic. We show two technologies needed for this approach, which are the dynamically performance controllable router architecture/circuit, and the traffic monitoring/predicting technology. We consider that working on these technologies will save more power. [C402]

"Design and evaluation of a BitTorrent proxy for energy saving"

Recent studies indicate that the Internet-related energy consumption represents a significant, and increasing, part of the overall energy consumption of our society. The largest contribution to this consumption is due to Internet edge devices. Typically, users leave their PCs continuously on for satisfying the connectivity requirements of file sharing P2P applications, like BitTorrent. In this paper we propose a novel proxy-based BitTorrent architecture. BitTorrent users can delegate the download operations to the proxy and then power off, while the proxy downloads the requested files. We implemented our solution and validated it in a realistic testbed. Experimental results show that, with respect to a legacy approach, our solution is very effective in reducing the energy consumption (up to 95%) without introducing any QoS degradation. [C403]

"Application Research of WSN in Precise Agriculture Irrigation"

In order to accurately get extent of the water deficit and therefore realize effective and water-saving irrigation, the application of wireless sensor networks (WSN) to precision irrigation system is explored based on the acoustic emission principle for crop water stress. Cluster based multi-hop routing algorithm is proposed to reduce energy consumption of node transmitting data. By the newest gateway in WSN, the system realizes bridging between wireless networks and wired networks. It runs distributed and possesses many advantages, such as good robustness, extensibility, scalability, and so forth. Simulation results show that the application is correct and reasonable and enables user to precisely acquire the crop water requirement information. The system can be effectively applied to some water-saving agriculture areas, for example, the cropland, the nursery garden, the greenhouse, etc. [C404]

"Reducing Average Power in Wireless Sensor Networks through Data Rate Adaptation"

The use of variable data rate can reduce network latency and average power consumption, and automatic rate selection is critical for improving scalability and minimizing network overhead. In the IEEE 802.15.4 standard the SNR can be inferred through the radio reported link quality or received signal strength, and an extension to the standard leads to highly dynamic and accurate rate selection. Using data from an experimental study of 44 IEEE 802.15.4 nodes in an industrial mesh network, SNR is extracted to show sufficient margin exists for higher data rate communication. A variable rate signaling scheme with automatic rate selection is proposed to provide links at the standard 250 kb/s as well as 500 kb/s, 1000 kb/s and 2000 kb/s with a minimum of hardware changes. Using the experimental data to generate a model of the real world system, total network energy is compared using legacy and variable rate signaling showing over 40% savings. [C405]

"A 116fps 74mW mobile heterogeneous 3D-media processor for 3D display contents"

A mobile heterogeneous 3D-media processor which supports all 3D display contents by combining a 3D display IP with a stereo video decoder and a 3D graphics IP is proposed. For mobile environment, adaptive power management scheme is adopted, saving 165mW. For high-end applications, fast modulo operators are designed to synthesize 3D images at 116fps, 17 times faster than the previous work. An IEEE 754 compliant floating point vector unit reduces critical latency by 30%. [C406]

"PAST-EnDRoP: Position aided STDMA MAC protocol with Energy and Delay Constrained Routing for MANET"

Energy conservation is a critical issue regarding wireless mobile ad hoc networks, since the nodes are battery restrained and the depletion of their power defines the lifetime of the network. This paper presents the PAST-EnDRoP: position aided spatial TDMA (PA-STDMA) MAC protocol with Energy and delay constrained routing for mobile ad hoc networks. It is a novel approach designed for optimized channel use and improved power consumption efficiency. PA-STDMA performs transmission scheduling based on positional information of individual nodes. This facilitates on-line topology transparent transmission scheduling and scalability. For optimized bandwidth use, the protocol integrates transmission scheduling with contention. PA-STDMA provides power efficient operation as a result of its efficient channel arbitration and intelligent use of low power mode. EnDRop is another mechanism for energy saving and timely delivery of data packets is incorporated into the route discovery phase to select paths with lower cost. The proposed algorithm utilizes two metrics: residual energy and queue length at each node. Buffer information is considered as a traffic load characteristic and its use is two fold: limitation of battery power consumption and end-to-end delay. To evaluate the performance of the protocol PA-STDMA MAC and EnDRoP is simulated in GloMoSim. The results of the simulations are compared to results obtained from simulations of the IEEE 802.11 MAC under the same conditions. The comparison suggests that PA-STDMA MAC provides improved medium access control efficiency and optimized power consumption. This is indicated by reduced communication overhead, improved network congestion and increased network lifetime. EnDRoP provides a modified energy and delay-constrained version demonstrates that the latter one improves system performance for certain network scenarios. [C407]

"An energy efficient and high securitywatermarking mechanism based on DS-CDMA"

In order to implement watermarking scheme for embedded systems, we present an energy efficient and robust watermarking mechanism based on DS-CDMA. The DS-CDMA based watermarking can obtain the capacity according to the orthogonal spreading codes. The high capacity can improve the robustness efficiently. For power saving, we propose a low complexity frequency domain transform for the DS-CDMA embedding method. The experimental results show that our approach not only reduces 82.19% energy consumption, but can survive from various signal distortions such as JPEG compression, sharpening, blurring, intensity adjustment, and cropping. [C408]

"Stream-oriented Lossless Packet Compression in Wireless Sensor Networks"

In wireless sensor networks, the energy consumption of participating nodes has crucial impact on the resulting network lifetime. Data compression is a viable approach towards preserving energy by reducing packet sizes and thus minimizing the activity periods of the radio transceiver. In this paper, we propose a compression framework utilizing a stream-oriented compression scheme for sensor networks. It is specifically tailored to the capabilities of employed nodes and network traffic characteristics, which we determine in a characterization of WSN traffic patterns. To mitigate the inapplicability of traditional compression approaches, we present the squeeze KOM compression layer. By shifting data compression into a dedicated layer, only minor modifications to applications are required, while efficient data transfer between nodes is provided. As a proof-of-concept, we implement a stream-based compression algorithm on sensor nodes and perform an experimental analysis to determine the potential gains under realistic traffic conditions. Results indicate that our presented lossless stream-oriented payload compression leads to considerable savings. [C409]

"Effects and Policy Responses of Energy Tax in China's Transport Sector"

The current increasingly outstanding contradiction between supply and consumption of energy has become an important restrictive factor affecting the development of Chinese economic society. This thesis brings forward a analytical method of tax policy research on sustainable energy for Chinese transport sector. The thesis studies the transportation energy consuming gross, the environmental influence of transportation energy consuming and the medium and long term development of energy price through the confirm of the optimum expected energy-saving target and the tax rates implementation scheme of the energy-saving target. It is found that the energy tax rates for transportation energy consuming will increase from 28% (in 2005) to 40% (in 2011) and then reduce gradually to 33% (in 2020), assuming the optimum energy-saving target to be 5% annually from 2005 to 2020. The gross transportation energy consuming, the relative CO2emissions and the tax-inclusive price of crude oil will increase to 321.8 MT, 977.78 MT and 1533.99 USD/T, respectively, in 2020 from 120 MT, 364.57 MT and 611.78 USD/T, respectively, in 2005. The application indicates that the analytical method could get the energy-saving target and tax-rate scheme directly, and guide the design of future finance and tax policy on sustainable energy. [C410]

"Energy Efficient Instruction Cache with Local Access Scheme"

As power consumption of the cache memory in modern processor designs tends to dominate, measures must be taken to keep it under control. This paper introduces an approach for reducing instruction cache power based on the operation of a local access control scheme added in the cache system. The average saving on the power consumption of the instruction cache could be up to 23% compared with the traditional instruction cache structure. [C411]

"Energy Efficient Register File with Windowed Control Scheme"

As power dissipation of the register file in modern processor designs tends to dominate, measures must be taken to keep it under control. This paper introduces an approach to reduce the power dissipation of register file window structure by using the operation of the partitioned register file inspector added in the integer pipeline of microprocessor. The power savings show that, when the size and entry-content of the register file inspector is properly fixed, the average saving on the energy consumption of the register file could be up to 79% compared with the traditional register file control scheme. [C412]

"Energy-Aware Scheduling for Practical Mode Real-Time Systems with QoS Guarantee"

Energy consumption and quality of service (QoS) are two primary concerns in the development of todaypsilas pervasive computing systems. While most of the research in energy-aware real-time scheduling has been focused on hard real-time systems, we study the problem of minimizing energy for soft real-time systems with the requirements of QoS-guarantee. In this paper, the QoS requirements are deterministically quantified with the (m; k)-constraints,which require that at least m out of any k consecutive jobs of a task meet their deadlines. A dynamic DVS algorithm is presented to reduce the energy while guaranteeing the given(m; k)-constraints. The simulation results demonstrate that our proposed techniques can achieve significant energy saving performance while ensuring the QoS guarantee. [C413]

"Design of Structure-Free and Energy-Balanced Data Aggregation in Wireless Sensor Networks"

Since sensor nodes are energy-constrained, energy saving is a critical issue in wireless sensor networks. By reducing the number of transmissions, data aggregation is an effective approach to save energy. In the literature, most of data aggregation protocols rely on a structured architecture to accomplish the data gathering task. Such structure-based methods suffer from high maintenance overhead in a dynamic environment where sensor nodes may move or fail unexpectedly. In this paper, we propose a structure-free and energy-balanced data aggregation protocol (SFEB). The two-phase aggregation and dynamic aggregator selection of SFEB enable both efficient data gathering and balanced energy consumption. Extensive simulations verify the superiority of our SFEB. [C414]

"Energy-Optimal Grid-Based Clustering in Wireless Microsensor Networks"

Wireless microsensor networks usually consist of a large number of small sensor nodes with limited onboard energy supply and deployed densely in a given area for information harvesting purposes. To reduce energy consumption and prolong network lifetime, clustering techniques are often used, among which the grid-based ones are very popular due to their simplicity and scalability. In this paper, we analyze and evaluate the energy-optimal grid size for a grid-based clustering and routing scheme proposed specifically for wireless microsensor networks. Through numerical and simulation results, we reveal the tradeoff generic to all grid-based clustering schemes. In addition, we propose a randomized technique to further prolong the network lifetime and discuss other energy-saving opportunities. This paper provides some insights into the intrinsic limits of grid-based clustering schemes for wireless micro sensor networks. [C415]

"Global time synchronization with high range transmitter"

Global time synchronization is an important service for wireless sensor networks, WSNs. Although there are global time synchronization techniques for WSNs, almost all of them assume that the sink has the same transmission range with the regular sensor nodes. In this paper, the performance of global WSN time synchronization is investigated with the existence of the sink with high range transmitter. A simulation environment is developed to investigate the precision, energy saving and run time. Simulation results have shown that the sink with high range transmitter can increase precision up to 4 times compared to a system without high range transmitter. The sink with high range transmitter can also consume 3 times less energy and reduce run time up to 11 times. [C416]

"Extremum seeking control for efficient and reliable operation of air-side economizers"

Economizers have been recognized as a class of energy-saving devices for heating, ventilating and air conditioning (HVAC) systems that may increase the energy efficiency by taking advantage of outdoor air during cool or cold weather. There has been a tremendous demand for reducing energy consumption of HVAC systems in commercial buildings. However, many economizers do not operate in the expected manner and waste even more energy than before installation, mostly traceable to the unreliable sensors and actuators in practice. In this paper, an extremum seeking control (ESC) based self-optimizing strategy is proposed to minimize the energy consumption. Rather than depending on the unreliable temperature and humidity measurements, the proposed strategy is based on the feedback of chilled-water supply command. The mechanical cooling load is minimized by seeking the optimal outdoor-air damper opening in real time. Such scheme does not need temperature and humidity sensors and depends much less on the knowledge of the economizer model. Simulation was performed on a Modelica based transient model of a single-duct air-handling unit (AHU) developed with Dymola and the AirConditioning Library. The simulation results demonstrated the potential of using ESC to achieve minimal mechanical cooling load in a self-optimizing manner. In addition, an anti-windup ESC scheme is proposed to overcome the ESC windup issue due to actuator (damper) saturation. The simulation results validated the effectiveness of the proposed anti-windup ESC. [C417]

"Low power mode in cloud storage systems"

We consider large scale, distributed storage systems with a redundancy mechanism; cloud storage being a prime example. We investigate how such systems can reduce their power consumption during low-utilization time intervals by operating in a low-power mode. In a low power mode, a subset of the disks or nodes are powered down, yet we ask that each data item remains accessible in the system; this is called full coverage. The objective is to incorporate this option into an existing system rather than redesign the system. When doing so, it is crucial that the low power option should not affect the performance or other important characteristics of the system during full-power (normal) operation. This work is a comprehensive study of what can or cannot be achieved with respect to full coverage low power modes. The paper addresses this question for generic distributed storage systems (where the key component under investigation is the placement function of the system) as well as for specific popular system designs in the realm of storing data in the cloud. Our observations and techniques are instrumental for a wide spectrum of systems, ranging from distributed storage systems for the enterprise to cloud data services. In the cloud environment where low cost is imperative, the effects of such savings are magnified by the large scale. [C418]

"Power-aware load balancing of large scale MPI applications"

Power consumption is a very important issue for HPC community, both at the level of one application or at the level of whole workload. Load imbalance of a MPI application can be exploited to save CPU energy without penalizing the execution time. An application is load imbalanced when some nodes are assigned more computation than others. The nodes with less computation can be run at lower frequency since otherwise they have to wait for the nodes with more computation blocked in MPI calls. A technique that can be used to reduce the speed is Dynamic Voltage Frequency Scaling (DVFS). Dynamic power dissipation is proportional to the product of the frequency and the square of the supply voltage, while static power is proportional to the supply voltage. Thus decreasing voltage and/or frequency results in power reduction. Furthermore, over-clocking can be applied in some CPUs to reduce overall execution time. This paper investigates the impact of using different gear sets, over-clocking, and application and platform properties to reduce CPU power. A new algorithm applying DVFS and CPU over-clocking is proposed that reduces execution time while achieving power savings comparable to prior work. The results show that it is possible to save up to 60% of CPU energy in applications with high load imbalance. Our results show that six gear sets achieve, on average, results close to the continuous frequency set that has been used as a baseline. [C419]

"The Sustainable Energy Tax Policy Decision-Making Model Based on Invest Willingness Constraint"

To increase the efficiency of exploiting energy resource and confirm the optimum expected energy-saving target and the tax rates implementation scheme of the energy-saving target, an analytical model of tax policy was set up for researching on the sustainable energy for Chinapsilas transportation sector. This model which is based on system dynamics, is taken the effects of the energy price, interest rate, energy tax rate and energy-saving marginal cost into account, and focused on investigating the effects of the finance and tax policy for China energy on the energy-saving program. It is found that the energy tax rates for transportation energy consuming will increase from 28% (in 2005) to 40% (in 2011) and then reduce gradually to 33% (in 2020), assuming the optimum energy-saving target to be 5% annually from 2005 to 2020. The gross transportation energy consuming, the relative CO2emissions and the tax-inclusive price of crude oil will increase to 321.8 MT, 977.78 MT and

1533.99 USD/T, respectively, in 2020 from 120 MT, 364.57 MT and 611.78 USD/T, respectively, in 2005. This work is of importance and possible to be the guidance for the design of future finance and tax policy on sustainable energy. [C420]

"The research on regenerative furnace combustion control based on multi-scale wavelet network"

This article proposes a compound control strategy. It is based on the multi-resolution wavelet controller, the sub-controller and the PID-NNC master-controller and integrated with the WNN wavelet neural network identifier. This strategy can be used to overcome effectively bad influences caused by the system initiation, the control mode, the object change and the exterior disturbance to the regenerative furnace in the process of combustion temperature control. This strategy has such characteristics as quick response, small overshoot, high stable state precision, strong robustness and etc. It can not be realized easily by conventional PID control, which has been proved by the simulation result. It offers a new way for applying the wavelet transformation in the steel metallurgy controlling domain and a new direction for saving energy and reducing consumption. [C421]

"Feasibility analysis using natural source cooling the IDC plant"

Based on the analysis of energy-saving technologies in current telecommunication industry, the paper analyzed the energy-saving renovation of air conditioning in IDC plant in Langfang. The technologies including introducing fresh air directly and air heat exchanging with isolated type were compared. According to the load characteristic of the air conditioning in plant and outdoor climate conditions in Langfang, the technology using outdoor fresh air cooling the plant is feasible. Beside, the economic analysis was also worked to carry out that natural cool source could reduce the operation energy consumption of air conditioning, realize power saving rate over 30%, recovery period below 2.5 year, so it has favorable economic and social benefits. [C422]

"An energy-efficient MAC protocol with Adaptive Scheduling for wireless sensor networks"

Medium access control (MAC) protocols play a crucial role in energy-efficiency, latency reduction for sensor networks. Many research efforts have been made to reduce energy consumption and shorten delay in multi-hop WSNs. Although some existing MAC protocols are energy-efficient and are able to mitigate the end-to-end delivery latency, there are great potential for further improvements. In this paper, we propose a new MAC protocol by introducing a new Adaptive Scheduling (AS) period within which the node's active duration is made adaptive to variable traffic load and able to resiliently schedule data packets for transmission in the Sleep period. The algorithm is designated to schedule more data packets for transmission in bursty and high traffic loads, thus enabling rapid dissemination of data and reduction of the end-to-end delivery latency. While in the light traffic loads, nodes enters the Sleep mode, mitigating idle listening and saving energy. Experiment results show that the proposed protocol is a great advancement of some existing protocols on performance, especially with heavy traffic loads. [C423]

"A Combined Approach for Receiver-Based MAC and Network Layers in Wireless Sensor Networks"

Data communication represents the greatest energy cost of wireless sensor networks. Both MAC and network layers of the protocol stack are responsible for data communication in these networks. This work proposes the Receiver- based Medium Access Control (Rb-MAC) protocol to be used in a combined solution with a receiver-based routing scheme. The main advantage of combining receiver-based MAC and routing protocols is that this solution does not use neighbor tables and, consequently, it saves energy when compared with MAC and routing protocols that use these tables. Simulation results reveal that receiver-based data communication has a great data delivery ratio, and reduces energy consumption, number of transmissions, and collisions when compared with a sender-based data communication. Moreover, we use a model checking technique to perform the formal verification of Rb-MAC. [C424]

"Feedback-Based Energy-aware Scheduling Algorithm for Hard Real-time Tasks"

In this paper, we propose a new algorithm for dynamic voltage scaling (DVS) based on feedback control mechanism. Besides handling a periodic tasks, our algorithm significantly reduces the energy consumption of periodic tasks and consequently the energy consumption of the whole task set. The results show that, comparing to on-line dynamic voltage scaling (the best algorithm to our knowledge), our approach improves the energy savings by 10% on most task sets tested and by 5% on average. [C425]

"Low power real-time seizure detection for ambulatory EEG"

Ambulatory Electroencephalograph (AEEG) technology is becoming popular because it facilitates the continuous

monitoring of epilepsy patients without interrupting their routine life. As long term monitoring requires low power processing on the device, a low power real time seizure detection algorithm suitable for AEEG devices is proposed herein. The performance of various classifiers was tested and the most effective was found to be the Linear Discriminant Analysis classifier (LDA). The algorithm presented in this paper provides 87.7 (100-70.2)% accuracy with 94.2 (100-78)% sensitivity and 77.9 (100-52.1)% specificity in patient dependent experiments. It provides 76.5 (79.0-73.3)% accuracy with 90.9 (96.2-85.8)% sensitivity and 59.5 (70.9-52.6)% specificity in patient independent experiments. We also suggest how power can be saved at the lost of a small amount of accuracy by applying different techniques. The algorithm was simulated on a DSP processor and on an ASIC and the power estimation results for both implementations are presented. Seizure detection using the presented algorithm is approximately 100% more power efficient than other AEEG processing methods. The implementation using an ASIC can reduce power consumption by 25% relative to the implementation on a DSP processor with reduction of only 1% of accuracy. [C426]

"Provisioning geographic data-centric dissemination in Wireless Sensor Networks"

In this paper, we propose to enhance a data-centric dissemination framework with geographic information and network-level caching in wireless sensor networks. The proposed framework enhances data-centric routing with three principal components: (1) publish/subscribe paradigm to coordinate sources and sinks; (2) geographic diffusion to mitigate unnecessary data forwarding; (3) network-level caching to process data or reduce redundancy in message delivery. We implemented the framework in ns-2 simulator, and conducted a simulation study to evaluate its performance in comparison with existing routing protocols. The simulation results indicate that the framework enhances message delivery ratio, reduces message delivery overhead, and saves energy consumption, regardless of wireless link errors. [C427]

"Progressive Energy-Aware Routing in Wireless Sensor Networks"

Wireless distributed micro-sensor systems enable the reliable monitoring of a variety of environments for both civil and military applications. A major issue in the design of Wireless Sensor Networks is to develop strategies to make efficient use of its energy and to increase the reliability of data. In this paper, we address the problem of routing the data in an hostile environment. The proposed approach reduces both energy consumption as well as communication bandwidth requirements. It also prolongs the lifetime of the wireless sensor network. Simulation results show that a large amount of energy can be saved using this strategy. [C428]

"Power efficiency of 40 Gbit/s and 100 Gbit/s optical ethernet"

Recently, there have been significant research and standardization efforts to specify and implement 40 and 100 Gigabit Ethernet systems (40 GbE and 100 GbE). The proposals for the physical layer range from parallel transmission using a number of optical fibers or a number of wavelength channels within a single fiber to serial transmission over a single wavelength channel by exploiting advanced modulation formats and high-speed data processing. Since power consumption is becoming the main limiting factor in scaling current switches, routers and data centers to very high capacities, it would be of interest to see if the proposed 40 Gbit/s and 100 Gbit/s Ethernet physical-layer transport options could contribute to reduce the total power consumption of high-performance networking and storage systems. This communication addresses power efficiency of different realization options for optical 40 Gbit/s and 100 Gbit/s Ethernet by considering five different realizations of line cards, three of them comprising 100 GbE ports and two other comprising 40 GbE ports. The 100 GbE options include parallel transmission over either 10 wavelength channels (10 times 10 G) or 4 channels (4 times 25 G) as it is expected to be defined in the 100 GBASE-ER10 and 100 GBASE-ER4 specifications of the future IEEE 802.3 ba standard [1], respectively. For the implementation of serial transmission at 100 Gbit/s (1 times 100 G) we consider single-polarization differential quadrature phase shift keying (DQPSK) format [2]. Similarly, 40 GbE systems include both serial option (1 x 40 G) that comprises electronic 1:4 muxes and demuxes and parallel transmission over 4 channels (4 times 10 G), analogous to the drafts of the 40 GBASE-LR4 and 40 GBASE-LR specifications, respectively. We estimated total power consumption of those systems by using a model that includes all functional blocks needed to implement Ethernet line cards and switches as well as realistic data of power consumption obtained from compo- nents' specs, research papers, and documents of the IEEE 802.3 Ethernet Task Force. Fig. 1 shows the energy efficiency of large switches when using the five options for the implementation of the physical layer. It is evident that switches equipped with 40 GbE or 100 GbE line cards are more energy efficient than those having only 10 GbE ports. Here, a reduction in energy consumption of more than 2 nJ per bit and relative power savings of more than 20% can be achieved. The relative power savings decrease exponentially when increasing the aggregated switch capacity (C) and by using a fixed number of either 40 GbE (P) or 100 GbE (M) ports together with a large number of 10 GbE ports (TV). For large switch capacities of more than 20 Tbit/s, the power savings shrink to values below 3%. [C429]

"Energy-Aware Prefetching for Parallel Disk Systems: Algorithms, Models, and Evaluation"

Parallel disk systems consume a significant amount of energy due to the large number of disks. To design economically attractive and environmentally friendly parallel disk systems, in this paper we design and evaluate an energy-aware prefetching strategy for parallel disk systems consisting of a small number of buffer disks and large number of data disks. Using buffer disks to temporarily handle requests for data disks, we can keep data disks in the low-power mode as long as possible. Our prefetching algorithm aims to group many small idle periods in data disks to form large idle periods, which in turn allow data disks to remain in the standby state to save energy. To achieve this goal, we utilize buffer disks to aggressively fetch popular data from regular data disks into buffer disks, thereby putting data disks into the standby state for longer time intervals. A centrepiece in the prefetching mechanism is an energy-saving prediction model, based on which we implement the energy-saving calculation module that is invoked in the prefetching algorithm. We quantitatively compare our energy-aware prefetching mechanism against existing solutions, including the dynamic power management strategy. Experimental results confirm that the buffer-disk-based prefetching can significantly reduce energy consumption in parallel disk systems by up to 50 percent. In addition, we systematically investigate the energy efficiency impact that varying disk power parameters has on our prefetching algorithm. [C430]

"Wavelength path optimization in optical transport networks for energy saving"

Today Energy Consumption is one of the fundamental topics also for telecommunication networks. In this paper, we report a numerical investigation about energy saving in a transport network both exploiting the transmission properties that permit to reduce 3R equipments and reducing optical links during low traffic periods. [C431]

"Design of low power precharge-evaluation based one bit adder cell"

Rapid changes in SoC power issues has mandated the reconsideration of design methodologies throughout the flow to account for power related effects. This led to the evolution of various design methods to meet power budgets while designing various modern age information systems and computers. In this work, we present a precharge/evaluation based carry generation logic circuit for adders which shows a good improvement in power consumption, exploiting different power saving techniques for the implementation, particularly reducing switching activity and operand pre-computation. Additionally sum logic exploits ldquodata sensingrdquo technique resulting in faster speed and lower transistor count. Design has been implemented in 90 nm process, showing 30% improvement in performance and 35% reduction in total dynamic power compared to conventional one. [C432]

"Multi-Engine Packet Classification Hardware Accelerator"

As line rates increase, the task of designing high performance architectures with reduced power consumption for the processing of router traffic remains important. In this paper, we present a multi-engine packet classification hardware accelerator, which gives increased performance and reduced power consumption. It follows the basic idea of decision-tree based packet classification algorithms, such as HiCuts and HyperCuts, in which the hyperspace represented by the ruleset is recursively divided into smaller subspaces according to some heuristics. Each classification engine consists of a Trie Traverser which is responsible for finding the leaf node corresponding to the incoming packet, and a Leaf Node Searcher that reports the matching rule in the leaf node. The packet classification engine utilizes the possibility of ultra-wide memory word provided by FPGA block RAM to store the decision tree data structure, in an attempt to reduce the number of memory accesses needed for the classification. Since the clock rate of an individual engine cannot catch up to that of the internal memory, multiple classification engines are used to increase the throughput. The implementations in two different FPGAs show that this architecture can reach a searching speed of 169 million packets per second (mpps) with synthesized ACL, FW and IPC rulesets. Further analysis reveals that compared to state of the art TCAM solutions, a power savings of up to 72% and an increase in throughput of up to 27% can be achieved. [C433]

"Study of compound differential gear train based on pump load hydraulic speed regulation"

Based on the operating characteristics of pump load, the hydraulic speed regulation is widely used in the high-power pump load to realize the speed regulation and energy saving. This paper analyzes the energy saving features of the currently-adopted hydraulic speed regulation method in the high-power pump load and the inevitable power loss problems. According to the fundamental features of differential gear train, analyzes the feasibility and problems in speed regulation of pump load. The paper put forward a compound differential gear train and a speed regulating method which can availability reduce the inevitable power loss caused by adopting traditional full power hydraulic speed regulation device system. The application of compound differential gear train in the hydraulic speed regulation of pump load is a new attempt in the energy saving technology research field. [C434]

"Power optimization through edge reduction in LUT-based FPGA technology mapping"

This paper considers the problem of lookup table (LUT) based FPGA technology mapping for power minimization in combinational circuits. The problem has been previously proved to be NP-hard, and hence we present an efficient heuristic algorithm, PowerMap_er. This paper describes a technique that reduces power consumption by reducing the edge count in mapped network. The purpose of this technique is to reduce edge and power by considering routability in early steps of the CAD flow. Since routability can be improved by reducing edge count in mapping, power would be optimized after placement and routing. The main idea of our algorithm is to exploit the ldquocut enumerationrdquo technique. Moreover, iterations of area and edge recoveries are deployed, and more effective edge cost function is proposed. The experimental results indicate that our algorithm reduces the average power consumption by up to 18.1%, the edge number by up to 10%, and the average number of LUTs by up to 6.8 % over an existing MacroMap algorithm. And compared to PowerMinMap-d [15], we achieved 12.74% power savings and 15.66% area reduction. [C435]

"An task scheduling algorithm of real-time leakage power and temperature optimization for MPSoC"

As technology scaling into the nanometer regime, the performance is accompanied by the ever-increasing chip power consumption, in which leakage power consumption has become a major factor. Based on temperature-electric coupling effect, we study the temperature-cooling and energy-saving algorithm for high-end multi-processor system-on-chip (MPSoC). This work proposes a TALO (temperature-aware leakage optimization) algorithm to schedule tasks for MPSoCs. TALO assigns high priority to the coolest processor when there are multi-processor can be used, reducing the temperature-electric coupling leakage power. Comparing with TALK and traditional DVS algorithm, experiments show TALO is more efficient in power consumption. It can reduce the leakage power up to 70 percents for MPSoCs in contrast with DVS algorithm. At the same time, TALO can help decrease the highest temperature of each processor in MPSoC. It can make the temperature of each processor 34degC lower than DVS systems. [C436]

"Power consumption reduction in CPU datapath using a novel clocking scheme"

Power consumption and performance are the crucial factors that determine the reliability of a CPU. In this paper, we discuss about some techniques that can be used for Instruction Level Parallelism which enhances the performance of the CPU by reducing the CPI there by reducing power consumption. We have also discussed about the power saving scheme using proper clocking strategies. We have mainly focused on implementing the simplified RISC pipeline datapath in HDL using two different clocking schemes to reduce the power consumption. We have adopted a new method which uses dual edge triggered clock that can decrease the power consumption of a pipelined datapath considerably, without sacrificing the throughput of the CPU. Finally, we have given the experimental result for our implementation of simplified RISC datapath. [C437]

"Impact of clock slope on energy/delay of pulsed flip-flops and optimum clock domain design"

In this paper, the influence of the clock slope (i.e., rise/fall time) on the performance and the energy dissipation of Pulsed flip-flop (FF) topologies is investigated. Results show that the adoption of a greater clock slope leads to a slight flip-flop energy increase, as well as to a negligible speed penalty. This insensitivity of Pulsed FF performance on the clock slope is shown to be a significant advantage that permits to relax (i.e., increase) the clock slope requirement at a given FF performance. In turn, this allows for downsizing the buffers of the local clock network, thereby reducing the overall energy dissipation within a clock domain. Detailed analysis shows that an optimum clock slope exists that minimizes the energy associated with the clock network within a clock domain. This optimization is shown to bring significant energy savings, which can be close to 50 % for a FF speed degradation of only a few percentage points. Extensive post-layout simulations are performed on a 65-nm CMOS technology to validate the theoretical results. [C438]

"A new MAC design using high-speed partial product summation tree"

A novel multiplication algorithm using high-speed partial product summation tree has been presented. Some changes have been done in previous algorithms to obtain speed and better electronic parameters. In partial product generation step a new modified Booth algorithm has been proposed. In partial product reduction step a novel tree structure has been modified. In final addition step a fast adder structure using high-speed components is used. The modified Booth structure decreases the delay with the production of partial products by using the additional parallelism of conventional Booth algorithm. Multiplication is partitioned in four slices which results more speed. A new carry save addition has been used in final addition step. Modified high-speed array architecture is proposed. Simulations have been done with SPICE and some programming codes. This study has

decreased transistor count by 8 percent, delay time of whole architecture has reduced 10 percent and power consumption reduction is 10 percent in compare with other previous designs. [C439]

"Register File customization for low power embedded processors"

Power consumption is a critical design issue in embedded processors. One common component in the processor is the register file (RF). RF takes a large portion of processor area and consumes a significant amount of power. This paper proposes a customization approach at the hardware description modeling level to reduce the register file power consumption. The customization does not alter the RF interface to other hardware components and is completely transparent to software code. Therefore, it can be readily integrated into any processor design tool. We have applied our approach to a set of benchmarks. Our experimental results show that the power savings range from 18.3% to 45.5%; on average, 30.625% of register file power can be reduced. [C440]

"An 8-channel, area-efficient, low-power audio sampling rate converter"

A novel 8-channel, area-efficient, low-power audio sampling rate converter is proposed in this paper, conversion ratio is 2:1 and 4:1. Filter design and implementation are the key points for the converter. First, excluded data and coefficients memories, adopting multiplier-free arithmetic unit (AU) and rounding methods allows its realization in a cell area of only 0.038 mm2in 0.18 mum technology; next a new timing division multiplexer (TMD) scheme lowers clock working rate to minimum in order to save power; third, a novel memory addressing scheme reduces 20% data memory at least. Experiments show proposed methods could not only saved hardware resources but also reduce power consumption, so it is very suitable for consumer electronics. [C441]

"Joint equalization technique and special spacing rules for link design"

Achieving high link speed and reliability is a key challenge in network-on-chip (NoC) design. To address the challenge,, we propose the equalization scheme and the joint equalization technique and special spacing rules solution for improving the communication speed and reliability for NoC links in the paper. The proposed equalizer employs a variable threshold inverter whose switching threshold is modified as a function of past output of the links. The experiment results for a 10-mm 32-bit link in 0.13um CMOS process technology show that 1.28times speedup is achievable by equalization alone with 1% area overhead. The simulation results show that the joint equalization and increasing spacing of the uncoded link can reduce 50% delay and save 42% power only with 50% area overhead compared with the minimum-spaced uncoded links. The BER of the links is improved from 10-5to 10-24. [C442]

"An energy minimization algorithm based on synergy choice for resource-constrained wireless senor network"

Cooperative diversity can be applied to energy-constrained resource-constrained wireless sensor network s to significantly reduce node energy consumption. However, cooperation synergy must be carefully selected and coordinated to practically exploit this energy saving potential. In this paper we investigate synergy choice for energy minimization algorithm in a resource-constrained wireless sensor network. We formulate novel and computationally efficient synergy choice heuristics for sensor nodes based on either global or local knowledge of average path loss values in the network. We present extensive simulation results of cooperation in a resource-constrained wireless sensor network to show that the proposed heuristics achieve near-optimally energy efficient synergy selection. Therefore, our simple synergy choice heuristics form the basis of an effective distributed cooperation protocol for improving the energy efficiency of a resource-constrained wireless sensor network. Very importantly from the point of view of practical implementation, we show that our synergy choice heuristic based on local information is the most effective cooperation strategy for resource-constrained resource-constrained wireless sensor networks, as it yields superior energy conservation results while enabling fully distributed and scalable cooperation. [C443]

"Fine Grain Partial Reconfiguration for energy saving in Dynamically Reconfigurable Processors"

Based on the power consumption analysis of a real dynamically reconfigurable processor array (DRPA) prototype MuCCRA-3, it appears that the key of power saving is keeping the datapath on the processing element (PE) array as possible. Fine grain partial reconfiguration (FGPR) is a simple technique to minimize the change of configuration code in a hardware context switching. In FGPR, a configuration code is divided into several components and only the configuration data for the required components are changed. Evaluation results demonstrate that about 15% of the power consumption is reduced with only 0.7% hardware overhead. The total amount of configuration data and its loading time can be also reduced by 37% in average. [C444]

"Design and application of auto-constant water supply system"

An automatic constant pressure closed-loop water supply and monitor system of small, secondary pressure waterworks, which composed of Siemens S7-300 PLC, WinCC and ABB frequency converter, is presented. The principle and construction as well as characteristics of the system are introduced also. The function, the stability and the reliability of the water supply system has been improved. The super-harmonic oscillation and labour intensity of workers is reduced. The purpose of saving energy and reducing consumption has been realized. The necessary support conditions have been provided for the entire production management information system. [C445]

"A multi-phase genetic algorithm for the efficient management of multi-chiller systems"

In HVAC plants of medium-high cooling capacity, multiple-chiller systems are often employed. In such systems, chillers are independent of each other to provide standby capacity, operational flexibility, and less disruption maintenance. However, the problem of efficiently managing multiple-chiller systems is complex in many respects. In particular, the electrical energy consumption in the chiller plant markedly increases if the chillers are managed improperly, therefore significant energy savings can be achieved by optimizing the chiller operation of HVAC systems. In this paper an unified method for multi-chiller management optimization is presented, that deals simultaneously with the optimal chiller loading and optimal chiller sequencing problems. The main objective is that of reducing both power consumption and operative costs. The approach is based on a cooling load estimation algorithm, and the optimization step is performed by means of a multi-phase genetic algorithm, that provides an efficient and suitable approach to solve this kind of complex multi-objective optimization problem. The performance of the algorithm is evaluated by resorting to a dynamic simulation environment developed in Matlab/Simulink, where the plant dynamics are accurately described. It is shown that the proposed algorithm gives superior performance with respect to standard approaches, in terms of energy performance. [C446]

"Application of the automatic control technology for energy conservation of the air-conditioning system in substations in Shanghai"

Energy conservation has been the trend around the world. In allusion to the status of the rough management of air-conditionings in substations in Shanghai, an automatic control strategy for energy conservation of air-conditionings is confirmed, after analyzing the distribution of brands of air-conditioning equipments. Then, an automatic control system based on the strategy has been established, which can centrally control the air-conditionings and fans of one or multiple brands to save energy automatically. In this system, "manual control mode" has been designed in view of human nature in the field. After the period of setting time, "manual control mode" will turn to "automatic control mode" automatically. The actual results show that the energy consumption can reduce at least 25 percent, when the control system has been put into operation. [C447]

"Power-Aware Scheduling for Multiple Feasible Interval Jobs"

Time-critical jobs in many real-time applications have more than one feasible interval. Such jobs can be executed in any of their feasible intervals. Given a Multiple Feasible Interval (MFI) job set that is schedulable, energy can be saved by carefully selecting the executing interval for each job. In this paper, we explore the energy minimization problem for real-time systems in which jobs have multiple feasible intervals. The static and dynamic energy management schemes are both investigated to minimize the energy consumption while preserving the systempsilas feasibility. Focusing on the EDF scheduling algorithm, we first study reducing the dynamic power consumption. We show that the static optimal speed assignment problem is NP-Hard and propose a Simulated Annealing (SA) based approach to solve it. Then, we develop an online greedy algorithm to exploit the run-time slacks by ldquofetchingrdquo the eligible job from a hot spot to execute earlier, thus, reducing the dynamic energy consumption. In addition, a leakage-aware version is discussed to improve the overall energy efficiency as well. Simulation results show that all the proposed schemes can achieve significant improvements on energy efficiency while the system remains schedulable. [C448]

"ROBTIC: An On-chip Instruction Cache Design for Low Power Embedded Systems"

The on-chip instruction cache is a potential power hungry component in embedded systems due to its large chip area and high access-frequency. Aiming at reducing power consumption of the on-chip cache, we proposed a Reduced One-Bit Tag Instruction Cache (ROBTIC), where the cache size is judiciously reduced and the cache tag field only contains the least significant bit of the full tag. We developed a cache operational control scheme for ROBTIC so that with the one-bit cache tag, the program locality can still be efficiently exploited. For applications where most of the memory accesses are localized, our cache is able to achieve similar performance as a traditional full-tag cache; however, the power consumption of the cache can be significantly reduced due to

the much smaller cache size, narrower tag array (just one bit), and tinier tag comparison circuit being used. The experiments on a set of benchmarks demonstrate that our approach can reduce up to 25.8% power consumption and 30.9% area of the traditional cache when the cache size is fixed at 32 instructions. With the cache size customization, a further 48% power saving can be achieved. [C449]

"Induction motors fed by PWM MV7000 converters enhance electric propulsion performance"

Recent progress in power electronics has opened a new area in power conversion and has enabled to design high-performance medium voltage PWM converters. Such converters have allowed the use of induction motors in electric propulsion systems bringing many advantages in terms of robustness and efficiency. In the recent years, there is a huge demand by ship owners and ship yard operators for electric propulsion based solutions in order to ease their maintenance efforts and to enhance their efficiency and durability levels. The expected propulsion solution needs to be compact, robust, competitive and easily installable. Two vital factors that decide the performance of an electric propulsion system are choice of proper power electronic converter and type of motor for a given application size. This paper presents a new electric propulsion strategy with a high performance IGBT converter and a high torque density induction motor. To achieve higher power density, higher switching frequencies and improved fault current limitation capabilities, high performance press-pack IGBT devices were used in the PWM converter realization. Use of NPC based 3-L converter also improves the motor control in terms of increased speed range, constant magnetizing current for constant flux control and excellent control on motor torque via motor active current. On the other hand, a novel high torque density induction motor is designed and developed to suit particularly for navy and merchant applications. The optimized HTD motors were able to satisfy all marine requirements such as larger airgaps (typically 5 to 8 mm), high efficiency about 97.5%, optimized power density through pin ventilation laminations and safe operation in any condition including a single-shaft line operation. In a large cruise liner and LNG carrier applications, how reduced fuel consumption with savings in weight and space were achieved is also presented. [C450]

"Clock gating architectures for FPGA power reduction"

Clock gating is a power reduction technique that has been used successfully in the custom ASIC domain. Clock and logic signal power are saved by temporarily disabling the clock signal on registers whose outputs do not affect circuit outputs. We consider and evaluate FPGA clock network architectures with built-in clock gating capability and describe a flexible placement algorithm that can operate with various gating granularities (various sizes of device regions containing clock loads that can be gated together). Results show that depending on the clock gating architecture and the fraction of time clock signals are enabled, clock power can be reduced by over 50%, and results suggest that a fine granularity gating architecture yields significant power benefits. [C451]

"A new methodology for multi-level thermal characterization of complex electronic systems: From die to board level"

Thermal management is becoming a major concern in microelectronics because of transistor technology reduction and power density increases within complex packages. Temperature rise due to power dissipation worsens harmful clock skew, jeopardizes reliability and leads to over-consumption because of leakage current dependence on temperature. To limit these risks, electronics engineers have to perform thermal simulations at an early stage of the design flow and for several granularity levels (die, package, PCB, ...). To speed up and ease the thermal characterization process, the engineers need small, accurate and easy-to-generate thermal models, which can be reused at every integration step. Several macro-modeling techniques exist (DELPHI, HotSpot, ...), but they cannot satisfy all the points mentioned above. This paper presents a new methodology called Flex-CTM for flexible compact thermal modeling to build and to interface compact thermal models at different granularity levels. Each part of an electronic system is prepared to be plugged into any other environment and reduced to save memory and time, resulting a thermal micro-model. Therefore, a fast-to-simulate macro-model of a full system can be obtained by assembling the micro-models. The Flex-CTM is found to have number of advantages over both current resistive models (junction-to-case and junction-to-board) and dynamic compact thermal models. The first advantage of coupling models together allows multi-source and dynamic simulations at any design level. The second is the control on the accuracy. The third advantage is the boundary condition independence property to allow architecture exploration. Finally and the most important, micro and macro-models are shared by teams to be reused and completed. [C452]

"DIII-D water-cooling system upgrades through modeling and power saving projects"

The DIII-D water-cooling system for the fusion facility at General Atomics consists of the vessel and coil cooling water systems (DIII-D water), components cooling water systems (power supplies, ion-sources, diagnostics and gyrotrons), and heat rejection system (cooling tower and heat exchanger) for the operation of the fusion facility.

Since 2005 the water-cooling systems have undergone major upgrades, resulting in average power savings of over 50%. The water-cooling system is now capable of handling future heat loads for long pulse duration (10 s) while operating at lower cost. This paper describes the design, installation and startup of energy efficiency upgrades which include: (1) Installation of new cooling towers, and upgrades to primary and secondary heat exchanger loops (2) Reducing power consumption of cooling water system by installing variable frequency drives (VFDs) for the cooling water pumps, implementing PLC monitoring of energy usage in the facility, systems modeling, and by automatic adjustment of system flow to better meet needs (3) Changes to control logic by the identifying systems and flows, such as fast wave and ECH operations, that can be shut off or reduced depending on operational status (4) Reducing parasitic power loss through pressure drop reductions in filters, strainer components, heat exchanger cleaning programs, and performing preventive maintenance for equipment to improve operating efficiency. Modeling and thermal performance results of the upgraded DIII-D cooling water system will be discussed. [C453]

"Energy efficient OLSR performance evaluation under energy aware metrics"

Mobile ad-hoc networks are one of the most active research areas in the wireless communications field. These networks do not need any fixed infrastructure or configuration, easily adapting to difficult scenarios and types of use. Since mobile nodes are often powered by limited batteries, energy is an important issue in MANETs since the lack of a node can lead to the partitioning of the network. In this paper, we analize the behavior of different energy-aware routing metrics applied to OLSR protocol, in order to verify their effectiveness in reducing energy consumption and prolonging network lifetime in combination with such a proactive routing protocol. We find that Minimum Drain Rate routing strategy is the better way to calculate paths between nodes in a network according to energy-saving needs, although this metric can have some drawback in the total amount of energy consumed in the network. We already tested as an hybrid approach (like Conditional MDR) can mitigate this drawback. [C454]

"NoC topology synthesis for supporting shutdown of voltage islands in SoCs"

In many systems on chips (SoCs), the cores are clustered in to voltage islands. When cores in an island are unused, the entire island can be shutdown to reduce the leakage power consumption. However, today, the interconnect architecture is a bottleneck in allowing the shutdown of the islands. In this paper, we present a synthesis approach to obtain customized application-specific networks on chips (NoCs) that can support the shutdown of voltage islands. Our results on realistic SoC benchmarks show that the resulting NoC designs only have a negligible overhead in SoC active power consumption (average of 3%) and area (average of 0.5%) to support the shutdown of islands. The shutdown support provided can lead to a significant leakage and hence total power savings. [C455]

"Research of heat source analysis of communication engine-room and cold configuration"

In order to cut down air-condition energy consumption in the communication room and reduce the heat island effect partially, through the use of CFD (computational fluid dynamics), we have a study on airflow characteristics in communication engine-room. On the basis of established mathematical and physical equation about airflow characteristics, we try to get the numerical solution, and analyze the speed field and the temperature field of the airflow comprehensively in air outlets and return-air intakes, around the communication equipments and in the cross-section of the engine room. Also we have an experimental test and verification analysis in the sample room. Experiments show that the numerical results are basically consistent with the measured values. From this we can see that the model is correct, and the result of numerical solution is credible. Finally, according to the result of numerical solution and the experiment test of the sample room, we can design the deployment program of the incoming (back) wind so as to optimize the operating environment of the equipments, reduce the cold waste and explore out the energy-saving potential in the engine room. [C456]

"A DVS-based pipelined reconfigurable instruction memory"

Energy consumption is of significant concern in battery operated embedded systems. In the processors of such systems, the instruction cache consumes a significant fraction of the total energy. One of the most popular methods to reduce the energy consumption is to shut down idle cache banks. However, we observe that operating idle cache banks at a reduced voltage/frequency level along with the active banks in a pipelined manner can potentially achieve even better energy savings. In this paper, we propose a novel DVS-based pipelined reconfigurable instruction memory hierarchy called PRIM. A canonical example of our proposed PRIM consists of four cache banks. Two of these cache banks can be configured at runtime to operate at lower voltage and frequency levels than that of the normal cache. Instruction fetch throughput is maintained by pipelining the accesses to the low voltage banks. We developed a profile-driven compilation framework that analyzes

applications and inserts the appropriate cache reconfiguration points. Our experimental results show that PRIM can significant reduce the energy consumption for popular embedded benchmarks with minimal performance overhead. We obtained 56.6% and 45.1% energy savings for aggressive and conservative VDD settings, respectively, at the expense of a 1.66% performance overhead. [C457]

"An Energy Reporting Aggregation Method Based on EAFM and DTRM in WSN"

Analyzed the energy consumption disciplinarian of the nodes in WSN, the node's energy attenuation forecast model (EAFM) can be established. A difference-threshold reporting mechanism (DTRM) is used to report the residual energy of nodes. The energy collection mechanism based on EAFM and DTRM can reduce energy data reporting times significantly, improve the efficient of energy data collection, save the node's energy at the same time. The experiments in the platform of telosb nodes show that the predicable rate is between 70% and 85%, and this method can extend the node's life by 1% ~ 4.5%. [C458]

"A Simulation Study of a New Green BitTorrent"

The use of P2P technologies, such as BitTorrent, to distribute legal content to consumers is actively being explored as a means of reducing both file download times and the energy consumption of data centers. This approach pushes the energy use out of the data centers and into the homes of content consumers (who are also then content distributors). The current BitTorrent protocol requires that clients must be fully powered-on to be participating members in a swarm. In this paper, we show that simple changes to the BitTorrent protocol, including long-lived knowledge of sleeping peers and a new wake-up semantic, can enable clients to sleep when not actively downloading or uploading yet still be responsive swarm members. Using ns-2 we simulate a green BitTorrent swarm. We show that significant energy savings are achievable with only a small performance penalty in increased file download time. [C459]

"Energy-Efficient Circular Sector Sensing Coverage Model for Wireless Sensor Networks"

Reducing the energy consumption in Wireless Sensor Networks (WSN) is an important goal, sought to extend the life-expectancy of the networks. One of the main problems in actual implementation is their inherently limited life-span, due to the (usually) not field-replaceable energy source. The energy consumption is due to the data and management communication, messages, sensing, processing (and storage) activities of the motes. The sensing may be local, e.g. temperature, radiation, humidity or similar physical measurement. There are a lot of applications, civilian or military alike, which implement some remote discovery, localization or tracking activities. In this case, the active sensing is performed mainly by emitting light, electromagnetic or sound waves. Obviously this imposes a heavy burden on the limited energy resources available to the mote, shortening his life and consequently the life of the WSN itself. Previously published sensing models use a circular coverage area around the motes, with fixed (unit-disk) or variable radius. Our work proposes a more energy-efficient sensing model, based on circular sectors with variable angles and radii, negotiated between the motes, as a function of their current energy capabilities. The performance of this model was checked vs. previously published schemes, using a proprietary simulation program, developed specifically for this purpose. The paper presents the results of simulations, showing significant energy savings. The obtained data confirm the viability and the advantages of this new sensing model. The possible implementation of such a WSN will significantly improve the energy-related performance of the WSN, allowing the development of new applications and improving the performance of existing ones. [C460]

"Genetic Algorithm Based Length Reduction of a Mobile BS Path in WSNs"

Energy in WSNs can be significantly saved by integrating a mobile BS, which on the other hand may impose the network an unacceptable latency. In this paper, we overcome this problem by making the path of the mobile BS as short as possible. Our method mainly consists of three steps. First, we construct a virtual network from which to choose the location that the BS must arrive. Next, we apply a weighting scheme to each points of the virtual network, and select a minimum number of them by implementing a genetic algorithm, while at the same time guarantee the network connectivity and coverage. Finally, after showing its NPC property, we construct the optimized BS path based on the point set obtained in the second step. Our method is testified by comprehensive experiments. The results show that it can greatly reduce the number of points that the BS must arrive, and then get us an optimized mobile BS path. [C461]

"Extending Host Identity Protocol with Paging"

Host identity protocol (HIP) is mainly designed to provide secure and continuous communication by decoupling the transport layer from the internetworking layer. Furthermore, HIP can provide for a degree of internetworking mobility and multi-homing at a low infrastructure cost. Currently, HIP does not support paging, which is widely

used in wireless networks to reduce the signaling cost for location management and to save the power consumption of the mobile node. In this paper, we propose P-HIP, paging extensions for HIP, and discuss the architecture, protocol, algorithm, and the data handling of P-HIP. We develop an analytical model to study the performance of HIP and P-HIP, and discuss the performance results in terms of the signaling cost. [C462]

"FPGA-based DPWM for digitally controlled high-frequency DC-DC SMPS"

Digital pulse-width modulator (DPWM) is known as the critical module in digital controller application for high-frequency switching mode power supply (SMPS). This paper presents a new Hybrid DPWM architecture operating at high frequency with high resolution. The proposed DPWM takes advantage of the phase-shift function of Digital Clock Manager (DCM) in FPGA, and combines a counter-comparator with a digital dither block. To verify the proposed DPWM, an 11-bit prototype DPWM is implemented on a FPGA-based digitally controlled high-frequency buck converter. Experimental results with constant switching frequency up to 2 MHz validate the functionality of the proposed DPWM. This hybrid architecture can operate at high switching frequency while reduce clock frequency so as to save power consumption. [C463]

"Service Discovery in Mobile Ad Hoc Networks Using Mobility-Aware Attenuated Bloom Filters"

Due to high mobility, highly dynamic topology and unreliable communication medium of Mobile Ad Hoc Networks (MANETs), nodes mobility must be taken into account in design of a service discovery protocol for such environment. A novel approach, Mobility-aware Attenuated Bloom Filters (maBF), to perform effective and efficient service discovery in MANETs is proposed in this paper. In order to guarantee both of the efficiency and performance in terms of low cost for advertisement, reasonable searching speed and high probability of finding a effective service, maBF employs a simple but efficient on demand advertisement algorithm to adapt nodes mobility. Such approach can significantly reduce the cost of service discovery but never enroll in performance degradation comparing with attenuated bloom filters. The Simulation results show that service discovery base on the use of maBF can well save traffic load even in the high mobility speed scenario. [C464]

"Intelligent network synchronization for energy saving in low duty cycle MAC protocols"

Several MAC protocols such as S-MAC, T-MAC, DSMAC, and TEEM have exploited scheduled sleep/listen cycles to conserve energy in sensor networks. These protocols use periodic SYNC packet in their SYNC period to follow the same schedule with their neighbors. We have found that these protocols use around 40% of their listen period for SYNC period. In an average, unused SYNC periods consume more than 20% of the total energy consumption. In this paper, we analyze the periodic nature of SYNC packet and develop a new algorithm, named as intelligent network synchronization (INS), which exploits the periodic nature of SYNC packet to reduce energy consumption. The proposed INS makes nodes bypass their own SYNC period by monitoring sleep/listen cycles of their each neighbor. We evaluate INS through both mathematical analysis and simulation. These results show the achievement of up to 25% of energy saving. [C465]

"A research on an optimized adaptive dynamic power management"

Low-power design for various applications has always been a challenge for system designers. Dynamic power management, by selectively shutting down idle components, is widely studied and considered to be effective in reducing power consumption. Management strategies based on online algorithm exhibit a feature of easy implementation and fast processing speed. However, merely based on the historical distribution of idle periods, these strategies will make inaccurate prediction if the real distribution of idle periods changes sharply. This paper presents an optimized adaptive dynamic power management for further power saving. We introduce a differential adjusting factor to optimize the exponential-average algorithm to rapidly and accurately adjust the predicted idle period to the real distribution. Experimenting results demonstrate that our policy of power management can reduce the power dissipation of processors in a larger scale and be utilized in diverse applications. [C466]

"Improved desing of existing 210mw hydrogen and water cooled generators"

In a synchronous machine rotor is the most important part. Excitation system size, earth fault levels, efficiency of the machine and reactive power required by the system depend upon the parameters of the rotor. This paper presents novel method of reducing the size of the excitation system thus improving the excitation system and reduced vulnerability to the earth faults, increasing efficiency, reducing the maintenance cost and less cost of the equipment, keeping the performance of the synchronous machine same. In this paper it is shown that by changing the rotor winding from 2 conductors in parallel to 1 conductor and increasing the number of turns, keeping the flux same how machine performance can be improved. This paper further brings out the energy saving or less energy consumption by generator itself eventually making the more capacity available of machine. [C467]

"Integrating Preemption Threshold to Fixed Priority DVS Scheduling Algorithms"

Dynamic voltage scaling (DVS) is an effective technique to reduce the energy consumption of CMOS powered embedded systems through software control. However, applying fixed priority DVS algorithms introduces increased number of preemptions, which, in turn results in extra time delay and energy cost. Effectively reducing the number of preemptions is therefore required. In this paper, we propose to integrate preemption threshold to fixed priority DVS scheduling algorithms to reduce such negative impact. Two preemption-aware algorithms ccFPPT and FPPT-WDA are studied. Performance evaluations in terms of both energy consumption and the number of preemptions are conducted among different fixed priority DVS algorithms, with or without preemption threshold. The experimental results show that our algorithms with preemption threshold can save up to 60% number of preemptions and 20% energy consumption over existing DVS algorithms. [C468]

"Technology Research on Energy-Saving Transform of Existing Residential Buildings in Han Dan City"

According to the climate characteristics of Handan, the existing residential building in Handan is studied and present characteristics of the existing residential building are analyzed in order to improve residential environment and condition, reduce energy consumption of existing residential buildings in cold regions and realize sustainable development. Practical technology and methods from the wall, roof, windows and balcony are put forward to provide basis and reference in terms of economy and energy-saving policy and scheme optimization of existing residential building. [C469]

"Design of 3D Optical Network on Chip"

Optical network on chip is an emerging research topic, which can provide low latency and high bandwidth with significantly lower power dissipation. A 3D mesh based optical network on chip is developed together with a new optical router architecture as the basic units. The new router fully utilizes the properties of dimension order routing in 3D mesh networks, and reduce the number of microresonators required for ONoCs. We compared the loss property of the new router with four other schemes. The results show that the new router achieves the lowest loss for the longest path in the network of the same size. The proposed 3D mesh ONoC is compared with 2D counterpart in three aspects, i.e. energy, latency and throughput. The comparison of power consumption with electronic and 2D counterpart show that 3D ONoC can save about 79.9% energy compared to electronic one, 24.3% energy to the 2D ONoC, all containing 512 IP cores. The simulation of the network performance of the 3D mesh ONoC is carried out by OPNET under different configurations. The results also show the performance improvement over the 2D ONoC. [C470]

"A Communication-Centric Embedded System Architecture (ACCESA)"

In the era of application convergence, the embedded systems are required to support multiple applications with different traffic patterns and quality of service (QoS) requirements. But continual process technology's shrinking trend makes the communication network of the embedded system the performance bottleneck for its increased latency. To ameliorate this problem, a communication-centric embedded system architecture (ACCESA) is proposed in this paper which is modular and block based. The modular and block based architecture of ACCESA helps in performance improvement of the embedded system by means of flexible and efficient QoS provisions and power management. The pre-fabricated or preconfigured hybrid and hierarchical communication network of ACCESA saves on run-time reconfiguration time and on interconnect cost by preventing under utilization of communication resources without sacrificing on processing speed and throughput of the applications. This reduced and efficient resource usage in ACCESA in turn saves on power consumption of the chip. [C471]

"The Study on Countermeasures of Promoting Energy-Saving and Emissions-Reducing Based on Circular Economy Theory"

Energy saving and emissions reducing is an important and urgent task for implementing the scientific development views in the new era. Development of circular economy is an important way to realize energy saving and emissions reducing. Cleaner production and industrial park can promote the level of the whole society saving resources, energy and to reduce the emission of pollutants. [C472]

"Feasibility of Using Composite Ground Source Heat Pump in Hot Summer and Cold Winter Region"

Using assistant cooling composite ground source heat pump system can reduce the initial investment and

enhance the efficient of energy-savings. This paper introduces the climate and the overview of building energy consumption of hot summer and cold winter region; also analyses the feasibility of ground source heat pump system using assistant cooling equipment in this region. Taking a building in Shanghai for example, compares the initial investment and operating cost between assistant cooling composite ground source heat pump system and no assistant cooling ground source heat pump system. The results show that the assistant cooling-source heat pump system has great advantages in the reduction of initial investment and operating cost in this region. [C473]

"An Energy-Efficient Handover Scheme with Geographic Mobility Awareness in WiMAX-WiFi Integrated Networks"

WiFi networks have been deployed in many regions such as buildings and campuses to provide wireless Internet access. However, to support ubiquitous wireless service, one possibility is to integrate these narrow-range WiFi networks with a wide-range network such as WiMAX. Under this WiMAX-WiFi integrated network, how to conduct energy-efficient handovers is a critical issue. In this paper, we propose a handover scheme with geographic mobility awareness (HGMA) by considering the past handover patterns of mobile devices. HGMA can conserve the energy of handovering devices from three aspects. First, it prevents mobile devices from triggering unnecessary handovers by measuring their received signal strength and moving speeds. Second, it includes a handover candidate selection (HCS) method for mobile devices to intelligently select a subset ofWiFi access points or WiMAX relay stations to be scanned. Therefore, mobile devices can reduce their network scanning and thus save their energy. Third, HGMA prefers mobile devices staying in their original WiMAX or WiFi networks. This can prevent devices from consuming too much energy on interface switching. Simulation results show that HGMA can reduce about 69% and 30% of energy consumption on network scanning and interface switching, respectively, and with 16% to 64% more probabilities for mobile devices staying in WiFi networks. [C474]

"Adaptive Location Update and Paging Scheme for Mobile Broadband Wireless Access Networks"

In mobile broadband wireless access networks such as Mobile WiMAX, idle mode is defined to save radio resources and reduce power consumption when a mobile station is not involved in packet transmission and reception. In order to support idle mode, location update and paging should be supported, where location update and paging overheads are affected by paging group size. In this paper, we propose a hierarchical paging group ID structure, an adaptive location update algorithm based on the paging group structure, and a predictive paging scheme for large size paging groups. The performance of the proposed scheme is compared with conventional scheme from the aspect of location update and paging signaling overheads. Numerical results show that the proposed scheme performs well for varying the velocity of mobile stations. [C475]

"Energy Savings Achievable in Connection Preserving Energy Saving Algorithms"

Energy saving is an important design consideration in wireless sensor networks. In this paper, we analyze the energy savings that can be achieved in a sensor network where each sensor is capable of reducing its transmission power from a maximum power pm, compared with that in a sensor network where each sensor can only transmit at a constant power level pm. To achieve a fair comparison, we assume sensors in both types of sensor networks are connected to the same set of neighbors, i.e. no connection is lost as a result of a sensor reducing its transmission power. We further assume that sensors are distributed in a given area following a Poisson distribution with known node density and the radio propagation is described by a log-normal model. Ignoring boundary effect, we establish analytically the probability for a sensor to achieve an energy saving of at least h dB. We also obtain the expected percentage of energy savings which can be substantial. The research reported in the paper helps to answer questions such as whether the energy savings achieved by using a sensor with a variable-transmission-power (and the consequent extension of its lifetime) justify the additional cost involved in manufacturing it. [C476]

"Energy Saving Study on the Tension System of a Tensioner for a Pipelaying Vessel"

Energy saving is a crucial factor in industry. This paper discusses the energy saving of the tension system of a tensioner for a vessel. The tension system includes the hydraulic pressure clamping system and the AC servo motor. According to analysis, in the hydraulic pressure system the main energy consumption factor is the power source. So we have chosen the A7V.80.EL which is a kind of high-efficiency, energy saving, and high power variable capacity pump. Furthermore, we adopted MCU to control the flow rate and pressure of the system. In the AC servo motor system, according to the characteristic of high-power motor, we route a start and stop control through the transducer and fuzzy control in the working process to reduce the energy consumption. The test results indicate the energy saving effects. [C477]

"Study of Power Saving Scheme Suitable for Wireless LAN in Multimedia Communication"

Wireless LAN access is now being offered by small personal terminals in addition to laptops. Since these terminals have very limited battery capacity, wireless LAN interfaces that offer some form of power saving are essential. IEEE802.11 specifies PSM (power save management); it reduces power consumption by suspending some communications functions. However, since multicasting and broadcasting are invariably received by all terminals regardless of PSM, the terminals unnecessarily consume electric power even if the terminal is not engaged in multicasting. This paper clarifies this problem, and proposes a scheme for reducing power consumption and the results of an experiment confirm its excellent performance. [C478]

"Centralized PSM: An AP-centric power saving Mode for 802.11 infrastructure networks"

Energy management in a wireless LAN is an important problem, as the viability of wireless devices depends very much on their battery life. In this paper, we propose a centralized power saving mode (C-PSM), an AP-centric PSM for 802.11 infrastructure networks. Having the AP select optimal PSM parameters, such as the beacon and listen intervals, CPSM is able to maximize the total energy efficiency for all clients. Moreover, C-PSM provides a first-wake-up schedule to further increase the energy efficiency by reducing clients' simultaneous wake-ups. Extensive simulation experiments show that C-PSM outperforms the standard PSM by a very significant margin. In our set of experiments, C-PSM reduces power consumption and increases energy efficiency by as much as 76% and 320%, respectively. As a side benefit, C-PSM also decreases the frame buffering delay at the AP by 88%. The wake-up schedule can save clients' energy consumption by 22% at most. Moreover, the improvement increases with the number of clients. [C479]

"Energy saving of green buildings using natural daylight"

This paper proposes the fundamental design and analysis approach on energy conservation of green buildings using a natural daylight strategy. The proposed energy-conservation scheme on power energy utilization of green buildings has been an important research topic in recent years due to the increasing price of international petroleum. Most of the power losses in typical buildings are from lights, motor loads, and air conditioners. This paper presents the design scheme on light management system to reduce power consumption of the power system in a research building by means of the utilization of natural daylight. Based on available illumination, the required supplementary artificial lighting is calculated and evaluated to meet the given lighting requirements. [C480]

"Power Saving Routing Protocol with Power Sieving in Wireless Ad Hoc Networks"

Wireless ad hoc networks becomes a new type of wireless networks gradually because it could communicate to each other without infrastructure base stations. Due to limited power, routing path is broken easily, so how to design an effective power saving routing protocol is an important issue in wireless ad hoc networks. To solve this issue, we propose a new routing protocol called power saving routing protocol with power sieving (PSRPS) in this paper. The proposed protocol partitions the network area into several square grids by the location information such as global position system (GPS). Routing is performed in a grid-by-grid manner. One node is elected as the grid leader in its grid with power sieving mechanism without broadcasting election packets. Therefore, nodes could save more power for data transmission and the network lifetime could be prolonged. The simulation results demonstrate PSRPS could reduce power consumption from 10% to 18% compared with the traditional grid-based routing protocol. [C481]

"LoSeCo: Location-based search computing for pervasive device augmentation"

Understanding human intention and performing different activities automatically is one of the key problems in pervasive computing. In this paper, a new location-based search computing framework (LoSeCo) is proposed to allow one's pervasive device to augment search devices. The objective of our problem is to recognize the real-time user goal through goal inference from traditional Wi-Fi localization techniques. We use accelerometer-based tracking to reduce the effort we need to collect Wi-Fi signals and save battery power consumption effectively. With the help of short-range search, the goal recognition module is enhanced, compared to previous ldquolocationonlyrdquo approaches. Therefore, we could augment our mobile devices by automatically analyzing our needs and connecting to corresponding devices. Experimental results on real-world wireless network environments validate the effectiveness of our approach and that even a rough localization accuracy can meet the need of QoS (Quality of Service) in search computing behaviors. [C482]

"A Novel Energy-Efficient Dynamic Voting Cluster Algorithm for Wireless Sensor Networks"

For monitoring burst events in reactive wireless sensor networks (WSNs),an novel energy-efficient dynamic

voting cluster (EE-DVC) algorithm is proposed. EE-DVC has three obvious features: Firstly, it adopts virtual grid ideas to divide each cluster into MtimesN square area and select a working node in each grid to reduce redundant information and save energy. Secondly, cluster head is dynamic voted according residual energy among the working nodes in each grid. Last, it improves energy utility by changing the activity of wireless communication module of sensor nodes, energy model and state transition of sensor nodes. Simulation results show that, compared with UVDC and LEACH, EE-DVC significantly reduces in average energy consumption and prolong the network lifetime. [C483]

"Study on the Application Potential of Solarwall System in Northern China"

There is a growing, government-led trend of applying renewable energy in China. One area of interest lies in the wider use of solar energy systems. Solar air heating system based on unglazed transpired collector (UTC, also known as solarwall) is a simple and inexpensive technique that results in reduced energy consumption and operating costs resulted from outdoor air ventilation requirements. Solar wall is easy to be integrated in building. This paper establishes the mathematical model of solar wall systems and presents an evaluation of the application potential of solarwall in five northern cities of China. Simulation results showed that energy savings rate for the subject building in Beijing, Shenyang, Changchun, Harbin, and Lanzhou is 22.9%, 19.3%, 18.8%, 16.4%, and 20.8%, respectively. The payback period is 9.3 years, 7.8 years, 6.4 years, 7.1 years, and 10.7 years, respectively. The actual payback period will be even shorter if the energy savings resulted from the reduction of heat transmission through the building envelope due to the increase of R-value of the exterior walls is taken into account. Solarwall system is viable for China to reduce heating energy consumption and improve indoor air quality in winter. [C484]

"Research and Application of Minimal-Oil Ignition Technology on Pulverized Coal Fired Boilers"

It is of great significance to reduce the consumption of fuel oil for pulverized coal fired boilers in China even throughout the world. Minimal-oil ignition technology is an effective solution to save fuel oil. The principal, system components and industrial applications of the minimal-oil ignition technology are introduced in this paper. Numerical simulation data shows that the newly designed coal burners have retained the superior performance of the original ones. According to the nearly two years operation results, the average fuel oil consumption after retrofit is reduced by over 90%, without any influence to the boiler's performance. [C485]

"User- and process-driven dynamic voltage and frequency scaling"

We describe and evaluate two new, independently-applicable power reduction techniques for power management on processors that support dynamic voltage and frequency scaling (DVFS): user-driven frequency scaling (UDFS) and process-driven voltage scaling (PDVS). In PDVS, a CPU-customized profile is derived offline that encodes the minimum voltage needed to achieve stability at each combination of CPU frequency and temperature. On a typical processor, PDVS reduces the voltage below the worst-case minimum operating voltages given in datasheets. UDFS, on the other hand, dynamically adapts CPU frequency to the individual user and the workload through direct user feedback. Our UDFS algorithms dramatically reduce typical operating frequencies and voltages while maintaining performance at a satisfactory level for each user. We evaluate our techniques independently and together through user studies conducted on a Pentium M laptop running Windows applications. We measure the overall system power and temperature reduction achieved by our methods. Combining PDVS and the best UDFS scheme reduces measured system power by 49.9% (27.8% PDVS, 22.1% UDFS), averaged across all our users and applications, compared to Windows XP DVFS. The average temperature of the CPU is decreased by 13.2degC. User trace-driven simulation to evaluate the CPU only indicates average CPU dynamic power savings of 57.3% (32.4% PDVS, 24.9% UDFS), with a maximum reduction of 83.4%. In a multitasking environment, the same UDFS+PDVS technique reduces the CPU dynamic power by 75.7% on average. [C486]

"Power Saving of Real Time Embedded Sensor for Medical Remote Monitoring"

The power saving is one of the important issue in the embedded systems. To reduce the consumption of the microprocessor of such a system, a way is to power down it when it is inactive. Theoretically, the time during which the microprocessor is inactive represents a pure gain of energy. But practically, we must consider that this time comprises a slot of time during which the clock must be synchronized. We propose to aggregate the idle times of the microprocessor to power down it the least possible but for the longest time possible. This aggregation can be perform by using a slack stealer algorithm. [C487]

"A Scheduling Algorithm for TDMA-Based MAC Protocol in Wireless Sensor Networks"

Because of the particularities of wireless sensor networks, the design of MAC protocol in wireless sensor

networks should be paid main attention to minimize the energy consumption. Many schemes, which have significant contributions in power saving, can be found. However, these schemes concentrate on reducing the end-to-end delay, or on the energy saving. This paper proposes a TDMA-based scheduling scheme that balances energy saving and end-to-end delay. This balance is achieved by an appropriate scheduling of the path, which is assigned by graph coloring method. Our approach consists of two phases: in the first phase, we use genetic algorithm to get the graph coloring strategy, and we use this scheme to color the each path of the networks; then, we use the solution of the edge-coloring to schedule. This proposed scheme achieves the reduction of the end-to-end delay caused by sleep state while it maximizes the energy savings at the same time. [C488]

"Integrated and Cost-effective Design Utilizes LNG Cryogenic Energy for Power Generation"

Recycling valuable LNG cold energy released in the gasification process for power generation is the main cold energy utilization mode in present LNG receiving terminals, it can reduce the cost of LNG regasification, relieve CO2emission, and provide electric power demand for receiving terminals. Aiming at the current low exergetic efficiency of the Rankin and direct-expansion system in LNG receiving terminals, based on the existing technology and demand of receiving terminals, a new integrated and cost-effective design is carried out to recycle the LNG cold energy to power generation in this paper. In the improved processes, LNG cold energy is employed to cool chilling water to meet the cooling demand from air-conditioning, air compressor and intake gas for gas turbine of LNG receiving terminals. On the one hand, it saves 1124 kW power consumed by refrigerator to produce chilling water; on the other hand, low temperature overplus heat cooled by circulating cooling water in gas-fired power plant is used to heat natural gas and propane working fluid, which result in the total expansion work power of natural gas and propane turbine increased by 2558 kW, and the natural gas and propane thermal efficiencies are increased by 55.2% and 22.5%, respectively. Compared with the original processes, about 61.5 kW power is recycled per LNG ton in the new Rankin and Direct-expansion power generation technique, the energetic and exergetic efficiencies are increased by 38%, meanwhile it gains annual economic benefits of 30.92 million Yuan for the LNG receiving terminals. [C489]

"Experiment Study of Electrohydrodynamic (EHD) Drying Scallop"

In order to improve the drying qualities of aquatic product, reduce the energy consumption, a new drying technology with electrohydrodynamic (EHD) was put forward for scallop muscle in the paper. The scallop muscle, as a representative of aquatic product, were dried in a high voltage electric drier at 15degC, as well as in a oven at 60degC and ambient air respectively, and the energy consumption of EHD drying and oven drying were investigated. At the same time, these dried scallop muscle's shrinkage rate and sensory qualities such as color, texture, and trimness were measured. The results indicate that EHD drying save 93.9% energy compared oven drying, and can improve the drying rate of scallop muscle significantly. With 45 kV voltage, the rate of EHD drying is seven times as long as the rate of ambient air drying. Compared with oven drying, the dried scallop muscle under the high voltage electric field had better sensory qualities such as better color, texture and lower distortion. [C490]

"Methods for Dispatching and Optimization of Economic Operation of Water Injection System of Large-Scale Oilfield"

The water injection system of large-scale oilfield is a very complicated pressure system, which consists of several water injection stations connecting with each other. At present, the system suffers a couple of prevailing problems, for example, low injection efficiency and high power consumption, and the dispatching and optimization of the system operation serves as an important approach to solve such problems. The mathematical model for optimization of operation scheme of the oilfield's water injection system is established with the minimum power consumption of water injection as the objective function, and the restriction on hydraulic balance, water injection rate and water injection pressure as the constraint conditions. The model belongs to a hybrid optimization design with discrete and continuous variables. In accordance with the structural characteristics of the model, the solving strategy based on the hybrid genetic algorithm is worked out; meanwhile, the methods for selection, chiasma and mutation of chromosome are put forward, and the corresponding software is also programmed. This method is adopted to make the optimization calculation for the operation scheme of high-pressure water injection system of certain oilfield, showing that the unit power consumption of water injection is reduced by 0.291 kW-h/m3, with the power saved totaling 6.76 times 106kWldrh/a. [C491]

"Real-Time Load Distribution Control for the Geheyan Hydropower Plant"

This paper investigates double objective real-time load distribution model in the mode of unit automatic control

for the Geheyan hydropower plant. Temporally, unit commitment scheme of real-time operation is setting by combining unit priority list with unit startup and shutdown rules. A set of optimal solutions can be obtained using dynamic programming method to resolve spatial object function and assort with temporal object, from which the load distribution scheme rules were chosen in accordance with real-time control demand. The results of daily simulation operation during April to July, 2006 show that proposed operation model can save water more than 2%, and reduce frequency number of unit crossing vibration area by 17.27%. Furthermore, under the condition of giving four different reserve load modes, consumption of power production and frequency number of unit crossing vibration area are also reduced more than 1.38% and 17.13%, respectively. [C492]

"Optimal Design and Energy Saving on Central Air Conditioning System of Ocean Going Ships"

Optimal design and energy saving have become the hot spots in air conditioning technology. This paper mainly describes the key design techniques of individual air conditioning system for multi-purpose marine monitoring center and central air conditioning system for "practice teaching ship" of Shanghai Maritime University. The results show that outdoor air pretreatment and second return air system give full play to the superiority of energy saving. The refrigerating capacity will be reduced by 25% without heater and about 30% of energy saving can be obtained comparing with the existing conventional air conditioning system. [C493]

"Power saving algorithm for clustered Ad-Hoc networks (PSA-CAN)"

Ad-hoc network is an infrastructureless network consisting of mobile nodes. So, the energy consumption of the interfaces can be significant. Reducing transmission power reduces the number of nodes reached but consumes less energy. The author propose a communication mechanism based on local beam search to organize the nodes of a single cluster in a tree leveled given a determined distance to each other. [C494]

"Optimized Multicast Service Management in a Mobile WiMAX TV System"

WiMAX technology is a good candidate to provide broadcast TV services for mobile users because it supports QoS based multicasting functionality. To provide multicast-based TV services over the mobile WiMAX network, a multicast session setup involves both MAC-layer and IP-layer multicast management. However, in mobile environment, IP-layer multicast management entails service interruption due to unreliable wireless transmission, and disrupts mobile terminal's power-saving mode. In this paper, we propose a cross-layer multicast service management scheme that can not only avoid the service interruption and power-saving mode disruption but also reduce the bandwidth consumption for IP-layer multicast signaling. Simulation results demonstrate that the scheme can eliminate the unnecessary power consumption caused by IP-layer multicast signaling, and improve the wireless uplink throughput as well. We also study, by simulation, the influence of the multicast management signaling procedures on channel switching time that is a major performance indication for mobile TV services. [C495]

"Techniques for the Design of Low Voltage Power Efficient Analog and Mixed Signal Circuits"

Emerging applications in various fields, such as Ambient Intelligence scenarios or remote biomedical monitoring, currently demand wireless sensor networks with transceivers having extremely low power consumption requirements. This is a key issue in order to decrease battery weight and size and to increase the lifetime of the battery, which usually in these sensing nodes is not replaceable. To achieve these strict power requirements, several solutions have been proposed at various layers. At the physical layer, savings in power consumption are achieved by low- voltage operation and optimized power-to-performance ratio. Supply voltages of IV (or less) are anyway mandatory in modern deep submicron technologies to operate reliably due to the extremely thin oxide. Furthermore reduction of the supply voltage (even of not required) strongly reduces power consumption in digital circuits since it scales with supply voltage. Although this is not so simple in analog circuits, they should operate at the same supply voltage than the digital part in mixed-mode systems to avoid the complexity involved in generating various supply voltages. The canonic way of designing analog circuits consist in using high-gain amplifiers with passive components in negative feedback loops, both in continuous-time or discrete-time form. Sometimes amplifiers are operated in open loop (e.g. Gm-C filters, some VGAs, etc.), and in this case a large linear range is required for the amplifier at the expense of gain. In any case, amplifiers play a key role in analog design, and their power consumption directly impacts that of the overall analog system. Such amplifiers usually take the form of Operational Transconductance Amplifiers (OTAs) with high output resistance, typically driving capacitive loads, or operational amplifiers with low output resistance able to drive low resistive loads. Besides low-voltage and power-efficient operation, these amplifiers should feature a fast settling response, not limite--d by slew rate. Conciliating all these requirements is difficult with conventional class A topologies, since the bias current limits the maximum output current. Hence a trade-off between slew rate and power consumption do exists. To overcome this issue, class AB topologies are often employed. These circuits provide well-controlled

quiescent currents, which can be made very low in order to reduce drastically the static power dissipation. However, they automatically boost dynamic currents when a large differential input signal is applied, yielding maximum current levels well above the quiescent currents. Several class AB amplifiers have been proposed. Most of them are based on adaptive biasing techniques, by including extra circuitry that increases quiescent currents (e.g. by increasing tail currents in differential stages). However, often the extra circuits included increase both power consumption and silicon area, and add significant parasitic capacitance to the internal nodes. Also positive feedback is often employed to get boosting of dynamic currents, which makes difficult to guarantee stability considering process and temperature variations. In this work we illustrate the use of new circuit design techniques to achieve low-voltage class AB amplifiers that combine simplicity and power efficiency. These techniques allow introducing class AB operation at the input stage and at the active load of the amplifier with minimum penalty in other performance parameters. The tutorial is divided into several sections. Section 2 presents the concept of Super Class AB amplifiers and various circuit implementations. As an application, a Sample and Hold circuit is described in Section 3. Section 4 covers the design of class AB amplifiers using quasi- floating gate transistors. Their application in a VGA and a sigma-delta modulator for a wearable electroencephalogram monitoring system is described in Section 5. [C496]

"Evolutionary Genetic Algorithm for Efficient Clustering of Wireless Sensor Networks"

Sensor nodes forming a sensor network usually have limited energy capacity so it is important to minimize sensor nodes' energy consumption because of difficulty in supplying additional energy for the sensor nodes. Much attention has been given to the clustering technique as an efficient way of reducing the energy consumption of a sensor node. Energy saving results can vary greatly depending on the number and size of clusters and the distance among the sensor nodes. In this paper, we aim to find an optimal cluster formation by applying a genetic algorithm in which the chromosome contains the information about the relative position of the nodes. The location-aware two-dimensional GA (LA2D-GA) proposed in this paper can performs more efficient gene evolution than one-dimensional GA (1D-GA) by giving unique location information to each node. The effectiveness of our algorithm is shown by simulation. [C497]

"Low-power High-throughput Deblocking Filter Architecture for H.264/AVC"

The paper proposes an efficient deblocking filter architecture for H.264/AVC. A four-stage pipeline has been adopted to boost the speed of deblocking filter process up to 192 clock cycles per one macroblock. Hybrid edge filter order enhances the reusability of intermediate data which not only increases system throughput, but also reduces power consumption because of diminishing memory access times. In addition, for saving power purpose, our architecture utilizes the buffers instead of SRAM on-chip for storing temporary data. Experimental results show that our design can achieve the throughput of 1146 kMB/s while saving up to 25% power consumption when compared with previous design. The architecture is implemented in 0.18 mum standard cell library, consumes 26.01 K gates at a clock frequency of 220 MHz. [C498]

"A New Intra-cluster Node Scheduling Algorithm of Clustering Data Collection Protocol in WSNs"

In clustering wireless sensor networks, cluster-head nodes are backbone network to process and transmit data. Vast intra-cluster nodes obtain sleep, reduce data delay, lighten cluster head burden. In this paper, we derived the smallest active node number K, and achieved a new intra-cluster active nodes scheduling algorithm. The experimental results show that the result of the algorithm in saving energy is very apparent and achieves its design goat. [C499]

"Impact of Variable Transmission Range in All-Wireless Networks"

In this paper we focus on the energy optimization based on the incremental exploration of the network. We perform one-hop neighborhood exploration of the neighborhood but the work can be generalized to 2-hop, 3-hop, . . . up to the diameter of the network, which is the minimum number of hops between any two nodes in the network. We propose three distributed algorithms for self-adjusting the transmission range of nodes in a wireless sensor network. The objective is to vary the transmission radii of selective sensor nodes to lower the energy spent in broadcasting or the diameter. Increasing the transmission power to reach more nodes may consume more energy, but lowers the network diameter. Reducing the transmission power (i.e., save energy) without reducing the reachability (in terms of the number of nodes) increases the network diameter. All three algorithms are simulated and compared based on the experimental results. [C500]

"HVAC Fault Diagnosis System Using Rough Set Theory and Support Vector Machine"

Preventive maintenance plays a very important role in the modern Heating, Ventilation and Air Conditioning (HVAC) systems for guaranteeing the thermal comfort, energy saving and reliability. The fault diagnosis on

HVAC system is a difficult problem due to the complex structure of the HVAC and the presence of multi-excite sources. As the HVAC system fault information has inaccurate and uncertainty characteristic, A new kind of fault diagnosis system based on Rough Set Theory (RST) and Support Vector Machine (SVM) is presented in this paper. The hybrid model is integrated the advantages of RST effectively dealing with the uncertainty information and SVMpsilas greater generalization performance. The HVAC diagnosis experiment demonstrated that the solution can reduce the cost and raise the efficiency of diagnosis, and verified the feasibility of engineering application. As a result, the presented hybrid fault diagnosis method can help to maintain the health of the HVAC systems, reduce energy consumption and maintenance cost. [C501]

"Collaborative Recommender Systems for Building Automation"

Building Automation Systems (BASs) can save building owners money by reducing energy consumption while simultaneously preserving occupant comfort. There are algorithms that optimize this tradeoff, such as detecting which appliances are turned on without requiring expensive status detectors to be attached to each appliance. However, better ways are needed to determine which algorithms are best-suited to a particular building. This paper explores the idea of allowing building managers to automatically communicate among themselves and exchange ratings of individual monitoring and control algorithms in such a way that each building manager can then obtain predicted ratings for all algorithms that he has not yet tried personally. We allow individual algorithms to be replaced by using a blackboard architecture to loosen the coupling between them. We propose a recommender system that operates on a database of contributed ratings to predict ratings of untried algorithms. To explore this approach, we developed a prototype that seamlessly interacts with both emulated physical buildings and buildings simulated in software and we implemented several of the control algorithms described in previous works. We demonstrate a recommender system that selects between algorithms in various types of buildings. [C502]

"A 20MS/s 5.6 mW 6b Asynchronous ADC in 0.6μm CMOS"

The design of an N-comparator based asynchronous successive approximation analog-to-digital converter (SAR ADC) is described (with N = 6) working at 20 MS/sand consuming only 5.6 mW for low power high speed applications like communication systems. Resetting the comparators in each conversion cycle is avoided (reducing power consumption compared to [Chen and Brodersen, 2006]) and only N latches are used overall (incl. comparator latches) for the output code. Further using only N comparators instead of 2N- 1 as in [der Plas and Verbruggen, 2008], leads to huge savings in terms of area at comparable power consumption. For example, a saving of ~90% comparator area is achieved for the 6 bit ADC design when compared to the design in [der Plas and Verbruggen, 2008]. [C503]

"Forecasting-Based Dynamic Virtual Channels Allocation for Power Optimization of Network-on-Chips"

In this paper, we present a dynamic power management technique for optimizing the use of virtual channels in network on chips. The technique which is called dynamic virtual channels allocation (DVCA) makes use of the traffic conditions and past buffer utilization to dynamically forecast the number of virtual channels that should be active. In this technique, for low(high) traffic loads, a small (large) number of VCs are allocated to the corresponding input channel. This provides us with the ability to reduce the power consumption of the router while maintaining the data communication rate. To assess the efficacy of the proposed method, the network on chip has been simulated using several traffic profiles. The simulation results show that up to 35% reduction in the buffer power consumption and up to 20% savings in the overall router power consumption may be achieved. Finally, the area and power overheads of the technique are negligible. [C504]

"New word-line driving scheme for suppressing oxide-tunneling leakage in sub-65-nm SRAMs"

A new word-line driving scheme is proposed in this paper for suppressing oxide-tunneling leakage in sub-65-nm devices. Reducing oxide-tunneling leakage is very essential in sub-65-nm era because of this tunneling leakage component becoming more and more serious comparing with the subthreshold component. In this paper, we propose to raise the word-line-off voltage higher than 0 V thereby relaxing the voltage stress across the oxides. This scheme can reduce not only oxide-tunneling leakage but also switching power because of the swing voltage of the word line being reduced. This scheme has been verified using the 65-nm devices obtained from the Predictive Technology Modeling group. The comparison with the conventional circuit shows the power consumption of the proposed one is lowered by as much as 11%, 19.7%, and 39.9%, at 75degC, 25degC, and -25degC, respectively, when all the rows are in sleep. And, during the read operation, the power consumption including both static and dynamic components is lowered by as much as 8.3%, 10.4%, and 10.9%, at 75degC, 25degC, and -25degC, respectively. At the write operation, amounts of power saving reach 37.5%, 38.7%, and

41.1%, for 75degC, 25degC, and -25degC, respectively, while showing very little delay overhead of word-line driving. [C505]

"A Distributed Cache Management Architecture for Mobile Computing Environments"

In mobile computing caching plays a vital role owing to its ability to alleviate the performance and availability limitations of weakly-connected and disconnected operations. An efficient way to reduce query delay, save bandwidth and improve system performance is to cache the frequently accessed data objects at the local buffer of a mobile. Owing to the disconnection and mobility of the mobile clients, classical cache management strategies may be inappropriate for mobile environments. Generally, cache placement, cache discovery, cache consistency and cache replacement techniques constitute cache management in mobile environment. In this paper, we design a distributed cache management architecture which includes all the above techniques. The architecture also includes a location update procedure for a moving mobile client. The simulation results illustrate that our proposed architecture achieves lower latency and packet loss, reduced network bandwidth consumption, and reduced data server workload. [C506]

"Low power adaptive pipeline based on instruction isolation"

One of the most effective techniques to reduce a processor's power consumption is to reduce supply voltage. However, reducing voltage in the context of parameter variations can cause circuits to fail. As a result, voltage scaling is limited by a minimum voltage, often called Vccmin, beyond which circuits may not operate reliably. In this paper, we propose an architectural technique that enables microprocessor to operate at low voltage, while maintaining high frequency operations based on instruction isolation. The instruction isolation scheme isolates the set of possible instructions that do not complete within the clock period at the scaled Vcc and avoids possible timing errors in the instructions by dynamically adapting the clock period. Compared to current design, our scheme enables extra 13% average power saving. [C507]

"A Penny Saved is a Penny Earned: Applying Optimization Techniques to Power Management"

Shortage of electricity is a major problem in many developing countries. Unfortunately, for some of these countries the only solution to this problem is to shut down complete electricity supply to a few neighborhoods to make up for the gap between demand and supply. To this end, we have developed a self-optimization approach to reduce the gap between demand and supply through remotely controlling high powered electric devices such as air conditioners. In this approach we have used mathematical optimization techniques such as linear programming to intelligently manage the electricity distribution. Not only through this approach we have been able to provide service-level guarantees to the consumers but we have also shown that our approach is fast, scalable and has the ability to handle unscheduled spikes in the system. [C508]

"Towards Efficient Processing of General-Purpose Joins in Sensor Networks"

Join processing in wireless sensor networks is difficult: As the tuples can be arbitrarily distributed within the network, matching pairs of tuples is communication intensive and costly in terms of energy. Current solutions only work well with specific placements of the nodes and/or make restrictive assumptions. In this paper, we present SENS-Join, an efficient general-purpose join method for sensor networks. To obtain efficiency, SENS-Join does not ship tuples that do not join, based on a filtering step. Our main contribution is the design of this filtering step which is highly efficient in order not to exhaust the potential savings. We demonstrate the performance of SENS-Join experimentally: The overall energy consumption can be reduced by more than 80%, as compared to the state-of-the-art approach. The per node energy consumption of the most loaded nodes can be reduced by more than an order of magnitude. [C509]

"Frequent value compression in packet-based NoC architectures"

The proliferation of chip multiprocessors (CMPs) has led to the integration of large on-chip caches. For scalability reasons, a large on-chip cache is often divided into smaller banks that are interconnected through packet-based network-on-chip (NoC). With increasing number of cores and cache banks integrated on a single die, the on-chip network introduces significant communication latency and power consumption. In this paper, we propose a novel scheme that exploits frequentvaluecompression to optimize the power and performance of NoC. Our experimental results show that the proposed scheme reduces the router power by up to 16.7%, with CPI reduction as much as 23.5% in our setting. Comparing to the recent zero pattern compression scheme, the frequentvaluescheme saves up to 11.0% more router power and has up to 14.5% more CPI reduction. Hardware design of the FV table and its overhead are also presented. [C510]

"Adaptive inter-router links for low-power, area-efficient and reliable Network-on-Chip (NoC) architectures"

The increasing wire delay constraints in deep sub-micron VLSI designs have led to the emergence of scalable and modular network-on-chip (NoC) architectures. As the power consumption, area overhead and performance of the entire NoC is influenced by the router buffers, research efforts have targeted optimized router buffer design. In this paper, we propose iDEAL-inter-router, dual-function energy and area-efficient links capable of data transmission as well as data storage when required. iDEAL enables a reduction in the router buffer size by controlling the repeaters along the links to adaptively function as link buffers during congestion, thereby achieving nearly 30% savings in overall network power and 35% reduction in area with only a marginal 1-3% drop in performance. In addition, aggressive speculative flow control further improves the performance of iDEAL. Moreover, the significant reduction in power consumption and area provides sufficient headroom for monitoring negative bias temperature instability (NBTI) effects in order to improve circuit reliability at reduced feature sizes. [C511]

"The Design of Way-Prediction Scheme in Set-Associative Cache for Energy Efficient Embedded System"

Embedded system develops rapidly, functions turn into more complicate, and multi-media applications are growing daily and they consume more electrical power. Therefore, how to improve stand-by time will become a very important issue. Related researches indicate that the power consumption of processor cache is accounted for a big proportion. Way-prediction and LRU (least recently used) algorithms improve hit rate and would help in reducing the number of tag comparisons, and therefore save energy consumption. In this paper, we use MRU (most recently used) table to record the most used block for each index and use modified pseudo LRU (MPLRU) replacement algorithm for reducing hardware complexity and cache miss rate.Experiments show our prediction hit rate reach 90.15%, thus save 64.12% energy. The experimental results are obtained by using Wattch cache simulator for SPEC95 benchmarks. [C512]

"A novel embedded bandwidth-aware frame compressor for mobile video applications"

To reduce the bandwidth requirement and the size of frame memory for video decoding, embedding a compressor/decompressor on the chip is a well-known solution. Video compression has been developed for a long time and numbers of algorithm have been proposed. Those algorithms show us that enhancing the complexity can reach better performance. However, algorithm with higher complexity is more difficult to be embedded in a video decoder system. Longer coding cycles and larger gate counts may become a heavy load of the original system. In this paper, a new embedded compressor/decompressor algorithm is proposed for H.264 video compression. It is a lossy compression formed by two dimensions discrete cosine transform and modified bit plane zonal coding. The proposed algorithm compresses the 4 x 4 size block into a 64 bits segment, and decompresses a frame into 4 x 4 blocks. The compression ratio is fixed at two. With pipelined architecture, it takes 72 cycles and 34 cycles per MB for encoding and decoding respectively. As a result, our proposal becomes flexible to be embedded with any video coding system to save power consumption while maintaining acceptable video quality. [C513]

"Prediction router: Yet another low latency on-chip router architecture"

Network-on-Chips (NoCs) are quite latency sensitive, since their communication latency strongly affects the application performance on recent many-core architectures. To reduce the communication latency, we propose a low-latency router architecture that predicts an output channel being used by the next packet transfer and speculatively completes the switch arbitration. In the prediction routers, incoming packets are transferred without waiting the routing computation and switch arbitration if the prediction hits. Thus, the primary concern for reducing the communication latency is the hit rates of prediction algorithms, which vary from the network environments, such as the network topology, routing algorithm, and traffic pattern. Although typical low-latency routers that speculatively skip one or more pipeline stages use a bypass datapath for specific packet transfers (e.g., packets moving on the same dimension), our prediction router predictively forwards packets based on a prediction algorithm selected from several candidates in response to the network environments. In this paper, we analyze the prediction hit rates of six prediction algorithms on meshes, tori, and fat trees. Then we provide three case studies, each of which assumes different many-core architecture. We have implemented a prediction router for each case study by using a 65 nm CMOS process, and evaluated them in terms of the prediction hit rate, zero load latency, hardware amount, and energy consumption. The results show that although the area and energy are increased by 6.4-15.9% and 8.0-9.5% respectively, up to 89.8% of the prediction hit rate is achieved in real applications, which provide favorable trade-offs between the modest hardware/energy overheads and the latency saving. [C514]

"Low-power frequency selective filtering"

Supply voltage overscaling has been studied recently for the design of low power finite impulse response (FIR) filters, where the supply voltage is deliberately scaled beyond the critical voltage so as to lower the power consumption quadratically. The violation of timing constraint leads to computational errors/noise, which is then reduced via prediction-based algorithms. In this paper, we first propose an estimation-based algorithm aiming at accuracy maximization. Then, practical design issues are addressed and the major problem that causes performance drop is identified, which leads to a novel flexible two-phase bilateral estimation-based noise reduction architecture with the use of error-delay detection mechanism that enables the flexible size estimator. Compared to conventional designs, simulation results show that the estimation-based algorithm and the two-phase bilateral estimation algorithm improve the noise reduction performance by 10-20 dB and 17-22 dB while achieving the same power saving ratio, respectively. Alternatively, the proposed algorithms can achieve lower power while a certain performance requirement is satisfied. [C515]

"Bluetooth Sensor Network Communication"

The wireless sensor network discussed in this article is one with Web interface based on radio frequency connection, information-driven star topology and energy-saved mode are used, the energy of each sensor node is reduced and secure management of each sensor node is improved. [C516]

"Node operation reduced decoding for LDPC codes"

A novel scheme combining a stopping criterion and a node deactivation mechanism is proposed in this paper to reduce the number of node operations in LDPC decoding. The proposed stopping criterion employs an adaptive threshold to remove the channel-condition dependence of the conventional parity-check based stopping criterion. The proposed node deactivation mechanism improves the accuracy of node reliability estimation. As compared to standard BP decoding, the proposed scheme can save up to 80.06% node operations for IEEE 802.16e (2304, 1152) code. It can be implemented with only minor modifications of parity check step in standard LDPC decoders. This scheme can reduce the power consumption and decoding latency of LDPC decoder with low hardware overhead. [C517]

"Leakage reduction in FPGA routing multiplexers"

There is a pressing need to reduce the static power consumption in FPGAs implemented in deep submicron so that it can also be used in portable battery operated devices. The multiplexer based interconnect matrix of an FPGA consumes most of the static power consumption. This paper investigates reducing leakage power in unused FPGA routing multiplexers by controlling their inputs at the deep submicron 22 nm technology node. HSPICE simulation using Berkeley Predictive technology models (BPTM) on different sizes and topologies of routing multiplexers show that the minimum leakage vector at the 22 nm technology node significantly varies from that at 65 nm node. This is due to higher gate leakage and output stage loading effects. The application of this vector results in 20% more leakage power saving as compared to the existing approaches. This technique saves significant leakage power because most of the routing multiplexers are unused in an FPGA. Moreover, there is no area overhead contrary to the existing approaches. [C518]

"Noise reduction for low-power broadband filtering"

Supply voltage overscaling (VOS) has been studied recently for the design of low power finite impulse response (FIR) filters, where estimation-based noise reduction schemes are used for reducing the computational noise. When broadband filters are concerned, which are widely used in the scenario of high speed communication such as frequency-division multiplexed (FDM) systems, existing noise reduction schemes fail due to the relatively low dependency among broadband filter output samples. In this paper, a novel noise reduction scheme is proposed for broadband filters, which is the first implementation-independent scheme that can effectively reduce the noise due to both voltage overscaling and environmental fluctuations. Simulation results show that the proposed scheme achieves 7-27 dB performance gain while achieving 10.33%-51.74% power saving. [C519]

"Cluster head selection using RF signal strength"

The LEACH algorithm for selecting cluster heads is a probabilistic method which produces clusters with a large variation of link distances and uneven energy consumption during the data transmission phase. To address this issue, a RF signal strength algorithm based on link quality is presented. Using a competitive distributed algorithm, nodes attempt to reduce the overall energy required for transmission in addition to forming favourable clusters based on Received Signal Strength Indication (RSSI) density and quality. Cluster heads form in areas of high node density leading to a significant reduction in transmission link length, a reduced variance in link length

distribution and greater opportunity for energy savings through data aggregation. Simulations show that cluster heads selected by this algorithm form clusters with a lower average link length and have less link distance variability. This produces a lower and more evenly distributed energy cost per node in the network. [C520]

"Multirate distributed source coding in wireless sensor network USIND LDPC codes"

Energy conservation in wireless sensor networks (WSNs) is the primary performance parameter, because of their limited energy resources. Thus, some energy saving technologies should be applied. One of these technologies for WSNs is distributed source coding (DSC), related to correlation between sensor outputs. In this paper, we propose to apply multirate distributed source coding to reduce energy consumption for a target BER value. Low Density Parity Check (LDPC) code is one of the practical codes that can be used for DSC to compress close to Slepian-Wolf limit. The simulation results for codes of length 1000 and three different compression ratios show that the proposed multirate approach achieves better energy efficiency rather than a single rate code with similar maximum BER value. [C521]

"Design and implementation of a low-power workstation"

A workstation requires a low-power design similar to a typical PC. In this paper we propose several strategies to reduce the power consumption of a workstation. First, we must comprehend the needed dynamic power management for the CPU by using a PWM (Pulse Width Modulation) chip to detect the workload or the current consumption of the CPU. The design then automatically adjusts the CPU voltage and the operating frequency to save power. Second, we design the chipset and memory and include a power saving control. Third, we provide the design with phase switching of the power switch to save power. The number of phases of a power switch can be controlled and is based on the loading of the CPU. The different loading of the CPU presents different power efficiencies of the VRM (Voltage Regulator Module), hence we design a power switch which can automatically change phases in order to obtain greater efficiency in power saving. Fourth, as we have examined the PC power states like the S3/S5, we have found that, in addition to saving power through the S0 state, many peripheral devices don't need electricity to maintain operation in these states. We therefore redesign the circuit to cut off the current and thus save more power. For example, we can disable the PCIE add-on card function in certain machine states to save power. [C522]

"A novel LDPC decoder for DVB-S2 IP"

In this paper a programmable Forward Error Correction (FEC) IP for a DVB-S2 receiver is presented. It is composed of a Low-Density Parity Check (LDPC), a Bose-Chaudhuri-Hoquenghem (BCH) decoder, and pre- and postprocessing units. Special emphasis is put on LDPC decoding, since it accounts for the most complexity of the IP core by far. We propose a highly efficient LDPC decoder which applies Gauss-Seidel decoding. In contrast to previous publications, we show in detail how to solve the well known problem of superpositions of permutation matrices. The enhanced convergence speed of Gauss-Seidel decoding is used to reduce area and power consumption. Furthermore, we propose a modified version of the lambda-Min algorithm which allows to further decrease the memory requirements of the decoder by compressing the extrinsic information. Compared to the latest published DVB-S2 LDPC decoders, we could reduce the clock frequency by 40% and the memory consumption by 16%, yielding large energy and area savings while offering the same throughput. [C523]

"Energy-efficient spatially-adaptive clustering and routing in wireless sensor networks"

Wireless sensor networks hold the potential to open new domains to distributed data acquisition. However, low-cost battery-powered nodes are often used to implement such networks, resulting in tight energy and communication bandwidth constraints. Cluster-based data compression and aggregation helps to reduce communication energy consumption. However, neglecting to adapt cluster sizes to local network conditions has limited the efficiency of previous clustering schemes. We have found that sensor node distances and densities are key factors in clustering. To the best of our knowledge, this is the first work taking these factors into consideration when adaptively forming data aggregation clusters. Compared with previous uniform-size clustering techniques, the proposed algorithm achieves up to 24% communication energy savings in uniform density networks and 36% savings in non-uniform density networks. [C524]

"Energy consumption in the production of high-brightness light-emitting diodes"

High-brightness light-emitting diodes (LEDs) form the basis for solid-state lighting (SSL) systems. SSL systems have the potential to reduce electricity consumption of lighting systems as they are much more efficient than current lighting technologies. One concern is that the full life-cycle energy requirements of SSL systems, including the production of the materials and LED components, may negate any savings during the use phase. As a start to estimating the life-cycle energy requirements of SSL systems, we present an estimate for the

manufacturing energy consumption of high-brightness light-emitting diodes. Results are based on full-scale, research-scale, and laboratory-scale equipment energy use data, and data from logic chip production processes. Energy consumption estimates for wafer production are 15 kWh to 60 kWh (approximately 1,000 LEDs). [C525]

"Energy saving analysis of supervisory control and data acquisition system applied in district heating"

Supervisory control and data acquisition (SCADA) system was employed in a thermal power corporation. The system aimed to improve management in district heating system of the corporation. The heating area that the SCADA system serves was 8.48 million square meters. It was, up to now, the largest district heating systems that had installed a SCADA system in China. This paper introduced the basic configuration of the SCADA system and analyzed its energy saving effect in heating system operation. The using of SCADA system had led to notable energy saving in heating and reduced running costs. The control strategies in the SCADA system were also introduced. [C526]

"Prediction on future DC power system"

Analyzed some serious issues, including power energy quality and large area power interruption, require complex method to overcome in 3-phase power system, so, suggested to go other way, proposed independent full DC power system to become one of main power systems in the future. The authors emphasized the necessity and capability of full DC power systems in the significance of technology and energy saving, so that safer, more reliable, stable, flexible and controllable DC power grids could serve the people better than that of the present AC power systems. Presented brief structure of full DC power system where DC power would be produced from multi-phase generator-rectifier group in power station, consumers take power from DC bus, which benefits motor control and energy flow between loads connected the same DC bus without 3 phase balance problems, and DC-DC converters based Duty-Cycle control implement commutations at two terminals of HVDC transmission lines, which reduce the technical difficulties than that in 3-phase AC commutation station. Non-crystal material with about 15 kHz of frequency could be selected for advanced isolators, so as to get smallest power consumption. Some new technology lifting DC voltage in geometrical progression was suggested to be available at the sent terminal of HVDC line. With the development of renewable power systems and their energy storages, DC interconnection grids could be a better choice than AC interconnection grids because no frequency and phase shift problems need to be considered. Bulky 3-phase transformer with industrial frequency and vary kinds of compensators for AC power qualities could be saved. The authors suggested scientific policy for economically implementing full DC power systems step by step. It could be predicted that people would see 3 kinds of power systems, full AC, full DC and hybrid AC-DC systems operating simultaneously by the middle of 21 century. [C527]

"VLSI design of spread spectrum encoding low power RFID tag baseband processor"

Due to the weak signal energy of the backscatter link, traditional RFID communication is easily affected by noises, interferences, and interceptions from the environment. To solve the problem, a novel passive UHF RFID tag baseband processor enhanced with spread spectrum technique is presented in this paper. In addition, power-saving strategies are proposed to reduce the power consumption of the tag. Simulated results show that spread spectrum approach largely reduces the Bit Error Rate and improves system's reliability and security. Finally, a complete RFID tag with the proposed baseband processor was designed and fabricated using 0.18 um 1P6M CMOS technology. From the measurement result, the overall power consumption of the baseband processor is about 8.8 uW at the minimum voltage of 1.04 V. [C528]

"A novel self-generated low-voltage power supply for the gate-driver of high-voltage off-line SMPS"

A novel self-generated low-voltage power supply for the gate-driver of high-voltage off-line switching model power supply IC is described. The structure and properties of the device are analyzed and simulated. The experimental results have verified that the structure can realize the self-generated function, be controlled by the low-voltage logic signal and get 14 V of the low-voltage power supply. Using this novel power supply structure for the off-line switching model power supply IC can save the cell area, reduce the power consumption of the circuit, make control be easily and supply enough large output voltage for the power supply of the gate driver as well. [C529]

"Bank-partition and multi-fetch scheme for floating-point special function units in multi-core systems"

A table loader unit with bank-partition and multi-fetch feature is proposed for multiple special function units in

multi-core systems. By sharing the look-up tables among special function units, the proposed scheme reduces look-up table size by 54% and read power consumption by 75% for 8-core/4-bank configuration. However, the performance loss is less than 25% for various benchmark applications. As the number of cores increases for the future multi-core systems, the effects of area and power saving by the proposed schemes increase, but the performance loss is reduced. [C530]

"Area-efficient R-C DACs with low-offset push-pull output buffers for a 10-bit LCD source driver"

Area-efficient resistor-capacitor DACs (R-C DACs) and low-offset push-pull output buffers for a 10-bit LCD source driver are proposed. Comparing to a 10-bit resistor-string DAC (R-DAC), the 10-bit R-C DAC has a smaller area. A new output buffer with a push-pull function is adopted so that the source driver can drive the pixel with two-dot inversion to save power consumption. To reduce channel to channel deviations, an offset averaging method is adopted in this work. The simulated settling time is under 7 mus so it is suitable for UXGA LCD TV applications. The chip is fabricated using the TSMC 0.35 mum 2P4M CMOS process. The chip area is 1704times262 mum2. [C531]

"Energy efficient collaborative beamforming in wireless sensor networks"

Reducing energy consumption is critical for wireless sensor networks. The dominant factor is the energy for data transmission. Collaborative beamforming can save transmission energy by improving the directivity of electromagnetic waves so that the signal at the receiver is stronger. Compared with a single transmitter, collaborative beamforming spreads the long distance transmission energy over multiple transmitters. This balances the battery lifetime on individual nodes because each transmitter can use lower power. However, beamforming depends on proper coordination of phases among the participating sensor nodes. This requires communication among the sensor nodes and consumes energy. This paper investigates whether the transmission energy can be saved by using beamforming based on the number of nodes and the total size of data needed to transmit. We determine the minimum size of data to balance the communication overhead when given the total number of nodes. [C532]

"A novel low power hybrid loop filter for continuous-time sigma-delta modulators"

A novel low power hybrid (Active-Passive) loop filter using the single amplifier biquad (SAB) filter is presented. This new hybrid loop filter saves power consumption by reducing the number of active elements in the continuous-time sigma-delta modulator. Also, the core biquad filter allows the loop filter of a high-order modulator to be implemented by cascading low-order biquad sections, considerably easing the design and implementation of the high-order continuous-time sigma-delta modulator. The proposed loop filter is a general type of hybrid filter which could be used for the both high and low oversampling ratios (OSRs). Experiment on a 5th-order low pass continuous-time sigma-delta modulator with a bandwidth of 30 MHz is conducted successfully and the results are presented. [C533]

"Low power integrate and fire circuit for data conversion"

We have developed an adaptively biased integrate and fire (I&F) circuit to reduce the power consumption of our ADC replacement approach. Unlike conventional circuits this I&F consumes no standby power. Power consumed is input signal dependent and increases exponentially as the input approaches the set threshold value. We describe the circuit model and present an intuitive as well as mathematical model for the power savings. Results from the chip fabricated in AMI 0.6 mum technology are also presented. [C534]

"Power Saving Class Management for Energy Saving in IEEE 802.16e Wireless Networks"

Power saving is a critical issue in the IEEE 802.16e broadband wireless networks. In order to reduce the power consumption, the IEEE 802.16e provides three types of power saving classes (PSCs) for the Mobile Subscriber Stations (MSSs), where each PSC may contain one or several connections. However, how to define a PSC and assign PSCs to connections are open issues in the standard. Focusing on real-time traffics, a single MSS and base station (BS) pair, previous studies use a single PSC of type II to manage the awake and sleep of the MSS. In this paper, two power saving class management algorithms based on multiple PSCs in the IEEE 802.16e are proposed. These two schemes define PSCs for real-time connections by referring to the delay bound and packet interarrival time of connections. Simulation results demonstrate that our schemes outperform the previous single PSC approach in both energy efficiency and resource utilization. [C535]

"Energy Efficient TDMA Sleep Scheduling in Wireless Sensor Networks"

Sleep scheduling is a widely used mechanism in wireless sensor networks (WSNs) to reduce the energy

consumption since it can save the energy wastage caused by the idle listening state. In a traditional sleep scheduling, however, sensors have to start up numerous times in a period, and thus consume extra energy due to the state transitions. The objective of this paper is to design an energy efficient sleep scheduling for low data-rate WSNs, where sensors not only consume different amounts of energy in different states (transmit, receive, idle and sleep), but also consume energy for state transitions. We use TDMA as the MAC layer protocol, because it has the advantages of avoiding collisions, idle listening and overhearing. We first propose a novel interference-free TDMA sleep scheduling problem called contiguous link scheduling, which assigns sensors with consecutive time slots to reduce the frequency of state transitions. To tackle this problem, we then present efficient centralized and distributed algorithms that use time slots at most a constant factor of the optimum. The simulation studies corroborate the theoretical results, and show the efficiency of our proposed algorithms. [C536]

"Optimal Anycast Technique for Delay-Sensitive Energy-Constrained Asynchronous Sensor Networks"

In wireless sensor networks, asynchronous sleep-wake scheduling protocols can significantly reduce energy consumption without incurring the communication overhead for clock synchronization used in typical sleep-wake scheduling protocols. However, the savings could come at a significant cost in delay performance. Recently, researchers have attempted to exploit the inherent broadcast nature of the wireless medium to reduce this delay with virtually no additional energy cost. These schemes are called "anycasting," where each sensor node forwards the packet to the first node that wakes up among a set of candidate next-hop nodes. In this paper, we develop a delay-optimal anycasting scheme under periodic sleep-wake patterns. Our solution is computationally simple and fully distributed. We show that periodic sleep-wake patterns result in the smallest delay among all wake-up patterns under given energy constraints. Simulation results illustrate the benefit of our proposed schemes over the state-of-the art. [C537]

"A Multi-Poller based Energy-Efficient Monitoring Scheme for Wireless Sensor Networks"

For sensor networks deployed in unattended, harsh environments, the knowledge of sensor statuses such as liveness, node density and residue energy, is critical for maintaining the normal operation of the network. In this paper, we propose a poller-pollee based architecture to monitor the sensor status, focusing on two important issues: false alarm and energy efficiency. To reduce the false alarm rate, each pollee is monitored by multiple pollers. However, this approach will increase the power and bandwidth consumption. To address this issue, we propose a novel solution where the monitored sensor sends the status reports to different pollers in a round robin manner. In this way, bandwidth and power can be saved, and the false alarm rate can be reduced. We further propose a simple randomized algorithm to select the optimal number of pollers to stochastically minimize the expected total energy consumption due to monitoring. Theoretical analyses and simulations are used to demonstrate the effectiveness of the proposed techniques. [C538]

"On-Line and Off-Line DVS for Fixed Priority with Preemption Threshold Scheduling"

Along with the prevailing of mobile devices, the demand for efficient power consumption has become one of the major issues in designing embedded system. Dynamic voltage scaling (DVS) is a technique that can reduce energy consumption by changing the processor voltage levels dynamically. Fixed priority with preemption threshold (FPPT) scheduling is a scheduling policy that includes preemptive and non-preemptive aspect of scheduling policy. In this paper, an efficient universal fixed priority DVS algorithm (FPPT-DVS) will be presented. This algorithm has the advantage of both fixed priority preemptive (FPP) DVS scheduling and fixed priority non-preemptive (FPNP) DVS scheduling. FPPT-DVS algorithm also combines the on-line DVS and off-line DVS together. Experimental results show that the proposed FPPT-DVS algorithm can save up to 20% energy over the existing DVS algorithms. [C539]

"Server Frequency Control Using Markov Decision Processes"

For a wide range of devices and servers, Dynamic Frequency Scaling (DFS) can reduce energy consumption to various degrees by appropriately trading-off system performance. Efficient DFS policies are able to adjust server frequencies by extrapolating the transition of the highly varying workload without incurring much of implementation overhead. This paper models DFS policies of a single server using Markov Decision Processes (MDP). To accommodate the highly varying nature of workload in the proposed MDP, we adopt fluid approximation based on continuous time Markov chain and discrete time Markov chain modeling for the fluid workload generator respectively. Accordingly, we design two frequency controllers (FC), namely C-FC and D-FC, corresponding to the continuous and discrete modeling of the workload generator. We evaluate the proposed policies on synthetic and Web traces. The proposed C-FC and D-FC schemes ensure performance satisfaction with moderate energy saving as well as ease of implementation, in comparison with existing DFS policies. [C540]

"Improve clock gating through power-optimal enable function selection"

Clock gating technology can reduce the consumption of clock signals' switching power of flip-flops. The clock gate enable functions can be identified by Boolean analysis of the logic inputs for all flip flops. However, the enable functions of clock gate can be further simplified, and the average number of flip flops driven by enable functions can be improved. In this way, the circuit area can be reduced; therefore, the clock gating can be improved and power saving can be achieved. This paper presents a technique for improving clock gating by optimizing the enable functions. The problem of improving clock gating is formulated as finding the optimal set of enable functions in the shared logic cone that leads to best power reduction on flip flops. First, enable functions are identified by random simulation and SAT. Then the optimal set of enable functions is found with partition method. This paper demonstrates the effectiveness of the approach through testing on MCNC benchmarks and industrial circuits. The experimental results show that the algorithm will get as much power saving as 3 times of that of the original clock gating circuits, and all benchmarks can run in tens of seconds. [C541]

"Reducing Power Consumption with Relaxed Quasi Delay-Insensitive Circuits"

This paper introduces novel circuits to mitigate power consumption in asynchronous logic. By exposing a preexisting timing assumption in quasi-delay insensitive (QDI) circuits, we develop a set of circuit templates that reduce dynamic power consumption while maintaining the robustness of QDI circuits. We refer to these as relaxed quasi delay-insensitive circuits (RQDI). Power consumption is reduced in four ways. First, we present a circuit template that saves power by reducing the logic required to generate enable/acknowledge signals. Second, we develop voltage converters for asynchronous channels that allow non-performance critical components to be moved to lower voltage domains. Third, we propose a circuit template that improves upon the use of multiple voltage domains by keeping the data logic in the high voltage domain, but moves the enable/acknowledge logic to the low voltage domain. Fourth, we utilize a novel 2-phase buffer to half the switching in global routing and static switching networks. Experiments show that we can reduce energy by 30-50%, with a minimal impact on area and performance. [C542]

"Remote-controllable and energy-saving room architecture based on ZigBee communication"

This paper describes room architecture to reduce power consumption and to make the room easily controllable with an IR remote control of an home appliance. The room is composed of automatic standby power cut-off outlets, a dimming light and a ZigBee controller. The automatic standby power cut-off outlet monitors the power consumption of the outlet and completely cut off the power supply when the monitored power value is below the threshold. Based on the ZigBee communication, the ZigBee controller plays a role of switches for the power outlet and the dimming light. It turns on the power outlet and dims the light in the room. The ZigBee controller has an education function of an IR remote control signal of a home appliance connected to the power outlet. With this architecture a user can handle the power outlet and the dimming light through one IR remote control in the energy-saving room. [C543]

"Sleeping policy cost analysis for sensor nodes collecting heterogeneous data"

Sleeping policies are widely used in many contexts to reduce energy consumption in sensor nodes, ad-hoc terminals or mobile cell phones. Although there is extensive literature on energy saving in sensor networks, little has been done with respect to comparing additional costs, such as packet drop probability and buffer occupancies of sleeping versus non-sleeping policies, especially for multiple classes of data. In this paper, we employ discrete time vacation modeling results from queueing theory to obtain the quantities of interest, i.e., blocking probabilities, and queue lengths incurred by sleeping policies for a sensor node with a finite buffer.We propose a 2-class Geo/G/1/K vacation model, where two classes of data, each with its own buffer, are collected by a sensor node following a sleeping policy. At any time instant, only one packet can be transferred and the transmission order is selected by a scheduling function. The sleeping, transfer and selection processes have general distributions. To the best of our knowledge, this is the first work on modeling and analyzing the performance characteristics of a sensor node with a sleeping policy, collecting heterogeneous data. First, we present a Markov renewal process embedded at the time instant of transfer completion and then obtain the marginal occupancy distributions at an arbitrary time instant. Simulation results validate our theoretical derivation and demonstrate how the results can be applied to understand the behavior of sensor nodes with heterogeneous data. [C544]

"Energy efficient video compression for wireless sensor networks"

Wireless video sensor networks are anticipated to be deployed to monitor remote geographical areas. To save energy in bit transmissions/receptions over a video sensor network, the captured video content needs to be

encoded before its transmission to the base station. However, video encoding is an inherently complex operation that can cause a major energy drain at battery-constrained sensors. Thus a systematic evaluation of different video encoding options is required to allow a designer to choose the most energy-efficient compression technique for a given video sensing application scenario. In this paper, we empirically evaluate the energy efficiencies of predictive and distributed video coding paradigms for deployment on real-life sensor motes. For predictive video coding, our results show that despite its higher compression efficiency, inter video coding always depletes much more energy than intra coding. Therefore, we propose to use image compression based intra coding to improve energy efficiency in the predictive video coding paradigm. For distributed video coding, our results show that the Wyner-Ziv encoder has consistently better energy efficiency than the PRISM encoder. We propose minor modifications to PRISM and Wyner-Ziv encoders which significantly reduce the energy consumption of these encoders. For all the video encoding configurations evaluated in this paper, our results reveal the counter-intuitive and important finding that the major source of energy drain in WSNs is local computations performed for video compression and not video transmission. [C545]

"Dynamic Reconfiguration of Two-Level Caches in Soft Real-Time Embedded Systems"

Cache reconfiguration is a promising optimization technique for reducing memory hierarchy energy consumption with little or no impact on overall system performance. While cache reconfiguration is successful in desktop-based systems, it is not directly applicable in real-time systems due to timing constraints. Existing scheduling-aware cache reconfiguration techniques consider only one-level cache. It is a major challenge to dynamically tune multi-level caches since the exploration space is prohibitively large. This paper efficiently integrates cache reconfiguration in soft real-time systems with a unified two-level cache hierarchy. We utilize a set of exploration heuristics during our static analysis which effectively decreases the exploration time while keeps the generated profile results beneficial to be leveraged during runtime. Our experimental results have demonstrated 32-49% energy savings with minor impact on performance. [C546]

"Energy Consumption Optimization for Data Collection with Precision Constraints in Wireless Sensor Networks"

Optimizing network energy consumption is one of the most important issues in wireless sensor networks (WSNs). In this work we consider the energy consumption optimization problem for data collection applications. The network energy consumption can be reduced by letting a subset of sensors go into energy saving sleep state. However, the cost of the energy saving is the loss of observation precision. Given the application precision constraints, we try to select a suitable set of reporters and relays such that the network energy consumption is optimized while the precision constrains are satisfied. We formulate the problem as a PCEO problem and give a binary integer linear programming (BILP) formulation for the problem. The linear programming (LP) extension of the BILP problem can provide a lower bound for the PCEO problem. The PCEO problem is shown to be NP-complete and three greedy heuristics are developed for it. The performance of the heuristics is studied through extensive simulations and compared with the lower bound by solving LP. [C547]

"A Clustering Algorithm Based on Communication Facility with Deterministic Cluster-Size in WSN"

With the energy constrained nature of wireless sensors, it is a substantial design issue to make efficient use of battery power in order to increase their lifetime. Focuses on reducing energy consumption of wireless sensor network, this paper proposed CABCF-DCS (clustering algorithm based on communication facility with deterministic cluster-size) algorithm. By changing the cluster-size of the cluster based on CABCF (clustering algorithm based on communication facility) algorithm, the new algorithm achieves the purpose of saving energy ultimately. Simulation results validate the energy efficiency of the new algorithm. [C548]

"Triangular Energy Saving Route Protocol by Energy Sieving in Wireless Ad Hoc Networks"

In grid-based routing protocol, one node in a grid is elected as the grid leader. However, nodes consume extra energy for in the traditional grid leader election, especially in a high node density environment. In this paper, we propose a triangular energy saving route protocol by energy sieving (TESRES) to address this issue. In TESRES, a new grid leader election and a triangular route discovery are proposed. In the grid leader election of TESRES, only few nodes are elected as a grid leader in the grid leader election. In the route discovery, TESRES selects the energy-efficient routing path to reduce energy consumption for transmitting packets. Therefore, TESRES could save energy for data transmission and prolong the lifetime of route. In the simulation results, TESRES could reduce 16% and 28% of energy consumption in the grid leader election and route discovery, respectively. [C549]

"Trajectory Optimization of Mobile Element for Sparse Wireless Sensor Networks"

Mobile element has been proposed to assist data collection or data relay in wireless sensor networks, since it is able to either significantly save energy consumption or reach disconnected nodes due to the limited radio range. Trajectory of the mobile elements play an important role in avoiding buffer overflow of sensor nodes. In this paper, we propose optimization problems for mobile elements in terms of reducing traverse time of the mobile element. The problem is formulated as searching for Euler cycle in the graph obtained from the restricted routes of the mobile element. Itpsilas shown that solution to the resulting Chinese Postman Problem can provide optimal trajectory for the mobile element. [C550]

"Collaborative communications: Joint relay and protocol selection"

We consider a decode and forward collaborative network and investigate the relay selection problem. Users are able to collaborate with each other; decode messages of each other, re-encode and forward along with their own messages to the destination (collaborative protocol). We study the performance obtained from collaboration in terms of 1) increasing the achievable rate, 2) saving the transmit energy, and 3) reducing the resource requirement. To ensure fairness among the users, we assume that the transmit energy to the rate ratio is fixed for all users. We allocate resource optimally for the proposed collaborative protocol (CP) with the imposed fairness constraint, and compare the result with the non-collaborative protocol (NCP) where users transmits their messages directly to the destination. We show that a considerable gain can be obtained if the direct source-destination channel gain is significantly smaller than those of alternative involved links. We demonstrate that a rate and energy improvement of up to (1 + etaradic(k/k+1))etacan be obtained, where eta is the environment path loss exponent and k is the ratio of the rates of involved users. The maximum gain can be obtained for low transmit-energy-to-received-noise-ratio (TERN). In contrast, in a high TERN environment the NCP is preferred. [C551]

"Exploiting a clustering mechanism for power saving in ad hoc networks: Performance evaluation"

Designing power aware protocols becomes a pre-requisite to conserve energy and extend network life time. In fact, many target applications may require such features when being deployed for long periods in hostile environments, such as rescue or military operations. To assure power saving while preserving network capacity, relaying on a virtual backbone seems a promising approach. Through keeping a subset of nodes active for communication tasks, we allow other nodes to switch to sleep mode reducing consequently energy waste. However, the benefits of clustering come at a cost in terms of time and the prohibitive overhead incurred during the clusters' establishment and maintenance. In this paper, we investigate the influence of the underlying clustering algorithm on the performance of a power saving mechanism. The conducted simulations confirm the importance given to the choice of an efficient clustering algorithm to achieve energy efficiency while preserving network capacity. [C552]

"Energy-Efficient Cluster Computing via Accurate Workload Characterization"

This paper presents an eco-friendly daemon that reduces power and energy consumption while better maintaining high performance via an accurate workload characterization that infers ldquoprocessor stall cycles due to off-chip activities.rdquo The eco-friendly daemon is an interval-based, run-time algorithm that uses the workload characterization to dynamically adjust a processorpsilas frequency and voltage to reduce power and energy consumption with little impact on application performance. Using the NAS Parallel Benchmarks as our workload, we then evaluate our eco-friendly daemon on a cluster computer. The results indicate that our workload characterization allows the power-aware daemon to more tightly control performance (5% loss instead of 11%) while delivering substantial energy savings (11% instead of 8%). [C553]

"Dynamic Power Saving Mechanism for Mobile Station in the IEEE 802.16e Systems"

In wireless communication system, power saving mechanism is a key issue since the mobile station operates depending on limited power. Hence, the IEEE 802.16e system provides three types of power saving classes (PSC I, PSC II and PSC III) for mobile station (MS) to reduce the power consumption. When the MS is using two or more power saving classes, the MS reduces the power consumption only during time interval that does not overlap with any listening window of active PSC called the unavailability interval. Therefore, in this paper, based on the IEEE 802.16e standard, we propose a dynamic power saving mechanism (DPSM) that increases unavailability interval when the MS is using two or more power saving classes (PSCs). The proposed mechanism adjusts sleep window of PSC I (III) to match the start point of listening window in PSC I (III) with that of listening window in PSC II. By doing so, the MS can reduce the listening time, and can increase the unavailability interval. Through analysis and simulation results, we show that the proposed DPSM can reduce the power consumption of MS with two or more PSCs considerably compared with conventional scheme. [C554]

"Cognitive Radio Sensing Architecture and a Sensor Selection Case Study"

The function of a cognitive radio system (CRS) can be classified as cognitive engine (CE) and sensing. The CE fulfills spectrum analysis and decision making of spectrum access. The sensing function is realized by either a CR node or distributed spectrum sensors. In this paper, we propose a sensing architecture, which adds new functional entities, sensing controller (SC) and sensing information processor (SIP) inside CE and sensing, respectively. Based on the architecture, we give a use case where sensing is realized by distributed sensors. Selection of these sensors is performed in Rayleigh fading channel to improve the detection performance and save power consumption. Using analytical analysis we prove the benefits of sensor selection. Results show that using energy detection with 5000 symbols in-15 dB signal-to-noise ratio (SNR) environment, we can reduce the false alarm rate from 0.95 to 0.1 while keeping 99% protection to primary users by selecting among ten sensors. Results also show that it is beneficial perform selection based on user channel. [C555]

"The More Relay Nodes, the More Energy Efficient?"

Existing work has been focused on minimizing the number of relay nodes to maintain the connectivity of a sensor network. However, we believe replacing batteries for nodes or redeploying the network is either labor-intensive or impossible, so it is more desirable to reduce energy consumption even if we need to use slightly more nodes. The question we are trying to answer is: is it possible to greatly reduce energy consumption by increasing the number of relay nodes? To properly answer this question, we first designed an algorithm that finds the most energy efficient relay nodes placement for a given number of relay nodes. By observing the energy saving with different numbers of available relay nodes, we found that slightly increasing the number of relay nodes can significantly reduce energy consumption. On the contrary, blindly adding relay nodes does not necessarily improve energy efficiency when the number of relay nodes exceeds a certain threshold. [C556]

"A New Robust, Energy-efficient and Scalable Wireless Sensor Networks Architecture Applied to a Wireless Fire Detection System"

In this work a new architecture called EDETA (energy-efficient adaptive hierarchical and robust architecture) optimized to save node's power is presented. This architecture is scalable and suitable for heterogeneous and homogeneous wireless sensor networks, supports single or multiple sinks, and also provides features increasely-demanded in the current applications such as fault tolerance and bounded-time response communications. All these features make EDETA suitable for the implementation of safety applications such as a wireless fire detection system. The proposed protocol is able to auto-configure, and it is based on two-levels hieratical architecture. The lower level is based on cluster organization, while the upper one is formed as a dynamic tree of clusters heads to send the data to the sink. A wireless fire detection system based on EDETA has been implemented, obtaining very satisfactory results about the reliability, response time and the consumption, the implemented system based on EDETA reduce the energy consumption in a factor of 8x compared with most popular power-aware protocols. Furthermore, EDETA multiplies the lifetime of the sensor network while providing, in addition, extra-features such as fault-tolerant mechanisms and bounded time. [C557]

"A Study on the Effects of Energy Storage System"

The energy storage system creates optimum conditions for energy regeneration in urban transit systems. The energy storage system is able to store and discharge energy at an extremely rapid rate. This enables a complete exchange of energy between vehicles, even when they are not braking and accelerating at precisely the same time, as is most frequently case in everyday service. The benefits of the energy storage system include energy savings and voltage stabilization. Energy storage systems are generally installed for the purpose of saving energy. However, energy storage systems are sometimes applied in order to stabilize voltage. This paper presents the energy storage system applied for the purpose of voltage stabilization. In this case, the system still saves a small amount of energy. This energy savings, coupled with the system's ability to reduce CO2emissions, will contribute greatly to environmental preservation efforts. [C558]

"Enhanced Blocking Expanding Ring Search in Mobile Ad Hoc Networks"

We introduce BERS*, an enhanced blocking expanding ring search (BERS) protocol for route discovery in mobile ad hoc networks (MANETs). BERS is an energy efficient alternative that was developed recently based on the expanding ring search (ERS). ERS is widely applied in reactive routing protocols such as DSR and AODV. BERS* is a faster and more energy-time efficient version of BERS. It reduces the route discovery latency of BERS by nearly half while maintaining a similar level of energy saving. Our results show that, among the three protocol schemes (BERS*, BERS and ERS), BERS* incurs the least search latency when the hop number of the route nodes is greater than 3, and has achieved the best performance in terms of energy-time efficiency when the hop number of the route nodes is greater than 7. We have also discovered the conditions that allow

collective optimisation of BERS* and ERS. [C559]

"A load management method to reduce the power energy cost for glass industry"

The aim of this research is to study the power cost reduction of glass manufacturing process for industrial customers and to relieve the crisis of electricity shortage during summer peak time period through load management (LM). This research can also provide decision makers and managers with useful LM strategies to use as guidance. The results indicate that local glass industry is highly willing to participate in the development of LM strategies. As the running time of a ball mill is adjusted to the preferential rates of time of use (TOU), industry customers can save a certain amount of electricity cost. [C560]

"A New Energy-Efficient, Scalable and Robust Architecture for Wireless Sensor Networks"

The major problem for most of wireless sensor networks applications is the energy consumption. In this paper we propose a new architecture called EDETA (Energy-efficient aDaptive hiErarchical and robusT Architecture) optimized to save node's power. This architecture is scalable and suitable for heterogeneous and homogeneous wireless sensor networks, supports single or multiple sinks, and also provides features increasely-demanded in the current applications such as fault tolerance and bounded-time response communications. The proposed protocol is able to autoconfigure, and it is based on two-levels hierarchical architecture. The lower level is based on cluster organization, while the upper one is formed as a dynamic tree of clusters heads to send the data to the sink. Our experiments, based on real energy measures, show that EDETA can reduce the energy consumption in typical applications in a factor of 8Γ΄Β— compared with most popular power-aware protocols. Furthermore, EDETA multiplies the lifetime of the sensor network while providing, in addition, extra-features such as fault-tolerant mechanisms and bounded time. [C561]

"Power Efficiency in Wireless Network Distributed Computing"

Advanced wireless applications such as sensor networks involve a close interaction between the communication and computation processes that deliver the services under stringent power constraints. Wireless network distributed computing (WNDC) is a potential solution to reducing the power consumption per node as well as that of the network. In WNDC, a computational task is executed among a network of collaborative nodes in a distributed manner as against performing the same task on a single node. In addition to providing power savings, WNDC enables power demand-supply matching that allows for system operation under a constrained power supply such as solar power. This paper presents fundamental power efficiency analysis of WNDC. The conditions for achieving power demand-supply matching and positive network power savings under power and computational latency constraints are derived. The results show the impact of non-linearity in the computational system characteristics and the communication overhead on the power savings. [C562]

"Reducing dynamic power consumption in FPGAs using precomputation"

This paper studies the effectiveness of employing precomputation in reducing dynamic power consumption in commercial off-the-shelf (COTS) FPGAs. Precomputation is a high-level logic optimization technique that lowers power consumption of a design by disabling part of the circuit based on a few relatively simple precomputation conditions. With careful design considerations, the increased logic utilization and its associated power consumption can be justified by the power saving resulted from disabling a much larger part of the design. This fundamental trade-off benefits particularly well from the tile-based structures of modern FPGAs that consist of large number of redundant logic cells. Using the design of a comparator as an example, we study the trade-offs and unique opportunities provided by modern FPGA architectures in employing precomputation as a technique to reduce dynamic power consumption. In our example, 83% of dynamic power from logic, or 43.1% of total dynamic power including routing is reduced with negligible increase in resource consumption. [C563]

"Ultra Low Energy Store-Carry and Forward Relaying within the Cell"

In this paper we address the issue of store-carry and forward (SCF) relaying within a cell in a mobile network. The proposed scheme can be considered as a generalization of various multihop wireless relaying schemes, where storing and carrying an information message by a mobile relay node is not allowed. The key motivation of utilizing SCF relaying within the cell is that energy consumption levels can be dramatically reduced by capitalizing on the inherent mobility of nodes and the elasticity of Internet applications. In that respect, we consider a novel multihop cellular architecture to achieve energy savings both at the network side (i.e., Base Stations) and at the user terminals. The proposed scheme makes use of mobility information of relays (vehicles) while roaming inside the cell to device flows that could achieve maximum energy savings. We show that under SCF relaying large energy savings can be achieved by tolerating a controlled delay over the initiated service. [C564]

"Sequential Fusion with Truncated SPRT for Event Detection in Centralized and Decentralized Wireless Sensor Networks"

In this work, the sequential fusion scheme is used to save the energy consumption for events detection in wireless sensor networks (WSNs). The fusion center (FC) sequentially accumulates the information forwarded by nodes, and broadcasts a termination message to stop the transmission of nodes when the accumulated information is enough for decision-making. Thus the average number of forwarded messages, as well as the average energy consumption, can be significantly reduced. Since the number of sensor nodes is generally limited, the truncated sequential probability ratio test (TSPRT) is applied at the FC. The main goal of this paper is to propose analytical approaches, for both centralized and decentralized detection, to determine the thresholds for TSPRT. According to the simulation results, with little performance degradation, the average number of transmissions can be greatly reduced compared with the nonsequential fusion scheme. [C565]

"Energy Efficient Radio Access Architectures for Green Radio: Large versus Small Cell Size Deployment"

In this paper new architectural approaches that improve the energy efficiency of a cellular radio access network (RAN) are investigated. The aim of the paper is to characterize both the energy consumption ratio (ECR) and the energy consumption gain (ECG) of a cellular RAN when the cell size is reduced for a given user density and service area. The paper affirms that reducing the cell size reduces the cell ECR as desired while increasing the capacity density but the overall RAN energy consumption remains unchanged. In order to trade the increase in capacity density with RAN energy consumption, without degrading the cell capacity provision, a sleep mode is introduced. In sleep mode, cells without active users are powered-off, thereby saving energy. By combining a sleep mode with a small-cell deployment architecture, the paper shows that the ECG can be increased by the factor n = (Rlarge/Rsmall)2while the cell ECR continues to decrease with decreasing cell size. [C566]

"When does Network-on-Chip bypassing make sense?"

Networks-on-Chip (NoCs) are becoming widespread in contemporary multi-core and many-core designs. Amongst their appeals are regularity of layout and flexibility of topology. However, the energy consumed by routing nodes is now vastly more than that of an ALU operation in one of the processing cores they service. We present an evaluation of bypassing, a technique where selected traffic can avoid the full routing functionality of selected nodes in a NoC. When implemented correctly, bypassing can dramatically reduce the overall energy consumption of data flowing through the network. We address the questions of when bypassing should be deployed at a given node, how much energy will be saved by doing so, and present some equations to quantify and answer these questions. We show that if 74-80% of data, depending on router implementation, is destined for a node further away than that employing bypassing, then bypassing is energy-effective. Using these figures, we define guidelines for the use of bypassing for a wide variety of NoC designs. [C567]

"Power reduction through adaptive data compression in Network-on-Chip architectures"

In this paper we present an adaptive compression technique that reduce the power consumption when compare to the compressed and original uncompressed data. We adapt a compression method by distances between transmitter and receiver. We show that compressing data for all of the distances is not useful. Experimental results indicate that our approach save power consumption as much as 24%. We also add encoding approach to compressor, to achieve both bit and transition reduction. Experimental results show that by using coder and decoder and adapting part, power saving can reach up to 30%. [C568]

"A 2.1-mW 0.3V-1.0V wide locking range multiphase DLL using self-estimated SAR algorithm"

This paper presents an all-digital multiphase delay-locked loop (ADMDLL) for wide-locking range and micro-power applications. To enhance locking range of the ADMDLL, we proposed the self-estimated successive approximation register-controlled (SESAR) algorithm, which uses the frequency-estimation selector (FES) to avoid harmonic lock issue. In addition, the FES can reuse the delay line to reduce circuit area and power dissipation significantly. By using the stack effect, the proposed leakage-reduced delay unit can save 12% leakage power consumption. After locking, the dynamic frequency monitor window is proposed to compensation phase error caused by PVT variations. The proposed ADMDLL is capable of operating in wide supply voltage range from 0.3V to 1.0V. The power dissipation is only 520Г‚ВїW at 1.25GHz/1.0V, and 2.1 Г‚ВїW at 13MHz/0.3V, respectively. This work is based on UMC 90nm standard CMOS technology. [C569]

"Analysis and Optimization of Embedded Software Energy Consumption on the Source Code and

Algorithm Level"

The energy consumption optimization of embedded systems can be undertaken in multiple levels of hardware and software. In this paper, based on the energy consumption measurement of embedded software, the generating reasons and influencing factors of embedded software energy consumption on the micro-structure and circuit level of hardware were analyzed firstly. Then, to reduce the energy consumption of embedded software, some measures were adopted to improve the software-related characteristics on the source code and algorithm level. Finally, a C program of typical "Eight Queens" puzzle was optimized with three methods of source code level, algorithm level and a mix of source code and algorithm level, the highest energy savings of embedded systems could achieve up to 93.1%, and experimental results demonstrated that the energy consumption optimization methods of embedded software were feasible and effective to minimize the energy consumption of embedded systems. [C570]

"Lossy Data Aggregation in Multihop Wireless Sensor Networks"

In wireless sensor networks, in-network data aggregation is an efficient way to reduce energy consumption in network. However, most of the existing data aggregation scheduling methods try to aggregate the data from all the nodes at all time-instances. It is neither energy efficient nor practical because of the link unreliability and spatial and temporal data correlations. In this paper, we propose anew data aggregation paradigm which allows estimated aggregation at the sink node. In our scheme, we will selectively let some nodes sample data and aggregate them to the sink node. Two different cases will be studied. Firstly, we assume that the links are reliable and the error between the value obtained from the data of all nodes and that from the data of sampled nodes is bounded. We give detailed analysis on the error bound when the confidence is given a priori. Secondly, we assume that the links are unreliable with a given probability and obtain that the error is still bounded under a given confidence when the probability of link unreliability is not too high or the success probability of retransmission is high enough. We also study how to assign the confidence level among the root nodes such that each root node can calculate the minimum number of sampling leaf nodes based on corresponding confidence level. Through analyzing, we show that it can surely save energy to adopt our method when the link is reliable. When the link is not reliable, the energy still can be saved if the success probability of retransmission is high enough. [C571]

"A Heuristic Energy-aware Scheduling Algorithm for Heterogeneous Clusters"

With the rapid development of supercomputers, the power consumption by large scale computer systems has become a big concern. How to reduce the power consumption is now a critical issue in designing high performance computers. Energy-aware scheduling for large scale clusters, especially the high performance heterogeneous ones, is one of the strategies for energy saving. Proposed in this paper is a novel energy-aware task scheduling algorithm (EAMM) for heterogeneous clusters, which is based on the general adaptive scheduling heuristics min-min algorithm. The algorithm is evaluated on a simulated heterogeneous cluster. The experiment results show that the new energy-aware algorithm can achieve a good time-energy trade-off and outperform the original min-min algorithm under various conditions. [C572]

"A high power efficiency Class AB switched-opamp for low voltage low power sigma-delta modulators"

Two-stage Class-A switched-opamp (SO) is the most popular module in previous low voltage low power SO sigma-delta modulators (SDM). The SO saves about 30%~40% of the total power since its output stage is just turned off at the integrating phase. To further increase efficiency a novel high power efficiency class AB current mirror SO is proposed in this paper. By turning off the entire SO together with its common mode feedback (CMFB) circuit, the power consumption of the SO can be reduced by 50%. A Class-AB load-compensated opamp version improves the power efficiency further. The proposed SO was fabricated in a 0.35 Г‚Вїm TSMC CMOS standard process and achieved a DC gain of 62.7 dB, a GBW of 4.39 MHz and a slew rate of 1.2 V/Г‚Вїs when the load capacitor is 10 pF. The effective power consumption including the CMFB circuit is 6.6 Г‚ВїW under 1.5 V supply voltage. The simulation results showed that the proposed SO can be applied to low power low voltage SDM with a frequency of less than 0.5 MHz. [C573]

"Location Aware Reduced Diffusion Hybrid Routing Algorithm (LARDHR)"

Mobile ad-hoc network (MANET) is a multihop wireless network formed by a collection of mobile nodes wherein the nodes move arbitrarily thus making the topology dynamic. MANETs have low bandwidth wireless links hence the routing protocols with less consumption of bandwidth are of great importance. This paper presents a new location aware hybrid routing algorithm with reduced diffusion of routing related messages called location aware reduced diffusion hybrid routing algorithm (LARDHR). This algorithm utilizes different mechanisms to reduce the

diffusion of route search messages in the whole network and also encourage the route stability to save the limited energy of the anemic mobile nodes. With the help of physical locations of the nodes route search messages are routed only through limited nodes therefore the algorithm utilizes the bandwidth optimally and also increases the efficiency of the route search method. [C574]

"Survey of network coding and its benefits in energy saving over wireless sensor networks"

Being one of the most important breakthroughs in communication fields, network coding (NC) allows the nodes in the network to code the incoming data as well as transmitting, which enhances the efficiency of network greatly. Especially, for data based wireless sensor networks (WSN) with huge information exchange operations, NC can improve the broadcast efficiency by combining different incoming data together using appropriate coding methods. In this paper, we first give a survey of NC and its benefits applied in WSN. Then, by comparing both the analysis results and the simulation results of different information exchange methods in a cluster structure WSN, it is proved that NC based information exchange method can significantly reduce the time of information exchange, so as to save the energy consumption of each node greatly. [C575]

"A proposed symmetric and balanced 11-T SRAM cell for lower power consumption"

Static random access memories (SRAMs) comprise an increasingly large portion of modern very large scale integrated (VLSI) circuits. The increasing importance of embedded SRAM is due to its low circuit activity factor, leading to low active power density, and productivity of design. The power consumption has become an important issue and has lead to the development of numerous schemes aimed at limiting that component of power during both standby and active operation. In the present paper, we have proposed a symmetric 11-T SRAM cell to reduce power consumption during read/write operation. We have simulated the designed circuit with the help of Tanner EDA tools for 0.25 Г,Вїm technology and simulated results were compared with 6T and ZA cell. It was found that proposed cell consumes 28% lower power than conventional 6T during write mode. During read operation, the average power saving is around 33% compared to conventional cell. The write delay is more in our proposed cell. By choosing width of tail transistors are equal to 3 Г,Вїm, the write delay of the proposed cell can be equated to conventional cell. [C576]

"Research and Application of the Natural Gas Heater"

The natural gas heater is an indispensable piece of equipment in natural gas production, transmission, and application systems and is widely used in gas wellhead, metering station, transfer station and gas power plant etc. As a special type of furnace, the natural gas heater adopts indirect heating through heat-transfer medium and is the important energy consumption equipment in natural gas industry. At a time when there is serious shortage of energy and energy-saving and efficiency enhancement is highly valued, more attention should be paid to how to improve the structure of the heater so as to reduce fuel consumption and protect the environment. The progresses achieved in the field of natural gas heater design were discussed. Especially for the weak point of not forming an effective heat transfer flow field in the large cylinder of natural gas heater, two effective optimizing arrangements of rotating the heating and cooling surfaces and setting baffles between the heating surfaces and cooling surfaces were brought forward to help the heat-transfer medium form a well-organized flow. As a result, the thermal efficiency of natural gas heater is improved, energy saved, and the consumption reduced. The above two technologies have been awarded patents in the People's Republic of China. [C577]

"Study on the Application of Hybrid System in a Large Space Building"

Energy efficiency and IAQ have become increasingly important and prominent concerns in building design, especially for large space buildings due to large amount of investment costs and energy consumption. Practically prolonging natural ventilation duration, extending intermediate seasons and reducing the operating time of air-conditioning could not only save energy but also provide a good IAQ. This paper presents the research on the application of hybrid ventilation system in a large space building. The hybrid ventilation system is an all-year coupled operation of ventilation with air-conditioning. The ventilation is used in intermediate seasons and air-conditioning is used in summer and winter. The switch-point temperatures determining the operating model of the hybrid ventilation system between ventilation and air-conditioning in intermediate seasons are investigated for the large space building. The analysis on energy saving potential in intermediate seasons shows that the hybrid ventilation system can reduce energy consumption in an efficient way. [C578]

"An Adaptive-Reliability Cyber-Physical Transport Protocol for Spatio-temporal Data"

In this paper, we propose a new transport protocol for data collection in sensor networks that monitor physical phenomena. In a network with variable channel condition, this protocol adapts transmission reliability based on the importance of transmitted spatio-temporal data to the reconstruction of the phenomenon. Data whose

omission generates a higher estimation error are transmitted more reliably. The protocol aggregates data from nodes to the base station and provides a constant expected estimation error while significantly reducing the energy consumption and bandwidth usage compared with other approaches to reliable communication. Moreover, our protocol is easy to implement on current motes. To the best of our knowledge, this is the first transport layer protocol, that incorporates predictive models, to be implemented on motes. We perform extensive experiments on MicaZ motes using LiteOS to compare the performance of our protocol against previous transport protocols and data suppression schemes. Our experimental results show that our protocol introduces a very small estimation error while saving orders of magnitude in consumed energy compared to reliable transport. In other cases, estimation error and energy consumption are simultaneously reduced by 50-85%. [C579]

"Financial Development and Energy Consumption: An Empirical Research Based on Guangdong Province"

it is obtained through the Guangdong primary energy consumption and financial development compared to the testing of Granger causality: energy consumption is Granger reason of the development of financial, however, the financial development is not the Granger reason of the energy consumption. It shows that: the various financial institutions in Guangdong implementing the national energy policy has made significant achievements, energy efficiency is improving. However, facing the strong increasing economic growth in Guangdong, energy-saving situation is still serious. Therefore, we will put forward some policy suggestions of energy-saving and environmental protection from the financial aspects. [C580]

"Scientific Management-The First Step of Building Energy Efficiency"

Scientific management is the first step of reducing energy consumption in buildings in China. Life style of the people, scientific management of energy is very important. Building energy management is a service. Energy conservation is not just from the number of users and reasonable restrictions on the demand for more energy conservation as an excuse not to reduce service quality, indoor environmental quality deterioration. Managers should provide users with the appropriate energy variety and reasonable energy prices, energy efficient equipment and energy-saving technologies, processes and management. The energy consumption of air-conditioning in buildings must be measured, especially electricity consumption. Regional building energy planning is an important part of building energy management. Building energy efficiency and building envelope are the main aspects to be considered. Non-white, near-infrared-reflective architectural coatings can be applied to reduce heat transfer into the room in summer. [C581]

"Analysis of Winter Operating Condition of Ground Source Heat Pump System in a Residential District of Qingdao"

Aiming at the problem of increasing energy consumption of winter heating in northern china, a new heating system- ground source pump system has been put forward for heating. Take a residential district of Qingdao for example, analyzing and comparing dynamic characteristic of each parameter of winter start-up stage and quasi-steady-state stage of ground source heat pump, measures and ideas for reducing operating energy consumption were proposed, the results provide basic data for the operation and extension of the ground source heat pump air-conditioning of Qingdao area. Keywords- Large public buildings; Building energy saving; Separate measurement; Energy consumption monitoring; Energy saving diagnosis. [C582]

"Research on Node Sleep/Wake-Up Mechanism in WSN Based on Fuzzy Energy Control"

Adjusting the operation mode of the nodes in wireless sensor networks can extend the networks lifetime effectively. The distributed protocol PEAS reduces the network's consumption by a method which maintains only a necessary number of nodes working and the other nodes sleeping, but in this method some of the nodes' energy will be exhausted early because of their continuous working. In response to this problem, this paper proposes a sleep / wake-up mechanism using fuzzy control algorithm to control the networks' energy. With this algorithm, energy efficiency of nodes can be improved by limiting their energy consumption. Thus, energy consumption of network is more balance and the problem of energy "hole" caused by nodes' continual working has been solved. The simulation results show that this method can be applied in wireless sensor networks well and can save the energy of networks significant. [C583]

"Trend Analysis of Energy Consumption and Atmospheric Pollutants Emission in China"

Along with rapid economic development in China, the energy consumption and pollutants emission are increasing rapidly. It has caused great pressure to resource and environment. How to improve energy productivity in a more cost-effective manner and reduce atmospheric pollutants emission is a big problem at

present. Based on Chinese energy consumption and atmospheric pollutants emission between 1990 to 2007, and the Г,Вїeleventh five-yearГ,Вї energy saving and emission reduction targets, we discuss the relationship between energy consumption and atmospheric pollutants emission, and accessibility of energy saving and emission reduction targets. The relationship between energy consumption and pollutants emission in China is analyzed by setting up IPAT model. The results show that the extensive economic development model of China, namely Г,Вїhigh energy input, high pollutants emissionГ,Вї economic development model, has not changed thoroughly. The atmospheric pollutants emission (or energy consumption) will realize Г,ВїdecouplingГ,Вї with economic growth in 2013. Finally, according to the analysis results and China's energy-saving and emission reduction targets as well as relevant countermeasures are suggested. [C584]

"An Accurate and Energy Efficient Fetch Direction Orientation Mechanism for Trace Cache"

Energy and performance efficiency of fetch unit is critical to processor design. Trace cache which stores dynamic instruction flow to form instruction trace can significantly improve performance efficiency by fetching multiple blocks from trace cache in a given cycle. Conventional trace cache (CTC) design suffers energy inefficiency because of its simultaneous access to both instruction cache and trace cache during each cycle but instructions from only one of them are used. The activation and access to the other results in energy waste. Many researchers have explored various approaches to avoid this problem to improve energy efficiency of trace cache, such as dynamic direction prediction based trace cache (DPTC). An alternative approach called advance direction directed trace cache (ADDTC) is proposed in this paper. By extending branch target buffer (BTB) with trace control information, whether trace cache hits or not can be predicted in branch prediction before the actual fetch. The fetch direction can be predicted and only the predicted one is accessed for energy saving. We evaluated the energy consumption and performance of ADDTC. Our experimental results show that ADDTC delivers fetch direction prediction accuracy as high as 88.4% on average. It reduces energy consumption by 39.9% with only 4.4% performance degradation compared to CTC. Our proposal also shows advantage of both energy and performance over DPTC. Energy consumption is reduced by 5.9% and performance is improved by 2.9% compared to DPTC. [C585]

"Development and Application of a Novel Kind of Burner"

In order to decrease heavy oil consumption, based on old low-pressure burner and characters of production process of industrial furnace in a factory, a novel type of burner was designed for the optimum combustion and operation. The burner could automatically and completely adjust the rate of oil and air in some range, and reduce working strength of workers. Due to heavy oil atomized by two different media at the same time, perfect combustion could be performed. The experiment showed that the burner was able to lower average oil consumption 7-10% and reduce nitrogen oxide about 10% in the emission. [C586]

"A case for dynamic frequency tuning in on-chip networks"

Performance and power are the first order design metrics for network-on-chips (NoCs) that have become the de-facto standard in providing scalable communication backbones for multicores/CMPs. However, NoCs can be plagued by higher power consumption and degraded throughput if the network and router are not designed properly. Towards this end, this paper proposes a novel router architecture, where we tune the frequency of a router in response to network load to manage both performance and power. We propose three dynamic frequency tuning techniques, FreqBoost, FreqThrtl and FreqTune, targeted at congestion and power management in NoCs. As enablers for these techniques, we exploit Dynamic Voltage and Frequency Scaling (DVFS) and the imbalance in a generic router pipeline through time stealing. Experiments using synthetic workloads on a 8x8 wormhole-switched mesh interconnect show that FreqBoost is a better choice for reducing average latency (maximum 40%) while, FreqThrtl provides the maximum benefits in terms of power saving and energy delay product (EDP). The FreqTune scheme is a better candidate for optimizing both performance and power, achieving on an average 36% reduction in latency, 13% savings in power (up to 24% at high load), and 40% savings (up to 70% at high load) in EDP. With application benchmarks, we observe IPC improvement up to 23% using our design. The performance and power benefits also scale for larger NoCs. [C587]

"Into the wild: Studying real user activity patterns to guide power optimizations for mobile architectures"

As the market for mobile architectures continues its rapid growth, it has become increasingly important to understand and optimize the power consumption of these battery-driven devices. While energy consumption has been heavily explored, there is one critical factor that is often overlooked-the end user. Ultimately, the energy consumption of a mobile architecture is defined by user activity. In this paper, we study mobile architectures in their natural environment-in the hands of the end user. Specifically, we develop a logger application for Android

G1 mobile phones and release the logger into the wild to collect traces of real user activity. We then show how the traces can be used to characterize power consumption, and guide the development of power optimizations. We present a regression-based power estimation model that only relies on easily-accessible measurements collected by our logger. The model accurately estimates power consumption and provides insights about the power breakdown among hardware components. We show that energy consumption widely varies depending upon the user. In addition, our results show that the screen and the CPU are the two largest power consuming components. We also study patterns in user behavior to derive power optimizations. We observe that majority of the active screen time is dominated by long screen intervals. To reduce the energy consumption during these long intervals, we implement a scheme that slowly reduces the screen brightness over time. Our results reveal that the users are happier with a system that slowly reduces the screen brightness rather than abruptly doing so, even though the two schemes settle at the same brightness. Similarly, we experiment with a scheme that slowly reduces the CPU frequency over time. We evaluate these optimizations with a user study and demonstrate 10.6% total system energy savings with a minimal impact on user satisfaction. [C588]

"ESKIMO-energy savings using semantic knowledge of inconsequential memory occupancy for DRAM subsystem"

Dynamic random access memory (DRAM) is used as the bulk of the main memory in most computing systems and its energy and power consumption has become a first-class design consideration for modern systems. We propose ESKIMO, a scheme where when the program or operating systems memory manager allocates or frees up a memory region, this information is used by the architecture to optimize the working of the DRAM system, particularly to save energy and power. In this work we attempt to have the architecture work hand in hand with information about allocated and freed space provided by the program. We discuss multiple ways to use this information to reduce the energy and power consumption of the memory and present results of this optimization. We evaluate the energy and power benefits of our technique using a publicly available, hardware-validated, DRAM simulator, DRAMsim. Our current studies show very promising results with energy savings on average of 39%. [C589]

"Efficient network coding for power saving in wireless sensor networks"

Power is one of the most critical resources in wireless sensor networks and packet transmission is a very energy-consuming action for sensor nodes. Network coding has the potential to reduce the number of packets transmitted by encoding multiple packets together in transmission. To the best of our knowledge, little work applies the practical network coding for power saving in wireless sensor networks and AdapCode is by now the most promising one among them. However, AdapCode works based only on partial of all actual neighbors of a node in coding process, which may waste some potential coding opportunities. In this paper, thus, we enhance the AdapCode by deploying an energy efficient neighbor discovery protocol to find out all the neighbors of a node. Our objective is to develop a more efficient coding scheme for wireless sensor networks to achieve more power saving from using network coding. [C590]

"Optimizing shared cache behavior of chip multiprocessors"

One of the critical problems associated with emerging chip multiprocessors (CMPs) is the management of on-chip shared cache space. Unfortunately, single processor centric data locality optimization schemes may not work well in the CMP case as data accesses from multiple cores can create conflicts in the shared cache space. The main contribution of this paper is a compiler directed code restructuring scheme for enhancing locality of shared data in CMPs. The proposed scheme targets the last level shared cache that exist in many commercial CMPs and has two components, namely, allocation, which determines the set of loop iterations assigned to each core, and scheduling, which determines the order in which the iterations assigned to a core are executed. Our scheme restructures the application code such that the different cores operate on shared data blocks at the same time, to the extent allowed by data dependencies. This helps to reduce reuse distances for the shared data and improves on-chip cache performance. We evaluated our approach using the Splash-2 and Parsec applications through both simulations and experiments on two commercial multi-core machines. Our experimental evaluation indicates that the proposed data locality optimization scheme improves inter-core conflict misses in the shared cache by 67% on average when both allocation and scheduling are used. Also, the execution time improvements we achieve (29% on average) are very close to the optimal savings that could be achieved using a hypothetical scheme. [C591]

"Research on the Environmental Sustainable Development of Industrial Skeleton-Infill Houses"

In this paper, the concept of industrial Г‚ВїSkeleton-InfillГ‚Вї (SI) house was described, and the characteristics of SI houses as construction durability, adaptability and suitability for industrial production were summarized. Based

on data collection and spot investigation of industrial Skeleton-Infill house of VANKE which is one of the top three real estate company in China, the author discussed the environmental sustainability of SI houses from several aspects comparing to the traditional residence. Firstly, SI houses could save water in direct construction link and living water consumption of on-site constructors. Secondly, in its life cycle SI houses could promote the residential land utilization degree and new wall adopting in order to meet the land saving demand. Thirdly, in the construction process of SI houses, the housing design could be optimized and the building materials could be better utilized and recycled in order to save material. Fourthly, some of the energy consumption processes in SI house construction could be eliminated while the heat-insulating capability of the residence could be improved. SI houses could work well in reducing emission of solid waste, wastewater, air pollution and noise pollution. [C592]

"An Energy-Efficient Distributed Office Environment"

Energy efficiency in the field of information and communication technology becomes increasingly important due to the increase in energy costs and the desire to reduce CO2emissions. Office environments of public administration and companies promise high potential in terms of energy saving. In such environments a high number of hosts are operating on a 24/7 basis. This paper suggests an Energy-Efficient Distributed Office Environment that reduces the number of always-on hosts and raises the energy efficiency within office environments. It describes the suggested architecture and its key technologies. In addition, it evaluates the benefits of the architecture analytically and illustrates experimental results to evaluate resulting overhead. [C593]

"A hybrid moving strategy in wireless sensor networks"

Mobile sinks are used widely in wireless sensor networks to balance the load among sensors and improve the network lifetime. But, the data transmission delay becomes larger while mobile sinks are used. Although using a static sink has shorter lifetime than a mobile sink, it can get a relatively lower transmission delay. In order to balance the lifetime and the transmission delay of a wireless sensor network, we propose a hybrid moving strategy by using a static sink in the center of a cellular network and a mobile sink locating at the periphery of the area to collect data collaboratively. Under this strategy, the sensor nodes can sent their data to the sink in shorter hops routing and thus save great amount of energy. Our moving strategy can improve the lifetime to 4 times compared with the strategy using only one single static sink. Also, by adopting our strategy, the transmission delay can be reduced to one fourth compared with the strategy using only one mobile sink. [C594]

"TopGen: A new algorithm for automatic topology generation for Network on Chip architectures to reduce power consumption"

The number of processors and storage elements on a single chip increased significantly as a result of shrinking technology sizes. However, this rapid component increase on systems made the traditional bus-based communication structures problematic since the components needed long interconnection lines. The distribution of the clock over the entire chip became almost impossible on huge systems because of the clock propagation and synchronization. Additionally, the power consumption on the interconnection lines became more critical than the computational blocks. Network-on-chip (NoC) has been introduced in the beginning of this millennium as an alternative to bus-based and point-to-point communication structures. NoC architectures made it possible to limit the length of interconnections by dividing them among routers and the components are connected the routers allowing sending data any time without synchronization problems. However, these additional components also brought extra power consumption on the system. To minimize this power consumption, the given application should be mapped on the optimized topology, which can be either a regular topology or irregular topology. Irregular topologies are a good candidate for optimization; however, there is still need for algorithms for topology generation. In this paper, we present an irregular application specific topology generation algorithm (TopGen) for Network-on-Chip architectures. We applied TopGen on some real multimedia benchmarks and compared with existing algorithms. We achieved up to 22% power savings. [C595]

"Probabilistic path selection in wireless sensor networks with controlled mobility"

We consider the problem of planning path of a Г‚Вїdata muleГ‚Вї in a cluster based sensor networks. Recent research shows that significant energy saving can be achieved by using this mobile data collection nodes. Although a data mule (DM) can reduce the energy consumption of the cluster head (CH), it increases the latency from the time the CH gain the data to the time the base station receives it. To address this issue, we propose a dynamic data mule path selection algorithm which called probabilistic path selection (PPS). In surveillance sensor networks, sensor nodes transmit data to CH only when event is detected. Some clusters which did not detect the event would have no data to transmit for power consumption. In this circumstance, DM ignores these CHs to shorten the length of path. The PPS algorithm can reselect the path based on the probability of CH

obtaining data. The simulation shows that our algorithm can significantly reduce the data latency and satisfy the user's delay requirement simultaneously. [C596]

"Towards Green Broadband Access Networks"

Energy consumption in next-generation access networks is rapidly increasing with the increase of bandwidth demands. In this paper, we devise design techniques aimed to build "green" access networks to reduce energy consumption. We apply these techniques on a novel access network paradigm named Wireless-Optical Broadband Access Network (WOBAN). We present a Mixed Integer Linear Program (MILP) model to investigate the power consumption in WOBAN over dynamic traffic profiles. We analyze the impact of energy-aware design on the performance of WOBAN. Our results indicate that there are large scopes of power savings if we incorporate energy-aware design and routing in access networks. [C597]

"Improvement of Capacity and Energy Saving of VoIP over IEEE 802.11 WLANs by a Dynamic Sleep Strategy"

Capacity and power consumption are two main bottlenecks in the wide deployment of Voice-over-IP (VoIP) over IEEE 802.11 wireless LAN, when mobile terminals are used, the impact on the Voice-over-IP (VoIP) by power consumption becomes more critical. In this paper, we analyze the capacity of VoIP traffic in 802.11 WLAN and do the relevant simulations with and without sleep strategy. We find that capacity decreases when the network adopts sleep strategy. After a detailed analysis by p-persistent model of the IEEE 802.11 protocol, we provide a dynamic sleep strategy, namely Collision Detective Dynamic Sleep Strategy (CDDSS) to improve both the capacity and energy saving rate of the VoIP over 802.11 WLANs. In our CDDSS, mobile station (MS) adjusts sleep interval and packetization interval adaptively according to the average collision probability pc of the network. Our simulation results show that CDDSS cannot only improve the capacity of VoIP in 802.11 WLANs, but also reduce considerable energy consumption. [C598]

"Non-uniform power access in large caches with low-swing wires"

Modern processors dedicate more than half their chip area to large L2 and L3 caches and these caches contribute significantly to the total processor power. A large cache is typically split into multiple banks and these banks are either connected through a bus (uniform cache access-UCA) or an on-chip network (non-uniform cache access-NUCA). Irrespective of the cache model (NUCA or UCA), the complex interconnects that must be navigated within large caches are found to be the dominant part of cache access power. While there have been a number of proposals to minimize energy consumption in the inter-bank network, very little attention has been paid to the optimization of intra-bank network power that contributes more than 50% of the total cache dynamic power in large cache banks. In this work we study various mechanisms that introduce low-swing wires inside cache banks as energy saving measures. We propose a novel non-uniform power access design, which when coupled with simple architectural mechanisms, provides the best power-performance tradeoff. The proposed mechanisms reduce cache bank energy by 42% while incurring a minor 1% drop in performance. [C599]

"Opportunistic error correction for MIMO"

In this paper, we propose an energy-efficient scheme to reduce the power consumption of ADCs in MIMO-OFDM systems. The proposed opportunistic error correction scheme is based on resolution adaptive ADCs and fountain codes. The key idea is to transmit a fountain-encoded packet over one single sub-carrier per antenna and to transmit more packets than needed for decoding. Comparing to the IEEE 802.11n standard, this approach allows around 83% of power saving in ADCs for a 2 ГґВ— 2 system and 90% for a 4 ГґВ— 4 system. With the current FEC scheme defined in the IEEE 802.11n standard, a 4 ГґВ— 4 system requires twice amount of power in ADCs as a 2 ГґВ— 2 system when receiving the same amount of information with the same power. However, using opportunistic error correction in a 4 ГґВ— 4 system costs only around 1.4 times amount of energy in ADCs comparing to a 2 ГґВ— 2 system. [C600]

"GAF&Co: Connectivity aware topology management for sensor networks"

In order to achieve energy conservation in WSNs, most topology management protocols use a subset of sensor nodes for global routing. Using fewer nodes results in a reduced connectivity of the network, which eventually increases the number of routing holes. Holes in networks often cause failures in message routing due to the local minimum problem. Therefore, traditional geographic routing protocols cannot be applied with such topology management protocols. In this paper, we propose a novel topology management protocol derived from the Geographical Adaptive Fidelity (GAF) protocol, called GAF with COnnectivity-awareness (GAF&Co). Instead of using virtual grids in GAF, our approach employs hierarchical hexagonal cells to avoid local minimums in WSNs. The purpose is to schedule redundant nodes into energy-saving mode, while maintaining the connectivity of a

network for simple geographic routing protocols. Comparing to GAF, the number of cells as well as the overall energy consumption of a WSN also drops dramatically with the proposed protocol. [C601]

"A high-speed differential receiver with low-power interleaved direct decision feedback equalizer"

A high-speed differential receiver with low-power interleaved direct decision feedback equalizer (DFE) is proposed and designed with a 0.18 um CMOS process. To save the power consumption, the new feedback topology is introduced. This architecture feeds back the previous bit to the proposed latch block. As a result, the adder blocks can be removed obtaining the low-power interleaved direct DFE. The current mode logic (CML) latch with embedded adder is used to reduce power consumption. [C602]

"The Optimal Sleep Control For Wireless Sensor Networks"

The sensor node in Wireless Sensor Network is with the characteristics of low power consumption, but the sensor node can't be rechargeable. Therefore, the consumed of power is limited. How to effectively control the power of the sensor node and extend the life time of the whole network become a very important issue. This paper sets forth "The Optimal Sleep Control For Wireless Sensor Networks ". When the sensor nodes are set randomly in the entire network and the sleeping probability is determined through the distance between the sensor node and the sink. This method will effectively reduce the frequency of the transmission of the sensor nodes more close to the sink and reach the loading balance of the whole network. However, the sleeping sensor nodes will process their sleeping schedule according to their own residual power and achieve the effectiveness of saving power. [C603]

"Novel RT level methodology for low power by using wasting toggle rate based clock gating"

In this paper, we propose a RT level power reduction scheme which can be used for the applications that require ultra-low power consumption. A novel wasting-toggle-rate (WTR) based clock power reduction technique is introduced. It compares the WTR of a stimulus with the pre-computed threshold WTR of the circuit, and clock gating is applied to the circuit only if there is power-saving benefit. It considers not only clock enable signal, but also data signal and wasting toggle rate of the clock in a fine-grained manner. The proposed technique is implemented at RT level in a complete CAD solution. We have tested the proposed technique on real industrial multimedia-mobile-processor design. For the accuracy of the power optimization results, all the power estimation results are measured at gate level after synthesis by using industrial 65 and 90 nanometer technology libraries. The experimental results show that using 65 nanometer technology, the technique reduces 35.46% power comparing with non-clock gating design and 18.80% power comparing with clock-gating design by Power Compiler; and that using 90 nanometer technology, the technique reduces average 39.34% total power comparing with non-clock gating design and 27.76% total power comparing with clock-gating design by Power Compiler. For the design overhead of the proposed technique, it increases 1.17% of the critical path delay and reduces 0.81% of the area for the whole circuit comparing with the original circuit in 65 nanometer technology, and increases 2.75% of the critical path delay and reduces 0.75% area for whole circuit in 90 nanometer technology. [C604]

"Event Reporting on Continuous Monitoring Wireless Sensor Networks"

Wireless Sensor Networks (WSNs) can be typically used to achieve Continuous Monitoring (CM) or Event-Detection inside the supervised area. In CM applications each sensor node transmits periodically its sensed data to the sink node while in Event-Detection Driven (EDD) applications, once an event occurs, it is reported to the sink node by the sensors within the event area. Applications using both continuous monitoring and event driven reporting can also be considered. In this paper, we investigate such hybrid WSNs. Specifically, we propose to reduce the energy consumption by grouping the nodes that sense an event into a separate cluster. By doing so, as it is shown in this paper, the efficiency of the data compression scheme is indeed improved. This event-aware clustering scheme is compared to the case where the event data is transmitted through already established clusters. Finally, the case where sensor nodes only transmit information whenever they sense relevant data is introduced in order to achieve further energy savings. [C605]

"Pipeline power reduction through single comparator-based clock gating"

Enable-based Clock Gating (ECG) during synthesis to reduce the pipeline power consumption is widely used in scaled technologies. However, the ECG does not provide optimal solution at all in terms of power because it is synthesized by a global way and it does not consider the correlation between clock-enable signal and data signal. We propose a novel single comparator-based clock gating (SCCG) scheme to enhance the ECG for pipeline. In the proposed SCCG, enable signal is moved from data path to control logic, the data signal is analyzed, and only single comparator is used to implement the clock-gating for all the pipeline stages. Simulation

results show that our proposed SCCG can save average 47.03% of total power with small 4-stage pipeline benchmark and can save 11.3% of total power with industrial multimedia-mobile processor design by using 90 nm industrial technology library comparing with the ECG-based designs. [C606]

"An Energy-Efficient Physical Layer Adaptive Modulation Scheme for Wireless Sensor Networks"

Wireless Sensor Networks pose numerous design challenges. They require long term, robust sensing for many applications. One important challenge is to design sensor networks that have long system lifetimes. Since the radio has the greatest impact on the energy consumption of the WSNs node, we present a physical layer adaptive channel coding and modulation scheme to lower the number of retransmission of package, then decrease the number of retransmission data because of error. So the energy consumption of the WSNs node can be saved and lifetime of the network is been extended. Experiment results show that the total amount of bits that are sent can be reduced by employing this scheme. [C607]

"Energy-Efficient Route Finding Scheme Based on Directional Antenna in Wireless Sensor Network"

In this paper, an energy efficient route finding scheme is proposed based on the directional antenna for wireless sensor networks (WSNs). First we derive the relationship between the number of hops and the energy consumption within a certain source-destination distance by analyzing the major factor influencing the power consumption on wireless channels. Second, combined with the benefits from directional antennas, we propose an energy efficient routing scheme which selects the next hop according to the optimal route and geographic coordinates of sink and sensors. The simulation result shows the significant improvement by reducing the flooding cost, selecting an energy-efficient route and saving energy. [C608]

"DSP power reduction through Generalized Carry-Save arithmetic"

We present a new method to systematically parallelize networks of additions and multiplications to dramatically reduce power dissipation in digital signal processing (DSP) blocks. This new method is termed Generalized Carry-Save (GCS) arithmetic. Results are presented for three industrial DSP blocks, separately implemented in IBM 130 nm, TI 65 nm and TI 45 nm technologies. Compared with the best delays obtainable using the best scripts from the leading commercial synthesis tool, GCS produces DSP block implementations that are at least 30% and up to 2X faster for similar area. As a consequence, the power supply voltage can be reduced to realize quadratic power savings for the same delays. [C609]

"Evaluation of control strategies in HVAC split systems"

The important and continuous increment in the global electricity consumption is doing that energy saving strategies have turned into a crucial solution. Efficient heating, ventilation and air conditioning controls are generally the most cost-effective ways to minimize the use of energy in buildings. In this framework, an energy management and control system has been developed to schedule electric end-uses in the campus of the Polytechnic University of Valencia, Spain. As a result, each system or device in the campus is able to be switched on/off by using a web platform. This paper presents an evaluation of different control strategies for HVAC split systems, which have been performed by using an energy management and control system, developed in a similar way by UPV. In order to adapt and compare several schedules, this paper analyzes the effect of these actions in a common air conditioning device. Not affecting the comfort level and the indoor air quality is an important requirement. For that reason, a multi criteria comparison must be drawn. Demand response strategies are tested in several situations, and the economic saving is calculated taking into account the electricity contract clauses. Finally, a test is realized for the control of a group of similar devices in order to reduce the maximum peak power and obtain a flexible load shape with the HVAC loads. The studies are then extrapolated on a large system, the whole university campus, for which energy and economic savings are quantified. [C610]

"Research on Chinese household practical energy technologies"

Chinese household energy consumption is growing fast with the steady rapid growth of economy, the constant increasing residents' income and the promotion of urbanization process. China has been actively developing and introducing the household energy practical technologies, which not only improves the energy efficiency and renewable energy utilization, but also reduces the household energy consumption. Meanwhile, the residents' life quality keeps rising. Firstly, this paper introduces the present situation of the development of Chinese household practical energy technologies--solar energy utilization technologies including solar water heater, solar energy lighting (PV), and solar stoves, and green lighting technologies like energy saving lamps (CFL). Then it further studies the working principles, applicable conditions, the status quo and problems in China of the typical

household energy practical technologies: Finally, it makes some suggestions such as strengthening the policy support in household energy practical technology, fully utilizing international mechanism, for example, CDM or other market mechanisms, enlarging the financing channel for household energy practical technologies promotion, and deepening the international cooperation in the field of household energy practical technology. [C611]

"A statistical power-saving mechanism for IEEE 802.16 networks"

The power-saving class of type I (PSC I), one of the sleep mode operations in the IEEE 802.16e standard, is designed to reduce power consumption for non-real-time traffic. However, the inefficiency of PSC I comes from its configuration and operation. Based on the notions of IEEE 802.16m sleep mode operation, a statistical sleep window control (SSWC) approach is proposed to improve energy efficiency for mobile stations in this paper. The SSWC approach exploits a partially observable Markov decision process (POMDP) to conjecture the present traffic state. Based on the properties of POMDP, the optimal policy for sleep window selection is acquired in the SSWC approach. The performance evaluation is conducted and compared via the simulations. Simulation results show that the proposed SSWC approach outperforms the IEEE 802.16e PSC I scheme and the inferred IEEE 802.16m power-saving mechanism. [C612]

"Energy-efficient routing protocol for large scale wireless sensor networks"

The traditional routing protocols for mobile ad hoc networks (MANET) are not appropriate for wireless sensor networks (WSNs). The reason is the large amount of overhead produced may exhaust the energy of the network and shorten its lifetime, especially in the process of maintaining routes. In this paper, considering a large scale WSN, we propose a simple but efficient AODV-based protocol, called AODV with Route Identification and RREP Capturing (AODV-RIRC). With route identification the source nodes don't have to build a new route. And after capturing the RREP the intermediate nodes build routes to the destination silently. The simulation results verify its efficiency in dealing with events in a large scale WSN which consists of 1000 nodes at most. According to the results, AODV-RIRC reduces the control overhead significantly, saves more energy and shortens the route building time relative to the other two AODV-based protocols. [C613]

"Link quality-based transmission power adaptation for energy saving in IEEE 802.11"

Today, many wireless devices are mobile and battery powered, which means that the service duration is highly dependent on energy consumptions and battery capacities. Based on the fact that battery capacity is still limited, energy saving is an important issue in wireless communication. Many methods have been proposed to save energy in wireless communication, such as power-aware routing and sleep mode. However, another important approach, transmission power adaptation, is not yet well discussed. In this paper, we propose a mechanism that selects the appropriate transmission power level to transmit packets instead of using a fixed default power level for all packets, which is common in IEEE 802.11. Lower transmission power levels may result in more retransmissions, but still consumes less energy. In total, energy can be saved and interference can be reduced by selecting a good transmission power level. We propose a two phase power saving mechanism and implemented it in a real test-bed. To evaluate the performance of our mechanism, we used an indoor environment to carry out measurements. The measurement results indicate that a significant amount of energy can be saved for the transmitter in most scenarios compared to using a fixed transmission power level for all packets. [C614]

"A Cross-Layer Protocol for Event-Driven Wireless Sensor Networks"

This paper presents a cross-layer Event-Driven Sensor MAC protocol (ED-SMAC) for event-driven WSNs. ED-SMAC defines two network statuses: regular status and event status. On regular status, sensor nodes only send little normal detection information to sink, so the basic techniques in SMAC protocol are adopted to reduce the energy waste and guarantee the data transmissions. On event status, a new cross-layer event-based cluster formation algorithm is proposed. Several sensor nodes which have been detected a specific event in the network form a cluster and elect a cluster head. The event information is collected, aggregated and transferred to sink by their elected head. Simulations results show that the proposed protocol improves event detection reliability, shortens the average packets latency, and saves node energy. [C615]

"A transmission of paging indicator information for mobile communication systems"

In a cellular system, efficient power saving techniques for a mobile station (MS) are necessary because of its inherently limited battery of MS. The paging indicator (PI) transmission scheme in CDMA cellular systems is known to be an effective power saving strategy. However, in OFDM-based cellular systems, the MS has to operate FFT for PI symbol detection, resulting in a significant power consumption. In this paper, a reduced

power consumptive PI transmission technique using the preamble in OFDM-based cellular systems, especially for mobile WiMAX systems, is proposed for the MS under power saving mode. Simulations indicate a 30~50% power saving result from our proposed PI transmission technique, at the expense of a slight increase of paging response delay. [C616]

"Scheme design of technology improvement for Coal Mine main fan"

Coal mine main fan is one of the largest-power-consuming facilities among various electrical and mechanical equipments, its power consumption usually accounts for 20% ~ 30% of the total. If a few percentage points can be lowered in its energy consumption, energy efficiency will be very substantial. One main reason for the main fan's high power consumption is its overall low efficiency. After a long time operation, most of the coal mine fans' impeller, intake air box, air inlet and chassis have a serious corrosion, which is a main threat to the safe operation of fans, and also increases the running resistance, less efficiency, thus can not meet the actual on-site demand. Therefore, performance optimization of the fan to reduce power consumption is imperative. A set of technical improvement program that focuses on saving energy and increasing efficiency is designed on the basis of surface anti-corrosion. [C617]

"Architectural Design of Home Energy Saving System Based on Realtime Energy-Awareness"

Recently, a global market related to energy efficiency and energy saving technologies is being extended rapidly with the growth of a matter of primary concern about extreme climate change. Especially, in the home network environments where only its functional aspects have been focused on without considering energy consumption, it is urgent to develop new energy-efficient technologies specialized in the home network environments. In this paper, architecture of home energy saving system (HESS) based on energy-awareness and its basic functional requirements are designed and proposed for real-time home energy monitoring service, reducing or cutting off standby power caused by home appliances, and intelligent home energy management service. [C618]

"Wireless sensor node design based on solar energy supply"

At present, there are two main ways in enhancing the life time of WSN. The first one is saving energy. Through reducing systematic energy consumption and routing protocol with low energy consumption, the energy will be saved to the greatest extent. The second is to obtain energy from the environment. WSN nodes can gain and store energy from its surrounding environment. As a result, how to effectively collect and store energy from the environment has been taken more and more seriously by researchers. In recent years, scientists have done some research and made some progresses, among which how to make use of solar energy collection machines has become a research focus. The paper puts forward the wireless sensor node design based on solar energy power supply. The experiment shows that the node design has following features. (1) Energy saving. During design, we have given full consideration to energy-saving principles. We have adopted low power consumption devices in each module. Temperature sensor, microprocessor, wireless transceiver are all low power consumption ones. (2) Energy harvester design. The solar energy can be collected to provide lasting energy for the system. It can be applied to various fields, such as data wireless communication systems, military affairs scout, environmental monitoring, and safe precaution systems. [C619]

"STP: In-network aggregation through proximity queries in a Sensor Network"

Event detection and notification is a common task in a wireless sensor networks (WSN). Efficient data aggregation and minimization of energy consumption are the great research challenges in WSN. In WSN, aggregated event information is more important than individual event information for energy saving and reliability. Proximity queries or query approximation can be used to reduce the complexity of data aggregation and energy consumption. This paper presents an efficient and scalable hybrid framework for processing spatial and temporal proximity queries in WSN which we call STP. STP builds tree structure with less overhead, and reduces the event propagation cost through proximity queries. STP reduces energy consumption by reducing the number of aggregator nodes, which ultimately increases the network life time. STP eliminates the unnecessary aggregation of events using a tunable temporal proximity threshold. We compare STP's performance with another spatial query processing method and we show that, STP performs better. [C620]

"Energy-saving and consumption-reducing in Cities of Anhui province based on PSR model"

Urban energy-saving and consumption-reducing is the only way to achieve sustainable development. Through the analysis of status quo of Anhui Province Cities' energy-saving and consumption-reducing, an indicator system is built to measure the level of it. The Г,ВїPressure-State-ResponseГ,Вї model and principal component analysis are selected for evaluation of the system. According to the empirical conclusions, optimization of the energy structure, realization of energy structural diversification, the promotion of introduction of new technologies

and improvement of energy technologies efficiency, restructuring of industrial structure ought to be speed up, which can build a energy-efficient production systems, while key industries' management need to be focused on in order to achieve the goals of energy-saving and consumption-reducing for these cities. [C621]

"Are cognitive radios energy efficient? A study of the Wireless LAN scenario"

Cognitive radios have been proposed in recent years to make more efficient use of the wireless spectrum and alleviate congestion on widely used frequency bands. A key aspect of these radios is the `cognition' gained through a spectrum scanning process. The benefits of this cognition is apparent and well studied in terms of better performance of communication. The benefits in terms of reduced energy consumption, however, due to easier channel access and less contention have not been quantified in prior work. On the other hand, spectrum scanning to gain cognition is a power-intensive process and the costs incurred in terms of lost energy need to be accounted for. Thus, it is not clear whether a cognitive radio would be more energy efficient than a conventional radio, and if so, under what circumstances. This focus on energy consumption is particularly important when considering portable communication devices that are energy constrained. This work takes a first step in this direction by exploring whether a cognitive radio can save energy over a conventional radio in the ad hoc wireless LAN scenario. The interplay between different important parameters to this problem is analyzed and their impact on energy consumption studied. [C622]

"Four-Layer Architecture Model for Energy Conservation in Wireless Sensor Networks"

We propose a four-layer architecture model (FLAM) to obtain the potential energy savings for sensor nodes in large scale wireless sensor networks. The very first layer, the bottom layer is a network of a resource-constrained sensor nodes deployed in the field. The second layer is ad hoc network formed by resource-rich dynamic sink nodes, also knows as cluster sink nodes. The third layer consists of resource-rich static sink nodes, known as zonal sink also, responsible for data collection from cluster sinks of its zone. The fourth (top) layer posses a resource-rich flying sink. We call this sink as hawk sink and is responsible for data collection from zonal sinks. A cluster sink may be few hops away from a static sensor node and moves to the vicinity of sensor nodes to collect the data and continuously updates its zonal sink by propagating the collected data from the respective cluster. Each zonal sink buffers the collected data and propagates to hawk sink through query response mechanism when later enters the transmission range of the zonal sink. Hawk sink is the one, responsible for data transmission from network environment to the base station. FLAM approach is scalable, increases sensor life by allowing them to operate with a limited transmission range only and provides reduced delay as cluster sink continuously updates to zonal sink without query. [C623]

"A new flip-flop based on multiple leakage reduction techniques"

In present CMOS circuits, the scaling of transistor sizes has resulted in dramatic increase of leakage currents. The sub-threshold and gate leakages have now become a major contributor to both leakage dissipations and total power consumptions. This paper proposes a new flip-flop, which uses P-type CMOS technique, power-gating and dual threshold technique to reduce both sub-threshold and gate leakage circuits. Simulation results show that the proposed MLRT (multiple leakage reduction technique) flip-flop saves 60-70% leakage power dissipations and 40-50% total power consumptions compared with the single-threshold transmission gate one. [C624]

"Online power management using DVFS for RTOS"

Power management is essential in microprocessor-based system design to avoid heat dissipation and preserve battery life time. In mobile devices running real time applications, the power consumed by the CPU can be more than the needed amount of power for best performance. At first glance, one can think of reducing the power budget of the system. Although this may seem an appealing easy solution, it can cause a huge degradation in performance if not controlled properly. Also a real time application's requirements vary with time, which implies that the power budget should also be variable. There must be a trade-off between power management and performance such that, the power consumed is always proportional to the required performance level. DVFS (dynamic voltage and frequency scaling) can be used to change the operating point (voltage-frequency pair) of the CPU according to the application's power requirement. In this paper, we present an implementation of a negative feedback control algorithm that uses DVFS for power saving in soft real-time systems that runs on Mentor GraphicsГ‚®NucleusГ‚®RTOS. A monitor periodically calculates the CPU utilization in runtime and reports it to the controller which adjusts the CPU operating point online such that the best performance is achieved with least power consumption. Our experimental results show that power savings up to 24% can be achieved just by using the proposed DVFS on a platform that supports only frequency scaling. [C625]

"Saving potentials of Adiab. Logic on system level: A CORDIC-based adiabatic DCT"

The energy consumption of digital systems can be greatly reduced by applying adiabatic logic (AL). Making best use of AL requires a dedicated system design regarding the inherent characteristics of AL. In this paper we investigate the CORDIC architecture, that can be used for various signal processing algorithms and is preeminently suitable for AL. For fast functional testing, we propose a methodology to describe AL in VHDL. An adiabatic CORDIC-based DCT is used as a test vehicle to demonstrate on system level the applicability of AL for ultra-low-power digital signal processing. We present an estimation method for the energy consumption and therewith compare a variety of static CMOS implementations of the DCT to our adiabatic DCT. The estimation results are verified by simulating the whole system in a 130 nm CMOS technology for various supply voltages. Even at a low supply voltage of 0.8 V the adiabatic DCT's energy consumption is less than 15% compared to the static CMOS implementation. [C626]

"Using checksum to reduce power consumption of display systems for low-motion content"

Power consumption of the display subsytem has been a relatively less explored area compared to other components of a mobile device including computing, storage, and networking units, although the former often constitutes one of the most power-hungry portions of the system. Typical applications on a mobile device such as Web browsing and text editing tend to have rather static image content; each frame hardly changes from the previous one. Efficiently detecting and handling no-motion scenarios is thus critical to extend the battery life. This paper focuses on image change detection. We propose to use checksum to detect image changes. Specifically, CRC hardware is used to optimize the power consumption of (1) refresh of a local display and (2) data compression for wireless remote display. Compared with a traditional, pixel-by-pixel comparison approach, using checksum for image change detection is not only fast, but also reduces accesses to the frame buffer, resulting in significant power savings. We have built a FPGA prototype to verify that CRC can capture image changes well enough to ensure a Г‚Вїvisually losslessГ‚Вї quality. [C627]

"Physical aware low power clock gates synthesis algorithm for high speed VLSI design"

In this paper, a new clock tree distribution design flow and algorithm of clock gates splitting to improve the clock tree power dissipation had been presented. The clock gating components are inserted in clock tree during VLSI design flow to reduce clock tree dynamic power consumption. The effective splitting and physical placement of the clock gates are vital to ensure the clock gating efficiency. The paper presents an approach that is able to achieve optimum power saving on clock tree during full operation mode and shut off mode. [C628]

"A simplified protocol for energy self-sufficient sensors in an IEEE 802.15.4/ZigBee WSN"

For the application of wireless sensor network technology in an energy self-sufficient condition monitoring appliance, we propose a new hybrid network topology to combine the advantages of the ZigBee standard with the need for lowest power consumption when applying an energy harvesting solution for a subset of the sensor nodes. For a research project on a wireless condition monitoring system, we developed a prototype implementation of a partly energy self-sufficient wireless sensor network. We adapted the ZigBee network protocols so that the energy consumption of the self-sufficient nodes is reduced albeit a ZigBee conform communication with the rest of the network is still ensured. In this paper, the prototype system is presented and the problem when applying a full ZigBee stack is stated. We propose to shift parts of the network functionality from the end-devices to the (mains- or battery powered) routers and show actual measurement results and calculated values to indicate the improvements of this adapted hybrid topology. [C629]

"A data-centric mechanism for Wireless Sensor Networks with weighted queries"

Wireless sensor networks (WSNs) are characterized by their low bandwidth, limited energy, and largely distributed deployment. To reduce the flooding overhead raised by transmitting query and data information, several data-centric storage mechanisms are proposed. However, the locations of these data-centric nodes significantly impact the power consumption and efficiency for information queries and storage capabilities, especially in a multi-sink environment. This paper proposes a novel dissemination approach, which is namely the dynamic data-centric routing and storage mechanism (DDCRS), to dynamically determine locations of data-centric nodes according to sink nodes' location and data collecting rate and automatically construct shared paths from data-centric node to multiple sinks. To save the power consumption, the data-centric node is changed when new sink nodes participate when the WSNs or some queries change their frequencies. The simulation results reveal that the proposed protocol outperforms existing protocols in terms of power conservation and power balancing. [C630]

"Dependence of Differential flip-flops performance on clock slope and relaxation of clock network

design"

In this paper, the impact of the clock slope on the performance of high-speed Differential flip-flops in a 65-nm CMOS technology is discussed. Usually the local network that distributes the clock signal to the flip-flops is designed to guarantee a steep clock waveform in order to not compromise the flip-flops performance. We show that, even doubling the clock slope (or more) with respect to typical F02 Г· F03 values, the impact on the Differential flip-flops speed is negligible. Correspondently, their energy dissipation increases but this drawback is balanced by the lower consumption resulting from the local clock distribution buffers, whose size/number can be reduced. Therefore, a tradeoff arises and, on the whole, the optimum clock slope can be different from the usual F02 Г· F03 assumption. This result allows to relax the local (domain) clock network design, thereby reducing the energy consumption associated with the distribution of the clock within a domain. Results with a 65-nm technology show that the resulting energy saving can be up to 60%. [C631]

"Dynamic grid quorum: A novel approach for minimizing power consumption without data migration in grid quorums"

In this paper, we present the dynamic grid quorum, a technique for reducing the power consumption of large-scale storage systems. The key idea is to skew the workload towards a small number of quorums by means of a novel optimization algorithm. Moreover, this system allows reconfiguration by exchanging nodes without any data migration so as to reallocate high-capacity nodes to busier quorums. We demonstrate that the dynamic grid quorum saves, on average, 6-12% energy when compared with the static configurations. [C632]

"Online Speed Fine Tuning Technique for Energy Minimization of Mixed Task Set"

This paper aims to present a two phase scheduling algorithm that offers lesser energy consumption for real time systems modeled periodic as well as aperiodic tasks by utilizing the concept of dynamic voltage scaling and dynamic power down. The first phase is same as used in Sim et al. whereas, second phase has been modified by utilizing the concept of idle slot, available slack and power down in case idle slot is enough to switch off and save energy. Besides reduction in energy modified approach also utilizes the system better by reduces number of idle slot and length of idle slot. The extensive examples and simulation results illustrate that our approach can effectively reduce the energy consumption with better system utilization. [C633]

"Power efficient multimodulus programmable frequency divider with half-integer division ratio step size"

A novel half-integer multimodulus programmable divider was presented in this paper. It is based on the combination of the zipper divider structure and the reversed phase-switching technique (RPST). To solve the unwanted division ratio (DR) decreasing problem which is inevitably introduced by RPST, we can set DR one more than the expected value with smart design of the feedback control block. Also, we adopt a power saving method to reduce the divider's power consumption about 21% on average. The proposed divider can be used in fractional-N frequency synthesizers to suppress the quantization noise with the folded DR step size. [C634]

"A low-power architecture for integrating analog-to-digital converters"

This paper reports on a modified architecture for single-slope integrating analog-to-digital converter (ADC) for use in image sensors and biomedical or any other applications where the value of the input analog signal has small and slow variations. In this architecture, instead of digitizing every new analog sample independently, the difference of the new sample with the previous sample is digitized. This idea will therefore considerably reduce the power consumption of the ADC. In order to illustrate the effectiveness of the proposed idea, an 8- bit, 4 kS/s ADC is designed and simulated in a 0.18 Г‚Вїm CMOS technology. The proposed ADC is very power efficient when the input signal is very slow and has a small variation in voltage amplitude. Simulations confirm that the proposed ADC architecture shows more than 80% power saving compared to conventional architecture for an input signal amplitude of 0.2VFS. [C635]

"An improved comparison circuit for low power pre-computation-based content-addressable memory designs"

This paper proposes a CMOS comparison architecture for low-power pre-computation-based content-addressable memory (PB-CAM). Instead of conventional architecture, we implement ours by CMOS logic gates to eliminate power consumption induced by short-circuit current. We use TSMC 0.18-Г‚Вїm techfile to estimate the power consumption by Synopsys Nanosim. The width ratio between PMOS and NMOS is set as 3:1. This ratio can effectively reduce both rise time and fall time, thereby reducing the delay for each comparison cycle. Compare with static pseudo-nMOS CAM word circuit, this architecture can save 50.2% power consumption on

average. [C636]

"A Clustering Protocol Based on the Probability Fading Strategy in WSNs"

In WSNs, energy efficiency are considered as the key issues in designing routing protocol. This paper proposes a clustering protocol F-LEACH based on the probability fading strategy. It makes further improvement over LEACH, which gives a better performance on energy consumption and system lifetime. In F-LEACH, nodes are preassigned different cluster-head probability values for cluster-head election in terms of their corresponding distances to the base station (BS). BS can carry out the assignment task. Nodes far from BS get little probability while nodes near BS get great probability. Then nodes elect cluster-heads using their different probability in a self-organizing manner. As a result, less cluster-heads appear in the area far from BS while the total number of cluster-heads is still keep optimal. This help saving the energy consumption by reducing long distance transmission from distant cluster-heads to BS. Simulation results show that F-LEACH performs better than LEACH in terms of energy consumption and system lifetime. [C637]

"TPSS: A two-phase sleep scheduling protocol for object tracking in sensor networks"

Lifetime maximization is an important factor in the design of sensor networks for object tracking applications. Some techniques of node scheduling have been proposed to reduce energy consumption. By exploiting the redundancy of network coverage, they turn off unnecessary nodes, or make nodes work in turn, which require high nodes density or sacrificing tracking quality. We present TPSS, a two-phase sleep scheduling protocol, which divides the whole tracking procedure into two phases and assigns different scheduling policies at each phase. To balance energy savings and tracking quality, we further optimize the node scheduling protocol in terms of network coverage and nodes state prediction. We evaluate our method in an indoor environment with 36 sensor nodes. Comparing with the existing methods, all the experimental results show that our method has a high performance in term of energy savings and tracking quality. [C638]

"Study on the non-coal high-energy-consumption chlor-alkali industry layout in China based on the development of the non-grid-connected wind power industry"

The chlor-alkali chemical industry has high energy consumption and is facing a developmental bottleneck presently due to a shortage of energy. Realizing the coupling space layout between the large-scale non-grid-connected wind power industry and the chlor-alkali chemical industry, and establishing the non-coal high-energy-consumption chlor-alkali chemical industrial bases have the vital significance to the comprehensive utilization of wind energy and the sustainable development of the chlor-alkali chemical industry. Based on determining the spatial distribution of China's large-scale non-grid-connected wind power industry by using development data of the social economy and of the wind power industry as of 2006, this paper studies the anticipated spatial layout frame of the non-coal high-energy-consumption chlor-alkali chemical industry in China by 2020 through overall consideration of the current situation and the planned objectives of the chlor-alkali chemical industry. The study shows that in 2020 China will form nine non-coal high-energy-consumption chlor-alkali chemical industrial bases including Jiangsu, Shandong, Zhejiang, Liaoning, Xinjiang, Inner Mongolia, Shanxi, Ningxia and Qinghai, which can generate 1 713.94times108 kilowatt hours of electricity, save 2149.84times104 tons of raw coal, reduce dust emission by 202.82times104 tons, reduce carbon dioxide emissions by 4056.31times104 tons, reduce nitrogen oxides emission by 20.28times104 tons, and reduce sulfur dioxide emissions by 32.45times104 tons, which are produced from burning coal, and thereby improve both economic efficiency and environment benefits. [C639]

"Cooperation helps power saving"

In wireless sensor networks (WSN), energy efficiency is crucial to achieving satisfactory network lifetime. The most commonly used and may be the only efficient method to reduce the energy consumption significantly is to turn off the radios most of the time, except when it has to participate in data communication. The key challenge is to operate the radio at a low duty cycle but still ensure the delay is relatively low. Various power-saving medium-access control (MAC) protocols have been proposed along this thread. However, most of such protocols focus on a point-to-point communication setting, in which a node will drop an overheard packet if it is not the destination. On the other hand, cooperative wireless communication has been drawing extensive attention in the past few years. Node cooperation has been exploited to reduce end-to-end delay, improve transmission reliability, etc. However, not much has been done in utilizing node cooperation to save energy. This idea may sound absurd since cooperation requires more nodes involved in a communication and would result in more energy being consumed. But is this true? In this paper, we will exploit the possibility of cooperative power saving in wireless ad-hoc networks. The trade-off between energy consumption and delay will be studied. Interestingly, our analytical and simulation results show that cooperation can indeed help achieve a better delay-power consumption trade-off. Our results also show that cooperation together with asymmetric power allocation can

achieve the optimal delay-power trade-off. [C640]

"Cross-layer approach for energy efficient routing in WANETs"

A wireless ad hoc network (WANET) is a collection of wireless terminals that communicate with each other without predetermined topology. Since WANET devices are power-limited, network protocols should be designed to prolong the battery lifetime of these devices. In this paper, we propose a cross-layer integration approach for power efficient routing protocol. The proposed cross-layer integration between power control in link layer and routing protocol in network layer aims to maximize the network lifetime. We implement our proposed protocol as an extension to AODV routing protocol. We evaluated the proposed protocol by comprehensively simulating a set of random WANET environments. We simulated six different metrics comparing our proposed protocol with AODV protocol. The results showed that the proposed protocol maximizes the network lifetime, reduces the end-to-end delay, and saves the total energy consumption while achieving the throughput requirement. [C641]

"An analytical study of subdividing hexagon-clustered WSN for power saving"

Hexagon is an ideal shape for clustering sensor networks, for it can seamlessly divide clustered areas, and is the largest regular polygon (in terms of the number of sides) that has this property. In this paper, we analyze the benefit of subdividing a hexagonal cluster for the purpose of reducing the overall power consumption in the cluster. Assuming a spatial Poisson distribution of sensor nodes in the cluster, we propose a subdivision scheme, and perform a comprehensive analytical estimate of power savings brought about by the subdivision. The analytical results show that subdivision will yield considerable saving in overall power consumption of the cluster, and the saving is heavily dependent on the nodes' transmission range and their deployment density. The limit on the depth of subdivision is also analyzed. [C642]

"Ultra-low-power wearable biopotential sensor nodes"

This paper discusses ultra-low-power wireless sensor nodes intended for wearable biopotential monitoring. Specific attention is given to mixed-signal design approaches and their impact on the overall system power dissipation. Examples of trade-offs in power dissipation between analog front-ends and digital signal processing are also given. It is shown how signal filtering can further reduce the internal power consumption of a node. Such power saving approaches are indispensable as real-life tests of custom wireless ECG patches reveal the need for artifact detection and correction. The power consumption of such additional features has to come from power savings elsewhere in the system as the overall power budget cannot increase. [C643]

"Dynamic Power Management Based Call Pattern Recognition for Telecommunication Equipments"

Lately around the world the Information and Communications Technology (ICT) industry has taken interest in reducing the power consumption of ICT equipment. Communications service providers are especially interested in the so-called Green-IT technology, hoping to reduce the power consumed by the large numbers of telecommunications equipment they operate in order to provide their services. Although a lot of research has been conducted into reducing power consumption, the developed methodologies are not effective to adapt them to telecommunication equipments. In this dissertation I will propose a method to actually reduce power consumption by implementing a Call Pattern Reorganization-Dynamic Power Management (CPR-DPM)-based call pattern policy, which follows subscriber connection patterns over time, in telecommunications equipment (specifically equipment located in the Central Office) of IP Multimedia Subsystem (IMS)-based telecommunications networks. [C644]

"Low-complexity video compression for capsule endoscope based on compressed sensing theory"

Recently, the notions of compressed sensing (CS) have attracted attention as an innovative concept in signal processing. In this exploratory paper, a CS-based video compression approach suitable for wireless capsule endoscopy is proposed. In general, the amount of video data generated by capsule endoscopy is so large that video compression is the best way to lower the communication bandwidth and save the RF transmitting power. However, due to power limitation and small size conditions, traditional video compression techniques are not appropriate. Applying state-of-the-art CS theory may significantly reduce power consumption and memory of video compressor, thanks to its low computational complexity. The proposed approach is based on YUV color space conversion, blocking, zigzag scan and CS measuring. Experimental results show the feasibility of the proposed idea and that future improving works are necessary. [C645]

"Research on integrated process of large-scale non-grid-connected wind power and coal-to-ethylene glycol"

The contribution rate of wind power on the grid is difficult to beyond 10%. The wind-powered generator increases the complexity and the manufacturing costs for meeting the requirements of power grid, which limits the applications of large-scale wind power. The coal-to-ethylene-glycol (EG) process is an important technology route for decreasing oil-importing, but release a large number of CO2. Integrated process of large-scale non-grid-connected wind power and coal-to-EG "grafts" the wind power on the traditional coal chemical industry to avoid the bottleneck issue of wind power. We found the integrated process can reduce manufacturing costs of wind farms and reduce the CO2emissions, and at the same time increase output of ethylene glycol if using smaller air separation unit and CO conversion devices. The integrated process will greatly make ldquogreenrdquo coal chemical industry possible and achieve optimization of efficiency, economic and environmental benefits, as well as provide new practical technologies of energy-saving and consumption-reducing to substitute oil strategy for China. [C646]

"Energy saving elevator group supervisory control system with Idle Cage Assignment using Genetic Network Programming"

Elevator group supervisory control system (EGSCS) is designed for managing the elevator movement to transport passengers in buildings efficiently. So far, genetic network programming which is a kind of evolutionary computation with a graph structure has been applied to such complex systems like EGSCS. On the other hand, in order to reduce the energy consumption in EGSCS, some studies have been done in our previous research, but when some cages become idle, the cages are supposed to go back to the first floor, which consumes much energy. In this paper, we use an idle cage assignment algorithm to dispatch the idle cages in a light traffic mode in order to reduce the energy consumption of EGSCS. [C647]

"Smart control of road-based LED fixtures for energy saving"

Lighting consumes one fourth of all energy consumed worldwide, and case studies have shown that commonly 50 to 90 percents of building lighting is unnecessary for the purposes required. Energy is wasted when light does not fall on its intended target, as when lighting fixtures allow light to go up instead of (as it is generally preferred) downward. Leakage also occurs when more light is generated than needed. Many governments are looking for ways to reduce energy use after signing the Kyoto Protocol, and individuals, organizations and local authorities are increasingly improving lighting efficiency in order to reduce energy consumption. The main scope of this paper is to establish some criteria in designing a sensing and signal conditioning system for energy saving in public lighting. [C648]

"An adaptive feedback timing control algorithm of delay-constrained data aggregation in wireless sensor networks"

Wireless sensor networks (WSNs) play an increasingly important role in civilian and military settings. With the limited energy supply, sensor nodes do neither large calculations nor further transmissions. Data aggregation can reduce the redundancy of packets and save energy to prolong the lifetime of sensor networks. This paper proposes a novel mechanism for the delay-ranged feedback timing control (DRFT) that tackles the problem of the waiting period of aggregation nodes. In order to increase the possibility of aggregating the data completely, DRFT not only assigns longer aggregation time to the nodes with more children nodes, but also adaptively adjusts the waiting time to meet various queries and different requirements. Theoretical analysis and simulation results demonstrate that DRFT can achieve a good trade-off between energy consumption and query delay. [C649]

"Efficient FPGA implementation of convolution"

This paper presents a direct method of reducing convolution processing time using hardware computing and implementations of discrete linear convolution of two finite length sequences (NXN). This implementation method is realized by simplifying the convolution building blocks. The purpose of this research is to prove the feasibility of an application specific integrated circuit (ASIC) that performs a convolution on an acquired image in real time. The proposed implementation uses a modified hierarchical design approach, which efficiently and accurately speeds up computation; reduces power, hardware resources, and area significantly. The efficiency of the proposed convolution circuit is tested by embedding it in a top level FPGA. Simulation and comparison to different design approaches show that the circuit uses only 5 mw that saves almost 35% of area and is four times faster than what is implemented in. In addition, the presented circuit uses less power consumption and has a delay of 20 ns from input to output using 32 nm process library. It also provides the necessary modularity, expandability, and regularity to form different convolutions for any number of bits. [C650]

"Dynamic time tuning for way prediction cache in low power embedded processors"

The rapid advances in embedded microprocessor technologies provide opportunities to promote digital avionic systems significantly. With the complexity and frequency increase, power consumption has quickly become a key design constraint in embedded microprocessor designs. The embedded processors in avionic systems must utilize energy efficiently, as their energy payload is restricted by battery factor and weight constraints in aircrafts. This paper proposed a new approaching using dynamic time slice turning with way prediction technology for achieving high performance and low energy consumption in set-associative cache. Among all the cache power saving approaches, prediction cache surpasses others for it reduces power dissipation along with negligible degradation of performance. However, way prediction cache depends heavily on locality principle of programs, especially for programs executed in embedded processor. Time turning way-prediction cache is introduced in this paper to self-adapt time slice turning, according to prediction misses and cache misses in execution interval. Since predictor consumes additional energy itself, dynamic time turning cache allow for proper reconfiguration actions; consequently, it cuts down unnecessary reconfiguration power dissipation. Simulators Sim-Panalyzer and Cacti are chose to estimate the power dissipations of the parameterized architectural components in implementing our dynamic time turning way prediction caches. This method avoids unnecessary reconfiguration actions by adapting program behavior much more intelligently; meanwhile, it keeps performance degradation in a very small scale. Suggested novel cache design in avionic embedded microprocessor satisfies low power and high performance requirement tendency in avionic electronics systems development. [C651]

"The influence of event-based sampling techniques on data transmission and control performance"

Event-based systems are becoming increasingly commonplace, particularly for distributed real-time sensing and control. Furthermore, remote monitoring and control through data-communication networks are very popular for process supervision and control. The usage of networks provide many well-known benefits, but it also presents some limitations in the amount of transmitted data. This fact is especially visible in Wireless Sensor Network (WSN), where the bandwidth of communication channel is limited and typically all nodes are battery powered. Event-based sampling techniques appear as a some possible solution to face this problem allowing considerably saving network resources and reducing the power consumption. On the other hand, the control system performance is highly affected due to the event-based sampling techniques, being necessary to analyze and study a compromise between control quality and reduction in the control signal commutations. This paper presents all these ideas applied to the greenhouse climate control problem. [C652]

"RA-SPAN protocol for improving QoS performance in wireless ad hoc networks"

In this paper an upgraded protocol referred to as Rate Adaptive Sustainable Physical Activity in Neighborhoods (RA-SPAN) protocol is proposed. In this protocol the power saving algorithm of SPAN is integrated with dynamic switching of data rates. Power consumption of nodes is reduced by cross-layer signaling between MAC and Network layers as in the SPAN protocol and dynamically electing the coordinators for routing so that other nodes can be made to sleep or be in idle state. Reduced latency and improved throughput is achieved by cross-layer signaling between MAC and PHY layers for assigning the highest possible transmission rate for a node based on the channel status measurements. [C653]

"Green ICT: Energy Efficiency in a Motorway Model"

Green ICT (Information and Communication Technology) is a new focus with the goal of saving energy by optimizing mobile network communications and ultimately protecting the natural climate. Here we consider the design of vehicular ad-hoc networks (VANETs) to reduce energy consumption due to communications. Based on a realistic transport traffic scenario on a motorway, rdquoM4rdquo in UK, this paper computes the energy consumption in a motorway ad-hoc wireless network. This is based on a geographical adaptive fidelity (GAF) topology management protocol, where the energy consumption has been analysed for equal-grid, adjustable-grid and genetic algorithm models. Considering nodes in the VANET network and their transmission ranges, this paper provides a network model to compute the energy consumption of VANETs and compare their energy efficiency performance. As a result, the proposed genetic algorithm model has been found to be more energy efficient than the adjustable-grid model which is better than the equal-grid model. [C654]

"Strategies of reliable transmission in practical network coding system"

In order to improve the communication quality in practical network coding system, three main strategies are proposed to protect the encoding vectors, which includes importing cyclical redundancy into the encoding vectors of the coded packets, executing distributed space-time code to the encoded packets and a shift between the above two modes above according to different signal-noise ratios. And then an amendatory CRC mode is proposed to reduce the energy consumption in transmission. The results of simulation reveal that the three strategies can improve the transmission quality efficiently and the amendatory CRC mode can help to save

transmission energy significantly. Applying the shift mode can tackle with the issue of instable transmission at the expense of a few times of retransmission. [C655]

"The Design and Implementation of a Smart Building Control System"

A significant proportion of total worldwide energy is consumed by buildings. For example, buildings in the US account for about 40 percent of total energy consumption and greenhouse gas emission. Making buildings more energy-efficient is an important step to reduce our energy consumption and carbon emission in the combat with global climate change. Broad participation by consumers, business owners, and governments is required to continuously improve on energy efficiency for new and existing buildings and to achieve the global greenhouse gas emission reduction objectives. This paper provides a software system perspective of improving energy efficiency for buildings. It proposes an architecture that allows for phased investments in technologies to capture the returns from energy savings in various use cases. In addition, it addresses the needs and objectives of different stakeholders, including owners, operators, users, and utility providers. A proof-of-concept implementation of the architecture is used to demonstrate the support for building-wide energy conservation policies using real-time energy pricing and individual occupants' locations and preferences. It shows that the proposed architecture enables fine-grained building control and reduces energy consumption while maximizing its occupants' comfort. [C656]

"A Tightly Coupled Network-on-Chip Router Architecture"

Network on chip (NoC) plays an important role in many core system. Recent researches on NoC focus on the design and optimization on network separately. This paper describes a tightly coupled NoC router architecture. In this architecture, the router and the core are designed as a whole. The router uses on-chip storage to improve the network performance. Several optimizations are introduced to make better use of the on-chip resource and information. This design can save 9.3% chip area in theory. The experiments results show the optimization on the ejection process can reduce latency by up to 75% and energy consumption by 31.5% in heavy traffic load network. And it can also improve latency by about 20% and energy consumption by nearly 25% under different buffer depth. The results also show that this tightly coupled router architecture can achieve better performance in the large scale network. [C657]

"A BIM-Based Design Method for Energy-Efficient Building"

Nowadays, global warming and high oil prices were a threat to the survival of the whole human race. One of a solution to respond to these problems is to reduce energy consumption of building. By adopting energy-saving design, the dissemination of low energy building is required. Therefore, to improve energy efficiency while reducing the usage of the design method is necessary to study actively. BIM-based systems applied to buildings, scheduled to be built by reducing the amount of energy reduction technologies can be analyzed. Depending on various design and equipment to set energy savings goals, you can select an alternative. If it is possible to predict the energy efficiency from the initial stage of design and support designing low energy building, we would be able to expect improvement in the economics of building due to the reduction of energy consumption. [C658]

"A Hybrid Power-Saving Algorithm Based on Linear Growth in IEEE 802.16e"

To support battery powered mobile broadband wireless access devices efficiently, IEEE 802.16e defines a sleep mode operation for conserving the power of mobile terminals. In this paper, a linear hybrid algorithm is proposed based on the adjustment of sleep window under circumstances of low service traffic, aiming for reducing the response time and energy consumption of mobile subscribe station (MSS). A performance evaluation for this algorithm is utilized by theoretical analysis, and the simulation result shows that the proposed algorithm improves the performance in power conservation. [C659]

"Shortest path queries in mobile broadcast environments"

Emerging technologies on Global Positioning Systems (GPS), wireless communications, networking, and Geographic Information Systems (GIS) makes it possible for people to access information related to their locations ubiquitously. In such wireless mobile environments, data-broadcasting can disseminate information to a large group of mobile clients effectively. Using data-broadcasting to provide different types of services, including range query, point query, and nearest neighbor search, has been extensively studied in recent years. Two measurements are usually considered when applying data-broadcasting to provide services, latency and tuning time. The latency is the time between the issuing and completion of a query and stands for the quality of service. The tuning time measures the actual time when a client listens to the broadcast and presents the power consumption. In this paper, we consider how to provide the shortest path service using data-broadcasting and use the idea of hierarchical graphs to propose the protocol. In our solution, the mobile client does not need to

store the entire road network and can derive the shortest path by selectively tuning into the broadcast. On the server side, we focus on how to organize the broadcast. In the broadcast, we add a little additional information to reduce the tuning time; thus saving the energy. On the client side, we provide a process to compute the shortest path by listening to the corresponding broadcast. Last, we present and discuss our findings through extensive experiments. Our experimental results show that our approach performs well in terms of the latency and tuning time. [C660]

"An Improved LEACH Protocol for Application-Specific Wireless Sensor Networks"

For wireless sensor networks, how to efficiently utilize limited energy directly affects the lifetime and the cost. LEACH is a clustering-based protocol with good performance, which employs localized coordination to balance the energy usage. In this paper, an improved LEACH protocol is proposed with a more reasonable set-up phase. The proposed protocol focuses on saving the energy cost induced due to redundant nodes and balancing the energy consumption among sensor nodes by splitting large clusters into smaller ones. Simulation results, compared with LEACH, demonstrate that the proposed protocol can reduce energy consumption and hence prolong the lifetime of WSN. [C661]

"An Energy-Saving Algorithm of WSN Based on Gabriel Graph"

In the wireless sensor networks transmitting power problem, the energy-saving control study has always been a hot topic, and also put forward a number of algorithms. The simplest strategy is flood-type broadcasting algorithm, that is, all the nodes send the broadcast message to its adjacent node as soon as it gets it. But this will cause the phenomenon of resending, greatly increasing the burden on individual nodes and overall network energy consumption. Based on network topology control theory this article proposes a design of energy-saving algorithm to solve the problem of broadcast storm caused by resending and to reduce overall energy consumption. [C662]

"An Novel Energy-Efficient Redundant Routing Tree Algorithm for Wireless Sensor Networks"

Nodes in wireless sensor networks(WSNs) are tiny and energy-limited,so in order to enhance the entire network lifetime, this paper puts forward a novel energy efficient redundant routing tree(EE-RRT) algorithm for wireless sensir networks. EE-RRT has three obvious features: Firstly, it improves virtual grid ideas to divide each cluster into MtimesN square area and select a working node in each grid to reduce redundant information and economize energy. Secondly, EE-RRT improves energy utility by changing the activity of wireless communication module of sensor nodes, energy model and state transition of sensor nodcs.hist.it builds a redundant routing tree as the transmission agents to realize the information exchange between the clusters and base-station so that the energy consumption of normal nodes and clusters' heads can be decreased and reduces the dynamic clustering time to save energy. Simulation results show that, compared with LEACH and RNTA,EE-RRT significantly reduce in energy consumption and prolong the network lifetime. [C663]

"Workload-adaptive management of energy-smart disk storage systems"

Recent studies have identified disk storage systems as one of the major consumers of power in data centers. Many disk power management (DPM) schemes were suggested where the power consumed by disks is reduced by spinning them down during long idle periods. Spinning the disks down and up results in additional energy and response time costs. For that reason, DPM schemes are effective only if the disks experience relatively long idle periods and the scheme does not introduce a severe response time penalty. In this paper we introduce a dynamic block exchange algorithm which switches data between disks based on the observed workload such that frequently accessed blocks end up residing on a few ldquohotrdquo disks thus allowing the majority of disks to experience longer idle periods. We validate the effectiveness of the algorithm with trace-driven simulations showing power savings of up to 50% with very small response time penalties. [C664]

"A 5-bit 1.35-GSPS DAC for UWB transceivers"

This paper presents a low-power 5-bit 1.35-GSPS current-steering digital-to-analog converter (DAC) for ultra-wideband (UWB) transceivers. A ldquo3 (thermometer) + 2 (binary)rdquo segmented structure is used for reaching a compromise between the circuit complexity and differential nonlinearity (DNL) error. To save the power consumption while maintaining the same output voltage swing, a bipolar current source cell is employed. Besides, a de-glitch latch is presented to reduce the clock feedthrough from the pass transistors. This DAC was implemented in a standard 0.18-mum 1P6M CMOS technology. The measured integral nonlinearity (INL) and the differential nonlinearity (DNL) are less than 0.04 LSB and 0.05 LSB, respectively. The spurious-free dynamic range (SFDR) is above 30 dB over the complete Nyquist band at a sampling rate of 1.35 GHz. The power consumption of this DAC is 9.7 mW. The active area of the circuit occupies 0.19 mm2. [C665]

"Development of the fuel-cell/battery hybrid railway vehicle"

In order to save energy and reduce environmental burdens, we (Railway Technical Research Institute) have been developing a railway vehicle powered by fuel cells since FY 2001. In FY 2006, we produced the railway vehicle powered by a 100 kW-class fuel cell system with assumed the power supply for railway vehicle traction, and succeeded in making the vehicle run for one car. The results of these tests indicated that energy efficiency of the fuel cell increased by about 50%, and that the fuel consumption rate varied widely depending on running conditions. In FY 2008, as a measure to utilize the energy at regenerative braking, we developed the lithium-ion battery system with an energy capacity of 36 kWh and the DC/DC converter for power management. With these equipments installed on the vehicle, we composed the fuel-cell/battery hybrid railway vehicle consisting of two cars, and executed running tests at our test line. [C666]

"Characterization of power consumption in thin clients due to protocol data transmission over IEEE 802.11"

In thin client computing, applications are executed on a network server instead of on the user terminal. Since the amount of processing at the terminal is reduced, thin clients are potentially energy efficient devices. However, a network connection between client and server is required for the transmission of user input and display updates. The energy needed for this intense network communication might undo or even exceed the power savings achieved by the reduction in client-side processing. In this paper, we present experimental results on power efficiency of the wireless platform on the thin client in case of thin client traffic. The discussion is focused on VNC-RFB, a widespread thin client protocol, over an IEEE 802.11 link in three typical user scenarios. The results indicate that a cross-layer approach between application and wireless link layer could potentially lead to important power savings. [C667]

"A neuromimetic ultra low-power ADC for bio-sensing applications"

A compact 8-bit analog-to-digital converter (ADC) targeted for bio-sensing applications in systems-on-chip is presented. In particular, the design and implementation of the ADC with operation similar to a natural neuron cell in that it produces actions potentials corresponding to a stimulus of sufficient strength is described. An energy-saving buffer by reducing its effective capacitance is proposed to achieve low power consumption, and a specially designed switch and calibration system were incorporated in the design to improve the integral non-linearity (INL) of the ADC. The circuit was implemented in a standard 0.18 mum CMOS process technology with a 1.5 V supply, and a compact core area of 0.05 mm2. Post layout simulations reveal that for a full scale range input current of 16 muA, the ADC maintains a maximum differential non-linearity (DNL) and INL of less than 0.16 LSB and 0.41 LSB respectively. The ADC achieves an ultra low energy dissipation of 5.46 pJ/cycle when operated at a sampling rate of 500 kS/s. This energy consumption is one of the lowest ever reported to date. [C668]

"Arterial velocity planning based on traffic signal information under light traffic conditions"

Vehicle fuel consumption and emissions are directly related to the acceleration/deceleration patterns and the idling period. In order to reduce emissions and improve fuel economy, sharp acceleration/deceleration and idling should be avoided as much as possible. Unlike on freeways, traffic on signalized corridors suffers from increased fuel consumption and emissions due to idling and acceleration/deceleration maneuvers at traffic signals. By taking advantage of the recent developments in communication technology between vehicles and roadside infrastructure, it is possible for vehicles to receive the signal phase and timing information well in advance of approaching a signalized intersection. Based on this traffic signal information, we have developed arterial velocity planning algorithms that give dynamic speed advice to the driver so that the probability of having a green light is maximized when approaching signalized intersections. The algorithms are aimed at minimizing the acceleration/deceleration rates while ensuring that the vehicle never exceeds the speed limit, and that it will pass through intersections without coming to a stop. Using a stochastic simulation technique, the algorithms are used to generate sample vehicle velocity profiles along a 10-intersection signalized corridor. The resulting vehicle fuel consumption and emissions from these velocity profiles are calculated using a modal emissions model, and then compared with those from a typical velocity profile of vehicles without velocity planning. The energy/emission savings for vehicles with velocity planning are found to be 12-14%. [C669]

"Design and implementation of a topology control scheme for Wireless Mesh Networks"

The wireless mesh network (WMN) backbone is usually comprised of stationary nodes but the transient nature of wireless links results in changing network topologies. Topology Control (TC) aims to preserve network connectivity in ad hoc and mesh networks and an abundance of theoretical results on the effectiveness of TC

exist. Practical evaluations of TC schemes that provide gradual transceiver power adjustments for the WMN backbone are however in their infancy. In this paper we investigate the feasibility of power control in a popular WMN backbone device and design and evaluate an autonomous, light-weight TC scheme called PlainTC. An indoor test-bed evaluation shows that PlainTC is able to maintain network connectivity, achieve significant transceiver power savings and reduce MAC-level contention but that no significant reductions in physical layer interference were realised. The evaluation has also highlighted the danger of associating power savings with network lifetime. Further larger-scale experiments are required to confirm these results. [C670]

"Carbon windfall profits in the power sector. Policies to mitigate redistributive effects. (February 2009)"

Reduction of emissions of greenhouse gases is one of the key goals of European Comisions's (EC) plan about energy and climate change. Methods chosen for allocation of free carbon permits show that increase of electricity prices is an intended and expected effect in order to provide a signal to consumers, to save energy and consequently to reduce the emissions of CO2, and to generators, to promote disinvesting in CO2intensive technology and to invest in non-emitting or low-emitting technologies. As a result of EU ETS implementation, two new rents appear (increase of capacity scarcity rent and carbon scarcity rent). At the same time, consumer surplus decreases as a consequence of the increase of power prices. Governments may feel tempted to limit the intensity of these redistributive effects through some regulatory measures which could distort the proper functioning of the markets and the signals derived from them. The new rents are essential to provide the necessary economic signal to promote a solution to the challenge of climate change through the development of a carbon-neutral power supply. Development of new nuclear capacity, hydro repowering, CCS and RES need an adequate price signal to be competitive. [C671]

"Energy Analysis of Confidentiality-Enhanced Multipath Streaming in Multi-Hop Wireless Networks"

High security and low energy consumption are two of the most important features in implementing today's wireless network systems and applications. They are not totally unrelated in terms of system design. In fact, there is a tradeoff relationship between security and energy. Generally the more secure a system is, the more energy it consumes. In this paper, we integrate a confidentiality (security) enhancement technique with an energy-saving scheme together, and analyze its power consumption. The multipath data allocation improves confidentiality, and the interference-aware minimum energy routing preserves transmission power. Based on our investigation, low density wireless networks can provide both enhanced security and reduced energy consumption at a reasonable level. [C672]

"Polymorphic FIR Filters with Backup Mode Enabling Power Savings"

A polymorphic FIR filter is proposed which can operate in two modes. The first mode is considered as a standard mode in which the filter performs a normal operation. In the second mode, the filter operates with reduced power supply voltage (Vdd), some filter coefficients are reconfigured (as response to the change of the polymorphic gates function which is controlled by Vdd) and some parts of the filter are disconnected. Experimental results indicate that while power consumption can significantly be reduced when half of the taps is suspended the filter is still able to achieve a reasonable quality of filtering. [C673]

"Grid-Based for Energy Conservation around Obstacles in Wireless Sensor Networks"

Reducing energy consumption has been a recent focus of wireless sensor network research. Topology control explores the potential that a dense network has for energy savings. We propose that the sensor field be overlaid with a honeycomb virtual mesh based on a tessellation. Then with the help of greedy forwarding algorithm and perimeter forwarding algorithm, we can bypass a void or obstacles easily. And we can save energy to prolong the life time of the wireless sensor networks. [C674]

"Energy Audit and Its Application in Coal-Fired Power Plant"

This paper addresses the implementation method of energy audit in coal-fired power plant. Energy audit, as an effective energy-saving and emission-reducing measure, was launched in thousands of high energy-consuming enterprises in China in 2006. In this paper, energy audit concept and purpose is analyzed. By analyzing current utilization situation of energy in China's coal-fired power plant, the significance of energy audit in coal-fired power plant to energy-saving and emission-reducing is introduced. Energy audit contents such as energy management audit, energy utilization audit and energy-saving potential analysis is given. According to energy audit practice in coal-fired power plant, the implementation step and a substantial case of energy audit are proposed. [C675]

"Research on Node Sleep/Wake-up Mechanism in WSN Based on Energy Threshold Setting"

Scheduling the nodes of wireless sensor network properly can effectively reduce the networks' energy consumption. The ordinary coverage algorithm is simply to identify redundant network nodes and let them go to sleep, without considering problem of power consumption of those continuing working nodes. This paper purpose a sleeping and wakening-up mechanism based on energy threshold setting, which can improve the nodes working efficiency by limit their energy consumption, balancing energy consumption of nodes, thus enhances the entire wireless sensor networks' life. The simulation results show that the sleep/wake-up mechanism based on energy threshold setting can be applied to wireless sensor networks very well with obvious energy-saving. [C676]

"Energy Saving Potential of Public Building in Jiangbei District of Chongqing"

Jiangbei belongs to Metropolitan Advanced Economic Sphere of Chongqing so its character of energy consumption can be very typical in Chongqing. A energy consumption investigation of 72 public buildings was organized by People's Local Congress in Jiangbei. Based on the investigation data and information coming from energy audit and site measurement for 14 public buildings, character of energy consumption for six different types of public building is summed up, and problems and its solutions of six energy consumption systems of public building are analysed also. It was pointed out that electricity is the main form of building energy and building electricity consumption was more than 50% of total electricity consumption in Jiangbei. Also, electricity consumption of public building, among which energy for heating, air conditioning and lighting can be half, is nearly 50% of building electricity consumption. At last, energy saving potential of public building in Jiangbei is evaluated. It is determined that if 289.3 million yuan is invested in energy saving retrofit project of public bulding in Jiangbei, it will create 9,640 work opportunities a year, drive 723.3 million yuan output of other industries and reduce 161,629 tons of CO2emission. [C677]

"Energy Measurement Audit and Its Implementation in Coal-Fired Power Plant"

This paper addresses energy measurement audit in coal-fired power plant. Energy audit, as an effective energy-saving and emission-reducing measure, was launched in thousands of high energy-consuming enterprises in China in 2006. The big part of energy audit is energy measurement audit. In this paper, the work center of energy measurement is obtained by analyzing the contents and characteristics of energy measurement works. According to Chinese standard, the basic requirement for equipping rate of the measuring instruments of energy in each class of organization and major energy-consuming equipment is introduced. A case of energy measurement audit in a coal-fired power plant is given. Auditing results show the equipping rate of the measuring instruments of most kinds of energy is unqualified. [C678]

"Energy Efficient Optical Burst Switched (OBS)Networks"

This paper presents an energy saving technique for optical burst switched networks that reduces energy consumption without significantly degrading the quality of service (QoS) and the connectivity of the network. We propose a distributed algorithm using anycasting an communication paradigm, where the wavelength routed nodes (WRNs) adopt a sleep mode cutting the traffic routed through them. This paper also provides a mathematical framework for calculating the energy per bit (Eta) across the fiber and the wavelength routed node. [C679]

"A New Type of Pre-Insulated Bonded Pipe"

The present paper introduces the structural form of PE-RT pre-insulated pipes (PE-RT used as service pipes) for use as a substitute for steel pre-insulated pipes (steel pipe used as service pipes). The technical advantages of the PE-RT pre-insulated pipes when used in district heating are also illustrated. For pipes with the same diameter, length, and flow-rate, the pressure drop and transportation energy consumption for both steel pre-insulated pipes and PE-RT pre-insulated pipes are analyzed. If PE-RT pre-insulated pipes are used in the secondary network of Taiyuan (capital city of Shanxi, China) district heating, up to 10.44 million kilowatt-hours of energy could be saved at the circulating pump in only one heating period. If implemented throughout the country, 0.44 billion kilowatt-hours (equivalent to 54 thousand tons of standard coal) could be saved. In addition, the change could reduce the emission of CO2by about 135,000 tons, SO2by about 3,240 tons, and NxO by 2,030 tons. Moreover, the yearly share expenses of PE-RT pre-insulated systems are much lower than those of steel pre-insulated systems in their service life. [C680]

"The Tactics of Urban Planning and Architectural Design on Urban Construction of Energy-saving and Environmental Affinity"

People have to increase energy-saving technology of urban planning and architectural design because of the dual crisis of energy and environment. Many countries have drawn up the policy and standard of energy saving one after another. In our country we have planed and designed on a large scale in the aspect of old city's reform, new city's extension and new rural communities construction. Old energy-saving tactic of urban buildings is not enough to meet the needs of development. So it is essential to probe multi-domain's, all-directional, innovative and more in line with China's national conditions design method and tactics on the basic of national standard of energy-saving design. Environmental load more and more with each passing day should be reduced in order to implement the planning of energy saving and environmental affinity. And it is important to decrease and control load, use efficiently resources and energy, recover prevenient function and create, etc to build safe and reassuring human settlement. It can supply comfortable and convenient life and raise glamour and quality. The field of view on planning is necessary from building monomer to the extent of block and city. The control of entire process from planning to design must be strengthened. The matching technology of the energy-saving planning and design should be explorated and used. The multipurpose use of many methods of architectural design, which including using the natural energy flexibly and efficiently, the control of zeroth energy connsumption in indoor environment, interdict energy consumption by structure measure, research and develop efficient electromechanical device, and so on, may aim at realizing energy saving building of environmental affinity. [C681]

"Power Saving Mechanism Based on Simple Moving Average for 802.3ad Link Aggregation"

Field=03-In this paper, we propose a power saving mechanism based on a simple moving average of the traffic rate in 802.3ad link aggregation. Two key components comprise the proposed mechanism: (1) a negotiation protocol for both nodes connected to an 802.3ad aggregated link and (2) an algorithm to estimate an appropriate number of active links to comprise the aggregated link in accordance with the current rate of traffic outbound on the link. We present an evaluation of the characteristics of the algorithm and its performance through simulation with real traffic trace data. Our simulations demonstrate that under certain conditions the proposed algorithm is capable of reducing the average number of active links by as much as 25.4% (6.7 W out of 26.4 W). [C682]

"Performance Evaluation of Energy-Efficient Parallel I/O Systems with Write Buffer Disks"

In the past decade, parallel disk systems have been developed to address the problem of I/O performance. A critical challenge with modern parallel I/O systems is that parallel disks consume a significant amount of energy in servers and high performance computers. To conserve energy consumption in parallel I/O systems, one can immediately spin down disks when disk are idle; however, spinning down disks might not be able to produce energy savings due to penalties of spinning operations. Unlike powering up CPUs, spinning down and up disks need physical movements. Therefore, energy savings provided by spinning down operations must offset energy penalties of the disk spinning operations. To substantially reduce the penalties incurred by disk spinning operations, we developed a novel approach to conserving energy of parallel I/O systems with write buffer disks, which are used to accumulate small writes using a log file system. Data sets buffered in the log file system can be transferred to target data disks in a batch way. Thus, buffer disks aim to serve a majority of incoming write requests, attempting to reduce the large number of disk spinning operations by keeping data disks in standby for long period times. Interestingly, the write buffer disks not only can achieve high energy efficiency in parallel I/O systems, but also can shorten response times of write requests. To evaluate the performance and energy efficiency of our parallel I/O systems with buffer disks, we implemented a prototype using a cluster storage system as a testbed. Experimental results show that under light and moderate I/O load, buffer disks can be employed to significantly reduce energy dissipation in parallel I/O systems without adverse impacts on I/O performance. [C683]

"Green Textile and Clothing Production System Evaluation Based on Grey Fuzzy Method"

Green textile and clothing production aims at saving energy, reducing emission and consumption to achieve efficient usage of resources. Green production evaluation contributes to realize coordinated growth between textile and clothing industry and the environment. By the analysis of production links, the evaluation index system is set up. The six first level indexes of which are consumption of water and energy, treatment of waste water, gas and materials, control of harmful materials to human health, advanced technology, product and design idea, package consumption and working environment of workshops. The first level indexes are subdivided into eighteen second level indexes for convenient analysis and computation. Grey fuzzy method is applied to the evaluation. Then textile and clothing industry of Hebei province is taken as case study. [C684]

"On the impact of 2G and 3G network usage for mobile phones' battery life"

Over the last years mobile phones had a remarkable evolution. From a simple device for voice communication, it

became a full blown multimedia device with multiple features and appealing services. In parallel with the introduction of novel services, mobile devices became more and more energy-hungry reducing the operational time for the user. To extend the battery life of mobile phones is one of the top priorities for mobile phones' manufacturers. This paper presents results of power and energy consumption measurements conducted on mobile phones for 2G and 3G networks. The services under investigation were text messaging, voice and data. The paper reports larger energy consumption in 3G networks for text messaging and voice services than energy consumption in 2G networks. On the other side the 3G networks become more energy friendly when large volumes of data have to be downloaded. The results imply that mobile phones should switch the network in dependency of the service used to save the maximum amount of energy. As this handover consumes energy, we include its analysis in our measurements. [C685]

"How Much Can The Internet Be Greened?"

The power consumption of the Internet is becoming more and more a key issue, and several projects are studying how to reduce its energy consumption. In this paper, we provide a first evaluation of the amount of redundant resources (nodes and links) that can be powered off from a network topology to reduce power consumption. We first formulate a theoretical evaluation that exploits random graph theory to estimate the fraction of devices that can be removed from the topology still guaranteeing connectivity. Then we compare theoretical results with simulation results using realistic Internet topologies. Results, although preliminary, show that large energy savings can be achieved by accurately turning off nodes and links, e.g., during off-peak time. We show also that the non-cooperative design of the current Internet severely impacts the possible energy saving, suggesting that a cooperative approach can be investigated further. [C686]

"Multiple-Antenna Post Low Noise Amplifier RF Combining"

In this paper we propose the superheterodyne receiver beamforming architecture called post-low noise amplifier RF combining (PLRC) to reduce the power consumption by using the single analog-to-digital converter (ADC). The RF chains in our proposed schemes includes the same number of the low noise amplifier (LNA) and the discrete-level phase shifters as the number of antennas followed by the single chain which consists of combiner, mixer, IF and the analog-to-digital converter (ADC). We propose simple channel estimation techniques based on the codebook stored in the baseband. We show from our some selected simulations that, when the exact phase information is available, the loss of beamforming gain of our proposed PLRC is not significant in terms of both signal-to-noise ratio (SNR) and bit error rate compared to the conventional baseband beamforming techniques while the power consumption of our proposed scheme can be much saved by using the single RF chain and single ADC. In addition, even for the use of the discrete phase level, the performance loss is negligible. [C687]

"Performance Evaluation of Power Saving Scheme with Dynamic Transmission Capacity Control"

Our major purpose in this study is to develop a method for achieving power conservation with a network itself. The proposed power saving approach takes traffic characteristics of network into consideration. If network switch can adapt its processing speed to arrival traffic rate, power saving can be expected depending on the network utilization. The same idea is already materialized just as Intel's SpeedStep technology. We first confirm this consideration by measuring the power consumption of some switches and show that a Gigabit Ethernet port consumes 2 or 3 W with an addition of a link. Based on this experiment, we propose a scheme to achieve the dynamic control of the transmission capacity between switches in order to reduce the power consumption based upon the change in traffic volume. To control the transmission speed dynamically and gradually, Link Aggregation is used in our scheme. From simulation studies, we show that the proposed architecture can achieve both high power saving capability and sufficient feasibility. [C688]

"The research of data compression algorithm based on lifting wavelet transform for wireless sensor network"

Aiming at the limited resources and data transmission redundancy of WSN, this paper proposes a novel data compression algorithm based on lifting wavelet transform, gives the rational design. The algorithm distributes the computing quantity which the lifting wavelet transform requires to all nodes, eliminates extra computing and data transmission, reduces the information redundancy of network, greatly saves the energy of wireless transmission, prolongs network lifetime. The simulation results show that the data compression algorithm based on lifting wavelet transform performs well in energy saving without sacrificing the reconstruction quality of signal in comparing with the data compression algorithm based on traditional wavelet transform. [C689]

"Tiny Function-Linking for Energy-Efficient Reprogramming in Wireless Sensor Networks"

The remote and automatic reprogramming is an indispensable part in the wireless sensor networks. Especially,

the energy saving problem is an important challenge because of a limited energy characteristic. Many kinds of conventional researches about reprogramming have tried to solve the energy saving problem. But they do not consider the energy consumption model and still have inefficient memory access times. In this paper, we propose a tiny function-linking scheme. It performs function relocation to decrease program code shift and connects relocated function with a tiny function-linker to eliminate function caller changes. This proposed scheme reduces access times to electrically erasable programmable read-only memory (EEPROM) and program memory during the decoding procedure of the reprogramming. Experimental results show that our scheme outperforms the previous reprogramming schemes in terms of the energy consumption. [C690]

"Mitigation of intra-array SRAM variability using adaptive voltage architecture"

SRAM cell design is driven by the need to satisfy static noise margin, write margin and read current margin (RCM) over all cells in the array in an energy-efficient manner. These constraints determine both the minimum cell size and supply voltage. RCM is set by the maximum read access time over the array. The randomness of transistor threshold voltages, and thus read times, makes maximum read time follow extreme order statistics, specifically, the Gumbel distribution which is characterized by long tails. Thus, the margin specification needs to be met at the high sigma corners in order to reach acceptable yield, resulting in oversizing and increased VDD. In this work, we demonstrate that a reduced-area bitcell design is achievable by reducing the impact of intra-array randomness through a new architecture that employs an adaptive voltage scheme in a partitioned SRAM array. The key idea is to be able to shift empirical distributions (realizations) of read time in a set of rows that form a single partition to meet the target. Because the partition is smaller than the whole array, the tail of the Gumbel distribution is significantly reduced. The adaptive voltage tuning policy is driven by the worst partition access time. For the blocks whose delay violates access time constraints, a higher voltage is selected out of the available set to gain yield, otherwise voltage is reduced for power saving. This permits smaller cell area and lower VDDat identical yield. The cost of adaptivity is in generation and routing of a small number (in our experiments, four) voltage levels and the area of one-per-partition set of PMOS switches. We demonstrate that through the voltage tuning architecture we propose, it is possible to obtain mean power consumption reduction on average by 21% iso-area. Alternatively, bitcell area can be reduced on average by 7% iso-power compared to the existing design strategy. [C691]

"Enhanced reliability-aware power management through shared recovery technique"

While Dynamic Voltage Scaling (DVS) remains as a popular energy management technique for real-time embedded applications, recent research has identified significant and negative impact of voltage scaling on system reliability. For this reason, a number of reliability-aware power management (RA-PM) schemes were recently proposed to preserve the system reliability when DVS is used. In this paper, we propose a new approach, called the shared recovery (SHR) technique, to minimize the system-level energy consumption while still preserving the system's original reliability. The main idea of the SHR technique is to avoid the offline allocation of separate recovery tasks to the scaled tasks by assigning a global/shared recovery block that can be used by any task at run-time. Our simulation results show that, compared to the existing RA-PM schemes, our scheme can achieve up to 35% energy savings. Further, this performance is shown to be comparable to the maximum energy savings that can be achieved by any algorithm. Interestingly, our extensive evaluation indicates that SHR offers also non-trivial gains over the previous algorithms on the reliability side. Further, a dynamic extension is proposed to improve energy and reliability management at run-time by reducing the size of the recovery block and re-using the slack that arises from early completions. [C692]

"Temporal and spatial idleness exploitation for optimal-grained leakage control"

Runtime leakage control techniques, such as power gating (PG) and body biasing (BB), have been applied in a coarse-grained manner traditionally. In order to enable more aggressive leakage reduction, researchers are seeking ways to control leakage with finer granularity. Our research proposes two novel methods, namely circuit clustering for temporal and spatial idleness exploitation, to systematically reduce the granularity of leakage control and improve leakage reduction. Another strength of this paper is the quantitative study of leakage saving and control cost by leakage control with different granularity. With our quantitative study, designers can make the trade-off between leakage saving and control cost, and decide the optimum granularity for leakage control. A heuristic algorithm has been developed to automate the two circuit clustering methods and determine the optimum granularity for any given circuit. The analysis and experiments of this paper is mainly based on RBB. They are also applicable to PG by modifying the cost function. [C693]

"Information fusion in Wireless Sensor Network based on rough set"

To reduce the energy consumption and extend the network's survival time is the key research problem in the

Wireless Sensor Network. Much research work has been done on the placement of nodes and routing protocol, eliminating data redundancy by density controlling and hierarchical clustering algorithm. In this paper, it is proposed that information fusion is an effective way to reduce the communication data, save the energy consumption and thereby extend the life of the network. With the specific analysis an information fusion algorithm based on rough set is designed. [C694]

"Sleep Mode for Energy Saving PONs: Advantages and Drawbacks"

A common approach to reduce energy consumption in communication networks is to allow network elements to switch to sleep mode. While this technique has been widely utilized in wireless networks, recent studies have proposed to exploit sleep mode in wired networks to conserve energy as well. This paper focuses on some feasible implementations of sleep mode in passive optical networks (PONs). In particular, ONU sleep mode is considered. The paper first outlines the ONU wake-up process using current time division multiplexing (TDM) PON protocols. Current and novel optical network unit (ONU) architectures that selectively switch-off some elements are then described. Their advantages in terms of energy savings are analytically computed under different traffic scenarios. Using the proposed architectures, analytical results show more than 50% energy saving under realistic TDM traffic. Finally, possible drawbacks in terms of new scheduling challenges are also discussed and potential solutions are presented. [C695]

"A novel asymmetric optical interconnection network architecture for network-on-chip"

As high performance multi-cores processor develops rapidly, highly integrated network-on-chip (NoC) for data interchange between the cores is needed. The traditional electrical NoC can hardly catch up with the steps of the demand of higher bandwidth, lower power consumption, lower latency and etc. However, the introduction of optical interconnection opens a new way to improve the performance of NoC, and many recent research achievements have promoted the development of the optical network-on-chip (ONoC). This paper proposes a novel asymmetric ONoC architecture constructed by the novel all-direction (AD) or limited-direction (LD) switching units. This novel AD/LD switching unit is composed of a key component: micro-resonator. We analyze and compare the performance of this novel asymmetric ONoC with other ONoC designed lately based on micro-resonator. The result shows that this asymmetric ONoC with AD/LD switching units can save at least 12%/32% of the micro-resonators. As a result the area and the power consumption can also be reduced. [C696]

"An improved rejoin procedure in ZigBee networks"

In this paper, we propose a method to save energy consumption for the rejoin procedure of ZigBee networks. By skipping the active scan process, a rejoining node and its neighbors are able to save a large amount of energy. In addition, the rejoining node chooses the suitable potential parent by reserving and utilizing original neighbor table. This method is capable of reducing the number of rejoin request command frames, thus reducing the network traffic to some extent. Simulation results demonstrate that the proposed rejoin procedure contributes to more effective and efficient energy consumption. [C697]

"Energy-Saving DVFS Scheduling of Multiple Periodic Real-Time Tasks on Multi-core Processors"

This paper addresses an energy-saving scheduling scheme of periodic real-time tasks with the capability of dynamic voltage and frequency scaling, on the lightly loaded multi-core platform containing more processing cores than running tasks. First, it is shown that the problem of minimizing energy consumption of real-time tasks is NP-hard even on the lightly loaded multi-core platform. Next a heuristic scheduling scheme is proposed to find an energy-efficient schedule with a low time complexity while meeting the deadlines of real-time tasks. The scheme exploits overabundant cores to reduce energy consumption using parallel execution and turns off the power of unused or rarely used cores. Evaluation shows that the proposed scheme saves up to 64% energy consumption of the existing method executing each task on a separate core. [C698]

"A 10-bit 500-KS/s low power SAR ADC with splitting comparator for bio-medical applications"

This paper presents a successive approximation register analog-to-digital converter (SAR ADC) design for bio-medical applications. Splitting comparator and energy saving capacitor array are proposed to achieve low power consumption. The average switching energy of the capacitor array can be reduced by 69% compared to a conventional switching method. The measured signal-to-noise-and-distortion ratios of the ADC is 58.4 dB at 500 KS/s sampling rate with an ultra-low power consumption of 42-Г,ВїW from a 1-V supply voltage. The ADC is fabricated in a 0.18-Г,Вїm CMOS technology. [C699]

"PDC-NH: Popular data concentration on NAND flash and hard disk drive"

In this paper, we present a network server architecture which concentrates popular data on both HDD and NAND flash. Popular Data Concentration (PDC) is a well known technique to reduce the power consumption of disk arrays. We extended PDC by adding NAND flash based Solid State Drive (SSD) and achieved better performance and energy savings. We developed a novel file placement policy which places popular files on either one of flash disk or hard disk based on their size, popularity and access characteristics. Our placement policy places large and sequential read files on HDD and small and random read files on SSD. This placement takes advantage of the benefits of each medium and hides their shortcomings. To boost the HDD's performance, we further clustered correlated files and placed them on the HDD in a sequential manner. This reduces seek counts hence leading to a performance improvement. And we reserved some space of HDD to use it for write caching. By this, all the requests including reads and writes are concentrated on a designated hard disk and flash disk letting other disks to stay longer in low-power mode. We evaluated our architecture with trace driven simulator and the results show that our architecture is more energy efficient and performance effective compared with existing energy efficient architectures. [C700]

"Energy-efficient scheduling algorithm of task dependent graph on DVS-Unable cluster system"

At present, energy-efficient scheduling algorithm in High-Performance Computing (HPC) environment is becoming a research hotspot owning to its high operation cost and low reliability. In this paper, we investigate energy-efficient scheduling algorithm of data dependent tasks in DVS-Unable cluster system. The proposed ESTD algorithm efficiently integrates task clustering with task duplication technologies to reduce data transmission time and communication energy consumption. In order to decrease the static power of processing elements, it also uses one of the power-saving techniques in system level-Dynamic Power Management on the premise that application execution is non-preemptive and predictive. ESTD algorithm not only optimizes the makespan of task dependent graph, but also confines its energy consumption into a certain extent. Compared with EAD algorithm and PEBD algorithm, experimental results and case studies demonstrate that ESTD algorithm can reduce more energy consumption while not affecting scheduling performance of applications. [C701]

"Development of a rack-type air-conditioner for improving energy saving in a data center"

We developed a rack-type local air-conditioner, focusing on the elimination of hot spots to reduce the energy consumption of data center air-conditioning. In doing so, we also regarded increasing the operating efficiency of the air-conditioner itself as an important problem. We therefore took up the challenge of developing energy saving techniques that optimize computer room air-conditioner as well as adopting a structure and control technology for more efficient local cooling. In this paper, we introduce those energy-saving techniques for a rack-type air-conditioner. Trial calculations of the air-conditioning method used together with this rack-type air-conditioner confirmed that a 43% reduction in the energy used for air-conditioning relative to the ordinary VUF (vertical under floor) method is possible.. [C702]

"LOP_RE: Range encoding for low power packet classification"

State-of-the-art hardware based techniques achieve high performance and maximize efficiency of packet classification applications. The predominant example of these, ternary content addressable memory (TCAM) based packet classification systems can achieve much higher throughput than software-based techniques. However, they suffer from high power consumption due to the highly parallel architecture and lack high-throughput range encoding techniques. In this paper, we propose a novel SRAM-based packet classification architecture with packet-side search key range encoding units, significantly reducing energy consumption without reducing the throughput from that of TCAM and additionally allowing range matching at wire speed. LOP_RE is a flexible packet classification system which can be customized to the requirement of the application. Ten different benchmarks were tested, with results showing that LOP_RE architectures provide high lookup rates and throughput, and consume low power and energy. Compared with a TCAM-based packet classification system (without range encoding) implemented in 65nm CMOS technology, LOP_RE can save 65% energy consumption for the same rule set over these benchmarks. [C703]

"On the energy efficiency of lossless data compression in wireless sensor networks"

In wireless sensor networks, energy is commonly a scarce resource, which should be used as sparingly as possible to allow for long node lifetimes. It is therefore mandatory to put a focus on the development of energy-efficient applications. In this paper, we analyze the achievable energy gains when packet payloads are compressed prior to their transmission. As the radio transceiver chips are the predominant power consumers on most current sensor node platforms, we present how local compression of data can be successfully employed to preserve energy. We compare two lossless mechanisms to eliminate redundancies in the packets with regard to

the overall energy savings. The results prove that data compression is a viable approach to reduce a platform's energy consumption, as it can reduce the radio transmission durations of packets and thus shorten the duty cycles of the radio device. [C704]

"Energy-aware resource allocation"

This paper deals with the reduction of energy consumption in large scale systems, especially by taking into account the impact of energy consumption for server consolidation. Decreasing the number of physical hosts used while ensuring a certain level of quality of services is the goal of our approach. We introduce a metric called energetic yield which represents the quality of a task placement on a subset of machines, while taking into account quality of service and energy efficiency aspects. It measures the difference between resources required by a job and what the system allocates ultimately, while trying to save energy. Our work aims at minimizing this difference. We propose placement heuristics that are compared to the optimal solution and to a related system. In this paper, we present a set of experiments showing the relevance of this metric in order to reduce significantly energy consumption. [C705]

"The study on the energy-conservation power generation dispatch"

At the present time, the country has carried out the measure of energy-saving power scheduling. The main object of this measure is to increase the efficiency and to reduce pollution which is important to the power stations. This paper calculated three kinds of equivalent price coefficient of energy and environment in the case of the lowest bidding price or the least energy or the most minimum pollution to the environment. In this way, the multi-objective optimal problem with different physical units was reformulated into a new single-objective optimal problem. The numerical result shows that only considering economic indicators is unable to meet the development of the market. More considering on saving energy, lower energy consumption and reducing pollutants discharge must be given to put the power suppliers in a favorable position in the future market. [C706]

"A fieldbus-based fuel and energy management simulation system for thermal power plant"

The contradiction between industrialization and the environmental protection as well as the energy saving has become the main restriction to the economic development of many countries in the world. In order to achieve the goal of sustainable development, it is a crucial strategy to greatly promote the actions about energy saving and emission reduction in coal-fired power plants. This paper just focuses on it by fuel management. Through studying the process of the fuel order, bespeaking, blending, acceptance and statistic, this paper analyzed how to save energy and reduce emission. On this basis, a fuel management system based on the CANbus is designed, which includes the subsystems of fuel order, fuel bespeaking, fuel blending, fuel acceptance and fuel statistic, and holds the aim that to automatically supervise, control and manage the consumption of energy and also provide the support and conduction to the managers. [C707]

"Research on the model and method for energy-saving generation dispatching"

Energy-saving generation dispatching can effectively reduce the energy consumption and harmful gas emission, which is of significant social benefits, helps to further clean energy resources development and promote the sustainable development of power system and the whole society. Therefore, it is of theoretical and practical significance. The establishment of a suit of effective models and algorithms for energy-saving generation dispatching is the core to ensure its effective implementation. This paper first expatiates that the implementation of energy-saving generation dispatching is of great significance for the promotion of clean energy resources and the achievement of energy saving and environmental protection goals. Then, after an in-depth study on the theory and practice of the energy-saving generation dispatching, the article analyzes the short-term and long-term feasible development models. That is, the article establishes a short-term mathematical model according to the energy consumption to dispatch, which is designed directly to reduce the system energy consumption as a major objective. Furthermore, from the foreseeable power industry institution in China and the development of energy and environment protection policies, economic optimization mode may be needed to be used in the energy-saving generation dispatching. Therefore, this article establishes a mathematical dispatching model according to energy price in the premise of the implement of related two-part electricity price. The energy price in this model takes various objectives and constraints into consideration such as energy-saving, environmental protection and economy. Afterwards, for the above-mentioned two types of models, this paper proposes a method combined with heuristic dynamic programming and linear programming for the generation output solution of day-ahead generation scheduling. Finally, numerical simulation results in a practical power system demonstrate the correctness and validity of- the proposed model and method. [C708]

"A multi-channel, area-efficient, audio sampling rate interpolator"

The area and power consumption of sampled rate converter are governed largely by associated digital interpolation filters. This paper presents a novel multi-channel, area-efficient audio sampling rate interpolator, whose conversion ratio is 1:2 and 1:4. Several architectural and implementation features reduces the complexity of the filter and allow its realization in a die area of 0.032 mm2in 0.18 Г,Вїm technology, meanwhile timing multiplexer scheme reduces clock frequency to minimum. Experiments show proposed methods could not only saved hardware resources but also reduce power consumption, so it is very suitable for consumer electronics. [C709]

"Minimizing Power Consumption with Performance Efficiency Constraint in Web Server Clusters"

Energy efficiency has become a very important issue to reduce the consumption of resources on the Earth. We have to consider how to save the energy consumption anywhere and anytime, including a large set of servers, for example, servers in the Google company. Hence, power and energy consumption has recently become key concerns, especially huge number of servers are deployed in large cluster configurations as in data centers and Web hosting facilities. Even though we emphasize power saving as much as possible, the performance of servers should be ensured. So far, there have been some discussions about enhancing power conservation. However, with the best of our knowledge, a mathematical model about consumed power and server's performance has not been discussed. Therefore, in this paper, we attempted to minimize the energy consumption with performance constraint of web servers. We know, the response time is the focus of the performance in web servers. Therefore, we first find the trade off value of load for each server based on optimized methods. With the trade off load, the performance of users can be satisfied at the same time the power consumption is minimized. Then, using the trade off load value, we propose a novel load allocation method and then discuss the effectiveness of our load allocation method by comparing with other two methods: random load allocation method and average load allocation method. [C710]

"Investigation of the impacts of energy-saving dispatching on generation companies"

The employment of energy-saving dispatching could reduce energy consumption and pollution emissions. The State Development and Reform Commission of China issued the policy of energy-saving generation dispatching, and it is expected that this dispatching scheme will be implemented in China soon. In this dispatching scheme, the ranking of generation dispatching will be based on the energy consumption and pollutant emission levels of different kinds of generation units, representing a significant change from the current dispatching practice in which each generation unit is allocated almost average utilization hours. Hence, the qualitative analysis of the impacts of this new dispatching scheme on the economical benefit of generation companies is a very important issue of extensive concern by itself. In this work, an effort is made to investigate the comprehensive impacts of the energy-saving dispatching scheme on generation companies. Simulations based on a sample example are employed for demonstration. Finally, some important problems to be studied are addressed from the viewpoint of generation companies. [C711]

"Confounded factor effects on battery life in wireless sensor networks"

Widely utilized for numerous applications, wireless sensor networks have become a boon to the academia and industrial communities. However, the stringent energy constraints place a hurdle to the continuous functioning of the sensing devices. Clustering a network leads to a lesser number of nodes participating in active transmissions. Data aggregation reduces redundant packet sending. Given that transmission is the primary energy consuming activity for a sensor mote, this paper exploits the joint advantages of clustering and data aggregation in decreasing communication cost. A data centric analysis was performed to justify the use of data aggregation. Experimental results on a realistic platform with MICAz motes running TinyOS embedded system showed 22% energy savings and 13% overhead reduction, confirming the attractive advantages of data aggregation and clustering such as more efficient transmissions. [C712]

"A study on energy storage system for Gold Line of LA Metro"

The ESS creates optimum conditions for energy regeneration in urban transit system. The ESS is able to store and discharge energy extremely quickly, consequently enabling a complete exchange of energy between vehicles, even if they are not braking and accelerating at precisely the same time, as is most frequently the case in everyday service. The ESS reduces primary energy consumption without affecting transport capacity and punctuality. The ESS is considered to be one of the useful devices for energy storing and recycling. This paper presents effects of energy saving and voltage stabilization by applying the energy storage system to Gold Line of LA Metro. The result indicates effect of the ESS. Application of the ESS and efficient use of regenerating energy cut CO2emissions and affects environmental preservation. [C713]

"Analysis of Energy Demand of Building Envelope Modification Schemes in Hot-Humid Areas"

Since the Kyoto Protocol signed in December 1997, the majority of governments around the world have committed themselves to reducing the emission of the greenhouse gases. Thus, efficient use of energy and sustainability has become a key issue for the most energy policies. It is known that cooling energy demand of a building can play an important part in building total energy consumption. In addition, most cooling energy has been lost from building envelope. In hot-humid climate, heat insulation becomes a more important issue for its heat storage capacity of the envelope energy efficiency of the building. In this paper, building envelope modification schemes and the energy consumption simulation on a typical building model are constructed to show the importance of thermal mass in hot-humid areas, using TRNSYS, an energy consumption-simulation software. Eleven cases are examined throughout the simulation process and the basic condition of the building and ten other cases of energy efficient envelope design are studied. The results show that the energy saving effect of thermal insulation of walls is not remarkable in Hot Summer, Warm Winter Region; however, energy efficient window design seems the most effective method by improving the window material and shading devices so as to prevent the heat transfer from outdoor to indoor. The energy saving rate of window is up to 33.89%. [C714]

"Analysis of energy savings using smart metering system and IHD (in-home display)"

Many electric power suppliers are suffering from huge losses due to higher cost related to generation of resources, especially fossil fuel. Many ideas have been proposed to renovate the price distortion in the electricity market. Among these ideas, smart metering system has been considered as an effective method for improving the pattern in power consumption of energy consumers thus reducing the financial burden of electricity companies. In this paper, we reviewed smart metering system of other countries and explained our development of smart metering system specialized for Korean residential environments. With this developed system, we have conducted a pilot demonstration for 2 months in the winter season Dec. 2008 to Feb. 2009. 77 various sized households in two different cities volunteered to participate in this demonstration. During this demonstration, our study focused on verifying the effectiveness of IHD (In-Home Display) which is an essential component of Korean smart metering system. The result of this demonstration is also included in this paper. [C715]

"An energy-recycling (ER) technique for reducing power consumption of field color sequential (FCS) RGB LEDs backlight module"

A single driving module with field color sequential (FCS) LCD technology needs to dynamically switch output voltage between 40 V for 12 series G- and B- color LEDs and 26 V for 12 series R-color LEDs at related time cluster. Thus, an energy-recycling (ER) technology is proposed to accelerate voltage settling and save compressed energy when the driving voltage is pressed from 40 V to 26 V. Only one recycling capacitor and one Schottky diode are added into the power structure of synchronous boost converter for composing the proposed ER technology. A proposed energy-recycling mode (ERM) controller is plugged into a boundary current mode (BCM) controller to control energy delivering and recycling. The proposed ER technology was fabricated by TSMC 0.25 Г,Вїm 2.5/5 V BCD process. Experimental results demonstrate fast and efficient tracking performance of driving voltage is achieved. [C716]

"Low cost test point insertion without using extra registers for high performance design"

This paper presents a new approach to improve random test coverage during physical synthesis for high performance design. This new approach performs test point insertion (TPI) to improve testability of random resistant nets. Conventional test point insertion approaches add extra registers either as control points or observation points to improve controllability or observability. However, adding extra registers has many disadvantages in high performance design. It might degrade the design performance in term of power and timing. It might also end up with even worse testability. The new approach does not add any registers; instead it only uses existing signals as test points. The test points are selected from logic paths with the most timing slack and physical placement proximity. This saves silicon area, reduces power consumption, and minimizes the design changes. The new approach also automates the test insertion process by integrating it in the physical synthesis flow. The integration helps reduce design closure turn around time significantly. Production results show nearly zero performance degradation from this approach and better testability improvement as compared to a manual test point insertion approach. Furthermore, this paper proposes a novel idea of exploiting unreachable states for test point insertion. Preliminary results on this idea are also given. [C717]

"Neighborhood aware power saving mechanisms for ad hoc networks"

Due to their mobility, stations in ad hoc networks are equipped with autonomous batteries providing limited resources of energy. Thus power conservation proves to be a paramount factor to increase the network lifespan.

A closer look at the mechanism of IEEE 802.11 PSM and all its numerous derivative proposals enables us to see some room for further improvements especially for large and dense cluster based networks. This paper presents an optimization of the functional properties of PSM to improve its energy conservation without changing or requiring additional control or management frames, yet it contributes to the betterment of all PSM derivatives especially for those based on a dynamic announcement window such as the Dynamic Carrier Sense DCS-PSM. PSM specifies that a station must announce its traffic before. The announcement traffic puts a heavy constraint on the size of both the ATIM period and the beacon interval and consequently on throughput, end to end delay and power saving. The proposed Neighborhood Aware Power Saving Mechanisms (NA-PSM and NTA-PSM) aim at reducing the number of exchanged announcement frames in order to increase the throughput and decrease both power consumption and delay. Simulation results testified to the superiority of NTA-PSM over PSM and the Dynamic Carrier Sense PSM (DCS-PSM) in ensuring greater power saving, higher throughput and lower delay. [C718]

"Energy saving active cooling systems for outdoor cabinet"

Currently the energy-saving strategy is one of the top priorities of Telecom Operators and Governments. In particular, the area of cooling has heavy impact on the total electrical energy consumption, and needs to be optimized to improve overall performances, reducing both CAPEX/OPEX and the environmental impact. In this paper, two innovative cooling solutions for outdoor cabinets are described: free cooling system and manhole cooling system. Free cooling system is a solution directly using external fresh air in order to increase the cooling efficiency of active outdoor cabinet. Three key technologies are developed and used in this system: experimental results indicate that excellent heat dissipation capacity and good corrosion resistance of outdoor cabinet are achieved simultaneously. Manhole cooling system is another innovative solution, in which manhole (part of the underground maintenance infrastructure of TLC operator) is innovatively used as a huge heat sink. The cooling performance of manhole cooling system is predicted through CFD simulations. It has been demonstrated that as much as 60% of the heat load can be dissipated into the ground, still maintaining the equipment well within its operating temperature range. The proposed cooling solutions are particularly interesting for the FTTCab architecture. FTTCab deployment, as foreseen in several NGN strategies, will strongly increase in the next years. [C719]

"Aisle-capping method for airflow design in data centers"

This report describes cold aisle capping and hot aisle capping methods, one of the airflow design techniques for data centers and telecommunications equipment rooms where high heat density equipments are installed in racks. In both cold and hot aisle capping, the aisles are enclosed by sidewalls at the end of the aisle and by a ceiling over the aisle. These are expected to provide effects of improving hot spots, which are caused by the exhaust air flowing into the cold aisle, and to provide an energy-saving effect by reducing the energy loss, which is caused by mixing of the supply air and the exhaust air of the IT equipment. This report presents the results of an experiment on the effects of improving the hot spots, energy-saving, and temperature-rise suppression during air-conditioner shutdown in the case that each method is applied. A practical example of installing the cold aisle capping in an existing equipment room is also described. [C720]

"The Green revolution in DC power systems"

The benefits of higher efficiency are clearly evident, both in reducing energy costs and increasing load capacity when limited by thermal constraints. There is also the impact on the global environment and reduction in growth rate of energy. HE technologies, if broadly adopted could have a substantial impact. If was assume that the average savings to a carrier is 5% across their network and that their network averages 60% of their energy consumption, that carrier would save 3% of their power consumption by adopting HE technologies. For a carrier spending $1B per year on electricity that would save over $30M (at $0.10 per kWh). The global savings are even more impressive. With global energy usage by the telecom industry at over 160 Billion kWh each year, a 3% reduction would save nearly 5 Billion kWh of electricity each year and reduce greenhouse gas emissions by nearly 4 Million tons. With a global electrical cost averaging over $0.15 per kWh this results in an annual operating expense savings of over $700 Million. A significant impact on both economic performance and environmental impact. One of the unusual aspects of HE technologies is that there is such a strong link between economic and environmental benefits, one of the missing elements in most 'green' technologies. Rather than make economic justification for the additional investment, the carriers can now make a decision which is mutually attractive. For new deployments this is an easy decision. HE technologies offer rapid payback of investment and substantial savings over the life of the network. For existing systems there is also a choice that has a rapid payback and will mitigate performance issues while providing lasting economic benefit.We believe that HE technologies are the beginning of a new thought process for the telecom industry: Leveraging the DC Power System for environmental and economic benefit. [C721]

"Real-time performance analysis of Adaptive Link Rate"

High speed links are widely deployed in modern day computer networks to meet the ever growing needs for increasing data bandwidth. However, with the increase in the link rate, the power consumption of the network interfaces increases exponentially, compounding growing concerns about network power consumption. Fortunately, network traffic characteristics show that rapid link rates are not always required. During times of reduced network traffic, the adaptive link rate (ALR) mechanism allows link rates to be reduced with little impact on network performance. Current research has focused on policies to control when and how to change link rates, and have shown promising energy savings. However, these works have been largely simulative, and have not addressed many of the challenges involved in implementation. In this paper, we develop a hardware prototype ALR system and address real-time challenges involved in realizing such an implementation. We also identify new considerations for control policy development given current technology capabilities as well as future projections. [C722]

"Energy logic: A road map to reducing energy consumption in telecom munications networks"

A non consideration just a couple of years ago, energy efficiency is quickly becoming the most important issue in every industry today. In the Datacom world, vendors are tackling this question from a holistic perspective, clearly showing that the consumption in data centers can be reduced by more than half. In the Telecom world however, most vendors have limited the discussion to the energy efficiency of their individual products. As such, the total impact of deploying higher efficiency rectifiers or cooling units remains quite small on a total site level. This clearly can blindside service provider employees into over looking the real opportunities and into investing poorly. For this reason, Emerson Network Power has launched Energy LogicTM, a holistic approach which looks at Data Centers and Telecom sites and provides a complete roadmap of recommendations and quantifies their savings. This provides complete awareness of the energy savings opportunities and helps take steps in the right sequence and full understanding of the real savings potential. [C723]

"Cooling system of outdoor cabinet using underground heat pipe"

Currently the energy-saving strategy is one of the top priorities of Telecom Operators and Governments. In particular, the area of cooling has a heavy impact on the total electrical energy consumption, and needs to be optimized in order to increase overall performances, reducing both CAPEX/OPEX and the environmental impact. The present paper describes a new cooling solution for FTTC outdoor cabinets (where a significantly high amount of heat needs to be dissipated). This solution is based on geothermal cooling technique, that takes advantage of the ground heat (in this case ldquocoldrdquo) source, which is always available and has an enormous potential. The geothermal cooling unit has been used in conjunction with forced air circulation within a sealed cabinet. The cabinet prototype is designed with an independent and integrated ventilation system which ensures that the thermal load generated within the cabinet itself is dissipated into soil and atmosphere. The aluminum-ammonia heat pipe technology is applied to this geotherm cooling unit. Experimental tests were carried out in real outfield. The cabinet was submitted to solar radiation and real ambient conditions. To carry out the analysis, a data acquisition system was set in the testing environment during a period of more than 3 months, over 40 measurement points were set to monitor temperatures, operating parameters and working loads. The experimental results show that, for a prototype cabinet with 700 W heat load, this innovative solution cool the cabinet with COP value at about 110 for normal ambient condition of 30degC, which is comparatively higher than traditional air heat-exchanger solution (normally at 10-15). Moreover, the acoustic noise level is seriously reduced. The air flows through an independent underground ventilation system, and the air's temperature within the sealed cabinet can be reduced of about 5degC. The test data show that more than half of total consumption is dissipated into underground--soil. Then, on a long-run perspective, the feasibility and the effectiveness of the described solution allow deep reduction of operational costs, with positive environmental impacts. [C724]

"Noise filtering for tilt compensated compass"

Presented in this paper is an noise filtering solution for a tilt compensated compass. The aim of the solution is to minimize the power consumption of filtering while still providing required characteristics. As the tilt compensation is achieved whit the CORDIC-core, it is feasible to use it to perform the filtering. By analyzing the effects of the filter coefficientspsila accuracy to the tilt compensated heading angle significant saving in power consumption can be achieved. Active power consumption of the filters in the system is reduced by 90% while retaining the accuracy of the compensated heading angle. [C725]

"EXCES: External caching in energy saving storage systems"

Power consumption within the disk-based storage subsystem forms a substantial portion of the overall energy footprint in commodity systems. Researchers have proposed external caching on a persistent, low-power storage device, which we term external caching device (ECD), to minimize disk activity and conserve energy. While recent simulation-based studies have argued in favor of this approach, the lack of an actual system implementation has precluded answering several key questions about external caching systems. We present the design and implementation of EXCES, an external caching system that employs prefetching, caching, and buffering of disk data for reducing disk activity. EXCES addresses important questions related to external caching, including the estimation of future data popularity, I/O indirection, continuous reconfiguration of the ECD contents, and data consistency. We evaluated EXCES with both micro- and macro-benchmarks that address idle, I/O intensive, and real-world workloads. Overall system energy savings was found to lie in the modest 2-14% range, depending on the workload, in somewhat of a contrast to the higher values predicted by earlier studies. Furthermore, while the CPU and memory overheads of EXCES were well within acceptable limits, we found that flash-based external caching can substantially degrade I/O performance. We believe that external caching systems hold promise. Further improvements in ECD technology, both in terms of their power consumption and performance characteristics can help realize the full potential of such systems. [C726]

"Generic 3-D Routing Protocols in Sensing-Covering Regions"

In recent years, sensor networks have been proposed to improve the detection level of natural disasters (e.g. volcanoes, tornadoes, tsunamis). However, this technology has several issues that need to be improved. We, therefore in this paper, focus on two main issues: coverage and routing. For coverage problem, we introduce a new approach for obtaining a static covered network in 3-D environment. This technique is referred to as the chipset coverage model. This would be accomplished by using a small number of sensor nodes in order to save up some energy. For routing issue, we propose several new position-based routing protocols which are the 3-D sensing spheres close to the line routing algorithm (3-D SSL), the 3-D smallest angle to the line routing algorithm (3-D SAL), and the 3-D SSL:SAL routing protocols. We show that the 3-D SAL and the 3-D SSL:SAL routing protocols guarantee the delivery of packets. In our simulation, we show that the 3-D SSL:SAL protocol has similar performance in terms of network (hop) dilation and routing delay to these for an existing 3-D progress-based routing protocol. Moreover, the 3-D SSL:SAL and the 3-D SAL routing protocols outperform an existing 3-D progress-based routing protocol in terms of Euclidean dilation. Thus, the new protocols reduce the energy consumption of the nodes and, therefore, prolong the life of the network. [C727]

"Neural cache: A low-power online digital spike-sorting architecture"

Transmitting large amounts of data sensed by multi-electrode array devices is widely considered to be a challenging problem in designing implantable neural recording systems. Spike sorting is an important step to reducing the data bandwidth before wireless data transmission. The feasibility of spike sorting algorithms in scaled CMOS technologies, which typically operate on low frequency neural spikes, is determined largely by its power consumption, a dominant portion of which is leakage power. Our goal is to explore energy saving architectures for online spike sorting without sacrificing performance. In the face of non-stationary neural data, training is not always a feasible option. We present a low-power architecture for real-time online spike sorting that does not require any training period and has the capability to quickly respond to the changing spike shapes. [C728]

"Reduction of sensor population in a camera sensor network"

The problem of surveillance for intrusion detection in a camera sensor network is addressed in this paper. In order to save limited resources, a sensing task should involve just the right number of sensors. For a wide enough coverage area random and uniform distribution can be applied. We propose a novel method which allows reduction of number of sensors and guarantees a desired surveillance against aerial intrusion. Enhancement of the method is also offered to further reduce the number of sensors and improve the performance. [C729]

"Enhanced Performance for Electrostatic Precipitators by Means of Conventional and Fuzzy Logic Control"

Modern high voltage power supplies based on fast switching devices like IGBTs offer the performance to adjust voltage and current regarding the process conditions. Optimum performance can be achieved if the control makes use of the enhanced properties of the power supply. In critical precipitation processes the control needs to be high dynamical and accurate. Furthermore, with IGBT inverter type high voltage power supplies it is possible to increase the electrical power significantly, in many applications a factor 2 can be achieved, which leads to a significant improvement of the dedusting. Unfortunately, then the energy consumption of the

precipitator increases leading to a higher amount of electricity to be generated in the power station and finally this results in higher CO2emissions of the power station. With central and decentralized control algorithms the total energy consumption of an electrostatic precipitator can be significantly reduced by continuous adaption of the control to the process conditions. Retrieving measured data from inside an electrostatic precipitator is always difficult and unreliable due to the high temperatures, dust and high voltage. Therefore, a rule based control system has been developed which can operate with a few input signals only. Mainly the measured values of voltage and current are sufficient for the control system and additional for energy savings the stack emission signal is required. [C730]

"Digital control power-The key to intelligent energy efficiency"

The rising demand for energy in all forms and the recent series of dramatic increases in energy prices have made it evident that energy must be used more efficiently. Today we are in a position where technologies for realizing substantial energy savings already exist. Unfortunately, these technologies have not yet been used up to their full potential, although a number of voluntary standards and labels in the field of energy efficiency have been suggested and introduced. To reach these goals new highly efficient power electronic technologies are needed as enabling factor to reduce todaypsilas massive waste of energy while keeping the conveniences of technical progress. The significant potential for saving energy through the use of power electronics will be highlighted in this paper. [C731]

"Magnet: A novel scheduling policy for power reduction in cluster with virtual machines"

The concept of green computing has attracted much attention recently in cluster computing. However, previous local approaches focused on saving the energy cost of the components in a single workstation without a global vision on the whole cluster, so it achieved undesirable power reduction effect. Other cluster-wide energy saving techniques could only be applied to homogeneous workstations and specific applications. This paper describes the design and implementation of a novel approach that uses live migration of virtual machines to transfer load among the nodes on a multilayer ring-based overlay. This scheme can reduce the power consumption greatly by regarding all the cluster nodes as a whole. Plus, it can be applied to both the homogeneous and heterogeneous servers. Experimental measurements show that the new method can reduce the power consumption by 74.8% over base at most with certain adjustably acceptable overhead. The effectiveness and performance insights are also analytically verified. [C732]

"Data quality driven sensor reporting"

Within the field of event driven data reporting from wireless sensor networks, reducing energy consumption is an ongoing problem. Using an applicationpsilas tolerance toward data imprecision (or, data quality) allows energy savings, via fewer messages sent, through the selection of how and when to send sensor readings. This paper is an early work that examines pushing or pulling data depending on which approach is expected to send fewer messages, based upon the recent history of application requests for a sensor and the changes of the sensor values predicted by application specific models. The simulation results indicate that our method is more efficient relative to the push only or pull only methods for situations where application request frequency or data change rate is variable or unknown. [C733]

"Node synchronization for minimizing delay and energy consumption in low-power-listening MAC protocols"

Low-power-listening MAC protocols were designed to reduce idle listening, a major source of energy consumption in energy starved wireless sensor networks. Low-power-listening is a MAC strategy that allows nodes to sleep for tis (the ldquointer-listeningrdquo time) when there is no activity concerning them. It follows that a node has to occupy the medium for at least tis to guarantee that its destination will probe the channel at some point during the transmission. Low-power-listening protocols have evolved with the introduction of new radios, and the most recent contributions propose to interrupt communication between the sender and the receiver after the data packet has been successfully received and acknowledged. This results in significant energy savings because a sending node does not need to send for full tiperiods. We propose a new and simple approach to synchronize nodes on a slowly changing routing tree so that energy consumption is further reduced at the sending node, and the delay is considerably less. Our method allows the nodes to use a lower duty cycle, at no cost of overhead in most cases. Simulation and implementation results show that energy consumption can be reduced by a significant factor (dependant on ti) and delay by at least 18%. [C734]

"GPEB: Power-efficient geographic broadcasting in sensor networks"

Nodes in a sensor network, operating on power limited batteries, must save power to minimize the need for

battery replacement. In this paper, we study the power efficiency issues related to geographic broadcast protocols in wireless sensor networks. Specifically, we study the problems in existing flooding based and pruning based broadcast algorithm and propose a new geographic power efficient broadcast algorithm to reduce the overlaps of broadcast coverage area and thus the total power consumption. The proposed algorithm is a hybrid protocol that combines broadcasts of maximum transmission radio range and forwards of much smaller transmission radio range. Through simulation, we show that the GPEB protocol proposed in this paper can save total power consumption up to 23% compared to existing geographic broadcast protocols. [C735]

"Integrating Clock Gating and Power Gating for Combined Dynamic and Leakage Power Optimization in Digital CMOS Circuits"

Clock gating and power gating are two of the most effective techniques that are applied today for reducing dynamic and leakage power, respectively, in digital CMOS circuits. The combined use of the two solutions, however, poses some challenges in terms of practical integration of the required control logic and the power/timing overhead associated to it. This paper presents an analysis methodology and a prototype CAD tool that support the designer in understanding when the joint application of clock gating and power gating may result in significant power savings. [C736]

"Energy Efficient Register File Window Access in SPARC Architecture"

As power dissipation of the register file in modern processor designs tends to dominate, measures must be taken to keep it under control. This paper introduces an approach for reducing the SPARC windowed register file power based on the operation of the Register File Inspector added in the decode stage of the pipeline. The power savings show that, when the size of the Register File Inspector is properly fixed, the average saving on the energy consumption of the windowed register file could be up to 74% compared with the traditional register file control scheme. [C737]

"Residential Electricity Consumption and Housing Development in Taiwan"

This research examines the possibility of managing housing development policy in terms of reducing residential electricity consumption by using monthly time series model. It is proposed that rural housing development may help reducing electricity consumption due to urban heat island effects. Using a monthly dynamic residential electricity consumption model, tests are performed to examine possible rural housing development policy in Taiwan. Empirically, rural housing proves to be influential to reduced residential electricity consumption. The estimated results conclude that rural housing instead of further urbanization should be promoted in Taiwan for effective reduction of residential electricity consumption. Green housing is also important to remodel or rebuild urban houses. [C738]

"Cointegration Relationship between Electricity Intensity and Power Price in China"

This paper analyzes the main factors impacting electricity intensity (namely power consumption per unit GDP) in China first, which include power price, gross domestic product and the proportion of industry in whole economy. Then the relationships between power price and electricity intensity was studied based on Granger-causality and cointegration tests. The result indicates that there exists Granger causality relationship running from power price to electricity intensity, so does the Granger causality relationship between the proportion of industry in whole economy and electricity intensity which running from the former to the latter . At the same time, it shows us a co-integration relationship between them, since the electricity intensity reduces 3.695% while the power price gets a 1% growth, and electricity intensity increases 18.922% while the proportion of industry in whole economy gets a 1% growth, which indicates that the proportion of industry in whole economy has a greater effect on electricity intensity. In order to reduce the level of electricity intensity, save energy, optimize energy efficiency and promote sustainable economic development, China should raise power price properly, what's more important is to adjust the industrial structure, reducing the proportion of high-power-consuming industries. [C739]

"An Energy-Saving Routing Protocol for Wireless Sensor Networks"

Wireless sensor networks consist of large number of sensor nodes which have a constraint energy capacity, so energy-efficient mechanism is important. Specially, sending packets from the source node to the destination node is the more majority part than merely sensing some events. Thus, energy-saving routing protocol in wireless sensor networks is necessary for increasing the network lifetime. Less energy consumption can be achieved by reducing the node transmission radius. In this paper, we present a transmission radius self-adjust energy-saving routing protocol (RSES) for wireless sensor networks. Using RSES, node reduces its max transmission radius only to reach the farthest neighbor before it sends the first packet. The on-demand route discovery process is

initiated whenever a source sensor node needs to communicate with another node for which it has no routing information in its route table, and energy-saving strategy has been designed for the route discovery. When remnant energy reaches a certain threshold, node reduces its transmission radius again in order to achieve less energy consumption under the premise of the certain coverage ratio. Simulation results demonstrate that RSES can prolong the network lifetime and has a balanced network load and routing traffic. [C740]

"A Variable Packet Length Adaptive MAC Protocol for Wireless Sensor Networks"

In this paper, we propose a variable packet length adaptive MAC Protocol (VPLA-MAC) for wireless sensor networks. VPLA-MAC is designed for clustering hierarchy networks based on the routing information collected from sensor nodes. A sensor node in cluster sends packet length and routing information to cluster head node, this cluster head node calculates the cycle length and selects nodes for data transmission, then information are broadcast via a sync packet. Thus, the nodes in the cluster can formulate cycle length based on packet length, while the unrelated nodes can go to sleep to save energy. The simulation results based on NS-2 show the efficiency of our proposed protocol, The energy consumption and latency are all reduced well. [C741]

"Joint Optimization of Node Cooperation and Energy Saving in Wireless Sensor Networks with Multiple Access Channel Setting"

Two critical issues in wireless sensor networks are cooperation of nodes and the limited availability of energy within network nodes. A widely employed energy-saving technique is to place nodes in sleep mode, corresponding to low-power consumption as well as to reduced operational capabilities. This causes a node may try to maximize the benefits it gets from the network without participating to its services (e.g. without forwarding packets of other nodes). To conquer with this problem, node cooperation schemes have been investigated in the literature. Therefore, it is crucial to find the optimal trade-off between the amount of cooperation and the amount of energy saving. In this work, we develop an analytical model of a sensor network which not only stimulates nodes to cooperation but also tries to satisfy energy consumption. In our scheme, nodes may enter a sleep mode while active nodes in a relay zone (Vakil and Liang, 2006) are allowed to cooperate with the source. We use this model to investigate the system performance in terms of node cooperation, energy consumption, and network capacity. Furthermore, the proposed model enables us to investigate the trade-off existing between these performance metrics. Numerical results show that the proposed scheme is successful in increasing node cooperation while energy consumption is satisfied. [C742]

"China economic mode transition research in two-oriented society construction"

At current, China's economy is showing the distinct resource consuming-oriented features: great resources consumption, low resources utilization rate and low unit output with the far behind industrial technology and unreasonable industrial structure. Therefore, resource saving and resource utilization improving is imminent. Wuhan "8+1" City Circle "Comprehensive Reform Zone" is the reformation experimental zone guided in energy-saving and consumption reducing with the centre of developing the Recycling Economy, which through constructing Two-oriented Society to constantly improve the sustainable development competence. The City Circle ecological construction and Environmental Protection Integration Planning have well embodied this core. This paper analyzed Wuhan City Circle "Comprehensive Reform Zone" to embody the China Resource-oriented Economic Development Mode Transition. [C743]

"Selective cooperation based on overall power minimization in wireless networks"

In this paper, we propose a selective cooperative scheme based on overall power minimization in wireless networks. While cooperation can potentially improve communication quality, this improvement often comes at a price in terms of extra power consumption for protocol overhead and the relaying device running. As such, we contend that it is worthwhile to consider a scheme that satisfies an overall symbol error rate (SER) constraint such that cooperation is only invoked to save power when necessary. We study that issue by looking at the overall power consumptions of cooperative and non-cooperative schemes in a 3-node model. Optimal power allocation strategies under an overall SER constraint are derived for both non-cooperative scheme and DF cooperative scheme. Taking into account overhead power, the scheme with minimum overall consumed power is adopted for a source-destination pair. When cooperative scheme is used, the potential relay leading to minimum overall power is also selected as the best relay. To reduce the complexity of the selective scheme, three geographical parameters, which are used to make decisions in proposed selective scheme, are evaluated. Numerical results show that the selective cooperative scheme is more power-efficient than both non-cooperative scheme and conventional cooperative scheme. [C744]

"A Distributed Index Based Multi-Resolution Data Storage Architecture in Wireless Sensor

Networks"

We propose a distributed index based multi-resolution storage architecture (DIMSA) for data storage and retrieval at multiple levels of detail in wireless sensor networks. The proposed scheme could automatically retrieve subsets of the data in correspondence to the user defined level of detail to save energy. In addition, DIMSA deploys attribute allocation scheme to further reduce energy consumption in the condition that some attributes are included in many events. In this condition, traditional data-centric storage schemes consumes more energy because the values for these attributes have to be replicated and stored at different places in the network for each individual event. A distributed index scheme is also proposed to avoid query flooding and extra data transmission. Analysis and simulations are conducted to evaluate the performance of the proposed scheme. The results show that DIMSA outperforms the traditional data-centric storage scheme like GHT. [C745]

"Scheduling based on time-sensitivity for wireless sensor network"

A key factor affecting the lifetime of wireless sensor networks(WSN) is its limited energy. Firstly, ratio of energy cost of different parts of a sensor node and time-dependent difference of data gathered is presented. Then, in order to prolong the lifetime of WSN under the limited energy, time-sensitivity of sensor is defined, sensors are classified based on it, scheduling for data gathering with time-sensitivity is presented and the ratio of energy saving is analyzed theoretically. Finally, the scheduling for data gathering based on time-sensitivity is implemented on Micaz platform, experimental data is gathered by simulation and measurement. The result illuminates that the scheduling based on time-sensitivity can reduce energy consumption by reducing data quantity transmitted, and it is more observable as the time-sensitivity become lower. [C746]

"Target Tracking Based on Connected Dominating Set in WSN"

Target tracking application in WSN should solve the problem of target status sharing well. To overcome the shortages of DCTC and cluster-based method, method using connected dominating set based aggregation tree is introduced. According to whether node has the capability of locating, target status information can be shared in aggregation tree by broadcast or unicast. Because of the structure stability of aggregation tree, target can be continuously monitored while it shift between different coverage area of sensors. The target status reaches base station after step by step data fusion in the aggregation tree, which will greatly reduce redundant packets to save node energy. [C747]

"Intelligent control of thermal comfort in automobile"

Saving consumable energy and maintaining the thermal comfort level are two main topics in heating, ventilating and air conditioning (HVAC) control field. A controller with temperature feedback can not best achieve these goals. Fangerpsilas ldquopredicted mean voterdquo (PMV) index is commonly used to better describe comfort. Therefore, this paper proposes a simpler form of PMV index for using as fuzzy controller feedback. A fuzzy controller with PMV feedback is first designed for automobile climate control. Next, the membership functions of the fuzzy controller are optimized by genetic algorithm. Finally, robustness analysis is performed to indicate the robustness of optimized controller to variable variation. Results show that the proposed controller not only better controls the thermal comfort but it also reduces energy consumption. [C748]

"A 2.64GHz wide range low power DLL-based frequency multiplier with CML circuits using adaptive body bias"

A wide-range, low-power delay-locked loop based (DLL-based) frequency multiplier with the PMOS active load and adaptive body biasing (ABB) circuit is proposed. Adding the PMOS active load in the delay cells has the inductive-peaking effect to increase the operation frequency range. With the clocked-power ABB current mode logic (CML) exclusive-OR (XOR) circuit, the frequency multiplier can achieve power saving to 54.9% compared with convention CML XOR circuits. This is achieved by reducing the supply voltage to 1 V and dc-level of the differential inputs, while maintaining the original swing of differential outputs. The frequency multiplier can generate N times of frequency of the input clock when the number of delay cells (N) in the voltage control delay line (VCDL) is even. The proposed DLL-based frequency multiplier can operate from 80 MHz to 2.64 GHz using 0.18 mum CMOS process. The measured peak-to-peak jitters of the DLL core are 30.56 ps at 330 MHz and 70 ps at 80 MHz. The power consumption and jitter of the proposed frequency multiplier at 2.64 GHz are 27.79 mW and 23.5 ps, respectively. [C749]

"A New Array Fabric for Coarse-Grained Reconfigurable Architecture"

Coarse-grained reconfigurable architectures (CGRA) employ square or rectangular arrays composed of many computational resources for high performance. Though these array fabrics are mostly suitable for embedded

systems including multimedia applications, they occupy large area and consume much power. Therefore, reducing area and power of CGRA is necessary for the reconfigurable architectures to be used as a competitive IP core in embedded systems. In this paper, we propose a new array fabric for designing CGRA to reduce area and power consumption without any performance degradation. This cost-effective approach is able to reduce the array size through efficient arrangement of array components and their inter-connections. Experimental results show that for multimedia applications, the proposed array fabric reduces area up to 40.32% and saves power by up to 28.35 % when compared with the existing CGRA architecture. [C750]

"Reducing Leakage through Filter Cache"

We evaluate the leakage reduction for both instruction and data cache in presence of drowsy or decay techniques. We discovered that a filter cache,traditionally used for reducing active power, can help reduce also leakage. The key idea is to reduce the lifetime of the lines that are in high-power state inside a leakage-saving cache. Power consumption has become one of the main concerns for designers, together with the performance. Caches account for the largest fraction of on-chip transistors in most modern processors. Therefore, they are a primary candidate for attacking the problem of the leakage. In average with the proposed solution, for instruction cache 24% improvement in leakage savings and 1.5% in IPC (Instruction Per Cycle) can be achieved with respect to drowsy cache. For data caches, 5% and 5.4% improvement can be achieved respectively. Experiments have been performed also with decay cache showing fewer benefits. [C751]

"Exploiting Internal Operation Patterns during the High-Level Synthesis of Time-Constrained Circuits"

Conventional high-level synthesis algorithms treat specification operations as atomic elements that are executed in one or several consecutive cycles and over one functional unit. However, in most specifications there exist different operations, in function of their type, representation, and width that handled at different decomposition levels may produce better designs. In this way, most arithmetic operations can be decomposed into smaller operations applying several arithmetical properties. Different decompositions can be performed, in function of the pursued objective: performance improvement, area reduction, or power consumption reduction. In this paper we propose a pattern-based design methodology able to treat every operation at its most appropriate decomposition level. It produces reduced datapaths while meeting the specified time constraints. In comparison to conventional algorithms the amount of area saved averages 40%. [C752]

"CCSL: A Connected Coverage Strategy Based on Logistic Layers in Wireless Sensor Networks"

This paper mainly studies the problem of connected coverage control in wireless sensor networks and proposes a strategy called CCSL (connected coverage strategy based on logistic layers) based on the relationship of coverage and connectivity. The strategy adopts the logistic layers to solve coverage and connectivity problems independently. By doing this, CCSL can achieve the optimization of both connectivity and coverage. What's more, CCSL uses a "tree cutting" arithmetic to induce the redundancy nodes and save energy. Our research about connected coverage problem includes not only the specific algorithm of CCSL but also a framework of protocol easily extended. Experimental results show that CCSL can reduce the energy consumption by turning off the connectivity redundancy nodes and coverage redundancy nodes, so it prolongs the network lifetime effectively. [C753]

"A Cross-Layer Power Controlled MAC Protocol in Wireless Sensor Networks"

Wireless communication channel and limited communication resource lead MAC protocol to be one of pivotal issue in wireless sensor networks. Focus on energy efficiency and avoidance of packets collision, a power controlled MAC that is named cross-layer power alternative MAC (CLPA-MAC) is proposed. In CLPA-MAC, nodes send packets with tow different transmission power levels instead of one fixed value. A power alternative scenario is discussed to help nodes choose appropriate power level to send packets. For saving energy, avoiding collision and reducing time delay, routing table based transmission mechanism is proposed. This cross-layer mechanism leads nodes to discern the available data and utilize the channel reasonably. Relatively, the frame of RTS/CTS/DATAACK is designed to adapt the power alternative scenario and cross-layer mechanism. With the simulations, the proposed protocol is evaluated in comparison with S-MAC and PCSMAC from transmission power of nodes to time delay. The performance of CLPA-MAC is verified to be efficient and competent. [C754]

"An Adaptive Energy Efficient MAC Protocol for Wireless Ad Hoc Networks"

Several transmit power control MAC protocols have been designed primarily to reduce the energy consumption in wireless ad hoc networks. On the other hand, many adaptive rate MAC protocols have been mainly proposed

to improve the network throughput. In this paper, we proposed a new energy efficient MAC protocol for the distributed coordination function (DCF) IEEE 802.11 b based ad hoc networks which also maximize the overall network throughput. This protocol is known as traffic sensing adaptive rate power (TSRP) control MAC protocol. The basic idea of the TSRP protocol is that, rather than just matching the channel condition, the sender sense outgoing traffic based on the traffic load and the queue condition. Then the MAC layer chooses the energy efficient rate-power combination that is suitable to deliver all the packets comes from upper layer or schedule the transmission of the packets waiting in its queue with minimum delay. Our analytical and simulation results show that, TSRP protocol can provide more energy saving and at the same time can achieve maximum throughput. [C755]

"Feasibility analysis of converting a Chicago Transit Authority (CTA) transit bus to a plug-in hybrid electric vehicle"

It has become apparent that a shift needs to be made in the USA from traditional vehiclespsila dependency on petroleum-based fuels to a more diversified source of fuels. Government, universities, and private sectors have begun to see the importance of fuel efficiency, fuel consumption, environmental factors, and health concerns to the population. The importance of these issues has begun to necessitate the development of PHEVs and other vehicle technologies. This paper will present a detailed economic study investigating the cost savings of transit bus drive train conversions from being traditional styles using only an internal combustion engine to PHEV propulsion systems using a retrofit approach. These conversions are expected to reduce emissions by more than 50% and improve fuel efficiency by more than 100%, and subsequently lead to a substantial cost saving per converted bus. This case study is centered around the Chicago Transit Authority (CTA), however, it is relevant to the transit bus market as a whole. The CTA is the second largest public transportation system in the US, serving over 1.6 million customers each weekday. Its fleet is composed of 2,100 buses, which cover a distance of 68.5 million miles per year and consume 24 million gallons, amounting to a total cost of $61 million each year. [C756]

"A Hybrid Algorithm in IEEE 802.16e Sleep Mode Operation"

In IEEE 802.16e system, mobile station (MS) is usually powered by battery. To save the limited power, IEEE 802.16e standard specifies sleep mode operation for power management. There are two significant performance metrics in sleep mode operation, one is energy consumption, the other is waiting delay. Our research is to shorten energy consumption and waiting delay. In this paper, a hybrid algorithm is proposed to reduce energy consumption and waiting delay. The proposed algorithm decreases the energy consumption and waiting delay efficiently, when data frame from base station (BS) to MS is in low traffic. [C757]

"Research of an energy-aware MAC protocol in Wireless Sensor Network"

Because of the manner of wireless communication channel and limited communication resource, research of MAC protocol is one of challenging issues in Wireless Sensor Network (WSN). S-MAC is a representative MAC protocol for Wireless Sensor Network, but its energy strategy is still not perfect. Focus on energy efficiency, a new S-MAC based protocol that is called Packets Decision MAC (PD-MAC) is proposed. In PD-MAC, data-based RTS/ CTS is designed to bring forth details of data packets to all neighbor nodes. Based on these details, packets decision scenario is proposed to help neighbor nodes selectively abandon the right of packets transmission. So the amount of transmitted packets and probability of collision can be reduced reasonably, and energy consumption on them will be saved. With the simulations, the proposed protocol is evaluated in comparison with S-MAC from energy efficiency to accuracy of packets received by sink The performance of PD-MAC is verified to be efficient and competent. [C758]

"Enhancing Power Saving Mechanisms for Ad Hoc Networks Using Neighborhood Information"

The power saving mechanism (PSM) was proposed by IEEE 802.11 for ad hoc networks in order to help prolong battery longevity for mobile nodes. A closer look at this mechanism enables us to see some room for further improvements of its performance especially for dense networks. According to the PSM, each station must announce its traffic before it can send it. Thus, PSM can require a large announcement period (the ATIM window) when there are many defined traffic flows so that all the stations can transmit their announcement frames. This paper contributes to the betterment of the PSM by proposing two new protocols (the BTA-PSM and the UTA- PSM), derived from the PSM. These protocols try to enhance its performance by inferring from the already advertised future behaviors of the neighboring nodes of a given mobile station. The proposed improvements aim at reducing the number of exchanged announcement frames in order to increase the throughput and decrease power consumption and delay. Simulations results testified to the superiority of the BTA-PSM and UTA-PSM schemes over the traditional PSM in ensuring greater power saving, higher throughput and lower delay. [C759]

"A new model for the industrial process control based on Data Mining"

In this paper, we propose a new model for the industrial process control based on data mining. It solves the problem to a certain extent, which difficult to diagnose and forecast the state of the aluminium electrolysis cell. It realizes that the control parameter optimized decision-making, and the evolution regularity of the state of aluminium electrolysis also be discovered. Finally, it enhances the electrolysis efficiency, reduces the energy consumption, and makes the industrial process more intelligence. [C760]

"A 150μW-11b readout circuit for Lab-on-a-Chip applications"

An integrated readout circuit for Lab-on-a-Chip applications is presented. The overall system consist of a 640times480 array of capacitor sensors and actuators. Sensors detect dielectric permittivity variation thanks to dielectrophoresis (DEP) process. Usually for this kind of applications an off-chip analog-to-digital converter is used. As a consequence, the noise floor increases and high signal-to-noise ratios are difficulty achieved. On the other hand, these applications requires a stringent noise floor specification (>10b) and a relaxed linearity (ap8b). In this design, the noise coupled to the signal at the chip pad is reduced by using an on-chip analog-to-digital converter. The complete sensor readout channel is composed by two main blocks: a pre-amplifier with programmable gain and an algorithmic analog-to-digital converter with a 1.5-bit/stage architecture. Each one is realized with fully differential switched capacitor technique. In order to save chip area and power consumption a time sharing technique has been taken into account using a single operational amplifier for the preamplification stage and the conversion stage. The proposed A/D converter has 11b resolution, a sampling rate of about 100 ksample/s and an input full-scale range of 1.2 Vp-p differential. Simulation results show a SNR=65.7 dB and an ENOB value of 10.6b. Its power consumption is about 150 muW. Readout chain is implemented in 0.35 mum CMOS technology with a 3.3 V supply voltage. [C761]

"Improving Energy Conservation Using Bulk Transmission over High-Power Radios in Sensor Networks"

Low power radios, such as the CC2420, have been widely popular with recent sensor platforms. This paper explores the potential for energy savings from adding a high-power, high-bandwidth radio to current sensor platforms. High-bandwidth radios consume more power but significantly reduce the time for transmissions. Consequently, they offer net savings in total communication energy when there is enough data to offset wake-up energy overhead. The analysis on energy characteristics of several IEEE 802.11 radios show that a feasible crossover point exists (in terms of data size) after which energy savings are possible. Based on this analysis, we present a bulk data transmission protocol for dual radio systems. The results of simulations and prototype implementation show significant energy savings at the expense of introducing acceptable delay. [C762]

"Escaping from Blocking: A Dynamic Virtual Channel for Pipelined Routers"

The virtual channel flow control approach provides an efficient way for the high throughput of the on-chip routers. However, allocating the virtual channels (VCs) statically results in a waste of the area and energy consumption. To remedy this drawback, we propose a novel dynamic virtual channel architecture (DVCA) in this paper. By inspecting the physical link state and speculating the packet transferring, it dispenses a variable number of VCs to escape the head-of line (HOL) blockings to maximize the throughput, and avoids the useless VC allocations to reduce the packet latencies. In its implementation, the VC allocation unit, the switch allocation unit as well as the VC control unit are modified to complete the DVCA router design. Then, under the 90nm CMOS process, the proposed routers using 50% buffers provide 6.2% throughput increase and 4.1% latency decrease averagely with the savings of 30.9% area and 31.3% power consumption compared to traditional routers. [C763]

"Energy efficient h.264 video transmission over wireless ad hoc networks based on adaptive 802.11e EDCA MAC protocol"

This paper presents an energy efficient H.264 video transmission over wireless ad hoc networks based on an adaptive IEEE 802.11e EDCA (enhanced distributed channel access) mechanism. The standard IEEE 802.11e EDCA mechanism provides only service priority differentiation for time bound applications over ad hoc networks. However, this standard does not provide adaptation mechanism to respond to the time varying network link status. Furthermore, the critical issues in energy efficient transmission have not been addressed under EDCA mechanism. In this research we develop a new adaptive scheme to adjust the Contention Window (CW) after each transmission attempt based on current network link status. This adaptation scheme is also integrated with energy efficient FHSS (BFSK) scheme in order to save the energy consumption during the transmission. An analytical model of Energy efficient estimator (E3metric) is developed to support the selection of modulation

scheme. We also carry out NS-2 based simulation, in combination with E3model, to evaluate the proposed scheme in comparison with standard IEEE 802.11e EDCA. Based on extensive simulation with H.264/AVC video over the proposed AEDCA and the standard EDCA, we demonstrate that the proposed AEDCA with Energy efficient BFSK scheme outperforms the standard IEEE 802.11e EDCA with an improved video quality as well as reduced energy dissipation. [C764]

"A power efficient hold-friendly flip-flop"

In this paper a hold-friendly scan flip-flop is introduced whose scan pin hold characteristic has improved while data pin timing and power are left intact. This characteristic helps to resolve scan chain hold problem while meeting the maximum frequency in data path. This solution can reduce the number of buffers inserted in the scan chain to fix hold violations. The new flip-flop can save up to 27% area and 15% power as compared to the usage of normal flip-flops combined with hold-fixing buffers. [C765]

"Hybrid flow-shop scheduling problem based on saving energy"

In this paper, the mixed-integer nonlinear programming model is established for hybrid flow-shop scheduling problem (HFSP), with the minimum of energy consumption as the objective function. Aiming at the characteristic of this problem and the shortcomings of simple genetic algorithm, a hybrid genetic algorithm (Memetic) is presented. To validate the preciseness of the model and the availability of the method, the simulating experimentation is done on the three-two-three HFSP, and the result indicates that the scheduling algorithm can reduce the energy consumption in the process of production. [C766]

"Electric motor standards, ecodesign and global market transformation"

The use-phase cost of most industrial electric motors, namely the consumed electrical energy, dominates by far their overall life-cycle cost. Because electric motors use about 70% of the total industrial electricity use, they present attractive opportunities to save a huge amount of electricity in a cost- effective way, and contribute to mitigate climate change. The lack of global efficiency classes has prevented the large-scale adoption of high efficiency motors in most countries around the world. This paper addresses the most relevant electric motor efficiency-related international standards, including minimum efficiency requirements and a new efficiency classification standard, which have a profound impact on motor market transformation, being a powerful tool to reduce electric motor systems consumption. Moreover, the final results and conclusions of a European study to identify and recommend ways to improve the life-cycle environmental performance of electric motors at their design phase are presented, focusing life- cycle cost assessment of standard and best available electric motor technologies. It was found that if high efficiency or premium class motors replace standard efficiency class motors, significant reductions in the environmental impact will be achieved. [C767]

"Chopper-cycloconverters for energy saving in motor control"

This paper proposes chopper-cycloconverters with simplest topologies, minimum devices and simple control modes for energy saving in motor systems. Typical waveforms and control regulations are presented. Passive freewheeling unit is introduced for reduce active device and simplifying the control method. Theoretical and simulation analyses show the significance in auxiliary small size applications for higher power factor operation than that of the traditional cycloconverters. The total power consumptions of them should be emphasized adequately in today's lacking of energy. [C768]

"A study on battery life tradeoff between deep sleep and sleep modes of an actual PDA"

Extending the battery life time for battery-powered devices has become a critical issue for portable system designers. This paper presents a comprehensive study of sleep and deep sleep modes on power consumption of an actual PDA. Our work is based on the concept that the effect use of each componentpsilas power saving mode can significantly reduce total power consumption in a PDA. In our experiments, we measured the current of each power rail of a real PDA to explore how much power is consumed by each power rail for the different modes. We measured the total power for playing a WMV file as well as for idle and system off modes. The results of this study show that a system CPU can save 16.9% in battery life by switching to deep sleep mode rather than sleep mode. With the understanding provided by this analysis, designers can extend battery life time by better managing the fixed amount of energy provided by the battery. [C769]

"Potentials for energy saving with modern drive technology-a survey"

Electrical drives consume with ca. 60 % the largest part of electrical energy in Germany. Until 2012 the generation of green house gas, caused by electrical drives, shall be reduced by 39 million tons p. a. within the

EU. The here presented energy saving potentials and the possibilities for future improvements of drive efficiency show, that the above noted aims may be reached, if the described measures are taken consequently and in time. [C770]

"Reducing power consumption of embedded processors through register file partitioning and compiler support"

As embedded processors being widely used in specific application domains, such as communications, multimedia, and networking, the register file has contributed a substantial budget in embedded processor energy consumption due to its long working time for the data intensive computations and the large switching capacitance. It is found that 25% of registers can account for 83% of register file accessing time during many embedded application execution. This fact motivates us to reduce the register file power consumption by partitioning the registers to different regions according to their usage pattern. The most frequently used registers are put in the hot part, and the cold part of register file is rarely accessed. We employ the register file bitline splitting and the drowsy register cell techniques in our design to reduce the overall accessing power of the register file. We propose a novel approach to partition the register file in a way so that the largest power saving can be achieved. We formulate the register file partitioning process into a graph partitioning problem, and apply an effective algorithm to obtain the optimal result. We evaluate our algorithm on MiBench applications, and an average saving of 43.6% in the register file access power consumption over the original non-partitioned register file is achieved for the SimpleScalar PISA system. [C771]

"Optimization of the electrical production of the electrical groups"

The excessive increase in the price of the oil barrel following the economic and political situation brought the public authority to adopt a national strategy of energy saving in order to preserve the energy resources of the country and to rationalise consumption. Among the adopted measures, we indicate theses ones: the productionpsilas optimization, the optimization of the transport and distribution of energy, the optimization of consumption... The Tunisian Society of Electricity and gas (STEG) developed various strategiespsila choices request kind of the production, transport and electricity distribution supporting the competitiveness of its activities in terms of price and Service Quality. The electric effectiveness consists in managing the request electricity while taking care of the production profitability and the energy saving on the consumption level by using as examples the low consumption lamps, the capacitor batteries installation for improving the power-factor and the setting of a new tariff for the reduction of the power during the peak hours. The conversion of the combustion turbines for operation into natural gas was very beneficial for the STEG, this is of the fact particularly of the difference in price between natural gas and the oil gas; moreover, the economic distribution of the energypsilas production groups is able to reduce the costs without additional loads. The problem consists in optimizing the total specific consumption and consequently the cost of the kilowatt-hour while respecting various constraints of exploitation and safety. [C772]

"Prediction revision strategies for data transmission in wireless sensor networks"

In this paper, a novel strategy for data transmission that is based on prediction revision dynamic adjustment data gathering algorithm (PRDA) is proposed in WSNs. The key idea of the PRDA is to separate the data prediction and model computing, and the autoregressive process model is employed for prediction revision algorithm. The model computing of PRDA is conducted by sink node firstly according to sampling data sequence from sensor nodes, then, sink node sends the parameters of model to sensor node. Each sensor node predicts the values of the data with parameters, and then, determines whether the current sampling data are sent out or not according to the comparison results of predicting data and sampling data. The dynamic adjustment mechanism of model computing is used to fit the variety of sampling data. Simulation results show that PRDA is able to reduce the amount of data transmission and lead to more significantly energy saving than the traditional approach. [C773]

"Dynamic Compilation Framework with DVS for Reducing Energy Consumption in Embedded Processors"

Dynamic voltage scaling (DVS) is an effective technique for reducing the energy consumption in embedded systems. There are several advantages using DVS technique into compiler framework. This paper present a framework for reducing energy consumption in embedded processors using the dynamic compiler collaborate with DVS technique. Two algorithms are implemented in this framework, and the framework is implemented using the Intel PIN systems and is deployed in a real hardware platform. Experimental results based on the software and hardware platform, show that significant energy saving are achieved while performance loss less than 5%. [C774]

"A novel energy saving algorithm based on correlation function in wireless sensor networks"

The energy of node in wireless sensor networks (WSN) is severely constrained, it is very important to maximize the lifetime of the entire network. In order to enhance energy efficiency and prolong the system lifetime, a novel energy saving algorithm based on correlation function is presented. Firstly, the relationship between the energy consumption and the length of communication data is introduced and analysed. According to the geographic information and the threshold of the redundant radius, the mutual supportability of nodes in the redundant area was obtained through the correlation function, then, some non-cluster head nodes with high supportability can be turned off and become candidate active nodes till the next round. Thus, the cluster head can get exact fused data through less non-cluster head nodes. The energy saving algorithm can reduce communication between non-cluster head nodes and the cluster heads. Finally, the reliability of algorithm is tested with 12 sensor nodes, and the efficiency of energy saving is analysed. The results of test and simulation demonstrate that the energy saving algorithm is effective, and the system lifetime is prolonged. [C775]

"Flexible S-band SSPA for Space Application"

This paper presents a new methodology for reducing power consumption of power amplifiers from low level to high level RF power with minimal amplitude and phase variations. The study also highlights the important design considerations to achieve a good efficiency and excellent amplitude and phase tracking among the SSPAs.Using this methodology a flexible S band SSPA has been designed for the new generation of a mobile telecommunications satellite system.The SSPA provides 20 W output power in the multicarrier excitation signal with noise power ratio (NPR) higher than 15 dB and DC to RF efficiency greater than 35%. The DC power saving for 11 dB of output power back-off is more than 60% compared to a classical one. [C776]

"Energy saving strategy for video-based Wireless Sensor Networks under field coverage preservation"

The demand for video-based wireless sensor networks (WSN) applications has significantly increased. Different from conventional sensor networks, video WSN imply a directional sensing model, complex in-node processing, and large data transfer, thus high clock frequencies and significant radio transmission time. Reducing energy consumption is a key requirement for reliable applications. We propose in this paper a novel energy saving method based on redundant node deactivation while preserving field coverage. [C777]

"A novel routing technology based on circle and wedge for wireless sensor network"

In this paper, a novel routing technology based on circle and wedge trained for wireless sensor networks is proposed to extend network lifetime and to reduce transmission delay. The routing protocol based on hierarchical architecture called CWR protocol need not the routing table, which saves lots of energy and cache of the sensor, also reduces the delay of looking for routing information. To solve the local routing for the same sector district, we present the new energy-efficient access point (AP) election algorithm, local position resolution protocol (LPRP) and the network position translation(NPT), which is cooperated with to support CWR protocol in the AP. An important by-product of the routing protocol is that we propose a new method to balance energy consumption and to keep approximate network wide energy equivalence by replacing AP with Backup AP when the AP is exhausted. We continue to describe each routing pathpsilas energy consumption in a wedge, and the whole sensor network deployment of energy is to be understood and improved accordingly. The simulation results show at last that the performance of our CWR protocol is better than the otherspsila under the condition of the system architecture for WSN trained (AWT). [C778]

"Impacts of Indirect Blocks on Buffer Cache Energy Efficiency"

Indirect blocks, part of a file's metadata used for locating this file's data blocks, are typically treated indistinguishably from file's data blocks in buffer cache. This paper shows that this conventional approach will significantly detriment the overall energy efficiency of memory systems. Scattering small but frequently accessed indirected blocks over allmemory chips reduce the energy saving opportunities. We propose a new energy-efficient buffer cache management scheme, named MEEP, which separates indirect and datablocks into different memory chips. Our trace-driven simulation results show that our new scheme can save memory energy up to 16.8% and 15.4% in the I/O-intensive server workloads TPC-R and TPC-H, respectively. [C779]

"A fuzzy control chip based on Probabilistic CMOS technology"

In this work, a novel approach using probabilistic CMOS (PCOMS) technology is used to reduce the energy consumption of a fuzzy PID (proportional-integral-derivative) controller. Energy saving is achieved through designing a probabilistic circuit which deliberately reduces the supply voltage of some less significant bits. The

fuzzy PID controller consists of 15 bits with floating point representation. Through numerical simulations and VHDL validation, the fuzzy PID can obtain a satisfactory tradeoff with about 4% deviation while achieving a total energy saving of about 32%. Through error analysis, a fuzzy PID is redesigned to tolerate more of randomness in the control signals, hence obtain a better steady state performance while achieving an energy saving of about 51%. [C780]

"CLE2 aR2 : A cross-layer energy-efficient and reliable routing protocol for wireless ad hoc networks"

The paper presents a cross-layer energy-efficient and reliable routing (named CLE2aR2) protocol to construct an energy efficient and reliable route and resist the variation of wireless channels for wireless ad hoc networks. CLE2aR2not only considers how to construct a route from the source to the destination, but also takes some important lower-layer factors, such as power strength, data transfer rate, and interference, into account to reflect the real situation of a wireless channel dynamically and instantly. Based on these factors, a reliable route can be constructed such that the retransmission cost can be reduced and the energy consumption can be saved. Simulation results also show that CLE2aR2can indeed construct an energy efficient and reliable route in comparison with the related work. [C781]

"Density Mining Based Resilient Data Aggregation for Wireless Sensor Network"

Data aggregation is generally used to reduce data streams and save energy consumption in cluster-based wireless sensor networks (CWSNs). However the vulnerable deployment environment of CWSN challenge the data aggregation in terms of data privacy and resiliency. If a node or a group of nodes are compromised or the sensing environment is manipulated by an adversary, the aggregation result will be changed easily. Therefore, it is essential to design a resilient data aggregation scheme with data privacy and security guarantees. This paper proposes a scheme that provides privacy-preserving data fusion, and tolerate data disruption and node compromise as well. We make use of subgroup within each cluster to improve the resiliency against node compromise; and we employ a novel encryption algorithm that support secure comparison between concealed data, which will be further used for density mining against the manipulating data disruption. The simulation results show that this scheme can preserve relatively accurate average aggregation with malicious data filtering. And the mathematical evaluation and comparison show better effectiveness and fitness of our scheme for CWSN in terms of fault tolerance and process efficiency than the previous data aggregation schemes. [C782]

"Saving register-file static power by monitoring short-lived temporary-values in ROB"

Modern portable or multimedia applications make embedded processors require not only low power-consumption, but also high computing performance. The reorder buffer (ROB) and the register file are the two critical components to enhance a processorpsilas ILP, but they unfortunately have serious static power, especially occurred in a large register file. In this paper, we use a hardware-based approach to reduce the static power of a register file. In the proposed approach, we design a monitoring mechanism in the ROB to identify which temporary values are short-lived. These values will potentially make registers become idle. A DVS mechanism can then be applied to power down those registers which store short-lived temporary values. Simulation results show that through ROB monitoring, a register file can save at least 50% static power consumption with almost negligible performance loss. [C783]

"Energy Efficient Home Gateway Based on User Service Traffic in Always-On Home Network Environment"

Home gateway (HG) is a device that connects multiple home network devices to an access network. The HG is to be always in operating state for providing any requested digital home services without suspension and user's waiting because these services can be started at any time, by any device and from any network. Furthermore, most home network devices are also required to be ready to operate at any time in the digital home environment. We call this characterized digital home network by 'always-on home network'. The characteristic of the 'always-on' in home network environment gives rise to consume more electrical power. In this paper, we propose a novel scheme to reduce the power consumed by a HG and the architecture to implement the proposed HG. The proposed scheme uses sleep and wake-up mechanism based on existence of real data traffic for user service. In the proposed scheme, almost hardware components of the HG are working, power-on, only in the period that some user service traffic is in the proposed HG; wake-up state or normal stat. On the other hand, some hardware components such as network protocol agent (NPA) with low power consumption are working in the period of no user service traffic. The NPA controls these sleep and wake-up for the proposed HG with cooperating with CPU. [C784]

"A low-power 1-Gbps reconfigurable LDPC decoder design for multiple 4G wireless standards"

In this paper we present an efficient system-on-chip implementation of a 1-Gbps LDPC decoder for 4G (or beyond 3G) wireless standards. The decoder has a scalable datapath and can be dynamically reconfigured to support multiple 4G standards. We utilize a pipelined version of the layered belief propagation algorithm to achieve partial-parallel decoding of structured LDPC codes. Instead of using the sub-optimal Min-sum algorithm, we propose to use the powerful belief propagation (BP) decoding algorithm by designing an area-efficient soft-input soft-output (SISO) decoder. Two power saving schemes are employed to reduce the power consumption up to 65%. The decoder has been synthesized, placed, and routed on a TSMC 90 nm 1.0 V 8-metal layer CMOS technology with a total area of 3.5 mm2. The maximum clock frequency is 450 MHz and the estimated peak power consumption is 410 mW. [C785]

"A Revised AODV Protocol with Energy Management for Real-Time/Non-real-time Services in Mobile Ad Hoc Network"

As the growth of multimedia communications involving digital audio and video, it is increasingly important for the MANET (mobile ad hoc network) routing protocols to simultaneously support both real-time and non-real-time traffic. MANET energy management should offer this support because devices are equipped with limited battery power. To achieve this end, we revise the ad hoc on-demand distance vector (AODV) routing protocol to provide an energy management mechanism such that both real-time and non-real-time packets can be effectively transmitted. In the proposed scheme, real-time traffic uses higher transmission power to reduce transmission delay time and selects a shortest route with the largest minimum residual energy to avoid route break. The non-real-time traffic uses normal transmission power to save energy and chooses a proper shortest route with highest average residual energy to balance node energy consumption. The simulation results show that the revised AODV obtains lower average end-to-end delay and fewer energy-exhausted nodes comparing to the conventional AODV. [C786]

"A contention-based MAC for wireless sensor networks including a mobile node"

Wireless sensor networks with many inexpensive sensor nodes allow users to accurately monitor a remote environment. Usually one or several mobile nodes are used to collect and combine sensor data from each individual stationary node. These networks require robust wireless communication protocols that are energy efficient and provide low latency. Motivated by these applications, we develop a novel medium access control (MAC) protocol for this kind of applications. The sensor nodes are expected to remain inactive for most of time, but become active when a mobile node is nearby. A few techniques for energy saving are developed in our protocol, e.g., true-sleep and pseudo-sleep modes are introduced to reduce energy consumption. They are implemented by radio-triggered circuit which wakes up the stationary nodes as a mobile node moves into the stationary nodespsila reception range. The proposed protocol is simulated in OPNET Modeler 10.5. The simulation results show that the proposed protocol has better performance than S-MAC and EAR (Eavesdrop-And-Register) in terms of latency, energy efficiency, and throughput. [C787]

"A DVS system based on the trade-off between energy savings and execution time"

DVS (dynamic voltage scaling) is a technique used for reducing the power consumption of digital circuits. The power consumed by these circuits has a main component (dynamic power) that is proportional to the square of the supply voltage. Additionally, for every supply voltage, there is a maximum value of the clock frequency. The advantage of using DVS is that the supply voltage (and hence clock frequency) can be adjusted depending on the specific needs during execution. The DVS concept has been used in some commercial products like Transmetapsilas Crusoe, Intel Speed Step, AMD K6, Hitachi SH4, etc. This paper presents results obtained by using a DVS algorithm based on the workload estimation and trade-off between the execution time and power savings. It is discussed about influence of the power supply's slew rate, algorithms influence on the system performance and problems to estimate the processors workload. The DVS system is realized on Intel's PXA255 platform and energy savings have been calculated by measuring directly voltages and currents on the platform. [C788]

"Providing data integrity in intermittently connected Wireless Sensor Networks"

Intermittently connected wireless sensor networks (WSN) for scientific environmental monitoring raise the issue for reliable data gathering which is a key factor for having a consistent data stream as a result. First, measurements must be taken and securely saved on a node. Per node local repository for measurements is a basic mechanism for making possible to retransmit any block of data towards a data sink if it has been lost or damaged. Second, high reliable data communication channels are established between nodes, including MAC-

layer and application-layer ldquoend-to-endrdquo acknowledgments. The last, and the most important aspect is using a multi-level data buffering mechanism based on an ldquoagingrdquo-factor for reducing power consumption taken by radio transmissions. We describe our solution, combining all these techniques, which is intended for use in a permafrost monitoring project. In our case where half-/hourly measurements are collected over a whole year and nodes can become disconnected for several months, we still manage to provide loss-free and power efficient data delivery. [C789]

"A 32nm SRAM design for low power and high stability"

A SRAM cell must meet stringent requirements for operation in the sub-micron/nano ranges. A nine transistor (9T) cell at a 32 nm feature size in CMOS is proposed to accomplish improvements in stability, power dissipation and performance compared with previous designs for low-power memory operation. Initially, this paper presents the optimal transistor sizing for this 9T SRAM cell considering stability, energy consumption, and delay. A write bitline balancing scheme is proposed to reduce the leakage current of the SRAM cell. By optimizing size and employing the proposed write circuitry scheme, a saving of 32% in power dissipation is achieved in memory array operation compared with a conventional 6T SRAM based design. The impact of process variations is investigated in detail, and the HSPICE simulation shows that the 9T SRAM cell has an excellent tolerance to process variations. [C790]

"The Research of Fault Diagnosis in Aluminum Electrolysis Based on Rough Set"

This paper combines rough set and genetic algorithm with fuzzy theory to diagnose faults in aluminum electrolysis to save energy. Firstly the author gets the simplest decision table by using the rough set to reduce the initial decision table which is made up of the original data. Because of one of important part in rough set being the reduction of condition attribute so a satisfied result can be got by using GA to reduce the condition attribute. And according to the simplest decision table, faults are diagnosed by fuzzy theory. Also, the method of original data pretreatment by rough set has simplified the fuzzy rules, decreased computation and diagnosis time, so the diagnosis efficiency, reliability and precision are obviously improved. The simulation has proved that the method can forecast and diagnose faults actually in the aluminum electrolysis to product aluminum safely and decrease energy consumption. [C791]

"A novel clustering algorithm by using mobile gateways in densely deployed sensor networks"

Clustering is an efficient and important method to facilitate energy conservation. Aiming to alleviate the high overheads of migrating management information in the re-clustering process of a clustering algorithm, an energy efficient, Complete Graph-based Clustering Algorithm (CGCA) is proposed in a densely deployed sensor network. CGCA divides the network into a few complete graphs, each complete graph independently being a cluster. CGCA is only executed at the system activation time and the cluster head role needs only to be rotated among the internal nodes in each cluster at the subsequent re-clustering phase, which incurs greatly reduced communication and computation overheads. Another contribution of our work is to add some mobile nodes to act as gateways so as to join the disconnected cluster heads, which puts the heavy inter-cluster traffic burden on the resource-rich mobile nodes thus saving much energy in the energy constrained sensor nodes. Extensive simulation experiments demonstrate that the number of exchanged messages produced by CGCA is only about 20% that of the traditional identifier based clustering algorithm in a densely deployed case. Furthermore, our proposed achieves an improvement in system lifetime of factor 2 that of the LEACH in a dense sensor network. [C792]

"Power-aware data reduction for continuous query in wireless sensor networks"

In sensor networks, continuous query is commonly used for collecting periodical data from the objects under monitoring. This query need to be carefully designed, in order to minimize the power consumption and maximize the lifetime. Data reduction techniques can be employed to decrease the size of data to be transferred in the network, and therefore save energy of sensor nodes. This paper presents a novel method for optimizing continuous query in sensor networks. Our approach is, by using packet merging or compression techniques, to reduce the data size to the best extent, so that the total performance is optimal. A weight item is specified together with a query, in which the importance of the two factors, power and delay can be expressed. Then an optimal query plan can be obtained by studying both power and time cost simultaneously, leading to the minimum cost. System models for energy and time consumptions of communication are created. Problem is formalized and algorithm is described in detail. Finally, experiments are conducted to validate the effectiveness of the proposed method. [C793]

"Performance evaluation of Enhanced relay-enabled Distributed Coordination Function"

In this paper we evaluate the performance of our earlier proposed enhanced relay-enabled distributed coordination function (ErDCF) for wireless ad hoc networks. The idea of ErDCF is to use high data rate nodes to work as relays for the low data rate nodes. ErDCF achieves higher throughput and reduced energy consumption compared to IEEE 802.11 distributed coordination function (DCF). This is a result of. 1) using relay which helps to increase the throughput and lower overall blocking time of nodes due to faster dual-hop transmission, 2) using dynamic preamble (i.e. using short preamble for the relay transmission) which further increases the throughput and lower overall blocking time and also by 3) reducing unnecessary overhearing (by other nodes not involved in transmission). We evaluate the throughput and energy performance of the ErDCF with different rate combinations. ErDCF (11,11) (ie. R1=R2=11 Mbps) yields a throughput improvement of 92.9% (at the packet length of 1000 bytes) and an energy saving of 72.2% at 50 nodes. [C794]

"Performance evaluation of power management for best effort applications in IEEE 802.16 networks"

Reduced energy consumption is a crucial aspect of mobile Broadband Wireless Access (BWA) networks, which are expected to be populated by battery-operated devices, like mobile phones and palmtops. For this reason the IEEE 802.16e, which is one of the front-runner competitors in this field, specifies a set of power saving mechanisms to be employed by the Base Station (BS) and Mobile Stations (MSs) to reduce the amount of time the latter spend with the wireless interface on. These mechanisms are classified into three class types, which are designed for different types of applications. In this paper we focus on class type I, which fits the typical requirements of best-effort traffic. With class type I, an MS with power saving enabled alternates between sleep and listening periods. The duration of the sleep periods increases by a factor 2 each time listening period ends, up to a maximum sleep window size. Since the standard does not provide guidelines for setting the above parameters, which are negotiated between the BS and MSs when setting up a power saving class, we evaluate via simulation their impact on the performance, in terms of both application-specific metric, i.e. delay or throughput depending on the type of traffic, and the amount of energy saved. [C795]

"Topology Aware Task Allocation and Scheduling for Real-Time Data Fusion Applications in Networked Embedded Sensor Systems"

In networked embedded sensor systems, data fusion is a viable solution to significantly reduce energy consumption while achieving real-time guarantee. Emerging data fusion applications demand efficient task allocation and scheduling techniques. However, existing approaches can not be effectively applied concerning both network topology and wireless communications. In this paper, we formally model TATAS, the topology-aware task allocation and scheduling problem for real-time data fusion applications, and show it is NP-complete. We also propose an efficient three-phase heuristic to solve the TATAS problem. We implement our technique and conduct experiments based on a simulation environment. Experimental results show that, as compared with traditional approaches, our technique can achieve significant energy saving and effectively meet the real-time requirements as well. [C796]

"RTL dynamic power optimization for FPGAs"

As FPGA devices grow in size and speed, power consumption is becoming a limiting problem. In this document, a dynamic power optimization CAD tool for FPGAs that is applied at the register transfer level (RTL) during design synthesis is described. The automatic design transformations implemented by this tool reduce dynamic power by eliminating unnecessary computation by functional units when unit results are not needed. Our new guarded evaluation algorithm locates design functional units that may perform unnecessary computation under specific unit input conditions. Once located, functional unit input logic is modified so that the function will remain dormant when the output of the functional unit is unused. This approach reduces unnecessary signal transitions, thus saving dynamic power. To locate the most desirable functional units for guarded evaluation, an area, depth, and switching activity estimation flow is presented that provides high-level estimates to aid in RTL design transformation. Our approach has been integrated into a design flow for Altera Cyclone II devices. Experiments show that, although not all designs benefit from our approach, an average 12% reduction in dynamic energy can be achieved for a subset of benchmark designs with suitable functional units. [C797]

"Memory-Aware Dynamic Voltage and Frequency Prediction for Portable Devices"

In recent years, dynamic voltage and frequency scaling (DVFS) has been considered as one of the most efficient techniques to decrease energy consumption, especially for battery-powered portable devices. However, many DVFS algorithms discuss the issue from the perspective of the processors only. Some researches have started to study the effects of memories in the DVFS algorithms. In this paper, an approximation equation (called MAR-CSE) based on the correlation of the memory access rate and the critical speed for the minimum energy

consumption is conducted for frequency and voltage prediction. The memory access information is obtained from the performance monitoring unit (PMU) provided on an Intel XScale platform which we used in this study. With MAR-CSE, an MA-DVFS (memory-aware DVFS) algorithm is proposed. The algorithm has been realized in the Linux kernel. Experiment results show that the energy consumption of the memory bound benchmarks can be reduced from 50% to 65%, much better than the result of 19% to 53% energy saving for the on-demand mechanism which is already supported by the Linux kernel. [C798]

"Research on digital controlled converter for AC power electronics burn-in test with Energy Feedback"

It is necessary to do burn-in test for many power electric products. Compared to conventional resistor method whose consumption is generally huge, equipments with power recycling function in burn-in test are recognized as more thrifty-not only reduce energy loss but also save manufacturing cost. This paper presents a digital controlled converter for AC power electronics burn-in test with energy feedback, which contains the load characteristic simulation part (LCSP) and the energy feedback part (EFP). The main topology is an AC/DC/AC structure comprised of two PWM voltage source rectifiers (VSR). SPWM current-mode control technique based on TMS320F2812 is adopted to make the circuit operate at a constant frequency. Simulation results indicate that the digital controlled converter can perform as all kinds of loads and feed energy back to the utility system with unit power factor. [C799]

"Energy-efficient multi-speed algorithm for scheduling dependent real-time tasks"

Reducing energy consumption is a critical issue in the design of battery-powered embedded systems to prolong battery life. With dynamic voltage scaling (DVS) processors, energy consumption can be reduced efficiently by making appropriate decisions on the processor speed/voltage during the scheduling of real time tasks. This paper addresses the problem of energy efficient real-time task scheduling over earliest deadline first (EDF) scheduling policy where the tasks are dependent due to shared resources. Furthermore, the paper proposes enhancements over the existing multi-speed (MS) algorithm where the proposed algorithm achieves more energy saving and has the capability to function with both stack resource policy (SRP) and dynamic priority ceiling protocol (DPCP) as resource access protocols. [C800]

"Sensitivity Based Power Management of Enterprise Storage Systems"

Energy-efficiency is a key requirement in data centers today. Storage systems constitute a significant fraction of the energy consumed in a data center and therefore enterprise storage systems need to deliver high performance in an energy-efficient manner. Static tuning of the storage system is not sufficient since energy consumption is strongly dependent on runtime variations in workload characteristics. Although dynamic disk power management can enable the storage system to adapt to varying workload conditions, prior work in this area has resorted to ad hoc heuristics that cannot guarantee that the system meets energy-efficiency goals. In this paper, we present a novel approach to storage power management that uses the sensitivity-based optimization technique. Our approach systematically balances the dynamic knobs in the disks to operate the storage-system at a desired performance level while maximizing the energy savings. We show that sensitivity-based power management can reduce the energy consumed by the storage system by over 20% for a set of commercial server workloads. We compare sensitivity-based power management to a previously proposed power management scheme for multi-RPM disk drives and show that our approach yields better performance and energy savings. [C801]

"Maximization of system lifetime in body sensor networks"

In this paper, the target is to reduce the energy consumption in the body sensor network as well as maximize the system lifetime of sensor nodes when they will make communication among body sensors and personal communication unit. The best compression technique like LPC is selected for energy saving based on some calculations. Formulation of a linear programming problem where is to maximize the system lifetime which is equivalent to the time until the first node runs out of battery. Maximum system lifetimes are calculated by MATLAB optimization technique using and without using efficient compression algorithm like LPC in various environments. The results show that maximum system lifetimes calculated in different scenarios using efficient compression technique like LPC is better than without using compression technique. [C802]

"Saving of natural gas through optimal operation of Bangladesh Power System"

The depletion of gas with its use is a great concern of Bangladesh. Electricity sector consumes 47% of total annual use of gas. Because of the peculiar input energy requirement characteristic of thermal units with their output the generating units are operated such that the total input energy requirement is minimum in a power

system. As load management through load shedding, is a common phenomenon of Bangladesh power system (BPS), it is generally considered that the scope of optimal loading of units in BPS does not exist. This paper investigates the scope of optimal loading of units of BPS. It applies dynamic economic unit commitment scheduling technique for BPS to evaluate the production cost and the corresponding gas requirement for the past and future period. It also studies the possibility of reducing gas requirement in BPS through its optimal operation. The investigation results deserve the attention of natural resource planners and utilities. [C803]

"An improvement on LEACH algorithm with a fuzzy processor"

Power dissipation management and hence increasing lifetime in wireless sensor networks (WSNs) is the most critical issue in the design procedure of the modern WSNs. There are many approaches through which power dissipation and lifetime of the WSNs are moderated. In this paper, we present a fuzzy rule based methodology in order to increase the power saving in LEACH algorithm. We propose a fuzzy processor to be in charge of performing fuzzy instructions. This processor is applied to track the best path online for forwarding packets instead of traditional offline table based forwarding process. In addition, this processor is capable of aggregating input data by which the network traffic is extremely reduced. Simulation results show the numerous efficiency of our methodology not only in balancing the power dissipation through network, but also in lifetime improvement, traffic management, and network availability. [C804]

"The Implementation of an Adaptive Data Reduction Technique for Wireless Sensor Networks"

Wireless sensor networks (WSN) have gained significant attention due to their ability to monitor physical phenomena within a wide range of applications. These networks are generally deployed in remote areas and are battery powered. This means that the lifetime of the network depends on the energy consumption, thus necessitating careful hardware and software design to sustain the long period of operation without human intervention. One way of reducing the energy required is to minimize the number of data transmissions. A prediction-based data reduction algorithm based on the least-mean-square (LMS) algorithm was implemented on a field programmable gate array (FPGA) to reduce the communication between the sensor nodes and the base station. Measurement results show that communication can be reduced by as much as 90% in a temperature monitoring application if an error of 0.5 degree is acceptable. This has a large impact on the lifetime of the wireless sensor network since the transceiver can be switched off during non-communication periods saving precious energy. [C805]

"Efficient data reporting for object tracking in wireless sensor networks with mobile sinks"

Object tracking is an important application in wireless sensor networks (WSNs). However, most of researches focus on how to track mobile objects accurately and do not consider data reporting, especially when sinks move arbitrarily in the sensor field. In this paper, we propose an efficient data reporting method for object tracking in WSNs with mobile sinks. In our network environment, the sensor field is divided into several grids. Only some nodes are elected as active nodes for tracking the object and reporting data, the others are in sleep mode for saving energy. Moreover, a simple scheduling is given to balance the energy consumption of nodes. To guide the current position of the sink and reduce the update cost as the sink moves, we design an elegant weight function for active nodes. By the weight function, the tracking data can be forwarded to the mobile sink efficiently. In addition, we also propose a simple object tracking method in which an object can be detected by two or more active nodes with tracking flags. Simulation results show that our proposed method outperforms than TNT and SNEM in terms of the energy consumption and average hop counts. [C806]

"Power saving effect of sensor collaborative beamforming for wireless ubiquitous network systems"

This paper evaluates transmission performance and power-saving effect of the collaborative beamforming for wireless ubiquitous network systems. The evaluation of power-saving includes the power consumption for signal transmission to collaborative sensors in beamforming. The simulation result shows that the total power consumption of the beamforming with 3 collaborative sensors can be decreased to about 1/2 compared with that of a transmitting sensor without the beamforming in free-space propagation channels. In typical mobile propagation channels with shadowing, the total power consumption of the beamforming by using 3 collaborative sensors can be reduced to 1/7 of that without the beamforming. The above results confirm that the collaborative beamforming can be achieve lower power consumption, and greatly contributes to realize low-power transmission in wireless sensor network systems. [C807]

"Energy-efficient congestion control on contention-based BW-REQ in WiMAX system"

The IEEE 802.16 standard for broadband wireless metropolitan area network supports diverse real time and non-real time services. The standard defined the contention-based bandwidth request mechanism for the nonreal

time (nrt-PS) and Best-Effort (BE) services. Before using the resource of base station (BS), the mobile station (MS) or subscriber station (SS) should send the bandwidth request (BW-REQ) in the allocated contention time interval. For avoiding collision, the standard supports truncated binary exponential backoff resolution. However this mechanism works inefficiently while the network traffic is overloading, and then the result will cause MSs waste power. In this paper we propose a new mechanism at MS, for BE service, to help the MS send the bandwidth request more efficiently and also avoid the traffic peak. By using the mechanism, the MS sends the bandwidth request in the low loading time and it reduces the power consumption of the MS. Additionally, the method balanced the burst of traffic loading and smoothed the traffic loading that brings the bandwidth request efficiency and higher power utilization. [C808]

"SDDA: Sparse and dynamic in-network data aggregation in sensor nets"

In-network data aggregation is an effective method to reduce the amount of data transmitted and therefore saves energy consumption in sensor networks. However, data aggregation removes the integrity of original data and thus increases the damage of data falsification attack. This paper proposes four new methods that select a subset of nodes as aggregators in a sparse and dynamic fashion to frustrate the adversary. The criteria for selecting aggregators include security risk, aggregation efficiency gain, and trust relationship among nodes. Simulation results are presented that demonstrate the new methods can effectively make tradeoffs between security risk and communications cost. [C809]

"Enhancing energy efficiency of processor-based embedded systems through post-fabrication ISA extension"

Application-specific instruction set extension is an effective technique for reducing accesses to components such as on- and off-chip memories, register file and enhancing the energy efficiency. However, the addition of custom functional units to the base processor is required for supporting custom instructions, which due to the increase of manufacturing and design costs in new nanometer-scale technologies and shorter time-to-market, is becoming an issue. To address above issues, in our proposed approach, an optimized reconfigurable functional unit is used instead, and instruction set customization is done after chip-fabrication. Therefore, while maintaining the flexibility of a conventional microprocessor, the low-energy feature of customization is applicable. Experimental results show that the maximum and average energy savings are 67% and 22%, respectively for our proposed architecture framework. [C810]

"Run-time Active Leakage Reduction by power gating and reverse body biasing: An eNERGY vIEW"

Run-time active leakage reduction (RALR) is a recent technique and aims at aggressively reducing leakage power consumption. This paper studies the feasibility of RALR from the energy aspect, for both power gating (PG) and reverse body bias (RBB) implementations.We develop two energy saving models for PG and RBB, respectively. These models can accurately estimate the circuit energy saving at any time, even when the circuit is in state transition. In PG modeling, we discover a physical phenomenon called ldquoinstant savingrdquo, which can affect the model accuracy by 30%-50%. Based on the RBB model, we derive the optimum design point of RBB for RALR. Finally in terms of energy saving, we define four figures-of-merit, to compare the efficacy of using PG and RBB to implement RALR. [C811]

"A resource efficient content inspection system for next generation Smart NICs"

The aggregate power consumption of the Internet is increasing at an alarming rate, due in part to the rapid increase in the number of connected edge devices such as desktop PCs. Despite being left idle 75% of the time, 90% of PCs have their power management features disabled. Consequently, much recent research has focused on reducing power consumption of Internet edge devices. One such method for reducing PC power consumption is by augmenting the network interface card (NIC) with enhanced processing capabilities. These capabilities pave the way for green computing by allowing the PC to transition to a low-power sleep state while the NIC responds to network traffic on behalf of the PC-a technique known as power proxying. However, such a Smart-NIC (SNIC) requires specialized low-power, resource-constrained processing, and architectural features in order to realize such capabilities. In this paper, we present a NIC-based packet content inspection system for power proxying and network intrusion detection. We use a novel partitioned TCAM technique that results in 87% energy savings and a 62% lower energy-delay product than existing non-partitioned router-based techniques, thus making our technique highly suitable for SNIC-based deployment. [C812]

"Energy-aware opcode design"

Embedded processors are required to achieve high performance while running on batteries. Thus, they must exploit all the possible means available to reduce energy consumption while not sacrificing performance. In this work, one technique to reduce energy is explored to intelligently design the instruction-opcodes of a processor based on a target-workload. The optimization is done using a heuristic that not-only minimizes switching between adjacent instructions, but also simplifies the decoding to reduce latches to save dynamic energy. On average, an optimized opcode is able to be decoded using 40-60% less latches in the decoder. In addition, it is shown that a decoder optimized for algorithms that had similar program structure, similar data-types or similar behavior exhibited consistent patterns of energy reduction. The techniques presented in this paper yield an average 10% reduction in the total dynamic energy. It is also shown that this heuristic can be used to achieve similar results on different issue-width processors. [C813]

"Distributed target tracking with selective transmitters in energy-constrained sensor networks"

The transmission and reception of sensor measures between nodes in distributed target tracking applications of wireless sensor networks is energy expensive. This paper shows that a selective transmission policy can be used to increase the network lifetime without reducing the accuracy of the target parameter (position, velocity) estimates in a significant manner. To do so, nodes compute an importance value of every measure, and make a decision about transmitting this information or not depending on this value, the energy available at the node battery and the energetic cost of transmitting and receiving information. In this way, weak or noisy signals are discarded, saving energy for future measurements. Simulation results show that the proposed scheme applied to a target tracking scenario is energy-saving as well as accurate. [C814]

"Reconfigurable hardware architecture for saving power consumption on a sensor node"

We propose the use of a reconfigurable hardware architecture to reduce the power consumption of small sensor node that has various sensors and wireless communication facilities, that were the result of an adaptive function specialization mechanism. Traditional sensor nodes must have had a powerful and multi functional Micro-Controller Unit (MCU) to satisfy the requirements for processing any kinds of application. However, most of these systems only use a part of the functions provided by an MCU. In other words, such a unit often consumes a great dead of power for unused circuits. To avoid this situation, we propose the use of a reconfigurable architecture based on a Field Programmable Gate Array (FPGA) instead of an MCU because this array dynamically changes the circuit to the optimal one that is just used for the calculation required by an application. Moreover, we implemented a prototype system to do a preliminary evaluation of our proposed mechanism. In this evaluation, we show the performance of our proposed reconfigurable architecture by comparison with traditional architecture that uses processing time and power consumption. The experimental result shows that our proposed mechanism reduces enough power of its sensor nodes to prolong the lifetime of nodes without decreasing the processing time. [C815]

"A data transmission method in ZigBee networks using power efficient device"

In this paper, we propose the method that reduces the power consumption by decreasing the network traffic on the ZED having the power saving feature. By using the proposed method, in order to recognize the ON-point time period of the ZEDpsilas RF receiver, the parent node does not receive a data request periodically from the ZED. Therefore, the network traffic between the ZED and the parent node is reduced. This method is used to transmit the data efficiently and reliably. Based on the current ZigBee stack application support sub-layer (APS), we present the ZigBee end device data transmission (ZEDDT) method. The simulation results by Network Simulator-2 (NS2) are included in order to demonstrate the validity and the usefulness of the proposed method. [C816]

"Adaptive Drowsy Cache Control for Java Applications"

Drowsy cache has been proved as an efficient technique to reduce cache leakage energy. However, current drowsy cache control policies generally suffer from performance loss and are not adaptive to different program behaviors. In this paper, we study adaptive drowsy cache control for Java applications, where just-in-time (JIT) compiler and runtime information can be used to make accurate decision on drowsy cache control. We first explore the impact of different phases of Java applications on the timing behavior of cache usage. Then we propose several techniques to adaptively control drowsy cache to reduce energy consumption with minimal impact on performance. Our experiments show that the adaptive drowsy control by exploiting the phase information can reduce the performance loss without impacting the energy saving, which is especially useful during the garbage collection. [C817]

"Application Specific Low Power ALU Design"

Power consumption is a critical design issue in embedded processor design. One of common components in the processor is the Arithmetic and Logic Unit (ALU). Usually, ALUs are designed with a combinational logic circuit containing a number of functional components for different arithmetic and logic operations. An ALU can be constructed with a tree or a chain structure. Existing approaches to reduce power often achieve power reduction at the cost of increased design complexity, thus resulting in delay and area overheads. In this paper, we present a customization approach for the chain-structure based ALU design by repositioning functional components in the chain. The approach can be easily integrated into a processor design environment to effectively reduce ALU power consumption for a given application. We have applied our approach to a set of benchmarks. Ourexperimental results show that the power savings range from 43.5% to 49.6%; on average, 46.9% of ALU power reduction can be achieved. Most importantly, this achievement is at cost of neither hardware complexity nor processor performance, and the implementation is extremely straightforward. [C818]

"Distance optimization based coverage control algorithm in mobile sensor network"

Coverage control is a basic research problem in wireless sensor networks (WSNs). This paper proposes a distance optimization based coverage control algorithm, which utilizes ant colony algorithm to place sensor nodes to an appropriate position and optimize the moving path of mobile sensor nodes. The proposed algorithm not only guarantees the biggest coverage of wireless sensor networks, but also reduces node moving distance, which saves sensor node energy and prolongs the entire network lifetime. Simulation results prove its validity. [C819]

"Power aware wireless receiver design utilizing carrier sensing based on cross-correlation"

Advancing technology has made it possible to integrate millions of transistors on a very small die and to clock these transistors at very high speeds. Power consumption has become the limiting factor for portable high-performance wireless applications. In this paper, we propose a system level technique to improve the power efficiency of the wireless receiver design. The proposed clock gating scheme utilizing carrier sensing based on cross-correlation is a very effective power-saving technique to reduce the dynamic power dissipation of the inactive circuit blocks and their local clock buffers. [C820]

"A multi-objective hybrid genetic algorithm for energy saving task scheduling in CMP system"

There are two important factors in the power-performance issues of chip multi-processor(CMP) system: the execution time of tasks and the system energy consumption. Most of exist energy saving methods are not designed to reduce the system energy while cut the execution time down. This paper represents a multi-objective hybrid genetic algorithm (MHGA) which can make the execution time of tasks minimize while reducing the system power consumption. We analyze the problem of energy saving task scheduling on CMP system and a novel coding scheme of genetic algorithm. Based on that, we improve the crossover and mutation operator of genetic algorithm. We propose the multi-objective genetic algorithm by using simulated annealing algorithm to enhance the search ability. Simulation results demonstrate that using our algorithm can make the efficiency of task scheduling on CMP increase, make both the execution time of task and energy consumption of system decrease. [C821]

"ESCAL: An Energy-Saving Clustering Algorithm Based on LEACH"

The application of wireless sensor network (WSN) is always restricted by the energy shortage of sensor nodes. In order to reduce the entire energy consumption of the WSN, a promising approach is to design light clustering algorithms. LEACH is such a well-known clustering algorithm that was designed to distribute the energy consumption to nodes in the WSN evenly. LEACH is characterized by its attractive cluster-based strategy; however, in the algorithm, energy dissipation of entire network is still great during the process that cluster-heads (CH) transmit data to base station (BS). In this paper, based on LEACH, we propose a modified clustering algorithm which is named ESCAL. In ESCAL, CHs won't communicate with BS directly, but transfer aggregated data to the nearest node in term of received signal strength; then this selected nearest node will compress and forward the data to BS. According to this mechanism, the transmitting distance between CHs and the base station is greatly shortened, and therefore the energy dissipation of entire network will be remarkably reduced. Theoretical analysis and experimental simulation demonstrate that the energy dissipation of ESCAL is no more than half of that of LEACH. [C822]

"A Sampling Algorithm of Non-band Limited Signals Based on SVD"

We combined the finite rate of innovation (FRI) method with singular value decomposition (SVD) theory and got an improved sampling algorithm of non-band limited signals. It used SVD instead of annihilating filter in FRI method to reduce noise. We took streams of diracs signal as an example and deduced the detailed sampling

and reconstruction process in the improved algorithm. It first found DFT coefficients of the samples, and constructed a Hankel data matrix. Then the matrix was decomposed according to SVD technique and the position information of diracs was gotten. Finally it computed weight coefficients from the Vandermonde system. The simulation results indicate that the original signal can also be reconstructed well in the presence of noise if only the sample rate is not less than its innovation rate. The sampling method based on SVD has good antinoise performance. It also saves power consumption and computational complexity. In some communication systems such as UWB and CDMA, a very narrow pulse which is like diracs signal very much is used to carry information. So this FRI algorithm based on SVD can be applied in their receivers. [C823]

"Forward error correction for high-speed I/O"

Modern state-of-the-art high-speed (Gb/s) I/O links today rely exclusively upon an equalization-based transceiver to achieve a bit error-rate (BER) of 10-15. This paper explores the potential of applying forward error-correction (FEC) in such links to reduce power and BER. The FEC coding gain can be employed to lower the power consumed in the analog components (e.g., transmit driver, clock recovery unit (CRU)) since these do not scale with process technology. A BER improvement of six orders-of-magnitude and ten orders-of-magnitude is demonstrated for a 20" FR4 channel operating at 10 Gb/s with a LE and a DFE, respectively, using a BCH code. Savings in the encoder-decoder power overhead of up to 50% is demonstrated for a (63, 36, 11) BCH code using a novel gated decoder architecture. [C824]

"Reducing the Path Length of a Mobile BS in WSNs"

Recent research shows that the node energy in WSNs can be significantly saved by integrating mobile BS into the network, which is capable of collecting data from sensor nodes. However, the mobile BS may aggravate the latency problem of the network, and thus hinder its use. Rendezvous points are a subset of nodes that buffer data from other sensor nodes, and transfer the buffered data to mobile BS. The locations that the mobile BS must arrive in order to collect all the data from the WSN are called the stop points. Reduction in the number of stop points can serve as a balance between network energy saving and network latency. In this paper, we propose a stop points reducing algorithm, which can get the smallest stop point set in sensor networks while guarantees the coverage of the entire network. The algorithm is verified by extensive experiments. [C825]

"SwitchR: Reducing system power consumption in a multi-client, multi-radio environment"

Multiple wireless network interfaces in a single mobile device exist in order to support their diverse communications and networking needs. This paper proposes a general switching architecture, SwitchR, for managing radio communications for multiple (client) devices utilizing multiple heterogeneous radios per device. SwitchR is deployable incrementally within existing wireless infrastructures, and considers the load imposed on the wireless channel by other communicating clients. SwitchR demonstrates reduction in energy consumption of a mobile device by 47%-72%, depending upon the application, over the Power Save Mode in WiFi and 13%-60% reduction in energy over previous multi-radio architectures that do not consider the interactions between multiple clients. [C826]

"On reducing power consumption and code size of H.264 intra luma prediction on multicore DSP"

As the latest international video coding standard, H.264 is gaining importance not only on desktop computers but also on handheld devices. For handheld devices, power consumption of the system is of ultimate importance, which needs to be addressed at every layer of the system design. At the application layer, the code size affects the memory hierarchy behavior, which in turn affects the system power performance. In this paper, we consider the power consumption of H.264 running on handheld devices using multicore DSP processors, focusing particularly on power saving through code reduction. We use the multiple intra-mode prediction as an example. There are nine optional prediction modes for each 4 times 4 intra luma sub-macroblock in H.264, which result in nine separate routines. We examine the access patterns of the modes and propose a general scheme that replaces eight of the nine routines with one. This dramatically reduces the code size and the resultant power consumption. We implemented the code on PACDSP, resulting in a 20% reduction of the code size with negligible performance degradation. [C827]

"Energy-saving techniques for low-power graphics processing unit"

This paper presents a graphics processing unit with energy-saving techniques. Several techniques and architectures are proposed to achieve high performance with low power consumption. First of all, low power core pipeline is designed with 2-issue VLIW architecture to reduce power consumption while achieving the processing capability of 400MFLOPS or 800MOPS. In addition, inter/intra adaptive mutli-threading scheme can increase the performance by increasing hardware utilization, and the proposed configurable memory array architecture can

reduce off-chip memory accessing frequency by caching both input data and output results. Furthermore, for graphics applications, a geometry-content-aware technique called early-rejection-after-transformation is proposed to remove redundant operations for invisible triangles. As for circuit level power reduction, power-aware frequency scaling is proposed to further reduce the power consumption. [C828]

"Energy Efficiency in Natural Stone Cutting Process"

The aim of this experimental study was to reduce electric energy consumption in marble cutting operation. We designed a prototype circular saw block cutting machine for marble cutting experiments. Fully computer-controlled this experimental set-up has a LabView based data acquisition and control system. In this study, manual and automatic cutting experiments were performed for three natural rocks (Cankiri beige and Afyon white marble and Denizli travertine). In experiments, travel speed is kept fixed in manual mode as usual in industry. Travel speed is controlled in automatic mode during the cutting process. Travel speed is controlled depending on specific energy. It is observed that, if automatic cutting is performed, electric energy saving can be provided in all of three rocks. Though energy saving is provided in all of three rocks, the best energy saving is provided in Cankiri beige marble. [C829]

"Optimizing Operational Energy Performance through Dynamic Computer Simulations"

A detailed energy audit is carried out for a complex of 6 office buildings in Brussels representing over 30 000 m2of occupied space. The results show very high energy consumption for both heating and electricity. Detailed computers models are created of all 6 buildings and calibrated based on real consumption, monitoring results from Building Energy Management Systems, actual occupation profiles and real meteorological data for Brussels. Based on the model, a series of measures to increase the energy efficiency of the buildings are then proposed. A technical and economic analysis which evaluates the environmental impact and payback time of each measure is carried out. The objective of the study is to reduce energy consumption of existing buildings by 30% while keeping improvement measures economically interesting. Results show that energy savings of 27% are feasible with an overall payback time of approximately 3 years. [C830]

"An Indoor Localization Algorithm for Lighting Control using RFID"

Occupant's identity and location are important information for lighting control in order to reduce the energy consumption while increasing livelihood. While active RFID system provides occupant's identity, it is nontrivial to localize the occupant's location in an indoor environment due to the multipath effect, the changing environment, and the unreliable communication link. In this paper, we implement a system with multiple active RFID readers, and develop a localization algorithm based on support vector machine (SVM). The algorithm uses round-robin comparison to localize the occupant to one of the multiple regions in a floor. The geometric relationship among the rooms and the historical localization data are used to further improve the localization accuracy. Numerical results demonstrate a high localization accuracy of this algorithm. We hope this work sheds insight on lighting control for energy saving and an increased livelihood. [C831]

"Intelligent Demand Response Scheme for Customer Side Load Management"

Demand response (DR) provides means for utilities to reduce the power consumption and save energy. Plus, it maximizes utilizing the current capacity of the distribution system infrastructure, reducing or eliminating the need for building new lines and expanding the system. A typical DR program requires two parties to cooperate: the utility and the customers. In this paper a novel intelligent demand response module is designed and proposed to be implemented at the customer side. The primary target of this design is large industrial sized customers that often have several manufacturing/production lines consisting of mostly large electric motors. The proposed DR module design is based on the expert systems theory. Different modules are designed that take the market rates as well as the local load management policy of the customer into account in order to make a decision for reducing the load. The validity of the proposed algorithm is tested on the IEEE 34-bus distribution test feeder in the real-time RT-Lab environment. [C832]

"Assessing the Impact of Smart Building Techniques: a Prospective Study for France"

Saving energy is an essential lever in cutting our greenhouse gases emissions. Worldwide, the building sector is responsible for 40% of energy consumption. We focus on the French commercial sector in order to assess the gains that could be made by using smart building techniques over the long term (2030-2050). We use a long-term planning model based on a Markal/Times approach. We develop a specific way of modeling energy savings potential and energy conservation techniques. The commercial sectors energy consumption, sorted by energy carrier, sub-sector and end-use, is determined for the baseline year (2000). It is then extrapolated to 2050, using existing French prospective studies. Assumptions are made on the value of other external parameters,

such as energy prices, technological evolution, etc. The model shows that smart building helps to reduce the commercial sectors overall consumption by 8%. This result remains stable when external parameters are modified: smart building solutions are robust. These solutions are complementary to passive (insulation) solutions, and they result in a reduction of the global cost of the energy system. [C833]

"Quarter-Rate Implementation of an 1 GSPS 128 Tap FIR Structure used as Cross-correlator in UWB Communication"

Finite impulse response (FIR) filters are widely used in many applications involving signal processing algorithms. The FIR can also be used as a convolver or as a cross-correlator due to its structural similarity. In general the problem with the hardware implementation of FIR is mainly the area complexity and this is much prominent if the number of taps is pretty large. For high throughput application, like UWB communication, the designer is forced to go for parallel-pipelined design and this increases the complexity many fold. Parallel architecture is required not only to meet the stringent throughput requirement but also to save power consumption. However an L level parallelization typically increases the number of computations (multiplications + additions) by L times compared to a single level FIR architecture. This increases the area complexity around L times. Typically the area complexity of multiplier is much more than an adder. A significant amount of research work has been conducted to reduce the multiplication complexity of FIR architecture. In this paper we present an adder-tree based multiplier block parallel FIR architecture which reduces the multiplication complexity in many fold compared to standard multiplier based or Canonic Signed Digit (CSD) based multiplier architecture. We also present a simple way of forming the exhaustive adder-tree multiplier block. [C834]

"An energy saving program for bangladesh, for reducing load shedding, and for continuity of power for IT sector"

The success of computers, IT, and telecommunications hinges greatly on the inexpensive and uninterrupted availability of power. Even with the gradual depletion of fossil fuel, and the rise in fuel prices, there has been insufficient effort towards saving electricity and making the most of remaining fuel reserves. It is time to adopt energy saving programs in Bangladesh, creating awareness that extravagant consumption is detrimental to national, global, and long-term interests. Such energy saving programs have been implemented to various extents in countries like Brazil, Norway, New Zealand, and the USA. With its high population density, low development, poor economic infrastructure, and dynamic river network, Bangladesh provides a unique backdrop to an Energy Saving programs. Such a program should reduce load-shedding, distribute electricity among more users, and divert electricity to productive uses like irrigating fields and preventing manufacturing stoppage. Continuity of electricity would also save our huge investment in generators and UPS equipment. An energy saving program should be well-understood and researched by policymakers and experts. An important part of such a program should be changing consumer behavior, such as turning off appliances when not in use. Power-hungry air-coolers develop acclimatization and dependence in users, who then perceive normal outside temperatures as uncomfortable. Low-power alternatives to air-coolers are ceiling fans and ventilator fans on walls. LED lights, compact fluorescent lamps, and IT and telecommunications are to be promoted as efficient uses of electricity. Urban sprawl to distant suburbs should be contained in favor of compact townships, which are better adapted to buses. Buses should be promoted over smaller cars, which should be promoted over larger hungry cars and SUVs. This paper pursues such common sense approaches, together with recommendations by experts, and implementation by policymakers. [C835]

"Distributed design of network codes for wireless multiple unicasts"

Previous results on network coding for low-power wireless transmissions of multiple unicasts rely on opportunistic coding or centralized optimization to reduce the power consumption. This paper proposes a distributed strategy for reducing the power consumption in a network coded wireless network with multiple unicasts. We apply a simple network coding strategy called ldquoreverse carpooling,rdquo which uses only XOR and forwarding operations. In this paper, we use the rectangular grid as a simple network model and attempt to increase network coding opportunities without the overhead required for centralized design or coordination. The proposed technique designates ldquoreverse carpooling linesrdquo analogous to a collection of bus routes in a crowded city. Each individual unicast then chooses a route from its source to its destination independently but in a manner that maximizes the fraction of its path spent on reverse carpooling lines. Intermediate nodes apply reverse carpooling opportunistically along these routes. Our network optimization attempts to choose the reverse carpooling lines in a manner that maximizes the expected power savings with respect to the random choice of sources and sinks. [C836]

"Power efficient switches with dynamic virtual channel allocation for network-on-chips"

In this paper, we present a dynamic power management (DPM) technique for optimizing the use of virtual channels in network on chips. The technique which is called dynamic virtual channels allocation (DVCA) makes use of the traffic conditions and past buffer utilization to dynamically forecast the number of virtual channels that should be active. In this technique, for low (high) traffic loads, a small (large) number of VCs are allocated to the corresponding input channel. This provides us with the ability to reduce the power consumption of the router while maintaining the data communication rate. The simulation results show that up to 35% reduction in the buffer power consumption and up to 20% savings in the overall router power consumption may be achieved. Finally, the area and power overheads of the technique are negligible. [C837]

"FKEE approaches in solving energy wasting in UMP's lecture halls-part II"

It is important to note that air-conditioning and mechanical ventilating system (ACMV) and lighting system consume the most electrical energy in a building in Malaysia. In University Malaysia Pahang (UMP), due to the nature of the buildings, split units air-conditioning systems are used in the faculty office blocks and the lecture halls. It is found that a major portion of the energy consumed came from the lecture hall buildings. The appliances are sometimes switched on when they should be off. This contributes to energy wastage. The energy wasted can be reduced by controlling the appliances and system using a control system while maintaining a comfortable and safe environment in the building. This paper presents the FKEE approaches in solving energy wasting in UMP's lecture hall. In the previous paper, we presented a preliminary case study on energy wastage occurrences in a UMP lecture hall, Dewan Kuliah 13 (DK 13). We found that the DK13 lecture hall is often left with lights and air-conditioning switched on with no occupants. Therefore, in this paper, we propose a design of energy saving control system for air-conditioning and lighting system that can be used in lecture halls to prevent energy wasting. [C838]

"A physical level study and optimization of CAM-based checkpointed register alias table"

Using full-custom layouts in 130 nm technology, this work studies how the latency and energy of a checkpointed, CAM-based Register Alias Table (cRAT) vary as a function of the window size, the issue width, and the number of embedded global checkpoints (GCs). These results are compared to those of the SRAM-based RAT (sRAT). Understanding these variations is useful during the early stages of architectural exploration where physical level information is not yet available. It is found that compared to sRAT, cRAT is more sensitive to the number of physical registers and issue width, however, it is less sensitive to the number of GCs. In addition, beyond a certain number of GCs, cRAT becomes faster than its equivalent sRAT. For instance, this is true when a RAT for 64 architectural and 128 physical registers has at least 20 GCs. This work also proposes an energy optimization for the cRAT; this optimization selectively disables cRAT entries that do not result in a match during lookup. The energy savings are, for the most part, a function of the number of physical registers. For instance, for a cRAT with 128 entries energy is reduced by 40%. [C839]

"Fault-Tolerant Scheduling for Periodic Tasks based on DVFS"

Dynamic voltage and frequency scaling (DVFS) technique is emerging in various battery-operated embedded systems to reduce the energy consumption and prolong the working life of the system. However, DVFS technology has been proved to have some direct and negative effects on the reliability of the system. Most existing schedulers of real-time tasks based on DVFS only focus on minimizing energy consumption without taking the fault-tolerant into account. To solve this problem, in this study, we developed a novel energy-aware fault-tolerant (EAFT) technique that was tailored for the real-time periodic tasks. The heuristic EAFT balances the allocation of slacks used for reducing energy consumption and used for re-executing the failed tasks. The simulation results showed that the proposed reliability-aware schemes could guarantee the system reliability and significantly save energy comparing to the existing allocating schemes. [C840]

"Sensor conditioning unit design for public lighting control"

Lighting consumes one fourth of all energy consumed worldwide, and case studies have shown that commonly 50 to 90 percents of building lighting is unnecessary for the purposes required. Energy is wasted when light does not fall on its intended target, as when lighting fixtures allow light to go up instead of (as it is generally preferred) downward. Leakage also occurs when more light is generated than needed. Many governments are looking for ways to reduce energy use after signing the Kyoto Protocol, and individuals, organizations and local authorities are increasingly improving lighting efficiency in order to reduce energy consumption. The main scope of this paper is to establish some criteria in designing a sensing and signal conditioning system for energy saving in public lighting. [C841]

"Low Power Optimization for MPI Collective Operations"

DVFS-available (Dynamic Voltage/Frequency Scaling) processors make it possible for a system to reduce the energy consumption by scaling down the frequency/voltage of the processors in high performance computing. For MPI collective operations, network communication time occupies the most of the whole time. Scaling down CPU voltage/frequency in non-critical path can effectively reduce energy consumption. This paper proposes Low-Power MPI_Gather algorithm (LPMG) and Low-Power MPI_Scatter algorithm (LPMS) and extend them to almost all the MPI collective operations. We evaluate the effectiveness of our low-power MPI collective operation algorithm using Intel MPI benchmark IMB on 128-processor cluster system connected by a 1000 Mbps Ethernet. Experimental results show that different MPI collective operations can achieve different energy saving. With 128 processes, average 45.9% and 55.7% energy savings can be reached through LPMG and LPMS, respectively. But MPI_Alltoall only gets 2.2% energy saving. [C842]

"Reconfigurable Ultra wideband radio receiver"

Wireless sensor network (WSN) applications demand ultra low power devices. Digital Ultra Wideband (UWB) transceiver can be used as the communication module in a WSN due it its potential for location tracking, ranging and low data rate communication. Current digital UWB receiver architecture incorporates heavy parallelism, which significantly increases power consumption, especially during the acquisition and synchronisation (AS) mode. Analysis shows that real time reconfigurability for the digital backend of the UWB receiver has the potential to reduce the average power consumption. This paper proposes a novel real time reconfigurability algorithm (RTRA) which reduces the power consumption by switching off the unwanted parallel blocks during the AS mode. It consists of estimation, translation and a control block. An FPGA implementation showed that an average power saving of approximately 30% can be achieved by the proposed RTRA over a normal receiver. [C843]

"MDS: Efficient Multi-dimensional Query Processing in Data-Centric WSNs"

Geographical hash table (GHT) has been widely used to provide energy efficiency for data-centric storage in wireless sensor networks. Such a mechanism, however, suffers from high communication cost when we apply multi-dimensional event search in the network. In this work, we present MDS, a flexible, complete, and efficient multi-dimensional search mechanism atop traditional GHT based data-centric storage architecture. MDS utilizes bloom filters to reduce the communication cost of in-network intersection and union operations for multi-dimensional queries in wireless sensor networks. This scheme can be easily extended to support multi-dimensional range queries. Our mathematical analysis indicates the optimal settings for the bloom filters that maximize the traffic savings according to the information popularities. We conduct comprehensive simulations to evaluate our design. Results show that MDS achieves significant performance improvement in terms of energy consumptions and thus improves the applicability of the multi-dimensional search over the GHT based data-centric storage in sensor networks. [C844]

"A Cluster-Interval-Based Algorithm for Optimizing Range Query in Wireless Sensor Network"

In wireless sensor network, how to use limited node energy efficiently to process data querying becomes an important research problem. We propose a cluster-based filter algorithm SFOA for range query in wireless sensor network because the data, sampled in cluster nodes, are highly similar to one another in cluster-based WSN. Its basic idea is to provide a filter for each cluster, and three filters for each node which are in the same cluster. This algorithm build cluster interval for each cluster, and inter-cluster interval for each node in the cluster to filter out the impossible clusters and nodes, which can reduce the number of nodes participating in the range query, saving nodes energy. Furthermore, the simulation experimental results indicate that, in most cases, SFOA has energy efficiency, which greatly reduce the data transmissions. [C845]

"Energy-efficient high-speed CMOS pipelined multiplier"

This work presents the design and fabrication of an energy-efficient high-speed 8times8-bits CMOS pipelined multiplier, based on a full adder cell built with an alternative internal logic structure and a swing-restored complementary pass-transistor logic style, that reduce static power dissipation while retaining a complete voltage swing at internal nodes. Post-layout simulations show that this multiplier is able to operate up to 1.2 GHz when supplied with 3.3 V, and the power savings obtained when compared against similar pipelined multipliers are about 20% when operating with transitioning input data, 25% with non-transitioning input data and 80% with the clock signal disabled. A test chip containing the multiplier was fabricated in a 0.35 mum CMOS technology and the experimental measurements confirm its operation at 1.2 GHz with a power consumption of 180 mW for a supply voltage of 3.3 V. [C846]

"The Evaluation and Optimization of Enterprises' Production-Run Efficacy based on Factor Analysis

and Fuzzy Association Rule Mining"

Generally, enterprises' production-run parameters will affect the height of the energy consumption. This paper using the methods of factor analysis and fuzzy association rule mining to evaluate the height of enterprises' energy consumption, and bring forward an optimization method to improve the high energy consumption parameters, a power plant case is presented at the end of the paper to illustrate the proposed model. [C847]

"An Algorithm of Data Fusion Based on Improved BP Natural Network"

Data fusion based on feed-forward natural network can get the goal of minimum error, as well as reduce redundant data to transmit and save energy consumption. BP neutral network is considered as one of the most mature algorithm, but the traditional BP algorithm converges slowly and easy traps in a local minimum value, so new improved BP algorithm named algebraic algorithm is put forward. The algebraic algorithm can make a complex nonlinear optimization problems turn to a simple algebraic equation, and the error function will equal to zero. Results show that the algebraic algorithm is higher precision and efficiency than BP algorithm. [C848]

"Intra-cluster Nodes Scheduling Algorithm Satisfying Expected Coverage Degree of Application in Distributed Clustering WSNs"

To satisfying expected coverage degree of application, we derived the smallest active node number K through node active-sleep theory. We also achieved intra-cluster active nodes scheduling algorithm. In data gathering protocol, this algorithm can make vast intra-member nodes obtain sleep, reduce data delay, lighten cluster head burden. The simulated experiment shows that the result of the algorithm in saving energy is very apparent. [C849]

"Routing in Three Dimensional Wireless Sensor Networks"

Sensor networks is a promising technology that can be used to avoid disasters such as fire, storm, etc. This technology needs to be improved in terms of several issues. In this paper, we focus on two issues: coverage and routing. For coverage problem, we introduce a new approach for obtaining a static covered network in the 3-Denvironment. This technique is referred to as the Chipset model. This would be accomplished by using a small number of sensor nodes in order to save up some energy. For routing issue, we propose a new position-based routing protocol referred to as the 3-DSensing Spheres close to the line routing algorithm (3-DSSL). We show that this protocol achieves 100% delivery rate on top of our 3-Dmodel. We also show that even this protocol has similar performance with the 3-DGFin terms of hop dilation and total running time, the 3-DSSLoutperforms the 3-DGFin terms of Euclidean dilation. Thus, this might reduce the energy consumption of the nodes. Therefore, prolonging the lifetime of the network. [C850]

"An Energy Efficient Hybrid Medium Access Control Scheme for Wireless Sensor Networks with Quality of Service Guarantees"

In this paper, we present a new MAC layer protocol for wireless sensor networks that reduces energy consumption and provides Quality of Service (QoS) guarantees through the use of service differentiation concept. The proposed protocol (named as EQ-MAC) consists of two sub-protocols: Classifier MAC (C-MAC), and Channel Access MAC (CA-MAC). C-MAC is responsible of classifying gathered data at sensor nodes based on its importance and then stores it in the appropriate queue of the node's queuing system. The CA-MAC is an energy efficient medium access mechanism that uses a hybrid approach of both scheduled and unscheduled schemes to gain a save in energy, and hence prolonging the network's lifetime. The save in energy achieved by CA-MAC is coming from the differentiation between control and data messages. Data messages are assigned scheduled slots with no contention (here we have to emphasize that slots are assigned only to those nodes which have data to send, this allows an efficient energy use of the TDMA slots), while short periodic control messages are assigned random access slots. To study the performance of the EQ-MAC protocol, several simulation experiments were conducted. EQ-MAC is compared with both Q-MAC and S-MAC protocols. Simulation results demonstrate that EQ-MAC outperforms the other two protocols and achieves a significant improvement in terms of energy expenditure. Under prioritized traffic, EQ-MAC is comparable to Q-MAC in average latency, while achieving less energy consumption. [C851]

"Design and implementation of WTB controller using SOPC technology"

The paper presents a novel WTB controller design method using SOPC (system on programmable chip) technology. The WTB Access IP (intellectual property), which is designed in Verilog HDL (hardware description language), achieves the function of encoding, decoding, FCS (frame check sequence) and bit stuffing. Finally the CPU and WTB controller are combined into one Alterapsilas Cyclone II EP2C8, so this method save PCB space

and reduce total power consumption. The paper describes each modulepsilas function and design method specifically. Simultaneously the simulation and two different experimentspsila results are given. [C852]

"Factory test for development of energy storage system"

The ESS is able to store and discharge energy extremely quickly, consequently enabling a complete exchange of energy between vehicles, even if they are not braking and accelerating at precisely the same time, as is most frequently the case in everyday service. The ESS reduces primary energy consumption without affecting transport capacity and punctuality. In addition, the ESS can stabilize the system voltage. The ESS is considered to be one of the useful devices for energy storing and recycling. This paper presents the factory test of the ESS. Characteristics with/without the ESS are also presented for comparison. The verification test in a factory focused on stabilizing voltage. The catenary voltage with the ESS did not drop. But The voltage without ESS is fluctuated. The overhead voltage is compensated. [C853]

"Cross-layer co-exploration of exploiting error resilience for video over wireless applications"

In this paper, we propose a cross-layer algorithm/architecture co-exploration for wireless multimedia systems to coordinate interactions among sub-layer optimizers for improvements in energy/QoS/reliability. By exploiting the inherent redundancy in wireless multimedia systems, we generate an expanded design space over traditional, layer-specific approaches. Specifically, we control the error resilient encoder at the application layer to provide awareness of architectural exploration at the physical layer (WCDMA) allowing new design points with lower power consumption via aggressive voltage scaling. While trying to reduce energy consumption, the fault tolerant technique compensates the effect of the hardware and network errors due to aggressive voltage scaling and lossy transmission, respectively. Our experiments on H.263 video over WCDMA communication system demonstrate that co-exploration enlarges the feasible design space which results in significant power savings of 34% in the H.263 encoder more than 20% in the WCDMA modem. [C854]

"Distributed Partner Choice for Energy Efficient Cooperation in a Wireless Sensor Network"

Cooperative diversity can be applied to energy-constrained wireless sensor networks to significantly reduce node energy consumption. However, cooperation partners must be carefully selected and coordinated to practically exploit this energy saving potential. In this paper we investigate partner choice for energy efficient cooperation in a wireless sensor network. We formulate novel and computationally efficient partner choice heuristics for sensor nodes based on either global or local knowledge of average path loss values in the network. We present extensive simulation results of cooperation in a wireless sensor network to show that the proposed heuristics achieve near-optimally energy efficient partner selection. Our results also demonstrate that large network-wide energy savings are achieved as a result of cooperative communication. Therefore, our simple partner choice heuristics form the basis of an effective distributed cooperation protocol for improving the energy efficiency of a wireless sensor network. Very importantly from the point of view of practical implementation, we show that our partner choice heuristic based on local information is the most effective cooperation strategy for resource-constrained wireless sensor networks, as it yields superior energy conservation results while enabling fully distributed and scalable cooperation. [C855]

"Greener Copper with Dynamic Spectrum Management"

Power-saving benefits of Dynamic Spectrum Management (DSM) result from its increased robustness to channel and noise changes, as in this paper. A proposed intermittent noise model enables evaluation of the performance of DSM algorithms. Polite Level-1 DSM algorithm consumes much less power than non-polite DSL management algorithms in the presence of intermittent noise. Secondly, a proposed robust level- 2 DSM algorithm compares favorably with methods that change the PSDMASK only upon modem initialization or retraining. The proposed robust level-2 DSM algorithm significantly reduces power consumption. This DSM reduction of DSL transmit power can be even more significant when considering the additional loss of robustness and stability of non-DSM methods. [C856]

"ADCA: An Asynchronous Duty Cycle Adjustment MAC Protocol for Wireless Sensor Networks"

In this paper, we propose an asynchronous duty cycle adjustment MAC protocol, called ADCA, for the wireless sensor network (WSN). ADCA is a sleep/wakeup schedule-based protocol to reduce power consumption without lowering network throughput or lengthening transmission delay. It is asynchronous; it allows each node in the WSN to set its own sleep/wakeup schedule independently. The media access is thus staggered and collisions are reduced. According to the statuses of previous transmissions, ADCA adjusts the duty cycle length for shortening transmission delay and increasing throughput. Simulation results show that ADCA outperforms related ones in terms of energy saving, network throughput and transmission delay. [C857]

"Cross-Layer Optimization for Energy-Timeliness Tradeoff in TDMA Based Sensor Networks"

Energy efficiency is a critical issue in wireless sensor networks. Energy consumption can be saved by using a lower transmission power, but this also increases the channel error rate and the energy consumption on packet retransmission, as well as the packet delay. In this paper, taking retransmission in physical layer into account, we propose a cross-layer strategy to explore the tradeoff between energy efficiency and packet timeliness in time division multiple access (TDMA) based sensor networks, by transmission power allocation and routing path selection schemes. We divide the problem into two optimization sub-problems of power allocation and path selection in each layer, and propose lower-complexity algorithms for each sub-problem. Numerical results show that a tradeoff exists between energy efficiency and packet timeliness, and energy consumption can be significantly reduced while satisfying the packet timeliness constraint by using the proposed strategy. [C858]

"W-MAC: Supporting Ultra Low Duty Cycle in Wireless Sensor Networks"

The duty cycle of a wireless sensor node is a key factor that determines the life time of a wireless sensor network. In general, sensor medium access control protocols reduce the duty cycle to achieve longer lifetime. However, we found out that their performance improvements substantially decrease under extremely low duty cycles (<0.1%). Our proposed W-MAC protocol targets achieving low energy consumption under extremely low duty cycle as well as low duty cycle (>0.1%). It is with estimation of the relative clock speed between the sender and the receiver, and uses it to minimize energy consumption. It saves energy significantly well compared to the existing schemes in an order of ten times, and the performance gap increases with lowering the duty cycle. [C859]

"Design of a memory-based VLC decoder for portable video applications"

In this paper, a VLC decoder supporting to decode coefficient data in blocks of MPEG-2 and CAVLC in H.264 is presented. To achieve programmability of the VLC decoder, a memory-based architecture with improved memory efficiency is proposed. Group-based look-up table (LUT) algorithm is extended to multi-table merging (MTM) which extracts redundancy of groups further. With multi-table merging algorithm, all coding tables are integrated into memory more efficiently. While the memory access may lead to much power consumption, a low-power scheme is proposed to reduce memory access. The distributed cache is adopted to save power and improve the decoding throughput as well. Simulation results show that the cache with replacement method can reduce about 60% ~ 95% memory accesses. [C860]

"Design of passive UHF RFID tag in 130nm CMOS technology"

This paper presents a low-power, passive, UHF RFID tag design compatible with EPCTMC1G2 protocol. In order to reduce its cost, diode-connected NMOS in a standard CMOS technology is used instead of Schottky diodes. With the help of low-threshold-voltage, triple-well NMOS, a minimum input power of -7.6 dBm is achieved. A sub-1 V, low temperature-coefficient voltage reference using self-biased mutual compensation is proposed without large resistors to save the chip area. In addition, an energy-aware irregular clock structure, together with clock gating, achieves low power consumption in the baseband processor. The whole tag is implemented in a 130 nm CMOS technology and the total chip area is 1200 mum times 1220 mum. [C861]

"Body-bootstrapped-buffer circuit for CMOS static power reduction"

In this paper, we present a new CMOS circuit design for increasing the threshold voltages (VT) of MOSFETS to reduce power consumption. Using a single voltage source VDD, the proposed circuit generates both the high positive and negative voltages, which are connected to the body nodes of MOSFETs to increase the reverse-bias voltage between the source and body in order to raise VT. Consequentially, static power consumption is reduced. The circuit is integrated into a 256-bit Ripple Carry Adder and a 32-bit Braun multiplier. Simulation results based on Chartered Semiconductor Manufacturing Private Limitedpsilas (CHRT) 0.25-mum, 0.18-mum and Berkeley Predictive Technology Modelpsilas (BPTM) 90-nm processes showed good trade-offs between power savings and delay. [C862]

"A moving binary search SAR-ADC for low power biomedical data acquisition system"

A moving binary search tree based successive approximation register analog-to-digital converter (SAR-ADC) dedicated for low power biomedical data acquisition system is presented. By performing the conversion based on the previous results, the required ADC conversion cycles is reduced significantly leading to great saving in power consumption. Simulation results based on typical electrocardiograph (ECG) signals show that the proposed SAR-ADC saves 52.6% of conversion cycles for a 10-bit SAR-ADC, corresponding to a power saving

of about 45% as compared to its conventional counterparts, while maintaining the same resolution and accuracy. [C863]

"Function-based memory partitioning on low power digital signal processor for cochlear implants"

A function-based memory partitioning (FBMP) method is proposed and adopted in a low power digital signal processor (DSP) for cochlear implants (CIs). Based on pre-analysis of intended application programs, instructions and data are divided into functional groups with different accessed frequencies. Monolithic instruction and data memories are then partitioned into multiple sub-banks and assigned to functional groups according to their accessed frequencies. The FBMP method can reduce both power consumption and silicon area overhead. The implementation result on the CI-dedicated DSP shows that this method can save about 50% of the power at best with little additional area cost. [C864]

"Using strong sustainability to optimize electricity generation fuel mixes"

This work represents a contribution to the field of sustainable electricity system design by using an optimization tool to specify the final mix composition, subject to the constraints of: emissions that are within the biocapacity of the region; a diverse and robust electricity supply system; and supply that at least meets current demand. The 25-country European Union (EU-25) is used as a case study. All the goals, save diversity, can be met by re-structuring the current fuel mix, thus maintaining current consumption levels. The diversity target is only met when consumption is reduced by 10-15% and the constraint on maximum material throughput is relaxed. Re-structuring the mix and reducing consumption is insufficient to achieve a sustainable EU carbon footprint. However, the solution proposed singlehandedly allows the EU to meet its Kyoto emissions target as well as its 2007 policy of a reduction of 20% in greenhouse gas emissions by 2020. [C865]

"Error-resilient low-power Viterbi decoders"

Two low-power Viterbi decoder (VD) architectures are presented in this paper. In the first, limited decision errors are introduced in the add-compare-select units (ACSUs) of a VD to reduce their critical path delays so that they can be operated at lower supply voltages in absence of timing errors. In the second one, we allow data-dependent timing errors which occur whenever a critical path in the ACSU is excited. Algorithmic noise-tolerance (ANT) is then applied at the level of the ACSU to correct for these errors. Power reduction in this design is achieved by either overscaling the supply voltage (voltage overscaling (VOS)) or designing at the nominal process corner and supply voltage (average-case design). Power savings in the first and second design are 58% and 40% at a coding loss of 0:15 dB and 1:1 dB respectively in a IBM 130 nm CMOS process. [C866]

"Asymmetric dual-gate multi-fin keeper bias options and optimization for low power and robust FinFET domino logic"

A variable threshold voltage keeper circuit technique using independent-gate FinFET technology is proposed in this paper for simultaneous power reduction and speed enhancement in domino logic circuits. The threshold voltage of a keeper transistor is dynamically modified during circuit operation to reduce contention current without sacrificing noise immunity. The optimum independent-gate keeper gate bias conditions are identified for achieving maximum savings in delay and power consumption while maintaining identical noise immunity as compared to the standard tied-gate FinFET domino circuits. With the variable threshold voltage asymmetric double-gate keeper circuit technique the evaluation speed is enhanced by up to 49% while reducing the power consumption by up to 46% as compared to a standard domino logic circuit designed for similar noise margin in a 32 nm FinFET technology. [C867]

"Two-step windowing technique for wide range motion estimation"

This paper presents a memory-efficient motion estimation (ME) technique for high-resolution video compression. The main objective is to reduce the external memory access, especially for limited local memory resource. The key to reduce the memory accesses is based on center-biased algorithm in that the center-biased algorithm performs the motion vector (MV) searching with the minimum search data. While considering the data reusability, the proposed two-step windowing approaches use the secondary windowing as an option per searching necessity. The proposed techniques can save up to 81% of external memory bandwidth and require only 135 MBytes/sec, while the quality degradation is less than 0.2 dB for 720 p HDTV clips coded at 8 Mbits/sec. [C868]

"Low power 32-bit UniRISC with Power Block Manager"

In this paper we propose a low power technique named Power Block Manager (PBM) to reduce power

consumption in various function units within a microprocessor. Power Block Manager considers each function block as an independent object. To disable running those function units which neither work nor affect the output results, the system can save the dynamic power dissipation. The PBM architecture involves three parts. The instruction type detector classifies the instructions. The power block table points out which power blocks can be turned on or off according to the instruction type. The scheduler arranges the power control signals to meet the pipelined system. We apply the PBM system to a 32-bit microprocessor named UniRISC which is designed by CCU SoC Center, and take three applications to examine the power. After the Post-Layout experiment, the processor with PBM system can save 20.1~30.2% power consumption. [C869]

"Distributed Routing for Wireless Sensor Networks Based on Cluster Maintenance"

Saving energy is an important goal in designing of wireless sensor networks, and routing algorithm has an important impact on energy consumption for wireless sensor networks. Therefore, improving the energy efficiency of routing algorithm to reduce energy consumption in the network is very necessary. This paper proposes a new distributed routing algorithm based on cluster maintenance (CMDR-LD). By prolonging the steady-state phase time and retaining the concept of round in routing algorithm, the new algorithm achieves the purpose of saving energy ultimately. Simulation results validate the energy efficiency of that algorithm. [C870]

"The Method to Dynamically Determine the Optimal Parameter Tmin for Energy Saving in IEEE 802.16e, with Light Traffic Load"

In this paper, first, sleep-mode and wake-mode existing in the Medium Access Control (MAC) layer of IEEE 802.16 are introduced. Next cycles of sleep-mode are described. Finally optimum Tmin, which is obtained by improving the length of Tminpsilas window in sleep-mode of previous methods, is described. This method changes Tmin with the changes of network load to reach the best situation in power consumption. This method reduces the power consumption more than 14% for IEEE 802.16e mobile standard. The soundness of all information is proved by numerical analysis. Finally random digit test was used to evaluate the results of the method for power reduction. [C871]

"An Enhanced Routing Protocol for ZigBee/IEEE 802.15.4 Wireless Networks"

ZigBee is a well accepted industrial standard for wireless sensor networks based on IEEE 802.15.4. Since aiming for the application of low data rate, low price and low power consumption, ZigBee networks have the limited resources such as computation complexity and storage space. So it is especially important to design an efficient and effective routing protocol to save the consuming energy and extend the lifetime for ZigBee networks. In this paper, we survey two kinds of routing methods of the existing ZigBee routing protocol, and then propose two improved algorithms respectively. Simulation results show that the proposed routing version is a more efficient routing protocol, which can reduce routing overhead and routing discovery delay. [C872]

"Energy Efficient Register File with Reduced Window Partition"

As power dissipation of the register file in modern processor designs tends to dominate, measures must be taken to keep it under control. This paper introduces an approach for reducing the SPARC windowed register file power based on the operation of the Partitioned Register File Inspector added in the decode stage of the pipeline. The power savings show that, when the size of the Register File Inspector is properly fixed, the average saving on the energy consumption of the windowed register file could be up to 77% compared with the traditional register file control scheme. [C873]

"Power-Aware and Branch-Aware Word-Length Optimization"

Power reduction is becoming more important as circuit size increases. This paper presents a tool called PowerCutter which employs accuracy-guaranteed word-length optimization to reduce power consumption of circuits. We adapt circuit word-lengths at run time to decrease power consumption, with optimizations based on branch statistics. Our tool uses a technique based on Automatic Differentiation to analyze library cores specified as black box functions, which do not include implementation information. We use this technique to analyze benchmarks containing library functions such as square root. Our approach shows that power savings of up to 32% can be achieved on benchmarks which cannot be analyzed by previous approaches, because library cores with an unknown implementation are used. [C874]

"Distributed Energy-Efficient Scheduling for Data-Intensive Applications with Deadline Constraints on Data Grids"

Although data duplications may be able to improve the performance of data-intensive applications on data grids,

a large number of data replicas inevitably increase energy dissipation in storage resources on the data grids. In order to implement a data grid with high energy efficiency, we address in this study the issue of energy-efficient scheduling for data grids supporting real-time and data-intensive applications. Taking into account both data locations and application properties, we design a novel Distributed Energy-Efficient Scheduler (or DEES for short) that aims to seamlessly integrate the process of scheduling tasks with data placement strategies to provide energy savings. DEES is distributed in the essence-it can successfully schedule tasks and save energy without knowledge of a complete grid state. DEES encompasses three main components: energy-aware ranking, performance-aware scheduling, and energy-aware dispatching. By reducing the amount of data replications and task transfers, DEES effectively saves energy. Simulation results based on a real-world trace demonstrate that with respect to energy consumption, DEES conserves over 35% more energy than previous approaches without degrading the performance. [C875]

"High-speed and low-power serial accumulator for serial/parallel multiplier"

This paper presents a new approach to serial/parallel multiplier design by using parallel 1psilas counters to accumulate the binary partial product bits. The 1psilas in each column of the partial product matrix due to the serially input operands are accumulated using a serial T-flip flop (TFF) counter. Consequently, the column height is reduced from N to [log2N]+1. This logarithmic reduction results in a very small carry save adder (CSA) array or tree required before the two final summands are added up to obtain the final product. The counters can be clocked at very high frequency (around 1.5 GHz as dictated mainly by the TFF propagation delay) and the accumulation frequency is independent of the operand size. The proposed accumulation method achieves 33%, 38%, 43% gain in speed respectively for 31, 63, 127 operands accumulators and on average 42% reduction in power consumption over CSA based accumulation implemented in 0.18 mum CMOS technology. [C876]

"Energy-Aware Interval Caching for Mirrored Video Servers"

Energy consumption is an important issue for data centers, and disks use a significant proportion of the total energy. Mirrored video servers handle data requests adaptively from their primary or backup copies allowing some disks to go into standby mode, and disk bandwidth utilization has a great effect on the total energy consumption. We analyze the relationship between the amount of cached data and the power consumption of each disk, and propose a new energy-aware interval caching (EAIC) scheme which considers the power state of the disks, so as to reduce their total energy consumption. Simulation results show that EAIC can save as much as 22% more energy than a conventional interval caching scheme. [C877]

"QCTC: QoS-Based Clustering Topology Control Algorithm for Wireless Sensor Networks"

Topology Control and energy saving is one of the most important challenges in wireless sensor networks because of Special characteristics of these networks such as limited transmission range, low bandwidth, limited power resource and the impossibility of recharging. In this paper, k-fault tolerant clustering topology control algorithm is presented. This algorithm named QoS-based clustering topology control algorithm (QCTC), improves network lifetime and reduces average consumed energy in two ways, first by reduction in transmission power of nodes to minimum possible power and second by choosing only one path among different existing paths to be active between each sensor and base station in time intervals. The active paths are selected periodically based on QoS provisions and energy cost. Our algorithm then saves battery power of nodes by scheduling sleep intervals for nodes in inactive paths. Through network simulation we show that our algorithm reduces average consumed energy and improves network lifetime. [C878]

"Dynamic spectrum management for energy-efficient transmission in DSL"

Dynamic spectrum management (DSM) is an important technique for mitigating crosstalk noise in multi-user digital subscriber line (DSL) environments. Until now, most of the proposed algorithms for DSM have been designed solely for the purpose of bitrate maximization. These algorithms assume a fixed maximum total power and neglect the energy consumption in DSL modems. However, since recently there is a strong interest in the DSL field to reduce energy consumption as shown, e.g., by the European CommissionsГ‚Вї code of conduct on energy consumption of broadband equipment. In contrast to traditional DSM, this paper will show how DSM can be used for minimizing the energy consumption. We will formulate a global optimization problem for energy minimization and discuss several of its peculiarities compared to the current DSM problems. Furthermore, we derive an iterative, dual-based and semi-distributed algorithm for its local solution, which we call energy-efficient spectrum balancing (EESB). The performance of the algorithm is evaluated through simulations, which show similar results to optimal schemes. In addition, EESB achieves substantial energy savings that can be exploited by adapting the transmit powers to usersГ‚Вї bitrate demand. [C879]

"Pre-processing of convolutional codes for reducing decoding power consumption"

This paper presents a new pre-processing approach for convolutional codes that can provide the adaptive capability to a standard Viterbi decoder. By identifying and generating the decoded data from the zero Hamming distance path, all computations in the Viterbi decoder can be avoided. This makes it possible to stop the Viterbi decoder in real time as long as no error occurs in the received code words; the Viterbi decoder is restarted to correct errors otherwise. With this approach, significant power, i.e. 97% of a standard Viterbi decoder power dissipation, can be saved when the Eb/No is as low as 13 dB. [C880]

"Computation as estimation: Estimation-theoretic IC design improves robustness and reduces power consumption"

Modern integrated circuits (ICs) are designed as massively parallel systems as a consequence of diminishing silicon feature sizes. This has adversely impacted reliability because of increased errors due to process and environmental variations, and particle hits. Viewing hardware errors as analogous to measurement or system noise allows us to borrow results from estimation theory and extend Moore's law. The estimation-theoretic framework provides a design optimization formalization that enables power/reliability trade-off in broad classes of applications. Two applications described here show that specific instantiations of the framework yield significant power savings and system reliability. [C881]

"Energy efficiency, its benefits and methods to close the efficiency gap"

In an age when the fuel shortage, global warming, and reduction of carbon footprint are becoming urgent issues, it is important that all appliances, equipments and other heavy usage machinery operate as efficiently as possible. It is for this reason that power technology is becoming an important field of specialization as most of the heavy machinery operates on AC or DC electrical power. Various energy efficiency initiatives such as green grid initiative by data center operators, climate saver computing initiative (CSCI) by electronic equipment manufacturers, and efforts by large corporations to reduce the consumption of energy are becoming the topic of intense debate. Many corporations are announcing energy saving methods not only for the equipments but also for their facilities under the banner of "Going Green." It is not GHz processors or TB of storage which is the hot topic of conversation among technology experts all over the world but tons of carbon emitted into the atmosphere. Not long time back, every expert in the industry was designing electronic equipment for the best performance from the processors, memory and I/O devices, energy consumption was not the issue. That era is behind us, and the new industry Mantra is "Go Green". Today this requirement is not being imposed by EPA or DOE or by any agency but by the customers. Every customer wants to know the exact energy consumed by a system he is buying. The marketing folks are flooded with the request to provide the actual load profile in addition to the efficiency from 20 % to 100% of the load. The power supply designers are being asked to improve efficiency as high as the technology will permit. The things have changed so much in the last few months that power efficiency has become the top priority instead of the cost. What has changed in such a short time? One, the processor and memory power demand has overwhelmed the system to a point that it is hard to be cooled by air cooling. Not only it could not be-cooled, the energy cost is almost reaching 30% of the cost of the infrastructure. There is a message here-"Either solve the customer problem by efficient systems or lose the business. [C882]

"An 8640 MIPS SoC with Independent Power-Off Control of 8 CPUs and 8 RAMs by An Automatic Parallelizing Compiler"

Power efficient SoC design for embedded applications requires several independent power-domains where the power of unused blocks can be turned off. An SoC for mobile phones defines 23 hierarchical power domains but most of the power domains are assigned for peripheral IPs that mainly use low-leakage high-Vttransistors. Since high-performance multiprocessor SoCs use leaky low-Vttransistors for CPU sections, leakage power savings of these CPU sections is a primary objective. We develop an SoC with 8 processor cores and 8 user RAMs (1 per core) targeted for power-efficient high-performance embedded applications. We assign these 16 blocks to separate power domains so that they can be independently be powered off. A resume mode is also introduced where the power of the CPU is off and the user RAM is on for fast resume operation. An automatic parallelizing compiler schedules tasks for each CPU core and also performs power management for each CPU core. With the help of this compiler, each processor core can operate at a different frequency or even dynamically stop the clock to maintain processing performance while reducing average operating power consumption. The compiler also executes power-off control of unnecessary CPU cores. [C883]

"A new active compensator scheme for dynamic voltage scaling in voltage regulators"

Dynamic voltage scaling (DVS) techniques are used to optimize the power consumption of the microprocessor by

reducing the operating voltage under light-load conditions. To maximize the power saving of DVS, the voltage regulator should adjust the operating voltage to the new voltage commanded by the system as soon as possible. However the voltage regulator output capacitors and the compensation network may impact the voltage transitioning and settling time during DVS operation. In this paper, these impacts are discussed in detail and an active compensator scheme is proposed to optimize the DVS performance. Experimental results are included to illustrate the effectiveness of the proposed scheme. [C884]

"An Advanced Save-Energy Mechanism of Ad hoc Networks"

This article improves on the energy-consuming equation and nodes 'energy states in the old energy model of ad hoc networks, which concerned of the nodes' energy consumption in listening and idle period, and enhances the comprehensive of solving energy problem in this area. In the communication range of a node, where include the nodes could reach the nodes' signal, setting the highest energy-state node as an Agent will reduce the number of Agent in old save-energy model, and for improving the surviving time of the net, we added a new conception: edge-agent. The experiment indicates that the new energy-saving model cut down the idle nodes' energy consumption, declines the probability for nodes becoming agent-nodes, and increase the whole net's surviving time and the stability of communication because of using edge-agents. [C885]

"Reducing CPU Power Cost of Cluster System"

Cluster systems with high price-to-performance ratio have been utilized in various fields and size of cluster systems is increasing rapidly. Also, as the information retrieval and sharing through the Internet are used widely, scale of portal sites that collect, process and provide information, become larger. These portal sites have large scale cluster system to serve mass information, and operation and maintenance of the large cluster system is a big challenge to the portal sites. Because power cost is one of the main issues in the maintenance of the large cluster system, it is necessary to reduce the power cost of the cluster system. As one solution for this problem, this paper presents the CPU power management mechanism that reduces power usage of the cluster system. [C886]

"A Novel Cluster Routing Protocol with Power Balance in Ad Hoc Networks"

Recently, many kinds of wireless communication protocols are meaning for research. In the structure of ad hoc wireless networks, there are many researches discuss how to use better scheme for saving power. On the other hand, some researches proposed differs routing protocol for speed up routing discovery in ad hoc networks. Furthermore, even achieve the goal above, it requires reduce loading of networks simultaneously. Therefore, we propose a novel cluster routing protocol with power balance scheme in ad hoc networks, calls NCRPB. By using NCRPB scheme, it can reduce the loading of networks, power depletion effective, and increase life time of nodes and networks. [C887]

"Using Transmit-Only Sensors to Reduce Deployment Cost of Wireless Sensor Networks"

We consider a hybrid wireless sensor network with regular and transmit-only sensors. The transmit-only sensors do not have the receiver circuit (or have a very low data-rate one), hence are cheaper and less energy consuming, but their transmissions cannot be coordinated. Regular sensors, also called cluster-heads, are responsible for receiving information from the transmit-only sensors and forwarding it to sinks. The main goal of such a hybrid network is to reduce the cost of deployment while achieving some performance goals (minimum coverage, sensing rate, etc). In this paper we are interested in the communication between the transmit-only sensors and the cluster-heads. Since the sensors have no feedback, their transmission schedule is random. The cluster-heads, on the contrary, adapt their reception policy to achieve the performance goals. Using a mathematical model of random access networks developed in [1] we define and evaluate packet admission policies for different performance criteria. We show that the proposed hybrid network architecture, using the optimal policies, can achieve substantial dollar cost and power consumption savings as compared to conventional architectures while providing the same performance guarantees. [C888]

"Test Enabled Process Tuning for Adaptive Baseband OFDM Processor"

As channel conditions in wireless communications improve, the noise performance of the baseband DSP processor can be degraded to save power without compromising bit error rate. The degradation of baseband signal noise is achieved by degrading the noise performance (reducing the wordlength and supply voltage) of the various baseband signal processing modules in specific proportions defined by a locus, that ensures minimum overall power consumption for a given channel. In the presence of intra-die process variations, this locus is determined by the delay/leakage parameters of each baseband module. In our approach, a path oscillation test applied to each module is used to select the "best" locus of choice and an EVM driven feedback loop is used to

dynamically modulate the wordlength/power consumption of each module as dictated by this locus to minimize power and modulate baseband SNR across a range of channel conditions. [C889]

"Optimal p-Persistent MAC Algorithm for Event-Driven Wireless Sensor Networks"

In event-driven wireless sensor networks nodes transmit information only if the monitored physical magnitude levels have triggered an alarm. In these networks, traffic exhibits a high spatial correlation, since it is likely that neighbor nodes detect and try to notify the same events. Thus, the probability of packet collision raises up, as well as notification delay, just as opposite as required. In this work we propose to use a p- persistent mechanism in the access control layer. The aim is reducing collisions and saving energy. We compute the optimal p for a coherent network deployment and describe the experimental implementation of our proposal. Theoretical computations predict a notable improvement, specially in terms of energy, and experiments reveal that our proposal achieves up to 67% of energy saving compared against a perfect (collision-free) mechanisms. [C890]

"Energy-Efficient Module applied with Run Length Coding for Wireless Sensor Networks"

In wireless sensor networks, sensor nodes are generally battery-operated. The efficient use of energy is very important, as the battery of sensor nodes cannot be recharged after deployment. The energy can be saved by placing the radio in the low power sleep mode, when data aren't transmitted or received. So, our goal is to keep minimizing energy consumption of a limited battery of sensor node and to prolong the network life as long as possible by maximizing the time of low power sleep mode. In this paper, to achieve these aims, we discuss the design of a new module that has the efficient use of energy by eliminating the major waste cause such as the sensing data equal to previous sensing data in monitoring environment periodically. So, we apply run length coding and make C-module (compression-module). C-Module residing between the transport layer and application layer has the efficient use of energy by reducing traffics. The performance of C-module is studied by simulation and is compared to that of well known 802.11, S-MAC, C-module cooperating with 802.11 and C-module cooperating with S-MAC. Finally, we prove that using C-module has more improved results than not using C-module in the aspect of efficient use of energy through NS-2 simulator. [C891]

"An Improved ARQ Scheme in Underwater Acoustic Sensor Networks"

In underwater acoustic communications, using the property of long propagation delay, a concurrent packet transmission between two nodes could be made feasible without any collision. In this paper, utilizing the channel-sharing property, an efficient ARQ scheme is proposed. By controlling packet size such a way that transmission time becomes smaller than propagation delay, and by scheduling such packets properly, the collision-free transmission between multiple nodes is achieved. In addition, during a packet-relay through multiple hops, the typical acknowledgement (ACK) signal is replaced with overhearing data packet returned back from the next hop. The usage of overhearing as an ACK not only save power consumption but also significantly reduces overhead and transmission latency. Through the mathematical analysis and simulations, we evaluate proposed scheme in terms of the latency by comparing with an existing Stop & Wait ARQ. [C892]

"Exploiting Energy Saving Opportunity of Barrier Operation in MPI Programs"

In high performance parallel computing, energy consumption has become a more and more important problem. Under the support of the voltage scaling- available processors, reducing CPU voltage/frequency in the non-critical path is an efficient energy reduction method. This paper exploited the energy saving opportunities in MPI_Barrier operation. Through testing NPB3.2-MPI programs on 256-process cluster system, we found that the busy time of each process has the big difference each other when the cluster is connected by a 100 Mbps network. We proposed two low-power methods: one is shut-down based MPI_Barrier (SDMB) and the other is dynamic voltage/frequency scaling based MPI_Barrier (DVSMB). Experimental results show that average 4.95% energy saving is obtained through SDMB and average 12.28% energy saving is obtained through DVSMB. SDMBavoids the performance loss through pre-activation strategy and the performance loss of DVSMBis less than 1%. [C893]

"P-HIP: Paging Extensions for Host Identity Protocol"

In wireless networks, paging is widely used to reduce the signaling cost of the location management and save power consumption. Currently, Host Identity Protocol (HIP) does not support paging. In this paper, we propose P-HIP, paging extensions for HIP, and discuss the paging architecture, protocol, algorithm, and location management scheme. In addition, we develop an analytical model encompassing the arbitrary subnet technology and the mobile network movement history to study the performance of HIP with and without paging extensions. The performance results show that P-HIP outperforms HIP under various scenarios in terms of reducing the total signaling cost. [C894]

"Energy Efficient Expanding Ring Search for Route Discovery in MANETs"

A mobile ad-hoc network is a self-configuring network of user devices that are connected by wireless links in infrastructure-less situation. These kinds of networks have many challenges such as unreliable links, lack of scalability, limited resources, etc. and energy consumption is a major issue in designing network protocols because of battery constraints. In on-demand multi-hop routing protocols e.g. AODV and DSR, the route discovery process uses expanding ring search heuristic algorithm for reducing broadcast overhead and saving energy consumption. However, based on our observation we see that there are still some redundant broadcasts of this process that causes overhead, wasted energy, and increased collisions in the network. Here we propose a method which solves the redundant broadcasts of route discovery based on expanding ring search. The performance evaluation results show that by applying the proposed scheme, we can reduce the overhead of expanding ring search based route discovery up to about 20%, and therefore the total energy consumption of AODV is decreased by 15%. [C895]

"On the Use of Chinese Remainder Theorem for Energy Saving in Wireless Sensor Networks"

In this paper we discuss the use of the Chinese Remainder Theorem (CRT) for a novel forwarding scheme in wireless sensor networks. The proposed approach is characterized by a computationally simple packet splitting procedure able to reduce the energy needed for transmission and increase the network lifetime accordingly. Simulation results show that the proposed algorithm outperforms more traditional approaches in terms of both energy efficiency and fair distribution of energy consumption among all nodes in the network. [C896]

"Low Power Consumption Solutions for Instant Messaging on Mobile Devices"

Instant messaging (IM) services enable real-time text and multimedia exchange and online presence awareness. Users typically log onto IM services persistently in order to discover available friends and also to be discovered. However, our analysis shows that running a desktop-oriented IM client on a mobile device over a cellular or a wireless LAN network incurs massive power consumption. Such power consumption penalty can render persistent-IM infeasible for battery-powered mobile devices. The reason for the power penalty lies in the fact that IM must communicate with the network frequently to exchange presence information with remote entities. In this paper, we propose several low power consumption solutions for IM on mobile devices. By reducing the network accesses and keeping mobile devices in the sleep mode as much as possible, these solutions achieve significant power saving. We implement the proposed solutions using a Jabber-based architecture. We also present power measurement results under this implementation. The results agree with our analysis very well. [C897]

"Design of a Low-Power and Low-Latency MAC Protocol with Nodes Grouping and Transmission Pipelining in Wireless Sensor Networks"

In wireless sensor networks (WSNs), the strategies of periodical sleeping and contending for using the channel are efficient in power consumption and channel utilization. However, the situations of contention and sleep arise another power consumption problem of overhearing the controls packets and increasing transmission latency. In this paper, we propose the design of nodes grouping and transmission pipelining to improve the power consumption and transmission delay. In nodes grouping design, there are several groups in the WSNs and each sensor node is initially set to belong to one of these groups where each group has different contention time and transmission time. In contrast to the situation that all nodes hear the control packets in the contention period, nodes grouping can reduce the number of nodes that overhearing the control packets in the same time to save the power consumption. To improve the transmission delay, we propose the design of transmission pipelining that makes the group number of the nodes on the path to be continuous. Therefore, the sensor node can transmit data to the sink node pipelining. From the simulation results, when the number of groups is 2, the power consumption of transmitting a byte (mJ/byte) and the transmission delay of our proposed design perform better than SMAC by about 50%. When the number of groups is 4, although the transmission delay shows only a little better than SMAC, the power consumption of transmitting a byte of our proposed design has much better than SMAC by 75%. [C898]

"An Enhanced Relay-Enabled Medium Access Control Protocol for Wireless Ad Hoc Networks"

In this paper we propose an enhanced relay-enabled distributed coordination function (rDCF) for wireless ad hoc networks. The idea of rDCF is to use high data rate nodes to work as relays for the low data rate nodes. The relay helps to increase the throughput and lower overall blocking time of nodes due to faster dual-hop transmission. rDCF achieves higher throughput over IEEE 802.11 distributed coordination function (DCF). The protocol is further enhanced for higher throughput and reduced energy. These enhancements result from the use

of a dynamic preamble (i.e. using short preamble for the relay transmission) and also by reducing unnecessary overhearing (by other nodes not involved in transmission). We have modeled the energy consumption of rDCF, showing that rDCF provides an energy efficiency of 21.7% at 50 nodes over 802.11 DCF. Compared with the existing rDCF, the enhanced rDCF (ErDCF) scheme proposed in this paper yields a throughput improvement of 16.54% (at the packet length of 1000 bytes) and an energy saving of 53% at 50 nodes. [C899]

"Efficient Uplink Resource Allocation for Power Saving in IEEE 802.16 OFDMA Systems"

In this paper, we define a resource allocation problem focusing on the scheme minimizing energy consumption of subscribers in uplink subframe of the IEEE 802.16 OFDMA systems. In order to clearly formulate the relation between the uplink resource allocation and energy efficiency of subscribers, we use the multiple choice knapsack (MCK) problem, which is proved to be an NP-hard problem. Instead of finding an optimal solution, we seek a suboptimal solution. Based on the problem formulation, we adopt the existing solution of the Multiple Choice Knapsack problem to solve the resource allocation problem. The suboptimal solution adaptively uses the modulation and coding scheme defined in the IEEE 802.16 systems to minimize the required transmission power while guaranteeing QoS. Our simulation results show that the suboptimal algorithm can reduce the energy consumption up to 53% compared to the channel state information (CSI) scheme, which determines the modulation and coding level only considering the channel state information. [C900]

"Quality Based Handoff in DVB-H Systems Assisted by Cellular Network"

This paper introduces a novel seamless handoff approach for DVB-H networks aimed at reducing the user terminal power consumption and at making the handoff algorithm be driven by the quality of the user received signal. This implies the substitution of standard RSSI-based procedures with a method based on the Modulation Error Rate (MER) monitoring. The additional use of an underlying cellular network, for DVB-H related data delivering, allows to achieve additional advantages: a superior power saving and a faster handoff execution. Obtained results suggest that the DVB-H handoff protocol design is an issue, which definitely deserves further investigation in the view of making DVB-H an effective solution for delivering broadcast content to mobile users. [C901]

"A Scheduling-Based Delay-Tolerant Power Saving Scheme for the IEEE 802.16e Wireless MAN"

When the system load is high or congestion occurs, a base station (BS) in the IEEE 802.16e metropolitan area network (MAN) is not able to transmit all buffered packets to mobile stations (MSs) within a frame interval, resulting in extra energy consumption for MSs to wake up for receiving pending packets. To save energy for such a situation, we first propose a scheduling- based delay-tolerant traffic indication message (D-TIM) scheme to enable a BS to properly schedule queued packets for non-real-time variable rate (NRT-VR) and best effort (BE) using information of delay threshold (DT), which can be derived from QoS parameters, and to determine the time offset between the frame in which an MS has to wake up and the frame containing a TIM message. With the time offset, MSs are able to wake up more precisely so that energy can be efficiently saved and less packet delay can be reached. Furthermore, two variants of D- TIM are also proposed for solving the problem of higher jitter to the unsolicited grant service (UGS). Through simulation, we demonstrate that D-TIM outperforms other related schemes in the literature in terms of energy efficiency and packet delay and the two variants reduce jitter greatly as compared to D-TIM while maintaining good energy efficiency and less packet delay. [C902]

"A Passive 915 MHz UHF RFID Tag"

This paper describes the implementation of a passive RFID tag targeting low power implementation, which works on 915 MHz UHF frequency. The proposed architecture allows customizing the command sets implemented inside its digital block, according to the target application needs, saving area and reducing power consumption. A flexible design flow is proposed for the customization, verification and synthesis of the digital block, targeting low power requirements. [C903]

"Complexity reduction of adaptive T-algorithm on UWB OFDM systems"

This paper proposes two algorithms to further reduce computation complexity for an adaptive T-algorithm. The complexity saving is achieved by a new way of threshold computation based on reusing already available metrics. The first algorithm requires knowledge of noise variance while the second algorithm does not. Simulation results on an ultra- wideband orthogonal frequency division multiplexing (UWB OFDM) system show that the proposed algorithms can reduce computational complexity significantly especially at high SNR while there is no performance degradation compared to the existing algorithms. [C904]

"Plenary Speech 2P3: The Greening of The SoC-How Electrical Engineers Will Save The World"

Global Warming is hot! Climate change is occurring all around us, and the scientific evidence is increasingly overwhelming pointing to man's hand in the phenomena. We are already seeing huge impacts of Climate Change, much faster than anybody predicted, only a few short years ago. What can we do about? How can we slow and even reverse our impact on Climate Change? The key man made contributing factor is carbon emissions, primarily from coal fired power plants. We need to reduce the number of plants that we building, then the number of power plants that we require.The key to this is a reduction in power consumption.There are many everyday actions we can take individually to help. Al Gore states that Global Warming is an engineering problem that will be solved by engineers, addressing the issue as an opportunity, rather than additional cost. We will explore how engineers will impact Climate Change. Low power IC design techniques will play a role in this just as new powerful techniques are coming into vogue. [C905]

"ETSP: An Energy-Efficient Time Synchronization Protocol for Wireless Sensor Networks"

Wireless sensor networks (WSN) have specific constraints and stringent requirements in contrast to traditional wired and wireless computer networks. Among these specific requirements, energy-efficiency is the most prominent. Sensor motes have finite amount of energy supply. In most WSN applications, hundreds or thousands of motes are deployed in an area (e.g., behind enemy lines or foliage) and there is no provision for battery recharging. Therefore, a fundamental constraint on WSN applications and services is to extend the network's lifetime by making the batteries run longer. In this paper we propose an energy-efficient time synchronization protocol, referred as ETSP, which gives significant improvement in energy consumption over existing time synchronization schemes. We first evaluate the existing reference broadcast synchronization (RBS) and time-sync protocol for sensor networks (TPSN), which are two prominent examples of receiver-receiver and sender-receiver synchronization methods. This performance analysis demonstrates that combination of RBS and TPSN can work better than using these techniques separately. In the proposed ETSP protocol, we identify conditions to toggle between RBS and TPSN based on a threshold value. We experimentally and mathematically derive an optimal value of the switching threshold for different sensor motes. In this way we effectively reduce the number of transmissions which results in saving energy. Moreover, we assess the performance of our protocol on the bit error traces collected over a real WSN test bed to cater for retransmissions overload for the time synchronization protocols under consideration. [C906]

"An Adaptive Approach to Manage the Number of Virtual Channels"

Network-on-chip (NoC) is a precious approach to handle huge number of transistors by virtue of technology scaling to lower than 50 nm. Virtual channels have been introduced in order to improve the performance according to a timing multiplexing concept in each physical channel. The incremental effect of virtual channels on power consumption has been shown in literatures. The issue of power saving has always been controversial to many designers. In this paper, we introduce a new technique which tries to adaptively mange the number of virtual channels in order to reduce the power consumption while not degrading the performance of the network without any reconfiguration. Our experimental results show the efficiency of our method in a torus topology under different traffic models and Duato routing algorithm with 49 % and 30 % power saving in the best and worst conditions, respectively. [C907]

"Early Design Phase Power Performance Trade-Offs Using In-Situ Macro Models"

Early phase space exploration with a focus on power performance tradeoffs has been shown to enable faster design convergence. Tightly coupled physical design considerations and system level models are needed to guarantee time-to- market. This paper describes a methodology for early design space exploration. A Pareto-front analysis using the proposed methodology was applied to an industrial design to perform design space exploration. The obtained low power design solution improved the designers best solution by additionally reducing power by 6% with 2% performance impact. The optimal trade-off solution improved designers best by additionally trading off 1.7% and 2.8% performance for power savings of 8.5% and 7.6% respectively. The absolute amount achieved here is not as important as knowing what the desired design options should be for each functional block in the design very early in the design phase. [C908]

"A Simple Battery Aware Gossip Based Sleep Protocol for Densely Deployed Ad-Hoc and Sensor Networks"

Conserving power in mobile ad-hoc and sensor networks is a big challenge. Most of the nodes in these networks, in general, are battery powered therefore, an efficient power saving protocol is required to extend the lifetime of such networks. A lot of work has been done and several protocols have been proposed to address this problem. Gossip based protocols, which are based on the results of percolation theory, significantly reduce

power consumption with very little implementation overhead. However, not much work has been done to make gossiping battery aware. In this paper we introduce a simple gossip based battery aware sleep protocol. The protocol allows low battery nodes to sleep more, therefore, improves overall network lifetime. [C909]

"Remaining Energy-Aware Power Management Mechanism in the 802.16e MAC"

The sleep-mode operation in power management helps to increase the life of a mobile station by saving energy consumption while it increases the MAC service data unit (SDU) response delay. Due to the trade-off relationship between these two performance metrics, it is important to determine the suitable values for two operating parameters, the initial sleep interval (Tmin) and the final sleep interval (Tmax), which manipulate the sleep-mode operation in the IEEE 802.16e MAC. To reach a fuller understanding of this problem, this paper first presents the sleep-mode operation. A new power management mechanism based on the knowledge on remaining energy in a mobile subscriber station (MSS) is then proposed. Benefits of this mechanism are to reduce the MAC SDU response delay under sufficient energy and to increase the life of a station under insufficient remaining energy. An analytical model for sleep-mode operation is developed, and the proposed mechanism is validated by computer simulation. [C910]

"A Power Efficient Approach to Fault-Tolerant Register File Design"

Recently, the trade-off between power consumption and fault tolerance in embedded processors has been highlighted. This paper proposes an approach to reduce dynamic power of conventional high-level fault-tolerant techniques used in the register file of processors, without affecting the effectiveness of the fault-tolerant techniques. The power reduction is based on the reduction of dynamic power of the unaccessed parts of the register file. This approach is applied to three transient fault-tolerant techniques: single error correction (SEC) Hamming code, duplication with parity, and triple modular redundancy (TMR). As a case study, this approach is implemented on the register file of an OpenRISC 1200 processor. The experimental calculation of the power consumption shows that the proposed approach saves about 67%, 62%, and 58% power for TMR, duplication with parity, and SEC Hamming code, respectively. [C911]

"Exploiting Variable Cycle Transmission for Energy-Efficient On-Chip Interconnect Design"

As on-chip interconnect in deep-submicron designs contribute to the system-wide power consumption, minimization of interconnect power consumption has become one of the important design issues in deep-submicron technologies. As transition activity mainly determines the interconnect power consumption, several bus encoding techniques have been proposed to minimize the activity. Unlike the existing low-power or energy-efficient bus encoding techniques, in this paper, we propose a scheme which exploits both dynamic voltage scaling and variable cycle transmission mechanisms for minimizing on-chip interconnect energy consumption. We transmit data using variable cycle transmission method and, based on the delay savings achieved through variable cycle transmission method at regular intervals, scale the voltage and frequency to obtain significant energy savings. Using our technique for a 5 mm interconnect wire we achieved energy savings of 30% and 45% over the base case in the address bus and data bus, respectively. Our technique also reduces the energy-delay-product by 34% and 52% for address bus and data bus, respectively. [C912]

"Energy-Efficient Soft-Error Protection Using Operand Encoding and Operation Bypass"

As designs scale further into the nanometer regime, the vulnerability of logic circuits in commodity products to soft errors is increasing and their contribution towards total chip soft-error rate (SER) is predicted to be as high as 60%, much more than that of memory. We employ a value-aware framework that enables operation bypass in combinational circuits to simultaneously reduce both energy consumption and SER in them. Unlike techniques that reduce SER in combinational logic with very high performance and/or energy overheads (since they usually employ significant explicit spatial or temporal redundancy), our technique dynamically exploits operand values by shutting off portions of combinational circuits, thus reducing vulnerable area and energy consumption with minimal performance overheads. On the average across the SPEC CPU2k benchmark suite, we obtain 60% SER reduction and 24% energy savings with minimal impact on performance. [C913]

"A Compiler-in-the-Loop framework to explore Horizontally Partitioned Cache architectures"

Horizontally Partitioned Caches (HPCs) are a promising architectural feature to reduce the energy consumption of the memory subsystem. However, the energy reduction obtained using HPC architectures is very sensitive to the HPC parameters. Therefore it is very important to explore the HPC design space and carefully choose the HPC parameters that result in minimum energy consumption for the application. However, since in HPC architectures, the compiler has a significant impact on the energy consumption of the memory subsystem, it is extremely important to include compiler while deciding the HPC design parameters. While there has been no

previous approaches to HPC design exploration, existing cache design space exploration methodologies do not include the compiler effects during DSE. In this paper, we present a Compiler-in- the-Loop (CIL) Design Space Exploration (DSE) methodology to explore and decide the HPC design parameters. Our experimental results on HP iPAQ h4300-like memory subsystem running benchmarks from the MiBench suite demonstrate that CIL DSE can discover HPC configurations with up to 80% lesser energy consumption than the HPC configuration in the iPAQ. In contrast, tradition simulation-only exploration can discover HPC design parameters that result in only 57% memory subsystem energy reduction. Finally our hybrid CIL DSE heuristic saves 67% of the exploration time as compared to the exhaustive exploration, while providing maximum possible energy savings on our set of benchmarks. [C914]

"QoS-Enabled Power Saving Access Points for IEEE 802.11e Networks"

IEEE 802.11 is now being used in many situations where access point (AP) power saving would be highly desirable. Unfortunately, this is not possible since the existing standard requires that APs remain active at all times. In this paper, we present a framework for a power saving quality-of-service (QoS) enabled access point (PSQAP), intended for use in low power infrastructure applications. The proposed scheme introduces infrastructure based power saving while preserving the QoS requirements for delay and loss intolerant real-time applications. Using an extensive simulation study we have evaluated the integrated framework, which consists of a proposed energy efficient media access control (MAC) protocol and an adaptive connection admission control (CAC) scheme. Our results show that the power consumption at PSQAPs can be significantly reduced without violating any of the QoS requirements for real-time traffic streams. The effect on power saving at the stations is also reasonable and can be controlled via protocol specific parameters. [C915]

"Throughput and Energy Efficiency of Bluetooth v2 + EDR in Fading Channels"

In this paper, we present a mathematical framework that permits an accurate performance analysis, both in terms of average throughput and energy efficiency, of Bluetooth link performance in fading channels. Conversely to most part of the literature concerning Bluetooth performance, this analysis takes into consideration the microscopic level power-saving mechanisms introduced in Bluetooth specifications to reduce the energy consumption during active mode. The analysis makes use of a two-state Markov chain to distinguish the transmission of useful and duplicate packets by the master. Then, the average energy spent, the amount of data exchanged and the time elapsed for each transition of the Markov chain, are derived. Hence, we apply the renewal reward theory to derive the average throughput and energy efficiency of the data link for different data packet formats and transmission rates, both in AWGN and fading channels. A proof of concept is provided by applying the mathematical framework to a Bluetooth v2.0 with Enhanced Data Rate data link. The analysis permits to appreciate the advantage, in terms of throughput and energy efficiency, of the enhanced data rate packet formats over the basic rate. [C916]

"Low-Cost VC Allocator Design for Virtual Channel Wormhole Routers in Networks-on-Chip"

Through low-level simulation and analysis, we find that the virtual channel allocator (VA) consumes large area and power while it is not critical in the performances of a NoC. Thus, it is possible to reduce the costs of VA with only a small penalty in network performances. This paper proposes two low-cost VA architectures: look-ahead VA and unfair VA. Compared with a general VA, the look- ahead VA reduces the number of both input VC arbiters and output VC arbiters while the unfair VA decreases the size of the output VC arbiters. Our experiments based on UMC 130 nm SP library show that the two architectures jointly save area cost by 70.95% and power consumption by 76.21% with nearly no adverse effect on network latency and throughput. To the best of our knowledge, it is the first time a VC allocator design is optimized in the context of NoC. [C917]

"Energy aware routing in high capacity overlays in wireless sensor networks"

One of the most critical issues in wireless sensor networks is the limited availability of energy within the network nodes. Recently, the idea of deploying a high capacity overlay using virtual sinks with long range 802.11 links to ease congestion in the underlying sensor network has been explored. Since the VSs are battery powered, it is important to conserve energy in them too. To reduce the energy consumption, usually the shortest path (SP) route is preferred in networks that do not use topology control. However, if only a few of the VS nodes are sending data, routing along the SP may require some additional VS nodes to be turned on just for the relaying purpose which otherwise could be turned off. Since the link bandwidth is high in 802.11 (Mbps) and the sensory data generation rate is low (Kbps) in comparison to the bandwidth, a high idle-mode energy cost may be incurred in the relaying VS nodes. In this paper, we explore the idea of using minimum connected dominating set (MCDS) based routes, since more energy can be saved by switching the non-dominator VSs to sleep mode and by funneling all the data through the MCDS nodes. We propose an energy-aware routing scheme that considers

both the SP route and the MCDS nodes to discover a path along the VS network to the physical sink. Performance evaluation of the routing scheme shows a notable reduction in the overall energy consumption in the network with respect to SP routing while simultaneously maintaining an acceptable packet delivery rate. [C918]

"A low power crosstalk-free bus encoding using genetic algorithm"

In this paper, we present a new bus coding scheme based on genetic algorithm to eliminate crosstalk delay and to reduce power dissipation. This algorithm can be applied usefully for large width bus, in which it is difficult to find the optimal solution for bus coding. Our bus encoding scheme is capable to eliminate completely crosstalk problems in bus partitions as well as inter-partitions by using crosstalk-free codewords and active shielding wires. The energy-optimum code mapping for crosstalk-free codewords is chosen by the genetic algorithm based on the probability of transmission data. The experiment shows that the proposed coding technique can save the dynamic power up to 51% for 64-bit buses while totally avoiding the crosstalk delay. [C919]

"The IEEE 802.11 Power Saving Mechanism: An Experimental Study"

This paper presents an experimental study of the IEEE 802.11 power saving mechanism on PDA in a wireless local area network (WLAN). The power consumptions of the PDA in both continuous active mode (CAM) and power saving mode (PSM) are measured under various traffic scenarios, and the impact of both internal and external factors on power performance, such as beacon/DTIM period and background multicast traffic, are examined. Our findings are: 1) The impact of beacon/DTIM period is only significant when their values are small and the imposed traffic rate is high. 2) The presence of background traffic can significantly reduce the effectiveness of the PSM. Analysis of these findings may provide important guidance to the design of future power saving mechanisms. [C920]

"Software-cooperative power-efficient heterogeneous multi-core for media processing"

A heterogeneous multi-core processor (HMCP) architecture, which integrates general purpose processors (CPU) and accelerators (ACC) to achieve high-performance as well as low-power consumption with the support of a parallelizing compiler, was developed. The evaluation was performed using an MP3 audio encoder on a simulator that accurately models the HMCP. It showed that 16-frame encoding on the HMCP with four CPUs and four ACCs yielded 24.5-fold speed-up of performance against sequential execution on one CPU. Furthermore, power saving by the compiler reduced energy consumption of the encoding to 0.17 J, namely, by 28.4%. [C921]

"Run-time power gating of on-chip routers using look-ahead routing"

Since on-chip routers in network-on-chips play a key role in on-chip communication between cores, they should be always preparing for packet injections even if a part of cores are in standby mode, resulting in a larger standby power of routers compared with cores. The run-time power gating of individual channels in a router is one of attractive solutions to reduce the standby power of chip without affecting the on-chip communication. However, a state transition between sleep and active mode incurs the performance penalty, and turning a power switch on or off dissipates the overhead energy, which means a short-term sleep adversely increases the power consumption. In this paper, we propose a sleep control method based on look-ahead routing that detects the arrival of packets two hops ahead, so as to hide the wake-up delay and reduce the short-term sleeps of channels. Simulation results using real application traces show that the proposed method conceals the wake-up delay of less than five cycles, and more leakage power can be saved compared with the original naive method. [C922]

"Fine-Grained Supply Gating Through Hypergraph Partitioning and Shannon Decomposition for Active Power Reduction"

Energy-efficient performance has emerged as the key design objective of high-performance logic circuits to address power-induced reliability concerns and battery life requirements in portable devices. In the sub-65nm technology regime, these problems continue to grow as leakage power becomes the predominant form of power consumption. Among numerous power reduction techniques employed at the circuit and architectural levels, supply gating has been proven to be very effective for standby power reduction. In this paper, we propose application of fine-grained supply gating to large complex circuits for active leakage and dynamic power reduction. A design methodology and associated CAD tool is developed to synthesize combinational logic using hypergraph partitioning and Shannon decomposition, which reduces both leakage and switching power by disabling unused logic dynamically in small clusters of gates. Simulation results for a set of ISCAS-85 benchmarks show that the proposed approach can achieve up to 40% saving in total power in active mode (and up to 37% saving in standby power) with negligible impact on performance and die area for a predictive 32 nm

technology. [C923]

"Performance of Energy Efficient Source Coding and Interference Reduction in Wireless Sensor Network Systems"

In this paper, our focus is on energy efficient coding schemes for wireless sensor networks. A source coding and modulation technique for reducing multiple access interference (MAI) as well as for reducing power consumption in MC-CDMA wireless sensor network systems is presented. In all our analysis we consider perfect power control mechanism. Source symbols are represented by a special coding, termed Minimum Energy coding (ME coding), which exploits redundant bits for saving power when transmitted via RF links with On-Off-Keying. This ME coding is applied to MC-CDMA sensor network systems in order to reduce MAI as well as to reduce power consumption. The proposed method is aptly suitable for wireless sensor video node in application of video coding. [C924]

"Efficient Software Architecture for IPSec Acceleration Using a Programmable Security Processor"

Cryptographic accelerators and security processors are often used in embedded systems in order to enable enhanced security without significantly impacting performance or power consumption. However, realizing the performance promised by them requires the design of efficient software architectures for crypto offloading (offloading cryptographic operations from a host processor). In this paper, we describe an efficient software architecture for IPSec crypto offloading on a state-of-the-art mobile application processor system-on-chip (SoC) that includes a programmable security processor. We consider both user-space and kernel-space implementations of IPSec, compare their performance, and identify factors that limit the efficiency of crypto offloading. We describe two optimizations, called protocol-level crypto offloading and adaptive crypto offloading, which further improve the performance of IPSec by (i) offloading higher granularity computations to reduce the crypto offloading overheads, and (ii) using crypto offloading judiciously based on the trade-off between the savings in processing cycles vs. the overhead of communication with the security processor. We measure the performance of our implementation of IPSec crypto offloading using a commercial network protocol stack on the mobile application processor SoC, under a wide range of workloads. Our results indicate that efficient crypto offloading can result in application-level improvements of up to 10.6X in data rate and up to 5X in latency, enabling IPSec to be used for emerging high-bandwidth and interactive mobile applications. [C925]

"A power saving system based on energy-aware control elements in ubiquitous home network"

In this paper, we propose the system reducing the power consumption based on the energy-aware control elements (ECE). ECE refers to the minimum unit module providing a service within the single system. For example, the home gateway system provides the visitor identification service. If it is the case, the main processor, the Ethernet module, the MPEG encoding module built-in camera, and etc. are needed. We classify the main ECE, the Ethernet ECE, the MPEG encoder ECE, and etc. The home gateway system provides the service like not only the visitor identification service but also Internet service, VoIP service, IPTV service and the home automation service. This kind of services can be independently carried out and be performed together with other devices. The home gateway system can save the power consumption by activating only ECE which it is necessary according to the performed service. Also, we suggest the method for saving the power consumption by controlling only ECE required based on the communication traffic. We implement the technology monitoring the communication traffic in the home gateway system through FPGA. This FPGA monitors the communication traffic and distinguishes between the user valid packet and invalid packet. The software embedded in FPGA notifies so that the high layer application can control required ECE according to the user valid packet. We show the marvelous effect for power saving through the ECE base power saving system implementation. [C926]

"A compact and power efficient local oscillator generation and distribution system for complex multi radio systems"

A 65 nm, 0.53 mm^2, CMOS multi-radio-frequency local oscillator (LO) generation and distribution system utilizes single phase routings, a single VCO, and smaller Q inductors (compensated by a negative R stage) to reduce area, quadrature coupling, and power consumption. The LO amplitude, IQ imbalances and current consumption are adjusted dynamically by an automatic control loop (ACL) in order to maintain optimum performance. This work results in 60% area and 50% power savings relative to prior implementation while maintaining the optimized performances [4]. [C927]

"Novel bus termination schemes to reduce IO power consumption on low power intel small form factor platforms"

In small form factor (SFF) platforms, motherboard space, and power are some of the most critical factors for their design. System memory bus is one of the major contributors to the I/O power consumption. Historically, the memory bus has always been terminated on the motherboard at the receiver end to meet Si/timing requirements. But these terminations result in significant power dissipation. This paper investigates the impact of removing these terminations [No-ODT (on die termination) for data/strobe and No-Rtt-parallel termination for command/control (CMD/CNTL) for different memory configurations], and provides motherboard routing recommendations to support No-ODT/No-Rtt without violating SI/timing specs. This paper also highlights the savings in power and motherboard space achieved by removing these terminations. [C928]

"Efficient Sensor Network Reprogramming through Compression of Executable Modules"

Software in deployed sensor networks needs to be updated to introduce new functionality or to fix bugs. Reducing dissemination time is important because the dissemination disturbs the regular operation of the network. We present a method for reducing the dissemination time and energy consumption based on compression of native code modules. Code compression reduces the size of the software update, but the decompression on the sensor nodes requires processing time and energy. We quantify these trade-offs for seven different compression algorithms. Our results show that GZIP has the most favorable trade-offs, saving on average 67% of the dissemination time and 69% of the energy in a multi-hop wireless sensor network. [C929]

"A Set Cover-Based Density Control Algorithm for Sensing Coverage Problems in Wireless Sensor Networks"

Wireless sensor networks consist of a large number of sensor nodes with limited power and resource. To prolong network lifetime, the energy consumption must be somehow reduced. In this paper, we propose a localized density control algorithm for energy savings. The goals are to maintain a minimal number of active sensor nodes and to reduce radio-traffic intensity while conserving the sensing coverage of the network. Our localized algorithm is based on a greedy solution of a weighted set-cover problem. Each node locally computes whether to sleep or to stay active. Given that the local decision might worsen the sensing coverage, we also introduce a voting scheme for selecting active nodes to assure that a node can sleep if and only if its sensing area is completely covered by its active neighbors. We have implemented our localized algorithm and voting scheme on Tiny OS and evaluated on TOSSIM. The result indicates that our algorithm is efficient and viable for practical use. [C930]

"Energy efficient workforce selection in special-purpose wireless sensor networks"

Sensors are typically powered by non-renewable energy sources (e.g. batteries). This fact makes sensors energy very precious resource that must be saved and used wisely. Many protocols have been proposed to optimize energy consumption in different areas of WSNs (e.g. MAC, routing, data aggregation, etc). However, literature has paid less attention to energy efficient workforce management, namely the way sensors are being recruited. In this work, we show that tasking sensors improperly may result in severely uneven consumption of sensors energy. This can negatively impact network performance through reducing network density, creating energy holes or reducing network lifetime. For the limited communication capabilities of sensors, communication in WSNs deployed in large areas is multihop by nature. However for some special WSN applications (e.g firefighting and handicapped assistance) where the central Aggregating Node (AN) (mounted on the firefighter helmet or the handicapped stick) has low mobility, the monitored area of interest is temporarily limited to a small disk that is centered at the AN. Sensors that reside on that moving disk and the AN form a dynamic WSN where a single hop communication model is appropriate and beneficial. For such scenarios, we propose and evaluate a new protocol that provides an energy efficient workforce management for single and multihop WSNs. Analytical and simulation results demonstrate that the proposed approach significantly increases network lifetime by evenly consuming sensors energy. We also propose an algorithm to extend the single hop version of the protocol to a multihop environment. [C931]

"Design and assessment of a sustainable networked system in the U.S.; Case study of book delivery system"

In this paper, we attempted to design and assess a sustainable networked delivery (SND) system, which can achieve significant reductions of energy consumption and environmental emissions of critical local pollutants and greenhouse gases due to growing local transportation in urban areas. SND system is a combination of e-commerce and centralized pickup point (PP), with the PP being a location that the consumer will already be visiting regularly. Transportation energy consumption and concomitant emissions in the three delivery systems (traditional networked delivery (TND) system, e-commerce networked delivery (END) system, and sustainable networked delivery (SND)) were compared. Our research results show that the SND system has a lot of

possibilities to save local transportation energy consumption and reduce environmental emissions in delivery system. [C932]

"An Analysis of Energy Efficient Communication in Ad-Hoc Wireless Local Area Network"

Despite a power saving function IEEE 802.11 network interfaces still consume a vast amount of the overall energy budget of a self-sustained end system. Hence, further efforts are necessary to reduce the energy demand of an IEEE 802.11 network interface. In this paper several aspects of energy consumption and efficient utilization of limited energy resources of IEEE 802.11 communication systems are explored regarding the media access control protocol. The results measured for energy per goodput shows the impact of the packet size, the transmission rate, and RF power level. The results also show us how BER effects the energy consumption. [C933]

"EEN: An Energy Efficient Multi-Hop Ad Hoc Wireless Networks"

This paper explores the power saving technique for multi-hop ad-hoc wireless networks that reduces energy consumption without significantly diminishing the capacity or connectivity of the network. EEN (Energy Efficient Network) builds on the corrective observation of Power saving network when a region of multi shared-channel wireless network has a sufficient density of nodes, only a small number of them need to be on at any time to forward traffic for active connections. Emphasis is also given for the measurements of a deployed wireless ad hoc network to illustrate the effects of link loss rates on routing protocol performance. Simulation results of this network show that the radio links between the majorities of nodes have substantial loss rate for high density region. [C934]

"Performance of TDMA scheduling algorithms in the presence of data correlation in sensor networks"

TDMA scheduling for data gathering in wireless sensor networks can potentially save energy by eliminating collisions and avoiding idle listening due to its built in duty cycle. Furthermore, temporal and spatial correlation in the sensed data gives room for better delay and energy efficiency. Several TDMA scheduling schemes have been suggested in the literature. However the impact of data correlation on those schemes is not widely reported. In this paper we study the effect of data aggregation on energy and delay performance of two scheduling schemes, namely, interleaved and non-interleaved scheduling. Through simulation we show that non-interleaved scheduling utilizes data aggregation more efficiently to reduce its delay by a factor of 2.13 to 4.9 compared to interleaved scheduling. However, its overall energy savings is minimal due to its short duty cycle. Interleaved scheduling shows a balanced performance in terms of energy and delay at different levels of data correlation. That could make it a more desirable choice for a wider range of sensor networks applications. [C935]

"Integrated Power-Gating and State Assignment for Low Power FSM Synthesis"

Power-gating is an effective technique for reducing standby leakage power and dynamic power. In power-gating one can shut off the power supply to sections of logic block while keeping other logic blocks active. However, careful design is required to make power-gating technique effective, otherwise, negative effect of power-gating may overwhelm the potential gain. In this paper we have presented the state partitioning and state encoding strategy targeting low power finite state machine (FSM) decomposition based on genetic algorithmic approach. All the previous works dealt only FSM partitioning but did not consider state encoding together. This is the first ever approach considering FSM partitioning and state encoding together in power-gating technique. Experimental result shows that upto 73% power saving can be done giving small amount of area penalty. [C936]

"Lowering power consumption using run-time reconfiguration for stereo rectification"

Trends of high power usage in portable consumer electronics and high speed designs is an important factor that biases the selection of an ASIC over a FPGA. ASICs are optimized to minimize the amount of logics used for a particular application; reductions in power are noticed when compared against FPGAs design for the same application. On the other hand, some FPGAs equipped with run-time reconfiguration, allow portions of the design to be changed on the fly. Having an appropriate methodology which creates a micro-level static architecture and reduces the reconfiguration overhead is used to lower the power consumption. This can allow the FPGA designs to be somewhat competitive against ASIC designs. This paper explores the reconfiguration methodology to lower the power consumption for the application of stereo rectification. The results obtained show significant savings in logical resources and power consumption when compared to ASIC-like FPGA implementations. [C937]

"The energy conservation supply curve from investments in energy savings in the existing Italian buildings"

In the paper we estimate an energy conservation supply curve form the investment in energy savings works in the Italian residential sector. First the average ldquotyperdquo of building, in terms of heating dispersion, is calculated for each age of construction and climatic zone. Then several possible strategies are considered, that range from substituting old heaters with new ones to installing thermal collectors and refurbishing the buildings, reducing the heating dispersion according to the new transmittance limits that will be compulsory in Italy (for new buildings) from the year 2010. The cost of implementing specific energy-saving works is calculated; a step-wise supply curve is obtained that measures the potential Mtep saved ad the merit order of the various instruments considered. [C938]

"iDEAL: Inter-router Dual-Function Energy and Area-Efficient Links for Network-on-Chip (NoC) Architectures"

Network-on-Chip (NoC) architectures have been adopted by a growing number of multi-core designs as a flexible and scalable solution to the increasing wire delay constraints in the deep sub-micron regime. However, the shrinking feature size limits the performance of NoCs due to power and area constraints. Research into the optimization of NoCs has shown that a reduction in the number of buffers in the NoC routers reduces the power and area overhead but degrades the network performance. In this paper, we propose iDEAL, a low-power area-efficient NoC architecture by reducing the number of buffers within the router. To overcome the performance degradation caused by the reduced buffer size, we propose to use adaptive dual-function links capable of data transmission as well as data storage when required. Simulation results for the proposed architecture show that reducing the router buffer size in half and using the adaptive dual-function links achieves nearly 40% savings in buffer power, 30% savings in overall network power and about 41% savings in the router area, with only a marginal 1-3% drop in performance. Moreover, the performance in iDEAL can be further improved by aggressive and speculative flow control techniques. [C939]

"Mitigating the environmental impact of power generation by direct load control in industrial sector of Oman"

Load management (LM) reduces the electric power consumption by altering the shape of the overall system demand versus time curve, in the aim of achieving better balance between the customers cycle demand and the utilities current and planned generation capacity, transmission and distribution (T&D) resources. LM programs use a variety of different means to manage electricity demand either by direct load control or indirect load control through variable tariffs. This study has found that from the utility point of view the capacity saving at the horizon year is about 130 MW and the overall energy saving for the whole planning horizon is about 9.7 TWh if the LM is carried out in industrial sector of the main interconnected power system of Oman. The CO2equivalent saving is about 5.4 million tons for the whole planning horizon. The total avoided cost saving is around M$ 161. [C940]

"Automatic Power Regulation Based on an Asynchronous Activity Detection and its Application to ANOC Node Leakage Reduction"

Asynchronous circuits are well-known for their benefits in terms of dynamic power savings, because asynchronous logic does not switch when inactive. Nevertheless, in deep-submicron technologies, leakage currents have become an increasing issue, and thus asynchronous circuits need to focus on static power consumption reduction. In this paper, we propose an innovative way to detect incoming asynchronous activity. Associated to an automatic power regulation, it efficiently reduces the supply voltage and thus both energy per op. and leakage currents. The proposed technique has been applied to an asynchronous network-on-chip node, and successfully implemented in a STM 65 nm technology. [C941]

"Automatic architecture refinement techniques for customizing processing elements"

In this paper, we propose an approach for designing high- performance energy-efficient processing elements (PEs) using statically- scheduled nanocode-based architectures. Our approach is based on bottom-up refinement/trimming techniques that optimize a given datapath irrespective of whether it was designed manually or generated automatically. The optimizations can also preserve parts of the netlist specified by the designers, and hence, allow reuse of design efforts and can lead to predictable convergence. In this paper, we show that trimming unused and underutilized resources of typical general-purpose datapaths can lead to 30-40% average energy savings, without any performance loss. However, general-purpose architectures often compromise parallelism to make the design implementable. With our trimming approach, we can afford to have a base architecture that is not intended for implementation and has more parallelism, and then apply refinement to make it implementable. For our benchmarks, we achieved up to 1.8 times (avg. 25%) and 2.6 times (avg. 40%)

performance improvement, compared to two general-purpose architectures (i.e. a 4- issue VLIW and a DLX), respectively. Additionally, the energy consumption is reduced by up to 5 times (avg. 2 times) compared to the trimmed general-purpose architectures. [C942]

"Adaptive waiting time threshold estimation algorithm for power saving in sleep mode of IEEE 802.16e"

Sleep mode is a key feature introduced in IEEE 802.16e standard, which ensures power-efficient operation of battery operated mobile devices. The 802.16e standard does not define when to take decision to trigger sleep mode. However to the best of our knowledge some published works define waiting time threshold as a time for which mobile subscriber station (MSS) waits before entering into sleep mode, which is constant. In this paper, we propose an algorithm which optimizes waiting time threshold according to traffic arrival pattern (downlink + uplink), which leads to significant reduction in energy consumption. We have compared the performance of our algorithm with constant waiting time threshold scheme through simulations for different DL to UL ratios. The results show that our algorithm reduces the power consumption significantly by 47% with little increase in average waiting delay by 11% at arrival rate 0.05 per MSS, which is well accepted within end to end delay for non-real time traffic. Furthermore, the simulation results of the proposed algorithm are within tolerable limit of theoretical analysis discussed in the paper. [C943]

"Improvement of home appliances design based on energy-saving concept: Case studies on hair dryer and coffee maker"

World market energy consumption is projected to increase by 57% from 2004 to 2030. Worldwide efforts to meet these challenges include developing alternative energy sources, exploring renewable energy resources, and reducing energy consumption. In this paper, the authors presented a new design method for energy-saving product by means of two simple case studies, hair dryer and coffeemaker. The results show that the new design method is useful and applicable. However, there were some simplifications in the case studies, and further research need to be done by considering improving all the parts of the product. [C944]

"A framework for dynamic 2D placement on FPGAs"

The presented paper describes an approach of dynamic positioning of functional building blocks on Virtex (Xilinx) FPGAs. The modules can be of a variable rectangular shape. Further, the on-chip location of the area to be reconfigured can be freely chosen, so that any module can be placed anywhere within the defined dynamic region of the FPGA. Thus the utilization of the chip area can be optimized, which in turn reduces e.g. costly area and power consumption. This paper describes a runtime system and the necessary framework, which is able to manage the reconfigurable area. Further it shows how a NoC approach can be applied to shorten wire lengths for communication. This will in turn save routing resources and potentially increases clock speed. [C945]

"Reusable context pipelining for low power coarse-grained reconfigurable architecture"

Coarse-grained reconfigurable architectures (CGRA) require many processing elements and a configuration memory unit (configuration cache) for reconfiguration of the ALU array elements. This structure consumes significant amount of power. Power reduction during reconfiguration is necessary for the reconfigurable architecture to be used as a competitive IP core in embedded systems. In this paper, we propose a power-conscious reusable context pipelining architecture for CGRA that efficiently reduces power consumption in configuration cache without performance degradation. Experimental results show that the proposed approach saves up to 57.97% of the total power consumed in the configuration cache with reduced configuration cache size compared to the previous approach. [C946]

"Reducing energy by exploring heterogeneity in a coarse-grain fabric"

This paper explores the impact of heterogeneity on energy consumption in a stripe-based coarse-grain fabric architecture. We examine the benefit of replacing 25-50% of functional blocks with dedicated vertical routes in the fabric. Additionally, we reduce the number of operations supported by the functional units from 23 to 16, 10 and 8. To assist in testing and examining the impact of these different architectures on energy consumption, an automation process was created to automatically generate fabric instances based on a fabric instance model (FIM) written in XML. The FIM is also used as an input parameter to our heuristic mapper in order to program a particular fabric instance. Upon testing these instances, we found that the fabric with ALUs supporting 10-operations and using an 8:1 interconnect with 33% of the functional units replaced with dedicated pass gates provided the best energy versus mappability tradeoff, resulting in a 32% energy improvement and a 47% area savings over the baseline fabric with ALUs supporting 23-operations and using an 8:1 interconnect without

dedicated vertical routes. [C947]

"Role of Resource Recovery of Waste Machinery and Electronic Products in Sustainable Development"

This paper investigates the necessity, feasibility and significance of resource recovery of waste machinery and electronic products (WMEPs), indicates that the basic approaches of resource recovery of WMEPs involve reuse, remanufacturing and recycling ("3R"), aiming at maximizing the part of reuse and remanufacturing and minimizing the part of recycling. Fast and healthy development of remanufacturing industry can create considerable economic benefit, offer plentiful employment opportunities, and help to save resource, energy and protect environment, which facilitates the sustainable development of our society. The means of driving resource recovery of WMEPs includes (1) incorporating the strategy of resource recovery of end-of-life product in the origin of product design; (2) adopting new technologies for extending the life of products and reducing energy consumption in the use stage of product; (3) using remanufacturing technologies fully in order to maximize the using efficiency of resource and minimize the environment pollution. [C948]

"Power management of distributed web savers by controlling server power state and traffic prediction for QoS"

In this paper, we propose a scheme based on server node state control, including stand-by/wake-up and processor power control, to achieve aggressive power education while satisfying Quality of Service (QoS). Decreasing power consumption on Web servers is currently a challenging new problem to be solved in a data center or warehouse. Although Web servers are configured to have maximum performance, the actual access rate to the servers can be small in a specific period, such as midnight, so it may be possible to reduce the power consumption of the servers while satisfying QoS with lower server performance. In order to reduce power consumption on the server nodes, we now have to consider the power consumption of the entire node rather than only processor power by Dynamic Voltage and Frequency Scaling (DVFS). We implemented the proposed scheme to the distributed Web server system using the power-profile of server nodes and considering load increment based on traffic prediction method and evaluated the proposed scheme with a Web server benchmark workload based on SPECWeb99. The result reveals that the proposed scheme achieved an energy saving of approximately 17% with sufficient QoS performance on the distributed Web server system. [C949]

"A simple power-aware scheduling for multicore systems when running real-time applications"

High-performance microprocessors, e.g., multithreaded and multicore processors, are being implemented in embedded real-time systems because of the increasing computational requirements. These complex microprocessors have two major drawbacks when they are used for real-time purposes. First, their complexity difficults the calculation of the WCET (worst case execution time). Second, power consumption requirements are much larger, which is a major concern in these systems. In this paper we propose a novel soft power-aware real-time scheduler for a state-of-the-art multicore multithreaded processor, which implements dynamic voltage scaling techniques. The proposed scheduler reduces the energy consumption while satisfying the constraints of soft real-time applications. Different scheduling alternatives have been evaluated, and experimental results show that using a fair scheduling policy, the proposed algorithm provides, on average, energy savings ranging from 34% to 74%. [C950]

"Short-Period Aeration Pilot Tests in Wuhan Shahu Wastewater Treatment Plant"

Short-period aeration method is to shorten aeration time effectively by reducing the number of running aeration tanks on the basis of traditional activated sludge process. The optimal working condition has been determined by short-period aeration pilot tests in Wuhan Shahu Wastewater Treatment Plant. The results of tests show that the effluents of the secondary sedimentation tanks can meet the sewage discharging standards and a lot of costs can be greatly saved. [C951]

"Simple and reliable low power image communication based on DPCM and multiple refinements through feedback"

There are basically two ways of reducing the power consumption in e.g. sensor nodes: the node algorithms should be simple and efficiently implemented, and the transmit power should be limited. In this paper we consider discrete time, progressive signal transmission with feedback. For the Gaussian case with an ideal return channel, the system performs according to OPTA (Berger, 1971). With substantial bandwidth expansion through multiple iterations, the power can be lowered close to a theoretical minimum. For a non-perfect return channel the performance is limited by the feedback channel's signal-to-noise ratio. We propose an image transmission

system based on differential coding and multiple transmissions. The pixel predictions are done in the receiver to obtain a closed loop joint-source channel coding system, and to save processing power in the transmit node. Performance limits as well as simulation results will be given. The suggested system performs without delay. [C952]

"Anticipatory access pipeline design for phased cache"

For an embedded processor, the cache design almost occupies half chip area and power consumption. According to Amdahl's law, if the power consumption of cache memories is reduced, the embedded processor can significantly save much power. However, the cache misses result in the penalty of thousands of cycles waiting and power consumption due to increasing the number of external memory access. Based on the above reason, the phased cache design is proposed and can largely improve the power consumption which wastes a set-associative cache. In this paper, the embedded pipelining processor without stalling and low-power phase cache is practiced with high-level simulation to achieve high-performance and low-power design. As experimental results, the proposed phase cache can reduce 44% power consumption compared with traditional one-access-cycle cache and eliminate pipeline stalls incurred by phased cache with only 6% gate count overhead. [C953]

"A reconfigurable MAC architecture implemented with mixed-Vt standard cell library"

In this paper, a 32-bit reconfigurable multiplication- accumulation architecture, which can execute flexibly one 32times32, two 16times16 or four 8times8 two's complement multiply- accumulation, is proposed and demonstrated. It is based on the modified Booth encoding scheme and designed with techniques of reducing sign-extension bits, removing one extra partial product row and adjusting the positions of hot signals but with elegant modifications. It is implemented with a 130nm mixed-Vt CMOS standard cell library and shows saving of area and power consumption by approximately 16% and 14% respectively as compared to the previous design. [C954]

"Microchip reuse: Environmental rationale and design implications"

The last decade has seen unprecedented growth in the variety and number of consumer electronics. Most of these devices, be it computers, game consoles or cell phones, require highly sophisticated semiconductors such as CPUs and memory chips. At the same time, actual lifetimes of almost all electronic devices are decreasing. Computers are replaced after 3 years or less, cell phones on average every 18 months. Microchips are therefore only used for a fraction of their technical lifetimes. Since the environmental impacts of semiconductor manufacturing are very large, it seems obvious that, for environmental reasons alone, microchips should be reused. Reality, however, is more complex, one important reason for this is Moore's law, which predicts a doubling of transistor density on integrated circuits every 18 months. Moore's law challenges the conventional wisdom that reuse always reduces environmental impact, since it implies that for a given computational demand, both required die size and use phase energy demand decrease with every new microchip generation. The environmental benefits of displaced microchip production are thus less than might be expected, and reuse also foregoes the use phase energy savings that come with each new microchip generation. [C955]

"Predictive coding on-sensor compression"

This paper presents the design and measurements of a predictive coding on-sensor compression CMOS imager. Predictive coding is employed to decorrelate the image. The prediction operations are performed in the analog domain to avoid quantization noise and to decrease the area complexity of the circuit. The decorrelated image is encoded with a bank of column-parallel entropy encoders. Each encoder is combined with a single-slope analog-to-digital converter (ADC) to reduce area complexity and power consumption. The area savings resulting from such combination allow to integrate an ADC and an entropy encoder at the column level. A prototype chip was fabricated in a 0.35 mum CMOS process. The output of the chip is a compressed bit stream. The test chip occupies a silicon area of 2.60 mm times 5.96 mm which includes an 80 times 44 APS array. Tests of the fabricated chip demonstrate the validity of the design. [C956]

"Partner Choice and Power Allocation for Energy Efficient Cooperation in Wireless Sensor Networks"

Energy efficient communication is a key requirement of energy-constrained wireless sensor networks. Cooperative diversity can be applied to wireless sensor networks to significantly reduce node energy consumption. However, judicious selection and coordination of cooperation partners is essential to exploiting this energy saving potential of cooperation. In this paper we investigate optimal partner choice and power allocation for energy efficient cooperation in wireless sensor networks. Our insights lead us to formulate power allocation

and partner choice heuristics which form a simple and practical cooperation strategy for energy-constrained wireless sensor networks, allowing nodes to autonomously make near-optimal cooperation decisions. We show that the power allocation optimisation problem is non-linear, necessitating the use of a search to find the optimum solution. We present the resulting cooperative energy savings in terms of network geometry for a range of potential partner locations. Our results reveal that the partner-destination and the source-partner channels have roughly equal influence over cooperation decisions for optimal energy efficiency. We use this observation to devise a simple yet near-optimal power allocation heuristic. [C957]

"Energy Efficient Location-Based Clustering for Skewed-Topology Wireless Sensor Networks"

The energy consumption problem in wireless sensor networks is investigated. The problem is to expend as little energy as possible receiving and transmitting data, because of constrained battery. In this paper, in order to extend the lifetime of the network, we proposed a location-based clustering algorithm for wireless sensor network with skewed- topology. The proposed algorithm is to deploy multiple child nodes at the sink to avoid bottleneck near the sink and to save energy. Proposed algorithm can reduce control traffic overhead by creating a dynamic cluster. We have evaluated the performance of our clustering algorithm through an analysis and a simulation. We compare our algorithm's performance to the best known centralized algorithm, and demonstrate that it achieves a good performance in terms of the life time. [C958]

"Innovative power gating for leakage reduction"

Leakage has become one of the most dominant factors of power management and signal integrity of nanometer scale integrated circuits. Recently, power gating structures has proven to be effective in controlling leakage. In this paper an alternative dual-F/A reduced power gating structure is proposed for better reduction of leakage currents, especially for low-power, high-performance portable devices. The proposed technique maintains an intermediate power saving state as well as the conventional power cut-off state. The experimental results have demonstrated that the proposed technique can significantly reduce leakage current and associated power consumptions during the HOLD and CUT-OFF power saving modes. [C959]

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