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**Shaw et al.**

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(54) **MULTIPLE MESH DRONE COMMUNICATION**

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(57) **ABSTRACT**

(51) **Int. Cl.**  
**H04W 84/18** (2009.01)  
**H04W 4/40** (2018.01)  
(Continued)

Communication between drones of multiple drone meshes is disclosed. Attributes of drones can be cataloged by a network device. A portion of the drone attribute catalog can be received by a drone belonging to a drone mesh. The drone can determine, based on the portion of the drone attribute catalog, an adaptation to the drone mesh in response to a change in a status of a drone of the drone mesh. The adaptation of the drone mesh can comprise adding a drone to the drone mesh, removing drone from the drone mesh, merging the drone mesh with another drone mesh, splitting the drone mesh into a plurality of drone meshes, forming a submesh of the drone mesh, etc. Receiving the portion of the drone attribute catalog can facilitate self-organization and/or self-optimization of a drone mesh by drones comprising the drone mesh. A drone can concurrently be a member of one or more drone meshes as a result of the adaptation of the drone mesh.

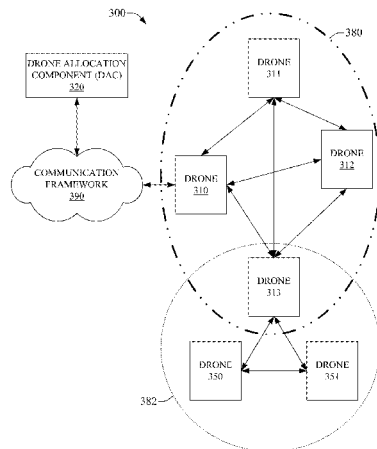
(52) **U.S. Cl.**  
CPC ..... **H04W 84/18** (2013.01); **H04W 4/40** (2018.02); **H04W 4/08** (2013.01); **H04W 8/186** (2013.01)

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 CPC ..... H04W 4/04; H04W 4/40; H04W 4/44;  
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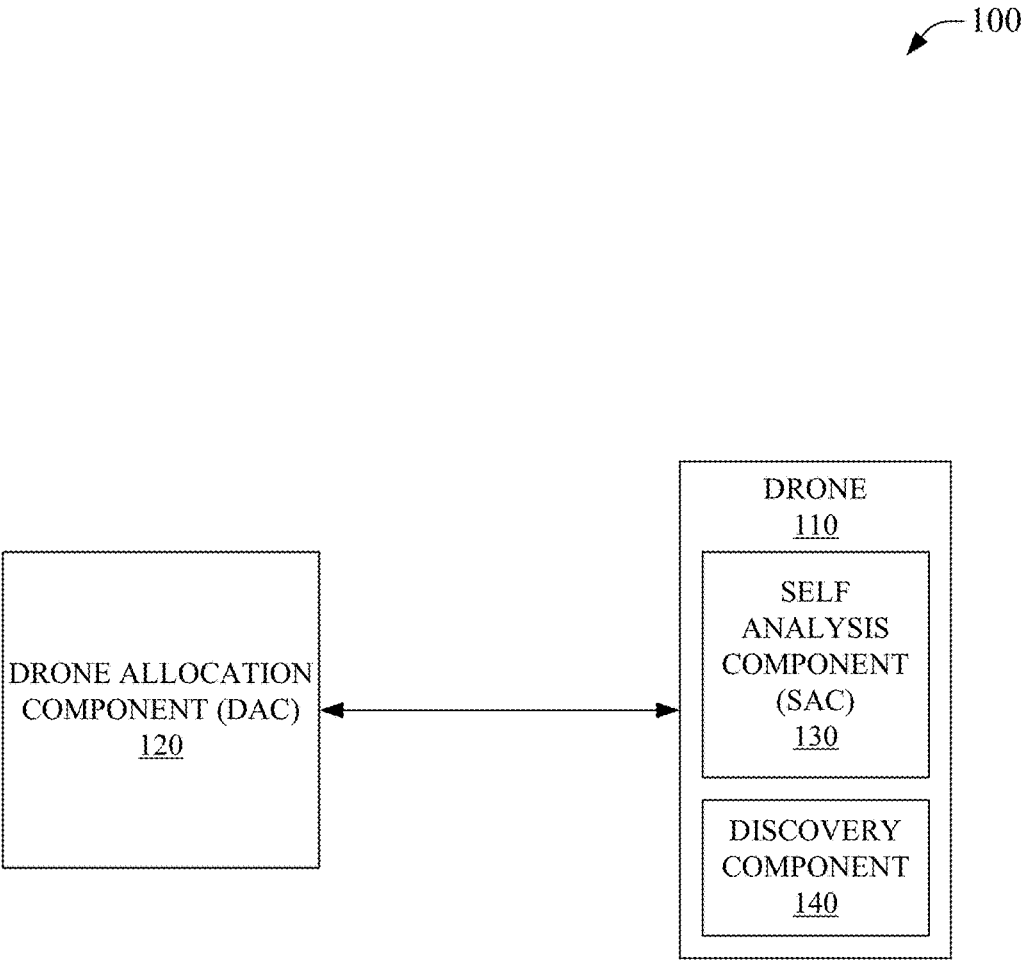


FIG. 1

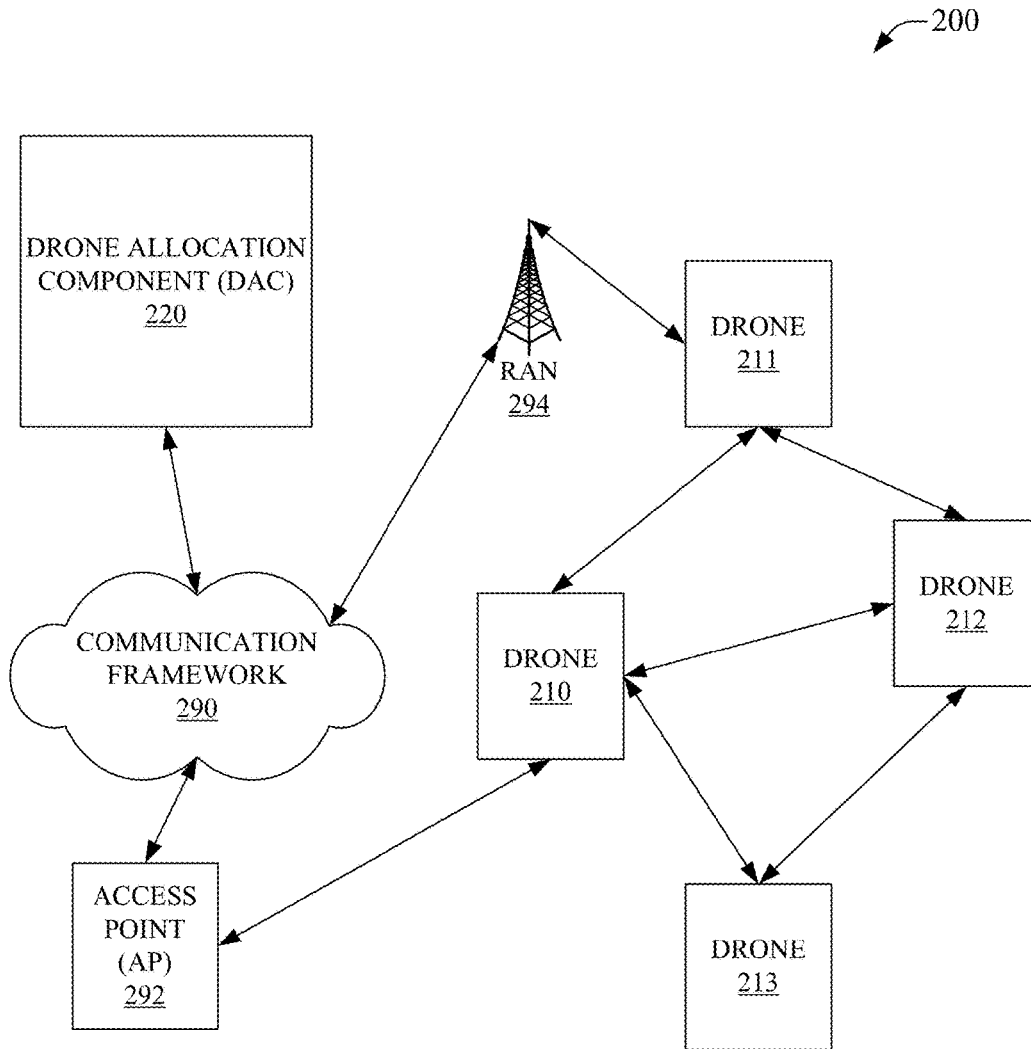


FIG. 2

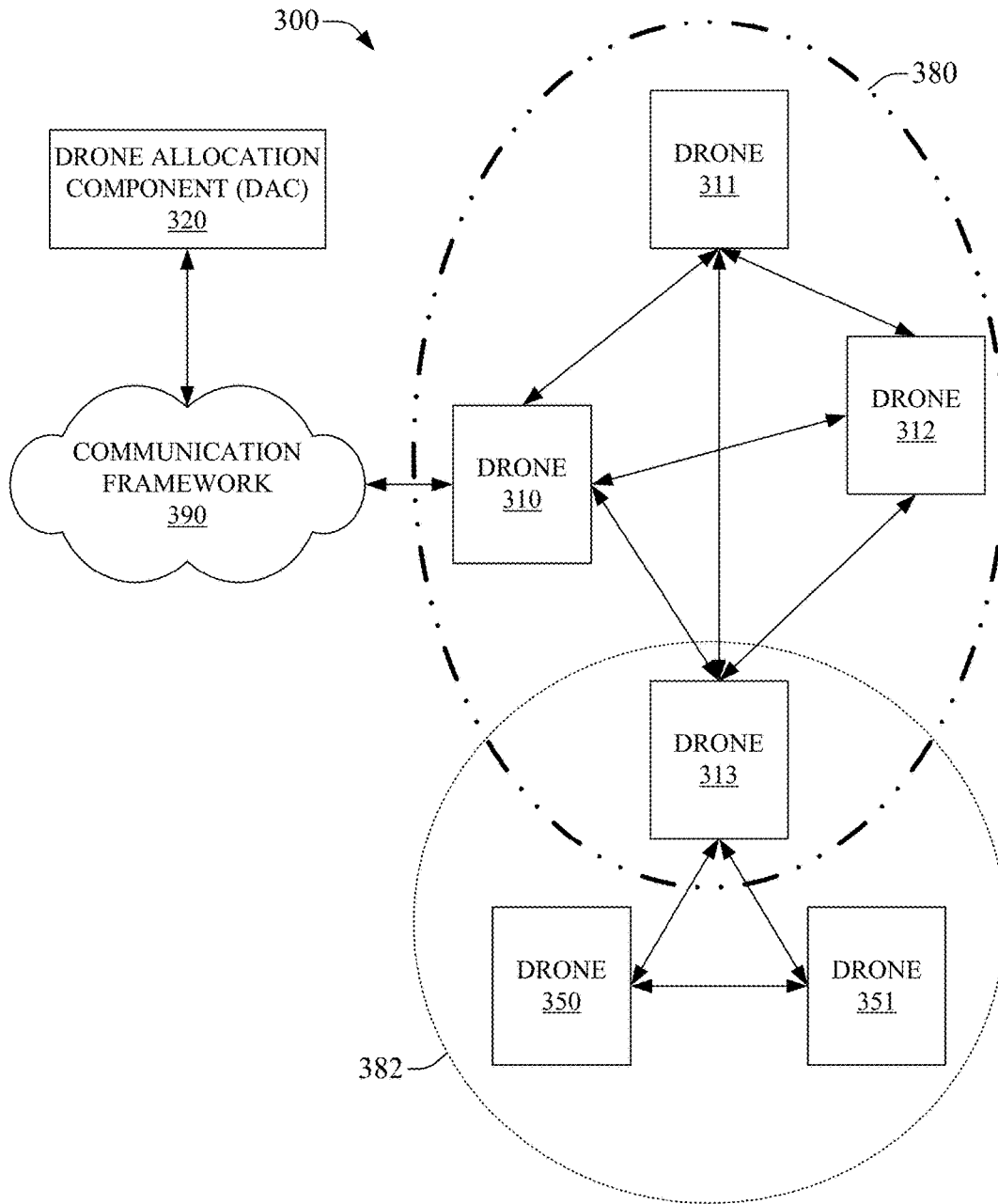


FIG. 3

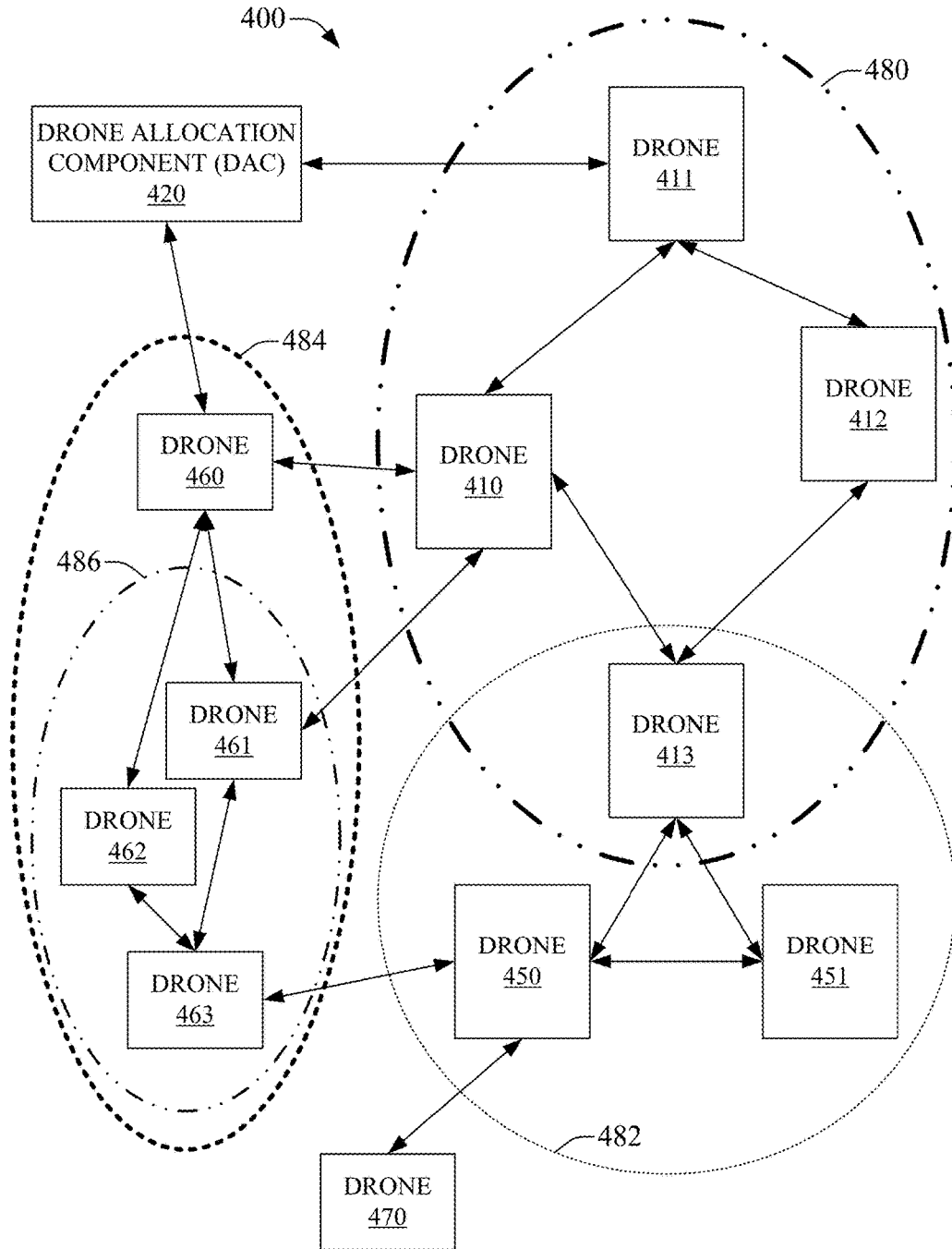


FIG. 4

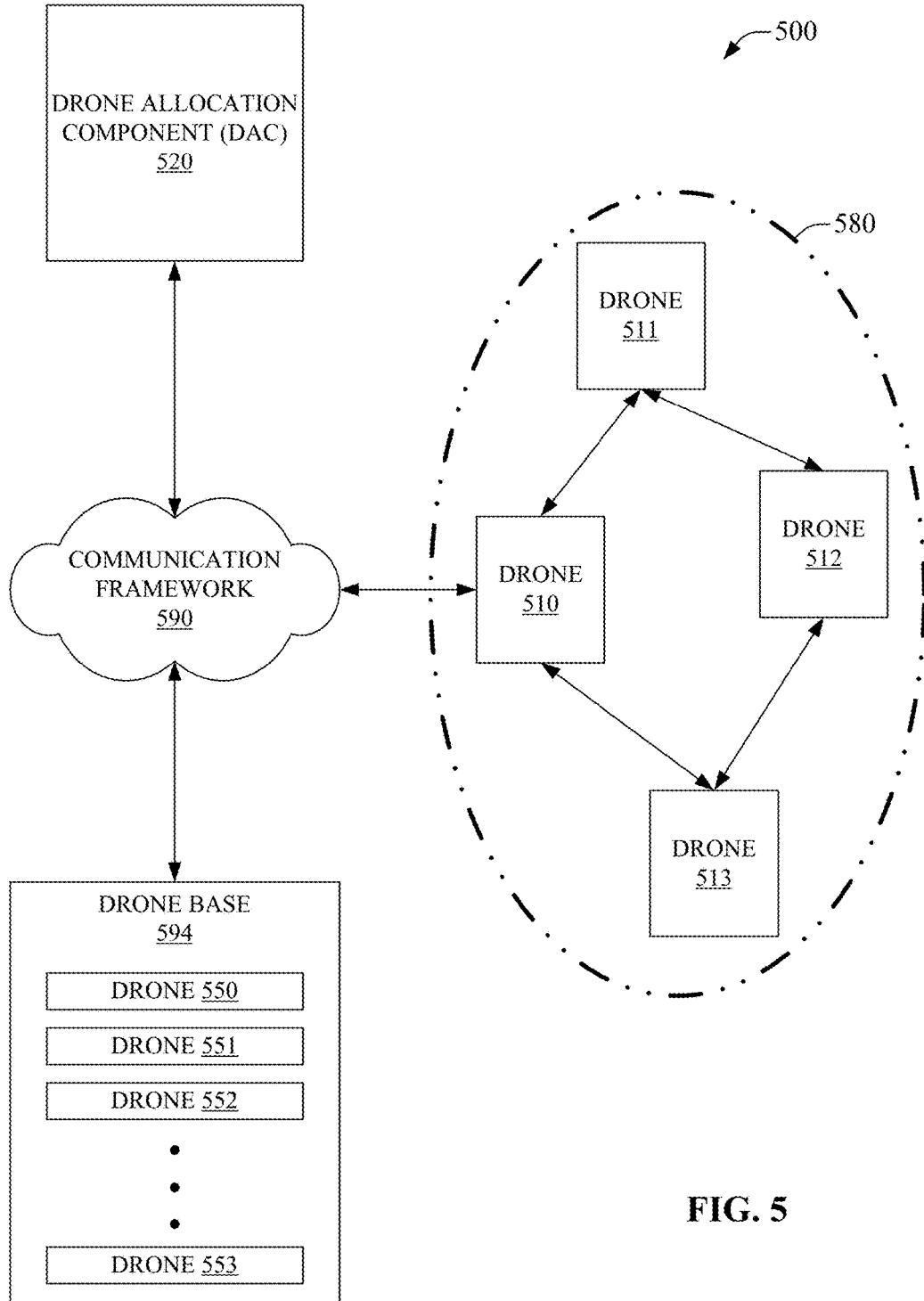


FIG. 5



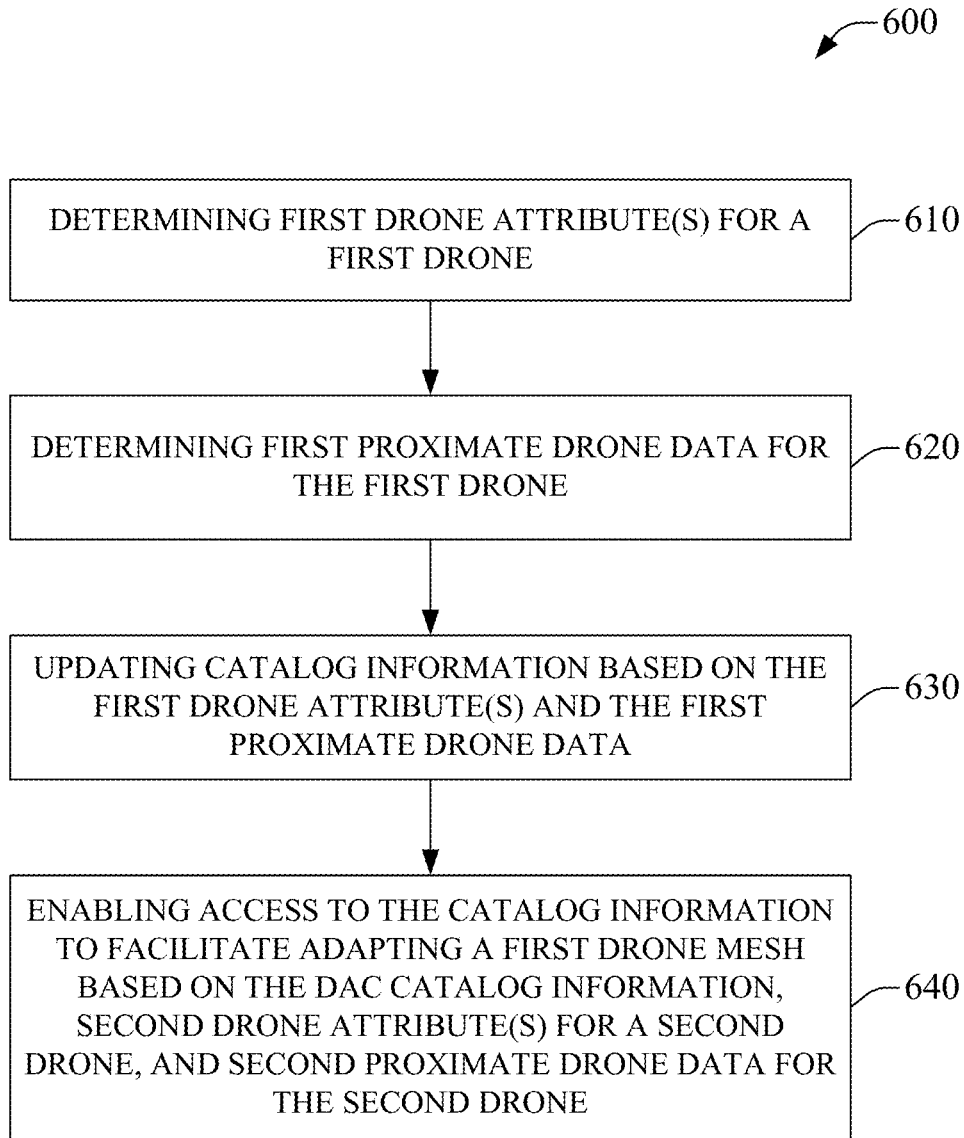


FIG. 6

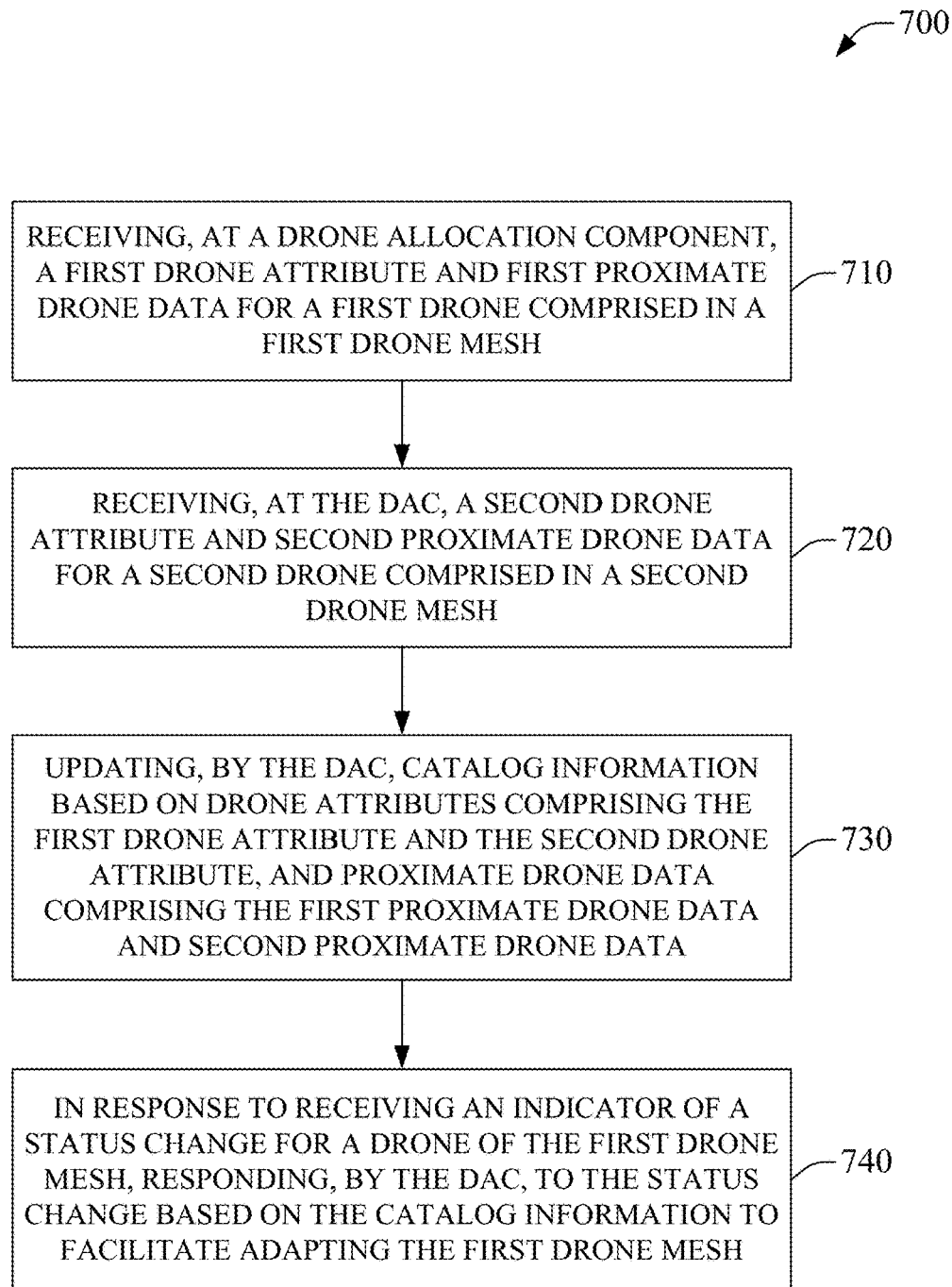


FIG. 7

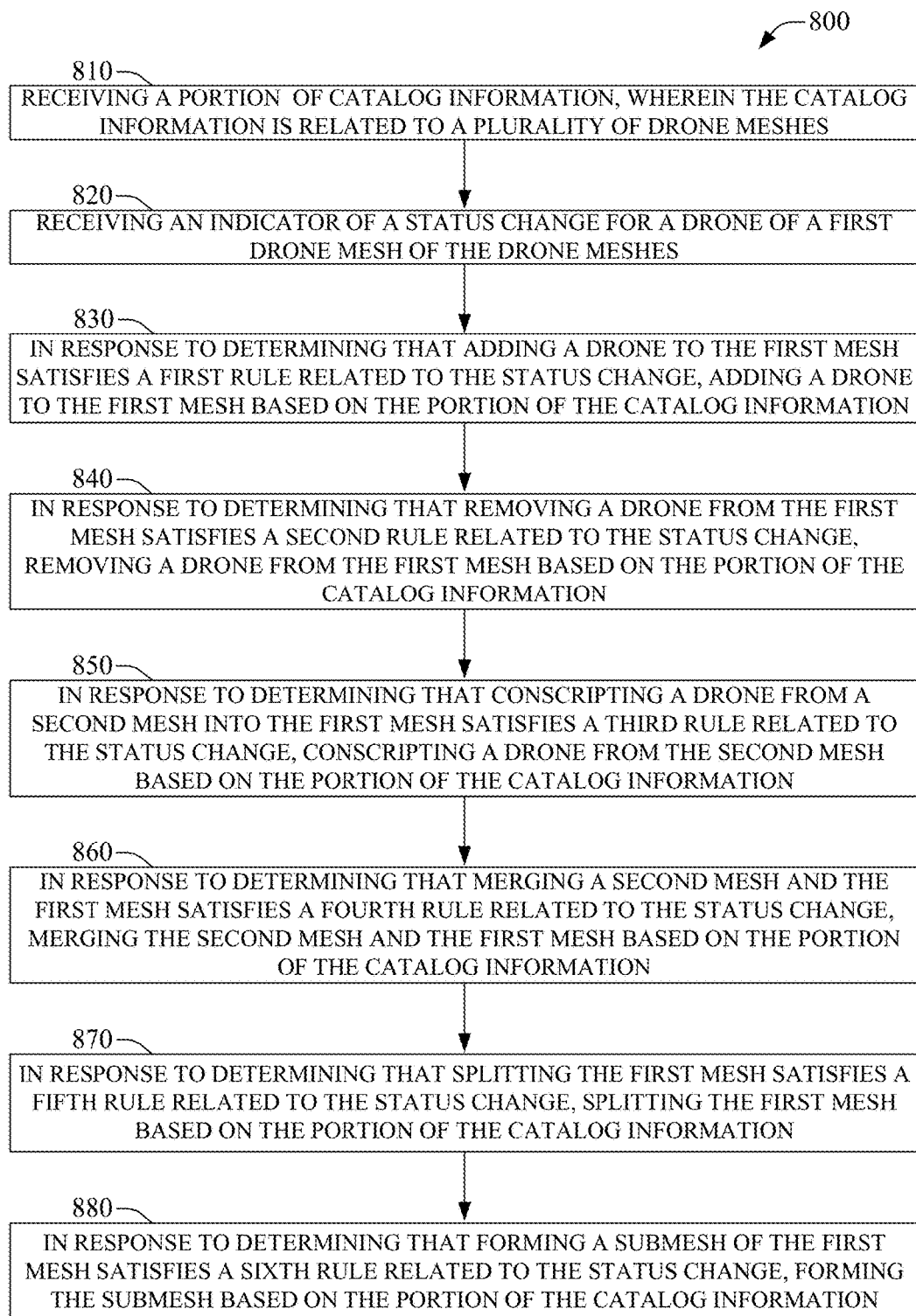


FIG. 8

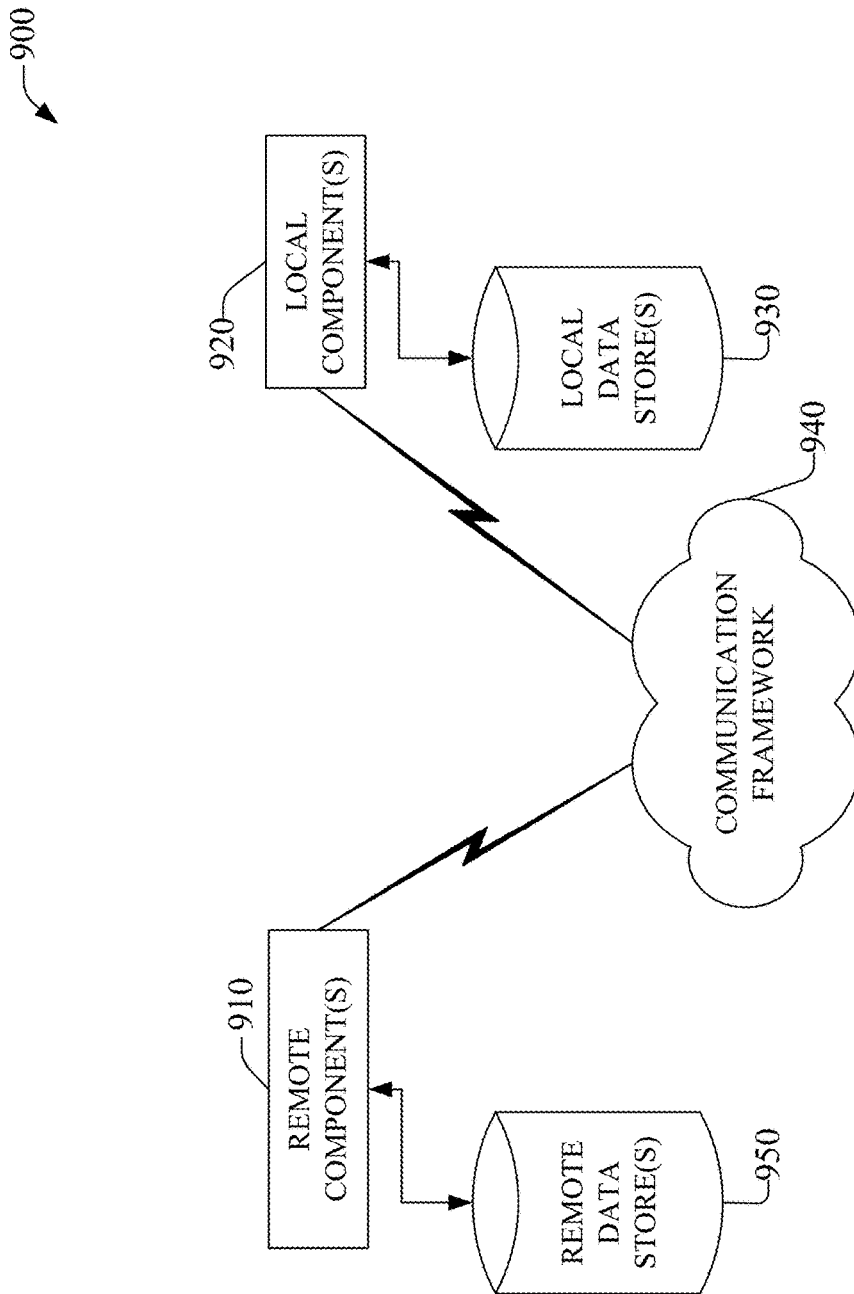


FIG. 9

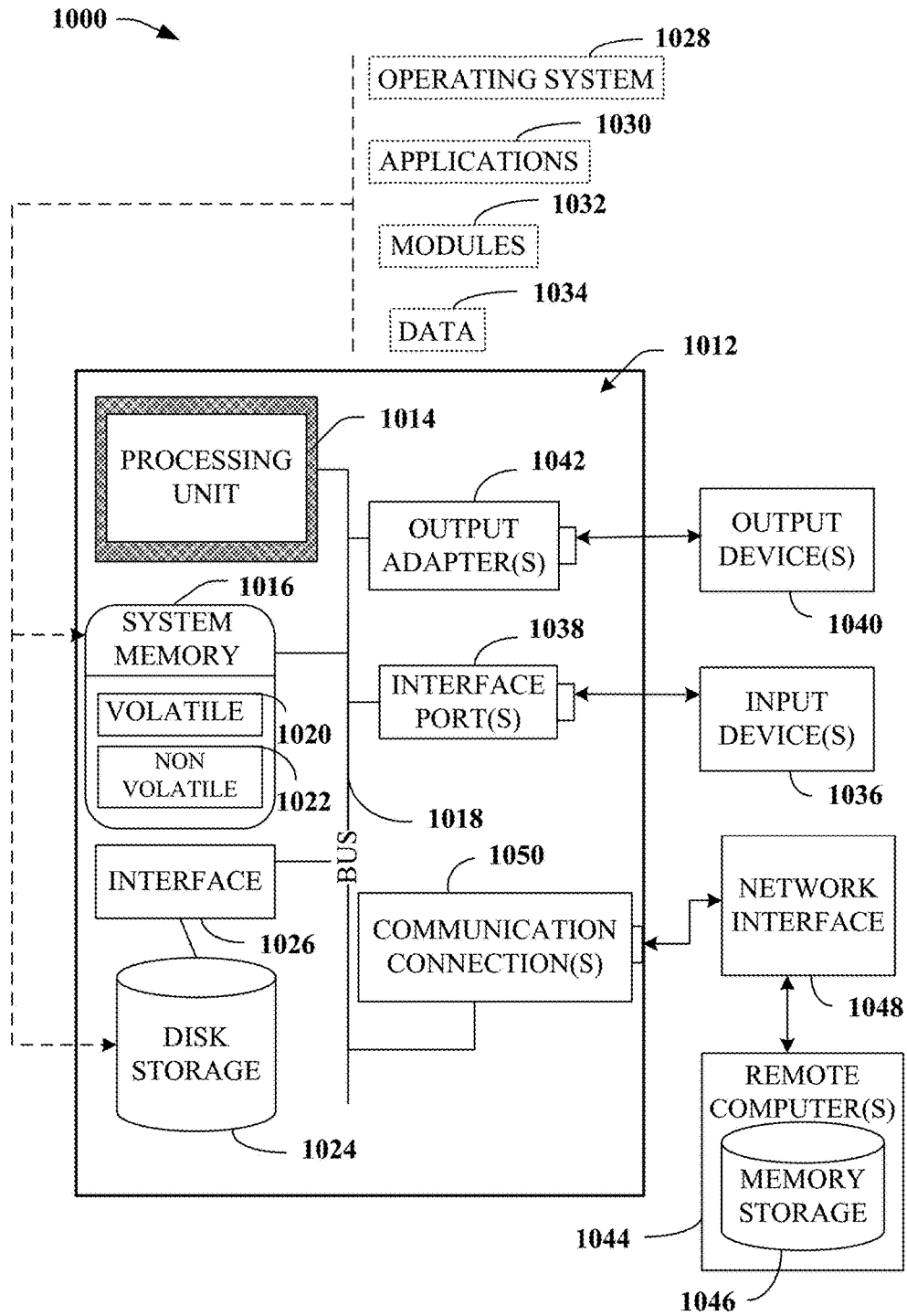


FIG. 10

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## MULTIPLE MESH DRONE COMMUNICATION

### TECHNICAL FIELD

The disclosed subject matter relates to a remotely controlled vehicle, including a land, air, water, and/or space vehicle, e.g., a drone for terrestrial, aerial, aquatic, or space use. More particularly, the disclosed subject matter relates to communication between drones of one or more drone mesh network(s).

### BACKGROUND

By way of brief background, conventional remotely controlled land, air, water, space vehicles, etc., often referred to as 'drones' or, in the case of flying devices, unmanned aerial vehicles (UAVs), generally can employ remote control operation and/or remote activation. As an example, a consumer drone product, such as a quad-copter, self-driving car, etc., can be operated via a remote control device, can be remotely deployed, etc. As another example, a military drone, such as a predator, global hawk, Robotic Mule (Legged Squad Support System (LS3)), etc., can be operated from a control center located remotely from the drone and can include instructions that direct the drone to operate in an autonomous or semi-autonomous mode, such as self-guided movement between designated waypoints. Conventionally, groups of drones can be directed to interact in a group, e.g., swarm-type autonomous behavior, etc. Conventionally, a group of drones typically operates with defined operational parameters, e.g., only specified models of drone can participate in the swarm, a fixed number of drones act as a swarm, a drone can only be in one swarm at any instant, communication routing between swarm drones can be by a fixed routing table, etc.

### BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is an illustration of an example system that facilitates multiple mesh drone communication in accordance with aspects of the subject disclosure.

FIG. 2 is a depiction of an example system that facilitates multiple mesh drone communication via a remotely located drone allocation component in accordance with aspects of the subject disclosure.

FIG. 3 illustrates an example system that facilitates multiple mesh drone communication via a drone committed to a plurality of drone meshes in accordance with aspects of the subject disclosure.

FIG. 4 illustrates an example system that facilitates multiple mesh drone communication via a plurality of example drone mesh topographies in accordance with aspects of the subject disclosure.

FIG. 5 illustrates an example system facilitating multiple mesh drone communication and provisioning of drone resources in accordance with aspects of the subject disclosure.

FIG. 6 illustrates an example method facilitating multiple mesh drone communication in accordance with aspects of the subject disclosure.

FIG. 7 depicts an example method facilitating multiple mesh drone communication via a drone allocation component in accordance with aspects of the subject disclosure.

FIG. 8 illustrates an example method facilitating multiple mesh drone communication comprising drone mesh adaptation in accordance with aspects of the subject disclosure.

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FIG. 9 depicts an example schematic block diagram of a computing environment with which the disclosed subject matter can interact.

FIG. 10 illustrates an example block diagram of a computing system operable to execute the disclosed systems and methods in accordance with an embodiment.

### DETAILED DESCRIPTION

The subject disclosure is now described with reference to the drawings, wherein like reference numerals are used to refer to like elements throughout. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the subject disclosure. It may be evident, however, that the subject disclosure may be practiced without these specific details. In other instances, well-known structures and devices are shown in block diagram form in order to facilitate describing the subject disclosure.

Conventional remotely controlled land, air, water, space vehicles, etc., hereinafter collectively referred to as drones, generally employ remote control operation and/or remote activation of vehicular self-control, in a generally closed system. The closed system can be expressed as ownership, e.g., a consumer can own a drone and operate the drone as their own, much as a car can be owned by a consumer and the car can be operated by the consumer. Multiple drones can operate as a group or constellation of drones, hereinafter collectively referred to as a drone mesh or similar term. A drone mesh conventionally is operated in a closed manner and under a single ownership, e.g., all drones in a drone mesh are owned by a single entity and drones owned by other entities are not typically admitted into the drone mesh. As an example, a drone mesh delivery system, such as operated by an online retailer, package delivery company, etc., can comprise only drones belonging to an operating entity, which can control the drone mesh, e.g., drones of the drone mesh, via a remote control device. As another example, a military drone mesh can comprise only military owned drones and be operated from a control center located remotely from the drone mesh for operation by designated military personnel, such as members of a drone pilot corps. Intelligent allocation of drone resources can also become increasingly significant where drones are becoming increasingly accessible to accomplish tasks. Further, as drones, for land, sea, air, and/or space operation, become increasingly ubiquitous, drones owned by other entities can have attributes that make said drones attractive for inclusion in a drone mesh, e.g., drone meshes comprising drones of different ownership can offer advantages over drone meshes comprising drones of single ownership. Moreover, communication between different drone meshes, both single owner drone meshes and multi-owner drone meshes, can provide advantages over a lone drone mesh. Intelligent interaction between drone resources can facilitate improved performance in real-world deployment(s).

The instant disclosure seeks, in an aspect, to facilitate drone communication in multiple mesh environments, e.g., environments having a plurality of drone meshes. Allocation of drone resources, in an intelligent and shared manner, generally in the absence of physical transfer of a remote controller device between users, can result in multi-owner drone meshes, which can be benefited by improved communication between drones of the one or more drone meshes and one or more drone owners. In an embodiment, remote provisioning of drone resources, e.g., allocating use of a drone to different sets of users, typically in a serial manner,

can allow for improved access to drone resources. As an example, a first user can be allocated drone use via a drone allocation component for a first time period, and then a second user can be allocated use of the drone via the drone allocation component for a second time period. In this example, the first user and the second user can, but need not, own the drone. As such, they can accord use, or be accorded use, of the drone to accomplish or facilitate accomplishment of a task or mission. In an aspect, this can be similar to reserving use of a shared automobile, where the first and second users may, or may not, own the car, but are allowed to use the car according to an agreement between the car owner and the intended users. However, unlike the shared car example, the use of the drone can be abstracted further, for example, a user can designate a drone mission, generally intended to mean a set of operations or goals for the drone to achieve, from a remote device, which the drone can then execute based on rules related to when and how a drone is used in the context of shared drones. As an example, a group of aerial drones can be tasked with collecting traffic images. This group of drones, e.g., a drone mesh, can intercommunicate to accomplish the traffic imaging task, e.g., between drones of single ownership or multiple ownership. Further, the example drone mesh can have multiple tasks, often, but not always, associated with a plurality of users, for example, the drone mesh can also be tasked with capturing weather or environmental data, such as for a first owner of a drone of the drone mesh, in addition to traffic imaging that can be for a second owner of another drone of the drone mesh. Communication between the drones of the drone mesh can, for example facilitate capturing weather data in periods where imaging traffic is not being performed, to accomplish both tasks for the example multiply owned drones of the drone mesh.

In some embodiments of this disclosure, multiple drone meshes can facilitate communication between meshes, e.g., inter-mesh communication. This can be enabled by a drone as a member of one or more drone meshes, to enable participation in accomplishment of one or more tasks, and to enable provisioning of drones for use in the one or more drone meshes based on a status of a drone or drone mesh of the drone meshes and attributes of drones in the drone mesh(es), other available drones, etc. As an example, where a first drone and a second drone are in a first drone mesh, a third drone and a fourth drone are in a second drone mesh, and a fifth drone is available for use, this disclosure enables the drones of the first mesh to communicate with the drones of the second mesh, to add the fifth drone to the first or second mesh, to merge the first and second mesh, to remove a drone from either the first or second mesh, etc., based on the attributes of the first through fifth drone, the status of the first through fifth drone, in view of task(s) allocated to the first or second drone mesh, etc. As such, for example, where the first through fifth drones are marine drones and the task is to map dissolved CO<sub>2</sub> in a lake, where the lake is small, the task may be readily accomplished by the first drone mesh, however, where the lake is large, the task can be accomplished faster by sharing the task with the second drone mesh. Where the fourth drone lacks a CO<sub>2</sub> sensor, the present disclosure can facilitate adding the fifth drone to the second mesh, and sharing the CO<sub>2</sub> mapping task between the first drone mesh and the third and fifth drones of the second drone mesh. In an aspect, drone attributes, such as sensor capabilities, battery status, solar power status, operational envelopes of a drone, drone radio technology(ies), drone mesh membership(s), environment characteristic(s) of an environment(s) in which a drone is operating, etc. As an

example, where the third drone is at 10% remaining battery life, the disclosed subject matter can facilitate adding the fifth drone to the second mesh to relieve the fourth drone, which can then, for example, return to a drone base to charge the depleted battery.

It will be noted that as drones become more pervasive and increasingly ubiquitous, multiple mesh drone communication can be effective for efficient distribution of drone resources. As an example, rather than every news channel in a region owning and operating a separate drone for capturing video of unfolding events, wherein the separate drones can be, to a large degree, redundant, fewer drones can be employed in a shared manner among the several news channels. The distribution of drones, e.g., in one or more drone meshes, can be based on sharing, lending, renting, auctioning, etc., drones among the tasks that are designated. In the above example, the news channels could participate in an auction, scheduling program, etc., to reserve a drone for a particular use and can also participate in shared use, such as several news channels each contributing to the cost of the drone monitoring a regional roadway during rush hour. As such, when the drone is not monitoring the regional roadway, the drone could be employed in alternate missions by other news channels, such as for aerial photography of a festival, monitoring of an evolving local news story, etc. As such, a drone can be shared, loaned, rented, leased, borrowed, auctioned, etc., for money, services, etc., e.g., a drone can be borrowed from a first mesh into a second mesh in exchange for a promise of money, credit, access to a good/service/data, reciprocity in lending a drone back to the first mesh, etc. Nearly any trade, exchange, lending library, etc., model can be employed in these aspects. In another example, even where a news channel does own a drone, use of that drone can be reserved for high priority uses, where more pedestrian uses can be allocated to rented drones that can be remotely provisioned, e.g., the regional traffic drone can provide traffic information to one or more news channels for exchange of monetary value so that another individually owned drone is unfettered and available for coverage of breaking news.

In effect, drones can become a more widely accessible resource when operating in one or more drone meshes that employ multiple mesh drone communication technology, such as is disclosed herein. Drones can take on a communal character, a rented or leased character, a gift character, a benefit character, etc. In an aspect, privately owned drones can be made available to others, e.g., be made publically available, such as to anyone, be made semi-publically available, such as to members of a group meeting determined criteria, be made shareable, such as to one or more specifically designated people, etc. Moreover, publically owned drone resources can be deployed, e.g., publically owned drone resources can be deployed for public use. Additionally, white-list and black-list filtering can be employed to include or exclude users, or users associated with determined characteristics, histories, uses, etc., to include or exclude drones in one or more meshes, etc.

Provisioning of the drone resource can include autonomous and/or semi-autonomous mission parameters. As an example, a drone can be remotely provisioned to monitor activity related to a curfew by driving a determined region in an autonomous manner. As another example, a drone can be remotely provisioned to arrive and remain proximate to a location in an autonomous manner where it can receive further instructions for operation from a user remote controller, such as via a smart phone touch interface, via a voice interface, via monitoring visual cues, such as hand signals,

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presented by a user or users, in the area of operation, etc. Expanding on the example, a game warden can request a drone mesh operate proximate to a wilderness area at a designated time, where the drones of the mesh can operate para-statically until they receive commands from a user, e.g., via a mobile device, etc., whereby the user can instruct the drone mesh to track an identified animal, providing video feedback to the user's mobile device. This can allow the game warden to view the tracked animal via the drones, wherein the drone mesh can keep the animal in view by orienting the constellation of drones to provide images to the warden as the animal passes between drones of the drone mesh, even when the warden does not have a sight line to the animal. In a similar example, a parent can request a drone mesh 'walk their child to school' in the morning, wherein the drones of the mesh can be provisioned to arrive and then track the child as they walk or ride a bike to school, providing images periodically unless the child departs from a determined route, wherein proximate drones of the mesh can capture video, audio, location information, an audible alarm, etc. This could allow a parent to see that their child is taking unsafe shortcuts on their way to school, could capture valuable video imagery, such as a license plate number, in the case of an abduction, etc. Moreover, drones regularly operate with sensors that provide improved capture of information, which could allow the drone mesh to capture audio from a scene, track a thermal image of the child through fog, rain, clouds, or darkness, etc., capturing RFIDs, SIM identifiers, etc., from devices proximate to the child, etc., which in an abduction situation could be immensely useful to law enforcement, such as getting a plate number of a van, video of the abduction even at night, and capturing the SIM identifier of a mobile device of the abductor contemporaneous with the abduction, all without the parent ever purchasing a drone, or physically renting and controlling the drones of the mesh in an active manner. Moreover, where the child transitions between zones affiliated with different drone meshes, inter-mesh communication can allow the continued monitoring of the child via different drone meshes. Multiple mesh drone communication can have a definitive impact on access to drone resources in a manner that can reduce the consumption of user resources.

In an aspect, multiple mesh drone communication can determine allocation of a drone according to parameters of a drone request. A drone mesh can then be provisioned in accord with the determined allocation. A request response can then be generated. As an example, a drone request can be employed to determine drone request information, which can be received by a drone allocation component. The drone allocation component can then determine drone-provisioning information based on the drone request information. The drone provisioning information can be employed to provision drones of one or more drone meshes and, in response, an acknowledgement that the drone is provisioned can be returned to the user via a generated response comprising request response information. In an embodiment, the drone allocation component can employ the drone request information to select appropriate drone(s) from a set of one or more drones for inclusion in the one or more drone meshes.

Selection can be based on parameters such as, but not limited to, a type of drone, a drone specification, an mission operating environment, drone availability, price, proximity, rules or laws, user profile, scheduling, a control interface or feature thereof, prior use of drones by the user, insurance features, intended use characteristics, certification, training, geographical or political boundaries, etc. As an example, parameters for remote provision of a drone mesh can be very

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different where the drones, in one case, are to be used to film a back yard birthday party for a user's 10 year old son, and in another case, are to be used to monitor surfing conditions in front of an incoming weather system for a large surfing competition. However, a drone allocation component can determine which, if any, drones in one or more drone meshes satisfy drone allocation parameters based on the drone request information.

It will be noted that the drone request information can be used to determine and/or infer values that can be employed in determining satisfaction of a drone allocation parameter, for example, the drone request information can comprise a designation that a drone of the drone mesh have video capability which can be used to filter out drones without video. Further, the drone request information can comprise requestor income information that can be used to infer drones in a probable cost/price range, allowing the drone allocation component to select one or more drone meshes that meet designated parameter(s) and are more likely to be 'affordable' to the requestor. It will be noted that many information vectors can be employed in inferring values that can be employed in determining satisfaction of a drone allocation parameter and that all such inferences are within the scope of the instant subject matter even where not explicitly disclosed for the sake of clarity and brevity. As another example, an inference can be made by the drone allocation component based on the requestor's usage history, drone operation certifications associated with the requestor, weather conditions, operational characteristics of one or more drones, etc., such that a drone mesh can be allocated that is most likely to be comfortably usable by the requestor, e.g., analogously it can be inferred that it would be less likely for a 90-year old man would like to rent a landscaping truck with manual steering and without a tilt-bed, and more likely to want to rent a compact truck with power steering and a dump-bed, even though both would be effective at delivering beauty bark to his home, even where the landscaping truck might be located closer and be available for the same cost.

In some embodiments, drone meshes can be tiered, e.g., hierarchically tiered. Tiers of drone meshes can be associated with different drone/mesh factors, for example, actual, anticipated, or estimated usage of drones or drone resources, ownership of drones or drone resources, organizational structures, regional proximities, etc. As an example, a first drone mesh, comprising one or more drones, can be associated with private drones made available to users other than the private owners, such as drones owned by one or more persons in a neighborhood being made available for provisioning to the general public, other members of the neighborhood but not the general public, to members of a club or determined group, etc. As such, where the private drones are made available to the public, then John Q. Public can request drones from this first drone mesh be tasked with a mission. Further, where a second drone mesh can be associated with a corporation, this second mesh can be designated as at another tier, for example, where a satisfactory drone from the first mesh cannot be found, the second mesh can be searched for an appropriate drone, which can then be shared between the two meshes, transferred from the second mesh to the first mesh, etc. This hierarchical tier scheme can enable drones in different tiers to be identified based on criteria associated with the distinction between the tiers. As an example, where a corporation has three tiers of drone meshes, the first tier can comprise older drones, the second tier can comprise newer drones that have already been amortized, and the third tier can comprise newer drones that



have not yet been fully amortized. As such, request for a drone can first be searched against the first tier, then the second tier, then the third tier, wherein each tier can be associated with rules pertaining to the provisioning of a drone from that tier to a drone mesh. Thus, where a satisfactory first tier drone is found, it can be provisioned in lieu of another satisfactory drone from the second or third tier drone sets.

Of note, the present disclosure is different from, and an improvement over, current 'drone sharing' techniques that generally rely heavily on human interaction and are typically closed groups of drones. An example of a conventional drone rental technique involves an online reservation that can be made for a drone from a rental group, to which the renter must then travel to pick up the drone for use and must return it to after use. In contrast, the instant disclosure can provide for direct provisioning of an appropriate drone mesh such that the drones of the mesh arrive where/when needed and can operate in an autonomous or semi-autonomous mode, e.g., being at the desired location and then taking commands, receiving a mission package and executing the mission autonomously, etc. As an example of another conventional system, higher end drones can be 'rented' online, wherein the renter discusses a mission with a human operator and the human operator coordinates execution of the mission for the renter. These types of services can be, for example, associated with a corporate user requesting a drone service provider to deploy a group of drones for a mission over an oil field half a world away. The instant disclosure again differs from, and can be an improvement over, such technologies in that the drones of the mesh typically can be automatically provisioned to execute the mission half a world away without generally needing to interact with the human operator. Moreover, the mesh, via multiple mesh drone communication, can cycle in or out drones based on a status of the drones, can merge or divided a mesh to accommodate a mission or multiple contemporaneous missions, can create or retire submeshes based on parameters of a mission(s), can share or transfer missions among different drone meshes, etc. Of course, in some instances, especially where the mission is highly complex, inclusion of human operators or planners can be employed without departing from the scope of the present disclosure while still maintaining a differential improvement over those systems either in the reduction in human interaction over conventional systems, or for other reason elucidated herein. Multiple mesh drone communication is generally distinct from conventional techniques that treat a group of drones as a closed set and do not facilitate communication to other drone meshes or drones thereof. Further, the ability to provision from different drone meshes, and/or different tiers of drones, is substantially different from conventional technologies, more so in that, where drone meshes can comprise large numbers of drones, a drone allocation component can improve provisioning of an appropriate or satisfactory drone over conventional techniques. As an example, rather than having to manually select from a handful of drones via a website or with a human operator, the instant disclosure can enable searching across large numbers of drone in existing or creatable drone meshes based on parameters, characteristics, history, intended use, schedules, locations, interface features, a user profile, etc., in a manner that can be faster and more accurate than a manual search. This can facilitate efficient allocation of drones and associated resources, such that, for example, a drone can be provisioned from company B that is farther away, rather than company A that is closer, based on the drone from B just meeting the drone request

parameters in contrast to the drone from A far exceeding the drone request parameters. Numerous other distinctions over conventional techniques are illustrated expressly or inherently herein, and are to be considered within the scope of the instant disclosure.

To the accomplishment of the foregoing and related ends, the disclosed subject matter, then, comprises one or more of the features hereinafter more fully described. The following description and the annexed drawings set forth in detail certain illustrative aspects of the subject matter. However, these aspects are indicative of but a few of the various ways in which the principles of the subject matter can be employed. Other aspects, advantages and novel features of the disclosed subject matter will become apparent from the following detailed description when considered in conjunction with the provided drawings.

FIG. 1 is an illustration of a system 100, which facilitates multiple mesh drone communication in accordance with aspects of the subject disclosure. System 100 can include drone allocation component (DAC) 120 that can facilitate multiple mesh drone communication. DAC 120 can receive drone information about drone 110. Drone information can comprise a characteristic, attribute, status, etc., of drone 110 via self-analysis component (SAC) 130. Moreover, drone information can comprise information related to drones within a discovery volume of drone 110 via discovery component 140, e.g., where other drones are within a distance of drone 110, discover component 140 can communicate to DAC 120 information about the other drone. This aspect can allow drone 110 to relay information to DAC 120 about other proximate drones. As an example, where drone 110 is a self-driving vehicle, discovery component 140 can communicate information about other drones in a discovery volume related to drone 110. This information can include identifying the other drones, e.g., other self-driving vehicles, etc., relaying attributes or characteristics of other drones, relaying statuses of other drones, etc., that, for example, can be near the self-driving vehicle on the freeway, such as identifying a drone flying overhead, relaying attributes of other self-driving vehicles within 50 feet in front and 20 feet behind the self-driving vehicle, etc.

In an embodiment, DAC 120 can catalog information about drone 110 received via SAC 130. Further, DAC 120 can catalog information about drones discovered via discovery component 140. The catalog can be updated by a plurality of drones from one or more drone meshes. As an example, drone 110 can determine via SAC 120 that drone 110 comprises an IR still camera, a Bluetooth controller, a location GPS system, a thermocouple, 85% remaining battery life, is operating in normal parameters, and can operate in winds up to 20 miles per hour, which information can be cataloged by DAC 120. Example drone 110 via discovery component 140, can determine that two other drones are proximate to drone 110, and can facilitate access to an identifier of each of the two drones as well as information relating to 10% battery life of one of the two drones, which information can be communicated to DAC 120. DAC 120 can enroll this information in a drone catalog. Moreover, DAC 120 can determine, based on the identifiers of the two proximate drones, characteristics of the other two drones from historical information related to the identifiers respectively. Further, the 10% remaining battery life of one of the two drones can be updated in the catalog and affiliated with a time stamp, such that where the drone is identified in other meshes near in time to the time stamp, an inference of low battery life can be made. In this example, where a drone mesh is tasked with a mission, DAC 120 can facilitate access

to the cataloged information to enable selection of appropriate drones for the mission. Continuing the example, a drone mesh comprising example drone **110** can be formed, or drone **110** can be added to or shared with an existing drone mesh, where a mission designates an IR imaging device for completion of the mission. Moreover, where the mission parameters indicate an extended operational period, the example other drone with 10% battery life can be removed from the mesh, or not included in the formation of a mesh, based on the low level of remaining battery life not being conducive to the indicated extended operational period. Alternatively, the example 10% battery life drone can be included/added where other parameters of said example drone are not satisfied by other drones, thereafter, DAC **120** can, as the catalog is further updated, swap out the example 10% battery life drone for another drone meeting the other parameters and having more battery life available, e.g., the low battery drone can be used in a mesh until another suitable replacement can be provisioned, noting that the other suitable replacement can be discovered after the low battery life drone has been provisioned/employed.

In some embodiments, DAC **120** can orchestrate adaptation of a mesh in response to a changing parameter, status, environment, task/mission, etc. Continuing the prior example, where example drone **110** is incorporated into a mesh, where weather conditions indicate that average wind speeds are exceeding the 20 mile per hour operational envelope, a different drone can be provisioned to the mesh to accommodate the higher wind speeds, the mesh can discover other drones, via discover component **140**, and communicate this information back to DAC **120**, which can adapt the first mesh based on attributes, characteristics, statuses, of discovered drones, to accommodate the changed average wind speed, etc. Moreover, where drone **110** is a drone of a first mesh and discovers, via discovery component **140**, another drone of a second mesh, drone **110** can communicate with the other drone to receive information about one or more drones of the second mesh, e.g., even where drone **110** is not in direct communication with said all the other drones of the other mesh, and can communicate the information about the drones of the second mesh to DAC **120** for cataloging. As such, DAC **120** can capture information about other drones/meshes via communication between drones of different meshes in an almost web-crawler type manner, e.g., information about the drones of the second drone mesh can be cataloged via a communication link between a drone of the first mesh in communication with a drone of the second mesh. Similarly, a drone of a third mesh can funnel information about drones of the third mesh to a drone of the second mesh, which can funnel the information about the drones of the third mesh to a drone of the first mesh, which can funnel the information about the drones of the third mesh to DAC **120** for cataloging even though there may be no direct communication between any drone of the first mesh and any drone of the third mesh except through a drone of the second mesh.

In some embodiments, DAC **120** can communicate with multiple drone meshes. As an example, DAC **120** can receive information from a first drone mesh, a second drone mesh, and a third drone mesh, e.g., via a communications link to one or more drones of the first, second, and third meshes. Moreover, DAC **120** can receive information about a fourth mesh via one or more of the first, second, or third meshes. Further, a plurality of DACs can source cataloged information among themselves and/or to a more centralized catalog, e.g., a regional or central drone catalog. In an example, where a fifth mesh is cataloged at a second DAC,

DAC **120** can receive information about the fifth mesh via the other DAC, via a communication path between the fifth mesh, the fourth mesh, and one or more of the first, second, and third meshes, via a communication path between the fifth mesh and one or more of the first, second, or third meshes, etc. As such, DAC **120** can facilitate adapting, for example, the first mesh to include a drone of the fifth mesh, even where there may be no direct communication link between the drones of the first mesh and the drones of the fifth mesh prior to adapting the first mesh.

In an aspect, DAC **120** can be located local to or remote from drone **110**. In some embodiments, DAC **120** can be comprised in an access point or network edge device, proximate to, and in communication with at least one drone of a drone mesh. In some embodiments, DAC **120** can be located more remote from the drone/mesh, e.g., at a network gateway, core-network component, etc., in communication with the drone/mesh via an edge device, e.g., an access point, radio access network device (RAN) such as a NodeB, eNodeB, etc. In some embodiments, DAC **120** can be comprised in drone **110**. In some embodiments, DAC **120** can be a virtual component, e.g., operating as an instance on one or more networked computing devices, such as, one or more servers, in a cloud-computing environment, such as AMAZON WEB SERVICES (AWS), MICROSOFT AZURE, etc., or nearly any other virtualization environment that can receive information via a wireless connection with drone **110**. Moreover, cataloged drone/mesh information can be stored locally or remotely from DAC **120**. As an example, DAC **120** can be located regional network gateway and catalog information on a web server or other remote storage device. As a further example, DAC **120** can be comprised in a RAN device including a storage device for storing cataloged drone/mesh information, e.g., via SAC **130** and/or discovery component **140**.

In an aspect, drone information can comprise an owner name, address, phone number, drone/owner identification information, drone/owner account information, drone/owner profile information, drone/owner certification information, drone/owner logged hours or other training, mission parameters, such as, but not limited to, mission location, mission time, mission duration, mission type, mission payload, mission controller or interaction devices/services, level of autonomy, other drones/devices associated with the mission, etc., clearances, permits, approvals, waivers, mission path, mission locus resources available, e.g., power, fuel, internet connectivity, etc., historical drone use, additional operators/controllers, etc., drone status, mesh status, etc. It will be noted that nearly any pertinent information about a drone, mesh, environment, drone characteristic, drone parameter, mission parameter, etc., can be included in drone information. Moreover, drone information can be originated by a first drone and can be supplemented with information from other drones, devices, meshes, etc. As an example, where a drone indicates an operation environment is within determined operational envelope parameters, this information can be supplemented by a weather data server indicating a fast approaching storm, by other drones nearer to the fast approaching storm indicating a changing environment advancing toward the drone, etc.

In some embodiments, drone information can comprise information that can be used to infer parameters, allowing DAC **120** to determine a drone/mesh that meets explicit and inferred parameters. It will be noted that nearly any information vector can be employed in inferring values that can be employed in determining satisfaction of a drone/mesh allocation parameter. As an example, an inference can be

made by DAC 120 based on predicted weather that certain drone parameters are likely important. Where a drone/mesh request is made, for example, four months in advance of the mission date, the weather can be inferred initially for provisioning drones to the mesh, and additional drones or associated resources can be earmarked where the inference is weak due to the long lead up time to the mission. As such, the inference can be revisited as the example weather information changes as the mission date approaches such that the provisioning of the drone/mesh can be updated and remain correspondingly more relevant.

DAC 120 can determine drone selection parameters related to a mission parameter, mission goal, mission preference, etc. Selection parameters can include, but are not limited to, a type of drone, a drone specification, a mission operating environment, drone availability, price, proximity, rules or laws, user profile, scheduling, a control interface or feature thereof, prior use of drones by the user, insurance features, intended use characteristics, certification, training, geographical or political boundaries, etc. Selection parameters can be based on drone information cataloged by DAC 120. Further, selection parameters can be based on other information, for example, drone mesh information, drone information for drones comprising a drone mesh, other meshes or drones thereof, weather information, schedule information related to persons related to the mission event, etc. As an example, drone information can indicate both mom and dad will be at the little league game and direct mission operations via smartphones, this can trigger capture of the type of smartphone used by both mom and dad to be a parameter in selecting drones for a mesh that can interact with both types of phone. DAC 120 can determine what, if any, drone in one or more meshes satisfy drone allocation parameters based on drone information and other related information. Additionally, selection parameters can identify a drone, a drone mesh, multiple drone meshes, tiers of drones/meshes, etc. This information can be employed in determining, in conjunction with the selection information, a drone to provision in a mesh.

In some embodiments, drone mesh can self-organize and/or self-optimize (SOSO). SOSO can be based on cataloged information via DAC 120. As such, multiple mesh drone communication, can allow 'on the fly' adaptation of a mesh in response to changes in nearly any drone/mesh/mission characteristic or parameter. In an aspect, this can provide a level of redundancy on a mesh to accommodate unexpected events. As an example, where a drone mesh is tasked with keeping birds away from an airport runway, DAC 120 can facilitate adapting the mesh by providing catalog information to drones of the mesh, allowing them to integrate drones of another mesh, deploy or provision new drones from a drone base, etc., where a drone of the mesh indicates to the other drones of the mesh that is experiencing a failure, that a battery is running low, etc., or where a drone of the mesh suddenly becomes unavailable, e.g., due to a crash, part failure, etc. Moreover, SOSO behavior can enable adaptation of meshes in a highly automated manner. As an example, a first mesh and a second mesh can overlap spatially, such that SOSO can adapt one or more of the first or second mesh to operate more efficiently, such as by removing a redundant drone, adapting mesh membership of one or both meshes, splitting the two meshes into three meshes that have less overlap, etc.

FIG. 2 is a depiction of a system 200 that can facilitate multiple mesh drone communication via a remotely located drone allocation component in accordance with aspects of the subject disclosure. System 200 can include DAC 220

that can facilitate multiple mesh drone communication. DAC 220 can receive drone information about drone 210-213. Drone information can comprise a characteristic, attribute, status, etc., of drones 211-213 via a self-analysis component, as disclosed hereinabove. Moreover, drone information can comprise information related to drones within a discovery volume of drones 210-213 via a discovery component, also as disclosed herein, e.g., where other drones are within a distance of one of drones 210-213, the discover component can communicate to DAC 220 information about the other drone. This aspect can allow drones 210-213 to relay information to DAC 220 about other proximate drones. This information can include identifying the other drones, relaying attributes or characteristics of the other drones, relaying statuses of other drones, etc.

In an aspect, DAC 220 can receive drone information via a communication framework 290. For example, communication framework 290 can communicate drone information from drone 210, via AP 292, to DAC 220. In another example, communication framework 290 can communicate drone information from drone 211, via RAN device 292, to DAC 220. In an aspect, drone 210 and drone 211 can represent drone mesh edge devices that are proximate to AP 292 and RAN device 294 correspondingly. Drone information from drone 212 and drone 213 can be communicated via the drone mesh comprising drone 210-213, to DAC 290 via one or more communication paths comprising an edge device, e.g., drone 210, 211, etc., AP 292 or RAN 294, and communication framework 290. In some embodiments, DAC 220 can be comprised in AP 292 or RAN device 294 such that communication framework 290 is not disposed between DAC 220 and AP 292 or RAN device 294.

In an embodiment, DAC 220 can catalog information about drones 210-213 and catalog information about other drones discovered via discover component(s) of one or more of drones 210-213. In an aspect, the catalog can be updated by a plurality of drones, e.g., drones 210-213, etc., from one or more drone meshes. As an example, drone 210 can determine that drone 210 comprises an video capture device, which information can be cataloged by DAC 220. Drone 210 of this example, can also determine that three other drones, e.g., drones 211-213, are proximate to drone 210, and can facilitate access to an identifier of each of the two drones as well as information relating to a characteristic, attribute, status, etc., of one or more of said proximate drones discovered, which information can be cataloged by DAC 220. DAC 220 can store this information in a drone catalog or other database relating to drone meshes. Moreover, where DAC 220 receives identifiers of the three proximate drones, e.g., 211-213, characteristics of the other three drones can be retrieved from historical information related to the identifiers of those three drones, e.g., where drones 211-213 are already cataloged, the identifier(s) relayed by drone 210 can be used to affiliate the historical drone profile for each of drone(s) 211-213 with the current state of the catalog and, where drones 210-213 are a mesh, the historical drone profiles for 211-213 can be affiliated with the mesh comprising drone 210. Where drone information communicated to DAC 220 via drone 210 is more recent than the historical drone profile data, the more recent data can be employed to update the catalog and the corresponding drone profile. As an example, where drone 212 has a historical profile showing a last software update of drone 212 as six months ago, and the discovery component of drone 210 conveys drone information to DAC 220 that drone 212 is indicating a recent software update, the recent software update can be placed in the drone profile of drone 212, e.g., the drone profile

associated with the identity of drone 212 communicated to DAC 220 via drone 210, and the updated software can be correspondingly cataloged for any mesh affiliated with drone 212. As such, adaptation of a mesh comprising, or soon to comprise, drone 212 can be based on the more recent software update, such as where the recent software update supports a particular data encoding scheme that was not supported in the previous software update, this attribute can be employed in determining if drone 212 should be included in a particular mesh, for example where a mission designates support of the data encoding scheme.

In some embodiments, DAC 220 can communicate with a mesh comprising drones 210-213 can occur via multiple communication pathways, e.g., via drone 210, via drone 211, or via both drone 210 and drone 211. This can provide a degree of robustness to communication between DAC 220 and said mesh, e.g., if drone 210 or drone 211 fails, communication to the mesh can occur through the other pathway. Moreover, distribution of data communication can occur across the plurality of communication pathways, e.g., providing higher data throughput, more bandwidth, etc., by employing multiple pathways for information, wherein the information can be the same or different information. As an example, drone information can be collected by DAC 220 via the pathway through drone 210 for the mesh comprising drone 210-213 and cataloged information can be accessed by the mesh from DAC 220 via the pathway comprising drone 211.

In some embodiments, DAC 220 can facilitate and/or orchestrate adaptation of a mesh in response to a changing parameter, status, environment, task/mission, etc. As an example, where drone 210 is incorporated into a mesh comprising drones 210-212, a different drone, e.g., drone 213, can be provisioned to the mesh based on cataloged drone information indicating drone 213 comprises a feature or attribute beneficial to a mission of the drone mesh, e.g., the drone mesh can be adapted to include drone 213. In an aspect, drone 213 can be included only in the mesh comprising drone 210-213, in the mesh comprising drone 210-213 and in one or more other meshes, shared with the mesh comprising drone 210-212, or can be requested to perform an action on behalf of the mesh comprising drone 210-212 without being shared or conscripted, etc.

In some embodiments, DAC 220 can communicate with multiple drone meshes. As an example, DAC 220 can receive information from a first drone mesh comprising drone 210 and drone 213, a second drone mesh comprising drone 211 and drone 212, and other drone meshes (see FIG. 4, etc.), e.g., via a communications link to one or more drones of the first (e.g., 210), second (e.g., 211), and third meshes. Moreover, DAC 220 can receive information about a fourth mesh via one or more of the first, second, or third meshes. Further, a plurality of DACs can communicate cataloged information among themselves and/or to a more centralized catalog, e.g., a regional or central drone catalog. In an example, where a fifth mesh is cataloged at a second DAC, DAC 220 can receive information about the fifth mesh from the other DAC via communication framework 290, via a communication path between the fifth mesh and one or more of the first, second, and third meshes with, or without, intervening meshes, etc. As such, DAC 220 can facilitate adaptation of, for example, the first mesh to include a drone of the fifth mesh, even where there may be no direct communication link between the drones of the first mesh and the drones of the fifth mesh prior to adapting the first mesh to include a drone of the fifth mesh.

DAC 220 can determine drone selection parameters related to a mission parameter, mission goal, mission preference, etc. Selection parameters can include, but are not limited to, a type of drone, a drone specification, a mission operating environment, drone availability, price, proximity, rules or laws, user profile, scheduling, a control interface or feature thereof, prior use of drones by the user, insurance features, intended use characteristics, certification, training, geographical or political boundaries, etc. Selection parameters can be based on drone information cataloged by DAC 220. Further, selection parameters can be based on other information, for example, drone mesh information, drone information for drones comprising a drone mesh, other meshes or drones thereof, weather information, schedule information related to persons related to the mission event, etc. As an example, drone information can indicate operation in a tropical storm environment, this can trigger capture of weather information for a targeted region to aid in selecting drones for a mesh that can operate in the expected conditions of a tropical storm in that environ. DAC 220 can determine what, if any, drone in one or more meshes satisfy drone allocation parameters based on drone information and other related information. Additionally, selection parameters can identify a drone, a drone mesh, multiple drone meshes, tiers of drones/meshes, etc. This information can be employed in determining, in conjunction with the selection information, a drone to provision in a mesh.

In some embodiments, a drone mesh, e.g., comprising drones 210-213, can self-organize and/or self-optimize (SOSO). SOSO can be based on cataloged information via DAC 220. As such, multiple mesh drone communication, can allow dynamic adaptation of a mesh in response to changes in nearly any drone/mesh/mission characteristic or parameter. In an aspect, this can provide a level of redundancy on a mesh to accommodate unexpected events. As an example, where a drone mesh comprising drone 210, 211, and 212, is tasked with package delivery, DAC 220 can facilitate adapting the mesh by providing catalog information to drones of the mesh, allowing them to integrate drones of another mesh, deploy or provision new drones from a drone base, etc., where a drone of the mesh indicates to the other drones of the mesh that it is experiencing a failure, that a battery is running low, etc., or where a drone of the mesh suddenly becomes unavailable, e.g., due to a crash, part failure, etc. Thus, in the example, where drone 212 is failing, or has failed, drone 213 can be added to the mesh, even where the drone is also part of another mesh, to facilitate completion of the mission. Moreover, SOSO behavior can enable adaptation of meshes in a highly automated manner. As an example, a mesh can comprise drones 210-213 to provide wireless network coverage to an event in an area lacking sufficient wireless coverage, e.g., drone 211 can act as a bridge device to allow wireless links through 210, 212, and 213 to be routed through drone 211 to RAN device 294 where, for example, RAN device 294 might not otherwise provide adequate coverage to the area covered by drones 210-213. Where, in the example, drones 210 and 212 provide sufficient coverage to wireless links also covered by drone 213, SOSO techniques can adapt the mesh by releasing drone 213 from the mesh, instructing drone 213 to change positions to reduce coverage overlap, etc.

FIG. 3 illustrates a system 300 that facilitates multiple mesh drone communication via a drone committed to a plurality of drone meshes in accordance with aspects of the subject disclosure. System 300 can include DAC 320 that can facilitate multiple mesh drone communication. DAC 320 can receive drone information about drones 310-313

and **350-351**. Drone information can comprise a characteristic, attribute, status, etc., of drones **311-313** and **350-351** via a self-analysis component, as disclosed hereinabove. Moreover, drone information can comprise information related to drones within a discovery volume of drones **310-313** and **350-351** via a discovery component, also as disclosed herein, e.g., where other drones are within a distance of one of drones **310-313** or and **350-351**, the discover component can communicate to DAC **320** information about the other drone. This aspect can allow drones **310-313** and **350-351** to relay information to DAC **320** about other proximate drones. This information can include identifying the other drones, relaying attributes or characteristics of other drones, relaying statuses of other drones, etc.

In an aspect, DAC **320** can receive drone information via a communication framework **390**. In an aspect, drone **310** and drone **313** can represent drone mesh edge devices. Drone information from drone **310-313** can be communicated via drone mesh **380** via one or more communication path comprising an edge device, e.g., drone **310** and communication framework **390**. Drone information from drone **310-313** can be communicated via drone mesh **382** via one or more communication path comprising an edge device, e.g., drone **313**, drone **310**, and communication framework **390**. As such, mesh **382** can communicate with mesh **380** and with DAC **320**, mesh **380** can communicate with mesh **382** and with DAC **320**, etc.

In an embodiment, DAC **320** can catalog information about drones **310-313** and **350-351**, and catalog information about other drones discovered via discover component(s) of one or more of drones. In an aspect, the catalog can be updated by a plurality of drones, e.g., drones **310-313** and **350-351**, etc., from one or more drone meshes, e.g., **380-382**. As an example, drone **312** can determine, via drone **313**, that drone **350** comprises a sensor device, which information can be cataloged by DAC **320**. Drone **312** of this example, can also determine that other drones, e.g., drones **350-351**, are proximate to drone **313**, and can facilitate access to an identifier of each of the two drones as well as information relating to a characteristic, attribute, status, etc., of one or more of said proximate drones discovered, which information can be cataloged by DAC **320**. DAC **320** can store this information in a drone catalog or other database relating to drone meshes. Moreover, where DAC **320** receives identifiers of the proximate drones, e.g., **350-351**, characteristics of the other drones can be retrieved from historical information related to the identifiers of those three drones, e.g., where drone **350** is already cataloged, the identifier(s) relayed by drone **312** via **310**, can be used to access the historical drone profile of drone **350**, for example indicating that drone **350** comprises the sensor device in the current example. Where drone information about drone **350** communicated to DAC **320** via drone **313**, **312**, and **310**, is more recent than the historical drone profile data, the more recent data can be employed to update the catalog and the corresponding drone profile. As an example, where drone **350** has a historical profile showing the sensor but the current drone status indicates the sensor is not present on drone **350**, this information can be employed to update the drone profile of drone **350**, e.g., indicating no sensor device. As such, adaptation of a mesh comprising, or soon to comprise, drone **350** can be based on the lack of the sensor device, where this attribute can be employed in determining if drone **350** should be included in a particular mesh.

In some embodiments, DAC **320** can communication with a mesh, e.g., **380-382**, via multiple communication path-

ways. This can provide a degree of robustness to communication between DAC **320** and a mesh. Moreover, distribution of data communication can occur across the plurality of communication pathways by employing multiple pathways for information, wherein the information can be the same or different information.

System **300** illustrates drone **313** as part of both mesh **380** and mesh **382**. As such, drone **313** can support a mission associated with mesh **380** and a mission associated with mesh **382**. This multiple mission support can occur concurrently, for example, where drone **313** participates in a temperature mapping mission of mesh **380** and concurrently participates in capturing audio in support of a second mission of mesh **382**. Moreover, drone **313** can, for example, map temperatures in periods where audio is not being captured, e.g., idle time from the mesh **382** mission can be allocated to the mission of mesh **380**.

In some embodiments, DAC **320** can facilitate and/or orchestrate adaptation of a mesh in response to a changing parameter, status, environment, task/mission, etc. As an example, mesh **380** can comprise drones **310-313**, and a different drone, e.g., drone **350**, can be provisioned to the mesh based on cataloged drone information indicating drone **350** comprises a feature or attribute beneficial to a mission of drone mesh **380**, e.g., drone mesh **380** can be adapted to include drone **350**. In an aspect, drone **350** can be removed from mesh **382** and included only in mesh **380**, drone **350** can be included in both mesh **380** and mesh **382**, can be requested to perform an action on behalf of mesh **380** without being conscripted into mesh **380**, etc.

In some embodiments, DAC **320** can communicate with multiple drone meshes. As an example, DAC **320** can receive information from drone mesh **380** via drone **310**, from drone mesh **382** via drone **313** and **310**, etc. Moreover, DAC **320** can receive information about a another mesh via one or more drones of mesh **380**, **382**, etc. Further, a plurality of DACs can communicate cataloged information among themselves and/or to a more centralized catalog, e.g., a regional or central drone catalog. In an example, where a fifth mesh is cataloged at a second DAC, DAC **320** can receive information about the fifth mesh from the other DAC via communication framework **390** (not illustrated), via a communication path between the fifth mesh and one or more of meshes **380-382** inclusive of any intervening meshes, etc. As such, DAC **320** can facilitate adaptation of, for example, mesh **380** to include a drone of the fifth mesh, even where there may be no direct communication link between the drones of mesh **380** and the drones of the fifth mesh prior to adapting mesh **380** to include a drone of the fifth mesh.

DAC **320** can determine drone selection parameters related to a mission parameter, mission goal, mission preference, etc. Selection parameters can include, but are not limited to, a type of drone, a drone specification, a mission operating environment, drone availability, price, proximity, rules or laws, user profile, scheduling, a control interface or feature thereof, prior use of drones by the user, insurance features, intended use characteristics, certification, training, geographical or political boundaries, etc. Selection parameters can be based on drone information cataloged by DAC **320**. Further, selection parameters can be based on other information, for example, drone mesh information, drone information for drones comprising a drone mesh, other meshes or drones thereof, weather information, schedule information related to persons related to the mission event, etc. As an example, drone information can indicate operation in a tropical storm environment, this can trigger capture of weather information for a targeted region to aid in selecting

drones for a mesh that can operate in the expected conditions of a tropical storm in that environ. DAC 320 can determine what, if any, drone in one or more meshes satisfy drone allocation parameters based on drone information and other related information. Additionally, selection parameters can identify a drone, a drone mesh, multiple drone meshes, tiers of drones/meshes, etc. This information can be employed in determining, in conjunction with the selection information, a drone to provision in a mesh.

In some embodiments, a drone mesh, e.g., 380-382, etc., can self-organize and/or self-optimize (SOSO). SOSO can be based on cataloged information via DAC 320. As such, multiple mesh drone communication, can allow dynamic adaptation of a mesh in response to changes in nearly any drone/mesh/mission characteristic or parameter. In an aspect, this can provide a level of redundancy on a mesh to accommodate unexpected events. As an example, where drone mesh 380 is tasked with detecting forest fires due to lightning strikes, DAC 320 can facilitate adapting the mesh by providing catalog information to drones of mesh 380, allowing them to integrate drones of another mesh, e.g., mesh 382, etc., deploy or provision new drones from a drone base, etc., where a drone of mesh 380 indicates to the other drones of mesh 380 that it is experiencing a failure, that a battery is running low, etc., or where a drone of mesh 380 suddenly becomes unavailable, e.g., due to a crash, part failure, etc. Thus, in the example, where drone 312 is failing, or has failed, drone 350 can be added to mesh 380, even where the drone is also part of another mesh, e.g., mesh 382, to facilitate completion of the forest fire detection mission. Moreover, SOSO behavior can enable adaptation of meshes in a highly automated manner. As an example, mesh 380 can release drone 350 from mesh 380 where drone 312 is no longer failing.

FIG. 4 illustrates a system 400 that facilitates multiple mesh drone communication via a plurality of example drone mesh topographies in accordance with aspects of the subject disclosure. System 400 can include DAC 420 that can facilitate multiple mesh drone communication. DAC 420 can receive drone information about drones, e.g., 410-413, 450-451, 460-463, 470, etc. Drone information can comprise a characteristic, attribute, status, etc., via a self-analysis component, as disclosed hereinabove. Moreover, drone information can comprise information related to drones within a discovery volume of other drones via a discovery component, also as disclosed herein, e.g., where other drones are within a distance of a first drones, the discover component of the first drone can communicate to DAC 420 information about the other drone. This aspect can allow drones to relay information to DAC 420 about other proximate drones. This information can include identifying the other drones, relaying attributes or characteristics of other drones, relaying statuses of other drones, etc.

In an aspect, DAC 420 can receive drone information via a drone of a mesh, e.g., via drone 411 of mesh 480, via drone 460 of mesh 484, etc., or via intervening drones of the same mesh or other meshes, e.g., drone information about drone 470 can be received via drone 450, 463, 461, 460, or via drone 450, 413, 410, 460, or via drone 450, 413, 412, 411, or via another pathway traversing one or more meshes, e.g., mesh 480, 482, 484, 486, etc.

In an embodiment, DAC 420 can catalog information about drones and catalog information about other drones discovered via discover component(s) of one or more drones. This cataloging of information about drones linked via other drones, either in one mesh or in a plurality of meshes, can be termed 'drone node crawling' and can be

viewed as analogous to web link crawling. In an aspect, the catalog can be updated by a plurality of drones, e.g., drones 410-470, from one or more drone meshes, e.g., 480-486. DAC 420 can store this information in a drone catalog or other database relating to drone meshes. Moreover, where DAC 420 receives identifiers of drones proximate to other drones, e.g., drone 470 can be proximate to drone 450, characteristics of the other drones, e.g., 470, can be retrieved from historical information related to the identifiers of those three drones, e.g., where drone 470 is already cataloged, the identifier for drone 470 relayed by drone 450 and intervening drones to DAC 420, can be used to access the historical drone profile of drone 470. Where drone information about drone 470 communicated to DAC 420 via drone 450 and intervening drones, is more recent than the historical drone profile data for drone 470, the more recent data can be employed to update the catalog and the corresponding drone profile. As an example, where drone 470 has a historical profile showing a one ton lift capacity, the sensor but the current drone status indicates the drone 470 can lift two tons, this information can be employed to update the drone profile of drone 470, e.g., updated to indicate a two ton lift capacity. As such, adaptation of a mesh comprising, or soon to comprise, drone 470 can be based on the two ton lift capacity of drone 470 rather than the historical one ton lift capacity.

In some embodiments, DAC 420 can communicate with a mesh, e.g., 480-486, via multiple communication pathways. This can provide a degree of robustness to communication between DAC 420 and a mesh. As an example, communication to drones of mesh 482 can be via communications pathways via mesh 480, via meshes 484 and 486, or via meshes 480, 484, and 486. Moreover, distribution of data communications can occur across the plurality of communication pathways by employing multiple pathways for information transfer, wherein the information can be the same or different information, as disclosed hereinabove.

System 400 illustrates drone 413 as part of both mesh 480 and mesh 482. As such, drone 413 can support a mission associated with mesh 480 and a mission associated with mesh 482. This multiple mission support can occur concurrently. System 400 further illustrates that mesh 486 can be a submesh of mesh 484, which can again support multiple missions concurrently.

In some embodiments, DAC 420 can facilitate and/or orchestrate adaptation of a mesh in response to a changing parameter, status, environment, task/mission, etc. As an example, mesh 486 can be formed from drones of mesh 484 where a submesh of drones 461-463 is determined to be needed and the cataloged drone information for 461-463 indicates that these drones are capable and appropriate. In an aspect, appropriateness can include compositional considerations, e.g., drone 463 can be less powerful than drone 411, but drone 463 can still be selected due to geographical placement, remaining power levels, transit time, etc.

In some embodiments, DAC 420 can communicate with multiple drone meshes, e.g., meshes 480-486, etc. As an example, DAC 420 can receive information from drone mesh 480 via drone 411, from drone mesh 482 via drone 413, 410, and 411, etc. Moreover, DAC 420 can receive information about another mesh, e.g., mesh 486, via one or more drones of mesh 484, etc. Further, a plurality of DACs can communicate cataloged information among themselves and/or to a more centralized catalog, e.g., a regional or central drone catalog. In an example, where mesh 486 is cataloged at a second DAC, DAC 420 can receive information about mesh 486 from the other DAC via communication framework 490 (not illustrated), via a communication path

between mesh **486** and one or more of meshes **484**, **482**, and/or **480**, etc. As such, DAC **420** can facilitate adaptation of, for example, mesh **480** to include a drone of mesh **486**.

DAC **420** can determine drone selection parameters related to a mission parameter, mission goal, mission preference, etc. Selection parameters can include, but are not limited to, a type of drone, a drone specification, a mission operating environment, drone availability, price, proximity, rules or laws, user profile, scheduling, a control interface or feature thereof, prior use of drones by the user, insurance features, intended use characteristics, certification, training, geographical or political boundaries, etc. Selection parameters can be based on drone information cataloged by DAC **420**. Further, selection parameters can be based on other information, for example, drone mesh information, drone information for drones comprising a drone mesh, other meshes or drones thereof, weather information, schedule information related to persons related to the mission event, etc. As an example, drone information can indicate operation in a tropical storm environment, this can trigger capture of weather information for a targeted region to aid in selecting drones for a mesh that can operate in the expected conditions of a tropical storm in that environ. DAC **420** can determine what, if any, drone in one or more meshes satisfy drone allocation parameters based on drone information and other related information. Additionally, selection parameters can identify a drone, a drone mesh, multiple drone meshes, tiers of drones/meshes, etc. This information can be employed in determining, in conjunction with the selection information, a drone to provision in a mesh.

In some embodiments, a drone mesh, e.g., **480-486**, etc., can self-organize and/or self-optimize (SOSO). SOSO can be based on cataloged information via DAC **420**. As such, multiple mesh drone communication, can allow dynamic adaptation of a mesh in response to changes in nearly any drone/mesh/mission characteristic or parameter. In an aspect, this can provide a level of redundancy on a mesh to accommodate unexpected events. As an example, where drone mesh **480** is tasked with collection of orbiting debris, DAC **420** can facilitate adapting the mesh by providing catalog information to drones of mesh **480**, allowing them to integrate drones of another mesh, e.g., mesh **482**, etc., deploy or provision new drones from a drone base, etc., where a drone of mesh **480** indicates to the other drones of mesh **480** that a particular piece of debris is too large to capture alone. Thus, in the example, where a drone, e.g., **413**, signals that assistance is needed, drone **450** and **451** can be added to mesh **480**, even where they remain part of another mesh, e.g., mesh **482**, to facilitate advancing the space junk collection mission. Moreover, SOSO behavior can enable adaptation of meshes in a highly automated manner. As an example, mesh **480** can release drones **450** and/or **451** from mesh **480** after the need for assistance has abated.

FIG. 5 illustrates a system **500** that facilitates multiple mesh drone communication and provisioning of drone resources in accordance with aspects of the subject disclosure. System **500** can include DAC **520** that can facilitate multiple mesh drone communication. DAC **520** can receive drone information about drone **510-513**. Drone information can comprise a characteristic, attribute, status, etc., of drones **510-513** via a self-analysis component, as disclosed hereinabove. Moreover, drone information can comprise information related to drones within a discovery volume of drones **510-513** via a discovery component, also as disclosed herein, e.g., where other drones are within a distance of one of drones **510-513**, the discover component can

communicate to DAC **520** information about the other drone. This aspect can allow drones **510-513** to relay information to DAC **520** about other proximate drones. This information can include identifying the other drones, relaying attributes or characteristics of other drones, relaying statuses of other drones, etc. In an aspect, DAC **520** can receive drone information via a communication framework **590**. For example, communication framework **590** can communicate drone information from drone **510** to DAC **520**.

In an embodiment, DAC **520** can catalog information about drones **510-513** and catalog information about other drones discovered via discover component(s) of one or more of drones **510-513**. In an aspect, the catalog can be updated by a plurality of drones, e.g., drones **510-513**, etc., from one or more drone meshes. DAC **520** can store this information in a drone catalog or other database relating to drone meshes. Moreover, where DAC **520** receives identifiers of proximate drones, characteristics of the proximate drones can be retrieved from historical information related to the identifiers of those three drones, e.g., where the proximate drones are already cataloged, the identifier(s) relayed by a drone of mesh **580** can be used to affiliate the historical drone profile of each proximate drone. Where drone information communicated to DAC **520** via mesh **580** is more recent than the historical drone profile data, the more recent data can be employed to update the catalog and the corresponding drone profile. As such, adaptation of a mesh comprising, or soon to comprise, a proximate drone can be based on up to date information.

In some embodiments, DAC **520** can facilitate and/or orchestrate adaptation of a mesh in response to a changing parameter, status, environment, task/mission, etc. As an example, where drone **510** is part of mesh **580**, a different drone, e.g., drone **550**, **551**, **552**, . . . , **553**, etc., can be provisioned to the mesh based on cataloged drone information indicating drone **550**, **551**, **552**, . . . , **553**, etc., comprises a feature or attribute beneficial to a mission of drone mesh **580**, e.g., the drone mesh can be adapted to include drone **550**, **551**, **552**, . . . , **553**, etc. Drones **550**, **551**, **552**, . . . , **553**, etc., can be deployed from drone base **594**. In an aspect, drone base **594** can house and deploy one or more drones, e.g., **550**, **551**, **552**, . . . , **553**, etc., in response to a request for a drone received via communication framework **590**. Drone base **594** can be operated, for example, by a drone lending, leasing, or rental entity; as a part of an delivery company, a transportation company, a school or university, a retail entity, etc.; as part of an enthusiast or hobbyist group, etc., or as part of nearly any entity that can provide access to a drone device. In an aspect, drone **550**, **551**, **552**, . . . , **553**, etc., can be included only in mesh **580**, in the mesh **580** and in one or more other meshes, shared with mesh **580**, can be requested to perform an action on behalf of mesh **580** without being shared or conscripted into mesh **580**, etc. As an example, a postal service drone can be added to a non-postal service mesh to aid in locating a child as part of an Amber alert response.

DAC **520** can determine drone selection parameters related to a mission parameter, mission goal, mission preference, etc. Selection parameters can include, but are not limited to, a type of drone, a drone specification, a mission operating environment, drone availability, price, proximity, rules or laws, user profile, scheduling, a control interface or feature thereof, prior use of drones by the user, insurance features, intended use characteristics, certification, training, geographical or political boundaries, etc. Selection parameters can be based on drone information cataloged by DAC **520**. Further, selection parameters can be based on other

information, for example, drone mesh information, drone information for drones comprising a drone mesh, other meshes or drones thereof, weather information, schedule information related to persons related to the mission event, etc. As an example, drone information can indicate operation in a tropical storm environment, this can trigger capture of weather information for a targeted region to aid in selecting drones for a mesh that can operate in the expected conditions of a tropical storm in that environ. DAC 520 can determine what, if any, drone in one or more meshes satisfy drone allocation parameters based on drone information and other related information. Additionally, selection parameters can identify a drone, a drone mesh, multiple drone meshes, tiers of drones/meshes, etc. This information can be employed in determining, in conjunction with the selection information, a drone to provision in a mesh. In some embodiments, a drone mesh, e.g., mesh 580, can self-organize and/or self-optimize (SOSO). SOSO can be based on cataloged information via DAC 520. As such, multiple mesh drone communication, can allow dynamic adaptation of a mesh in response to changes in nearly any drone/mesh/mission characteristic or parameter. In an aspect, this can provide a level of redundancy on a mesh to accommodate unexpected events. Moreover, SOSO behavior can enable adaptation of meshes in a highly automated manner.

In view of the example system(s) described above, example method(s) that can be implemented in accordance with the disclosed subject matter can be better appreciated with reference to flowcharts in FIG. 6-FIG. 8. For purposes of simplicity of explanation, example methods disclosed herein are presented and described as a series of acts; however, it is to be understood and appreciated that the claimed subject matter is not limited by the order of acts, as some acts may occur in different orders and/or concurrently with other acts from that shown and described herein. For example, one or more example methods disclosed herein could alternatively be represented as a series of interrelated states or events, such as in a state diagram. Moreover, interaction diagram(s) may represent methods in accordance with the disclosed subject matter when disparate entities enact disparate portions of the methods. Furthermore, not all illustrated acts may be required to implement a described example method in accordance with the subject specification. Further yet, two or more of the disclosed example methods can be implemented in combination with each other, to accomplish one or more aspects herein described. It should be further appreciated that the example methods disclosed throughout the subject specification are capable of being stored on an article of manufacture (e.g., a computer-readable medium) to allow transporting and transferring such methods to computers for execution, and thus implementation, by a processor or for storage in a memory.

FIG. 6 illustrates a method 600 facilitating multiple mesh drone communication in accordance with aspects of the subject disclosure. At 610, method 600 can comprise determining a first drone attribute(s) for a first drone. As drones, for land, sea, air, and/or space operation, become increasingly ubiquitous, can be determined to have attributes that make said drones attractive for inclusion in a drone mesh. Attributes can comprise sensor capabilities, drone characteristics, battery status, solar power status, operational envelopes of the drone, drone radio technology(ies), drone mesh membership(s), environment characteristic(s) of an environment(s) in which a drone is operating, etc. In an embodiment, attributes, e.g., characteristics, status, functionality, etc., can be determined by a self-analysis component of a drone. Attributes can further comprise a drone/owner name,

address, phone number, identification information, account information, drone/owner/user profile information, certifications information, logged hours or other training, mission parameters, such as, but not limited to, mission location, mission time, mission duration, mission type, mission payload, mission controller or interaction devices/services, level of autonomy, other drones/devices associated with the mission, etc., clearances, permits, approvals, waivers, mission path, mission locus resources available, e.g., power, fuel, internet connectivity, etc., historical drone use, additional operators/controllers, etc. It will be noted that nearly any pertinent information can be included in drone attributes.

At 620, method 600 can comprise determining first proximate drone data for the first drone. In an aspect, the first drone can discover, for example via a discovery component, other drone(s) proximate to the first drone. The discovered proximate drone data can comprise an identifier for the proximate drone(s), attributes, characteristics, status, missions, meshes of the proximate drone, etc. In an embodiment, the identifier can be used to gather historical information about the identified proximate drone.

At 630, method 600 can comprise updating catalog information based on the first drone attribute(s) and the first proximate drone data. The catalog of drone data can comprise data on one or more drones, which can each be part of, or affiliated with, one or more drone meshes. In an embodiment, the done data can be cataloged by a drone allocation component (DAC), e.g., DAC 120, 220, 32, 420, 520, etc. The catalog of drone data can provide information for analysis to facilitate determining which drones should be made part of a drone mesh to best accomplish a drone mission for a given set of circumstances. As an example, a drone mesh to photograph a wedding can comprise drones with cameras, drones with video/audio recording device, etc., whereby, the catalog of drone data can be analyzed to locate drones having these attributes that are available, located near to the planned event in time and space, are low cost, and capable of functioning for the prescribed length of the event. Where such drones are determined from the catalog, the drones can be provisioned for the mission. In an aspect, especially where many drones are available and can meet the requirements, drones can be rank ordered by one or more criteria, e.g., lowest to highest cost, highest to lowest reliability, quietest to noisiest, by camera/video/audio functions, etc., to afford selection of a best fit of individual drones and combinations of drones in a mesh for a given set of parameters. As an example, the wedding mesh can indicate three highly reliable, quiet electric drones, for \$500, rather than eight, noisy gasoline drones for \$100. Moreover, the drones can be provisioned from drones comprised in existing meshes or can be added to/removed from a mesh, or a new mesh can be formed based on the catalog data. As an example, where the wedding is occurring near to a movie shoot, drones of a drone mesh used in the movie shoot can be used in a drone mesh for the wedding event, such that when the drones are not being used for the movie shoot they can participate in the wedding event. This can optimize drone usage. Moreover, sharing of drones, or use of drone in multiple meshes can be facilitated by compliance with rules, for example, rules related to ensuring that drones are ready for use in a primary mission with a higher priority than a secondary mission, rules related to types of use, rules related to areas of use, etc. As such, the drones from the movie shoot example can be shared with the wedding event if they comply with a rule that assures that the shared drones are returned to the movie shoot at a determined time in advance



of expected use on the movie shoot, e.g., to allow charging, cleaning, repair, and availability of the drones on the movie shoot.

At **640**, method **600** can comprise, enabling access to the catalog information to facilitate adapting a first drone mesh based on the catalog information, second drone attribute(s) for a second drone, and second proximate drone data for the second drone. At this point method **600** can end. The first drone mesh can be adapted based on the catalog information in relation to attributes of another drone in the mesh, e.g., the second drone, and drones proximate to the second drone. As an example, where the first drone indicates that a battery level is low, and the second drone indicates normal operation and proximity to the first drone, the catalog information can be updated accordingly and can then be leveraged to adapt the mesh comprising the first and second drones to, for example, minimize power consumption of the first drone, substitute a third drone for the first drone to allow the first drone to return to a drone base for charging, share a drone with another mesh to accomplish the mission of the first mesh, etc.

FIG. 7 illustrates a method **700** that facilitates multiple mesh drone communication via a drone allocation component in accordance with aspects of the subject disclosure. At **710**, method **700** can comprise receiving a first drone attribute for a first drone comprised in a first drone mesh. The first drone attribute can be received by a drone allocation component, such as described herein, e.g., DAC **120**, **220**, **32**, **420**, **520**, etc. Attributes can comprise sensor capabilities, drone characteristics, battery status, solar power status, operational envelopes of the drone, drone radio technology, drone mesh membership, environment characteristic of an environment in which a drone is operating, a drone/owner name, address, phone number, identification information, account information, drone/owner/user profile information, certifications information, logged hours or other training, mission parameters, such as, but not limited to, mission location, mission time, mission duration, mission type, mission payload, mission controller or interaction devices/services, level of autonomy, other drones/devices associated with the mission, etc., clearances, permits, approvals, waivers, mission path, mission locus resources available, e.g., power, fuel, internet connectivity, etc., historical drone use, additional operators/controllers, etc. It will be noted that nearly any pertinent information can be included in drone attributes. In an embodiment, attributes can be determined by a self-analysis component of a drone. Further, at **710**, method **700** can also comprise the DAC receiving first proximate drone data for the first drone. In an aspect, the first drone can discover, for example via a discovery component, other drone(s) proximate to the first drone. The discovered proximate drone data can comprise an identifier for the proximate drone(s), attributes, characteristics, status, missions, meshes of the proximate drone, etc. In an embodiment, the identifier can be used to gather historical information about the identified proximate drone. At **720**, method **700** can comprise receiving a second drone attribute and second proximate drone data for a second drone comprised in a second drone mesh.

At **730**, method **700** can comprise updating, by the DAC, catalog information based on the first drone attribute, the first proximate drone data, the second drone attribute, and the second proximate drone data. The catalog of drone data can comprise data on one or more drones, e.g., the first drone and the second drone, which can each be part of, or affiliated with, one or more drone meshes, e.g., the first mesh and the second mesh. The catalog of drone data can provide infor-

mation for analysis to facilitate determining which drones can be made part of a drone mesh to best accomplish a drone mission under a set of circumstances associated with a drone mission. Where such drones are determined from the catalog, the drones can be provisioned for the mission. In an aspect, especially where many drones are available and can meet the requirements, drones can be rank ordered by one or more criteria. Moreover, the drones can be provisioned from drones comprised in existing meshes or can be added to/removed from a mesh, or a new mesh can be formed based on the catalog data. This can allow drones to self-organize and/or self-optimize drone usage based on the catalog information. Moreover, sharing of drones, or use of drone in multiple meshes can be facilitated by compliance with rules, for example, rules related to ensuring that drones are ready for use in a primary mission with a higher priority than a secondary mission, rules related to types of use, rules related to areas of use, etc.

At **740**, method **700** can comprise, receiving an indicator of a status change for a drone of the first mesh and, in response, facilitating, by the DAC, adapting the first drone mesh based on the catalog information. At this point method **700** can end. The first drone mesh can be adapted based on the catalog information, which comprises first and second drone attributes and first and second proximate drone discovery. As an example, where the first drone indicates that an engine is underperforming in relation to design specifications, the first drone mesh can be adapted, based on the catalog information, to augment the operations of the second drone by adding a third drone, removing the first drone, merging the first mesh with another mesh, etc., to facilitate completion of the mission of the first mesh.

FIG. 8 illustrates a method **800** that facilitates multiple mesh drone communication comprising drone mesh adaptation in accordance with aspects of the subject disclosure. At **810**, method **800** can comprise receiving a portion of catalog information, wherein the catalog information is related to a plurality of drone meshes. The catalog information can comprise a drone attribute for a drone of a drone mesh of the plurality of drone meshes. An attributes can be a sensor capability, a drone characteristic, a battery status, a solar power status, an operational envelope of the drone, a drone radio technology, a drone mesh membership indicator, an environment characteristic of an environment in which the drone is operating, a drone/owner name, address, phone number, identification information, account information, drone/owner/user profile information, certifications information, logged hours or other training, mission parameters, such as, but not limited to, mission location, mission time, mission duration, mission type, mission payload, mission controller or interaction devices/services, level of autonomy, other drones/devices associated with the mission, etc., clearances, permits, approvals, waivers, mission path, mission locus resources available, e.g., power, fuel, internet connectivity, etc., historical drone use, additional operators/controllers, etc. It will be noted that nearly any pertinent information can be included in a drone attribute. In an embodiment, attributes can be determined by a self-analysis component of a drone.

Method **800**, at **820**, can comprise receiving an indicator of a status change for a drone of a first drone mesh of the drone meshes. A status change of the drone can correspond to a change in a characteristic or attribute of the drone, such as, loss of communication with the drone, indications of drone failure or under performance, change in location of drone, change in an environment in which the drone is operating, e.g., weather change, temperature change, change

in pressure, change in lighting, change in depth/altitude, etc., change in membership of the drone mesh, etc. The status change can relate to changed conditions related to completion of a mission of the first drone mesh that can indicate that adaptation of the first drone mesh can increase a likelihood of mission completion.

At **830**, method **800** can comprise adding a drone to the first drone mesh, based on the portion of the catalog information, in response to determining that adding a drone to the first drone mesh satisfies a first rule related to the status change. In an embodiment, a drone of the first drone mesh can determine that the first rule is satisfied and, in response can initiate adding a drone to the first drone mesh. In another embodiment, a DAC can determine that the first rule is satisfied and, in response can initiate adding a drone to the first drone mesh. In a further embodiment, another device can determine that the first rule is satisfied and, in response can initiate adding a drone to the first drone mesh.

At **840**, method **800** can comprise removing a drone from the first drone mesh, based on the portion of the catalog information, in response to determining that removing a drone from the first drone mesh satisfies a second rule related to the status change. In an embodiment, a drone of the first drone mesh can determine that the second rule is satisfied and, in response can initiate removing a drone from the first drone mesh. In another embodiment, a DAC can determine that the second rule is satisfied and, in response can initiate removing a drone from the first drone mesh. In a further embodiment, another device can determine that the second rule is satisfied and, in response can initiate removing a drone from the first drone mesh.

At **850**, method **800** can comprise conscripting a drone from a second drone mesh into the first drone mesh, based on the portion of the catalog information, in response to determining that conscripting the drone from the second drone mesh satisfies a third rule related to the status change. In an embodiment, a drone of the first drone mesh can determine that the third rule is satisfied and, in response can initiate conscripting the drone from the second drone mesh. In another embodiment, a DAC can determine that the third rule is satisfied and, in response can initiate conscripting the drone from the second drone mesh. In a further embodiment, another device can determine that the third rule is satisfied and, in response can initiate conscripting the drone from the second drone mesh.

At **860**, method **800** can comprise merging a second drone mesh into the first drone mesh, based on the portion of the catalog information, in response to determining that merging the second drone mesh and the first drone mesh satisfies a fourth rule related to the status change. In an embodiment, a drone of the first drone mesh can determine that the fourth rule is satisfied and, in response can initiate merging the first and second drone mesh. In another embodiment, a DAC can determine that the fourth rule is satisfied and, in response can initiate merging the first and second drone mesh. In a further embodiment, another device can determine that the fourth rule is satisfied and, in response can initiate merging the first and second drone mesh.

At **870**, method **800** can comprise splitting the first drone mesh, based on the portion of the catalog information, in response to determining that splitting the first drone mesh satisfies a fifth rule related to the status change. In an embodiment, a drone of the first drone mesh can determine that the fifth rule is satisfied and, in response can initiate splitting the first drone mesh. In another embodiment, a DAC can determine that the fifth rule is satisfied and, in response can initiate splitting the first drone mesh. In a

further embodiment, another device can determine that the fifth rule is satisfied and, in response can initiate splitting the first drone mesh.

At **880**, method **800** can comprise forming a submesh of the first drone mesh, based on the portion of the catalog information, in response to determining that forming a submesh of the first drone mesh satisfies a sixth rule related to the status change. At this point method **800** can end. In an embodiment, a drone of the first drone mesh can determine that the sixth rule is satisfied and, in response can initiate forming the submesh of the first drone mesh. In another embodiment, a DAC can determine that the sixth rule is satisfied and, in response can initiate forming the submesh of the first drone mesh. In a further embodiment, another device can determine that the sixth rule is satisfied and, in response can initiate forming the submesh of the first drone mesh.

In an embodiment, the catalog information can be determined by a DAC, e.g., DAC **120**, **220**, **320**, **420**, **520**, etc. The cataloging can be based on a characteristic, an attribute, a functionality, etc., of a drone of the first mesh. The cataloging can be based on a characteristic or parameter of a mission of the first drone mesh. The cataloging can be based on an environmental characteristic or condition of an operating environment of the first drone mesh, or an expected environment of the first drone mesh during execution of a mission of the drone mesh. In some embodiments, drones can be part of one or more drone meshes. In an aspect, drones of the multiple meshes can communication with other drones of the same or different meshes to facilitate communication of information to a DAC for cataloging and to facilitate receiving the portion of the catalog information to enable adapting the first drone mesh. In some embodiments, the first drone mesh can SOSO based on the portion of the catalog information received at **810**. SOSO can comprise adding, removing, conscripting, sharing, merging, splitting, forming a submesh, etc., to adapt the first drone mesh to response to the receiving the indicator of the status change received at **820**.

FIG. **9** is a schematic block diagram of a computing environment **900** with which the disclosed subject matter can interact. The system **900** includes one or more remote component(s) **910**. The remote component(s) **910** can be hardware and/or software (e.g., threads, processes, computing devices). In some embodiments, remote component(s) **910** can include servers, personal servers, wireless telecommunication network devices, etc. As an example, remote component(s) **910** can be DAC **120**, **220**, **320**, **420**, **520**, etc., access point **292**, RAN device **294**, etc., drone base **594**, etc.

The system **900** also includes one or more local component(s) **920**. The local component(s) **920** can be hardware and/or software (e.g., threads, processes, computing devices). In some embodiments, local component(s) **920** can include, for example, drone **110**, **210-213**, **310-313**, **350-351**, **410-413**, **450-451**, **460-463**, **470**, **510-513**, **550-553**, etc.

One possible communication between a remote component(s) **910** and a local component(s) **920** can be in the form of a data packet adapted to be transmitted between two or more computer processes. Another possible communication between a remote component(s) **910** and a local component(s) **920** can be in the form of circuit-switched data adapted to be transmitted between two or more computer processes in radio time slots. The system **900** includes a communication framework **940** that can be employed to facilitate communications between the remote component(s) **910** and the local component(s) **920**, and can include an air

interface, e.g., Uu interface of a UMTS network. Remote component(s) **910** can be operably connected to one or more remote data store(s) **950**, such as a hard drive, SIM card, device memory, etc., that can be employed to store information on the remote component(s) **910** side of communication framework **940**. Similarly, local component(s) **920** can be operably connected to one or more local data store(s) **930**, that can be employed to store information on the local component(s) **920** side of communication framework **940**.

In order to provide a context for the various aspects of the disclosed subject matter, FIG. **10**, and the following discussion, are intended to provide a brief, general description of a suitable environment in which the various aspects of the disclosed subject matter can be implemented. While the subject matter has been described above in the general context of computer-executable instructions of a computer program that runs on a computer and/or computers, those skilled in the art will recognize that the disclosed subject matter also can be implemented in combination with other program modules. Generally, program modules include routines, programs, components, data structures, etc. that performs particular tasks and/or implement particular abstract data types.

In the subject specification, terms such as “store,” “storage,” “data store,” data storage,” “database,” and substantially any other information storage component relevant to operation and functionality of a component, refer to “memory components,” or entities embodied in a “memory” or components comprising the memory. It is noted that the memory components described herein can be either volatile memory or nonvolatile memory, or can include both volatile and nonvolatile memory, by way of illustration, and not limitation, volatile memory **1020** (see below), non-volatile memory **1022** (see below), disk storage **1024** (see below), and memory storage **1046** (see below). Further, nonvolatile memory can be included in read only memory, programmable read only memory, electrically programmable read only memory, electrically erasable read only memory, or flash memory. Volatile memory can include random access memory, which acts as external cache memory. By way of illustration and not limitation, random access memory is available in many forms such as synchronous random access memory, dynamic random access memory, synchronous dynamic random access memory, double data rate synchronous dynamic random access memory, enhanced synchronous dynamic random access memory, Synchlink dynamic random access memory, and direct Rambus random access memory. Additionally, the disclosed memory components of systems or methods herein are intended to comprise, without being limited to comprising, these and any other suitable types of memory.

Moreover, it is noted that the disclosed subject matter can be practiced with other computer system configurations, including single-processor or multiprocessor computer systems, mini-computing devices, mainframe computers, as well as personal computers, hand-held computing devices (e.g., personal digital assistant, phone, watch, tablet computers, netbook computers, . . . ), microprocessor-based or programmable consumer or industrial electronics, and the like. The illustrated aspects can also be practiced in distributed computing environments where tasks are performed by remote processing devices that are linked through a communications network; however, some if not all aspects of the subject disclosure can be practiced on stand-alone computers. In a distributed computing environment, program modules can be located in both local and remote memory storage devices.

FIG. **10** illustrates a block diagram of a computing system **1000** operable to execute the disclosed systems and methods in accordance with an embodiment. Computer **1012**, which can be, for example, part of DAC **120**, **220**, **320**, **420**, **520**, etc., access point **292**, RAN device **294**, etc., drone base **594**, etc., drone **110**, **210-213**, **310-313**, **350-351**, **410-413**, **450-451**, **460-463**, **470**, **510-513**, **550-553**, etc., includes a processing unit **1014**, a system memory **1016**, and a system bus **1018**. System bus **1018** couples system components including, but not limited to, system memory **1016** to processing unit **1014**. Processing unit **1014** can be any of various available processors. Dual microprocessors and other multiprocessor architectures also can be employed as processing unit **1014**.

System bus **1018** can be any of several types of bus structure(s) including a memory bus or a memory controller, a peripheral bus or an external bus, and/or a local bus using any variety of available bus architectures including, but not limited to, industrial standard architecture, micro-channel architecture, extended industrial standard architecture, intelligent drive electronics, video electronics standards association local bus, peripheral component interconnect, card bus, universal serial bus, advanced graphics port, personal computer memory card international association bus, Firewire (Institute of Electrical and Electronics Engineers **1194**), and small computer systems interface.

System memory **1016** can include volatile memory **1020** and nonvolatile memory **1022**. A basic input/output system, containing routines to transfer information between elements within computer **1012**, such as during start-up, can be stored in nonvolatile memory **1022**. By way of illustration, and not limitation, nonvolatile memory **1022** can include read only memory, programmable read only memory, electrically programmable read only memory, electrically erasable read only memory, or flash memory. Volatile memory **1020** includes read only memory, which acts as external cache memory. By way of illustration and not limitation, read only memory is available in many forms such as synchronous random access memory, dynamic read only memory, synchronous dynamic read only memory, double data rate synchronous dynamic read only memory, enhanced synchronous dynamic read only memory, Synchlink dynamic read only memory, Rambus direct read only memory, direct Rambus dynamic read only memory, and Rambus dynamic read only memory.

Computer **1012** can also include removable/non-removable, volatile/non-volatile computer storage media. FIG. **10** illustrates, for example, disk storage **1024**. Disk storage **1024** includes, but is not limited to, devices like a magnetic disk drive, floppy disk drive, tape drive, flash memory card, or memory stick. In addition, disk storage **1024** can include storage media separately or in combination with other storage media including, but not limited to, an optical disk drive such as a compact disk read only memory device, compact disk recordable drive, compact disk rewritable drive or a digital versatile disk read only memory. To facilitate connection of the disk storage devices **1024** to system bus **1018**, a removable or non-removable interface is typically used, such as interface **1026**.

Computing devices typically include a variety of media, which can include computer-readable storage media or communications media, which two terms are used herein differently from one another as follows.

Computer-readable storage media can be any available storage media that can be accessed by the computer and includes both volatile and nonvolatile media, removable and non-removable media. By way of example, and not limita-

tion, computer-readable storage media can be implemented in connection with any method or technology for storage of information such as computer-readable instructions, program modules, structured data, or unstructured data. Computer-readable storage media can include, but are not limited to, read only memory, programmable read only memory, electrically programmable read only memory, electrically erasable read only memory, flash memory or other memory technology, compact disk read only memory, digital versatile disk or other optical disk storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or other tangible media which can be used to store desired information. In this regard, the term “tangible” herein as may be applied to storage, memory or computer-readable media, is to be understood to exclude only propagating intangible signals per se as a modifier and does not relinquish coverage of all standard storage, memory or computer-readable media that are not only propagating intangible signals per se. In an aspect, tangible media can include non-transitory media wherein the term “non-transitory” herein as may be applied to storage, memory or computer-readable media, is to be understood to exclude only propagating transitory signals per se as a modifier and does not relinquish coverage of all standard storage, memory or computer-readable media that are not only propagating transitory signals per se. Computer-readable storage media can be accessed by one or more local or remote computing devices, e.g., via access requests, queries or other data retrieval protocols, for a variety of operations with respect to the information stored by the medium. As such, for example, a computer-readable medium can comprise executable instructions stored thereon that, in response to execution, cause a system comprising a processor to perform operations, comprising: receiving drone information drone, e.g., drone **110**, **210-213**, **310-313**, **350-351**, **410-413**, **450-451**, **460-463**, **470**, **510-513**, **550-553**, etc., and in response to the receiving drone information, cataloging the drone information to facilitate determining drone provisioning information to enable provisioning of a drone mesh.

Communications media typically embody computer-readable instructions, data structures, program modules or other structured or unstructured data in a data signal such as a modulated data signal, e.g., a carrier wave or other transport mechanism, and includes any information delivery or transport media. The term “modulated data signal” or signals refers to a signal that has one or more of its characteristics set or changed in such a manner as to encode information in one or more signals. By way of example, and not limitation, communication media include wired media, such as a wired network or direct-wired connection, and wireless media such as acoustic, RF, infrared and other wireless media.

It can be noted that FIG. **10** describes software that acts as an intermediary between users and computer resources described in suitable operating environment **1000**. Such software includes an operating system **1028**. Operating system **1028**, which can be stored on disk storage **1024**, acts to control and allocate resources of computer system **1012**. System applications **1030** take advantage of the management of resources by operating system **1028** through program modules **1032** and program data **1034** stored either in system memory **1016** or on disk storage **1024**. It is to be noted that the disclosed subject matter can be implemented with various operating systems or combinations of operating systems.

A user can enter commands or information into computer **1012** through input device(s) **1036**. As an example, a user

interface can allow entry of user preference information, etc., and can be embodied in a touch sensitive display panel, a mouse input GUI, a command line controlled interface, etc., allowing a user to interact with computer **1012**. As an example, UI Component **584** can receive touch, motion, audio, visual, or other types of input. Input devices **1036** include, but are not limited to, a pointing device such as a mouse, trackball, stylus, touch pad, keyboard, microphone, joystick, game pad, satellite dish, scanner, TV tuner card, digital camera, digital video camera, web camera, cell phone, smartphone, tablet computer, etc. These and other input devices connect to processing unit **1014** through system bus **1018** by way of interface port(s) **1038**. Interface port(s) **1038** include, for example, a serial port, a parallel port, a game port, a universal serial bus, an infrared port, a Bluetooth port, an IP port, or a logical port associated with a wireless service, etc. Output device(s) **1040** use some of the same type of ports as input device(s) **1036**.

Thus, for example, a universal serial busport can be used to provide input to computer **1012** and to output information from computer **1012** to an output device **1040**. Output adapter **1042** is provided to illustrate that there are some output devices **1040** like monitors, speakers, and printers, among other output devices **1040**, which use special adapters. Output adapters **1042** include, by way of illustration and not limitation, video and sound cards that provide means of connection between output device **1040** and system bus **1018**. It should be noted that other devices and/or systems of devices provide both input and output capabilities such as remote computer(s) **1044**. As an example, user input can be captured in relation to drone mission parameters, drone ranking rules, drone provisioning rules, etc., to enable use of drones, e.g., drone **110**, **210-213**, **310-313**, **350-351**, **410-413**, **450-451**, **460-463**, **470**, **510-513**, **550-553**, etc., in accordance with the presently disclosed subject matter.

Computer **1012** can operate in a networked environment using logical connections to one or more remote computers, such as remote computer(s) **1044**. Remote computer(s) **1044** can be a personal computer, a server, a router, a network PC, cloud storage, cloud service, a workstation, a microprocessor based appliance, a peer device, or other common network node and the like, and typically includes many or all of the elements described relative to computer **1012**.

For purposes of brevity, only a memory storage device **1046** is illustrated with remote computer(s) **1044**. Remote computer(s) **1044** is logically connected to computer **1012** through a network interface **1048** and then physically connected by way of communication connection **1050**. Network interface **1048** encompasses wire and/or wireless communication networks such as local area networks and wide area networks. Local area network technologies include fiber distributed data interface, copper distributed data interface, Ethernet, Token Ring and the like. Wide area network technologies include, but are not limited to, point-to-point links, circuit-switching networks like integrated services digital networks and variations thereon, packet switching networks, and digital subscriber lines. As noted below, wireless technologies may be used in addition to or in place of the foregoing.

Communication connection(s) **1050** refer(s) to hardware/software employed to connect network interface **1048** to bus **1018**. While communication connection **1050** is shown for illustrative clarity inside computer **1012**, it can also be external to computer **1012**. The hardware/software for connection to network interface **1048** can include, for example, internal and external technologies such as modems, including regular telephone grade modems, cable modems and

digital subscriber line modems, integrated services digital network adapters, and Ethernet cards.

The above description of illustrated embodiments of the subject disclosure, including what is described in the Abstract, is not intended to be exhaustive or to limit the disclosed embodiments to the precise forms disclosed. While specific embodiments and examples are described herein for illustrative purposes, various modifications are possible that are considered within the scope of such embodiments and examples, as those skilled in the relevant art can recognize.

In this regard, while the disclosed subject matter has been described in connection with various embodiments and corresponding Figures, where applicable, it is to be understood that other similar embodiments can be used or modifications and additions can be made to the described embodiments for performing the same, similar, alternative, or substitute function of the disclosed subject matter without deviating therefrom. Therefore, the disclosed subject matter should not be limited to any single embodiment described herein, but rather should be construed in breadth and scope in accordance with the appended claims below.

As it employed in the subject specification, the term “processor” can refer to substantially any computing processing unit or device comprising, but not limited to comprising, single-core processors; single-processors with software multithread execution capability; multi-core processors; multi-core processors with software multithread execution capability; multi-core processors with hardware multithread technology; parallel platforms; and parallel platforms with distributed shared memory. Additionally, a processor can refer to an integrated circuit, an application specific integrated circuit, a digital signal processor, a field programmable gate array, a programmable logic controller, a complex programmable logic device, a discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. Processors can exploit nano-scale architectures such as, but not limited to, molecular and quantum-dot based transistors, switches and gates, in order to optimize space usage or enhance performance of user equipment. A processor may also be implemented as a combination of computing processing units.

As used in this application, the terms “component,” “system,” “platform,” “layer,” “selector,” “interface,” and the like are intended to refer to a computer-related entity or an entity related to an operational apparatus with one or more specific functionalities, wherein the entity can be either hardware, a combination of hardware and software, software, or software in execution. As an example, a component may be, but is not limited to being, a process running on a processor, a processor, an object, an executable, a thread of execution, a program, and/or a computer. By way of illustration and not limitation, both an application running on a server and the server can be a component. One or more components may reside within a process and/or thread of execution and a component may be localized on one computer and/or distributed between two or more computers. In addition, these components can execute from various computer readable media having various data structures stored thereon. The components may communicate via local and/or remote processes such as in accordance with a signal having one or more data packets (e.g., data from one component interacting with another component in a local system, distributed system, and/or across a network such as the Internet with other systems via the signal). As another example, a component can be an apparatus with specific functionality

provided by mechanical parts operated by electric or electronic circuitry, which is operated by a software or firmware application executed by a processor, wherein the processor can be internal or external to the apparatus and executes at least a part of the software or firmware application. As yet another example, a component can be an apparatus that provides specific functionality through electronic components without mechanical parts, the electronic components can include a processor therein to execute software or firmware that confers at least in part the functionality of the electronic components.

In addition, the term “or” is intended to mean an inclusive “or” rather than an exclusive “or.” That is, unless specified otherwise, or clear from context, “X employs A or B” is intended to mean any of the natural inclusive permutations. That is, if X employs A; X employs B; or X employs both A and B, then “X employs A or B” is satisfied under any of the foregoing instances. Moreover, articles “a” and “an” as used in the subject specification and annexed drawings should generally be construed to mean “one or more” unless specified otherwise or clear from context to be directed to a singular form.

Further, the term “include” is intended to be employed as an open or inclusive term, rather than a closed or exclusive term. The term “include” can be substituted with the term “comprising” and is to be treated with similar scope, unless otherwise explicitly used otherwise. As an example, “a basket of fruit including an apple” is to be treated with the same breadth of scope as, “a basket of fruit comprising an apple.”

Moreover, terms like “user equipment (UE),” “mobile station,” “mobile,” subscriber station,” “subscriber equipment,” “access terminal,” “terminal,” “handset,” and similar terminology, refer to a wireless device utilized by a subscriber or user of a wireless communication service to receive or convey data, control, voice, video, sound, gaming, or substantially any data-stream or signaling-stream. The foregoing terms are utilized interchangeably in the subject specification and related drawings. Likewise, the terms “access point,” “base station,” “Node B,” “evolved Node B,” “eNodeB,” “home Node B,” “home access point,” and the like, are utilized interchangeably in the subject application, and refer to a wireless network component or appliance that serves and receives data, control, voice, video, sound, gaming, or substantially any data-stream or signaling-stream to and from a set of subscriber stations or provider enabled devices. Data and signaling streams can include packetized or frame-based flows.

Additionally, the terms “core-network,” “core,” “core carrier network,” “carrier-side,” or similar terms can refer to components of a telecommunications network that typically provides some or all of aggregation, authentication, call control and switching, charging, service invocation, or gateways. Aggregation can refer to the highest level of aggregation in a service provider network wherein the next level in the hierarchy under the core nodes is the distribution networks and then the edge networks. UEs do not normally connect directly to the core networks of a large service provider but can be routed to the core by way of a switch or radio access network. Authentication can refer to determinations regarding whether the user requesting a service from the telecom network is authorized to do so within this network or not. Call control and switching can refer to determinations related to the future course of a call stream across carrier equipment based on the call signal processing. Charging can be related to the collation and processing of charging data generated by various network nodes. Two

common types of charging mechanisms found in present day networks can be prepaid charging and postpaid charging. Service invocation can occur based on some explicit action (e.g. call transfer) or implicitly (e.g., call waiting). It is to be noted that service “execution” may or may not be a core network functionality as third party network/nodes may take part in actual service execution. A gateway can be present in the core network to access other networks. Gateway functionality can be dependent on the type of the interface with another network.

Furthermore, the terms “user,” “subscriber,” “customer,” “consumer,” “prosumer,” “agent,” and the like are employed interchangeably throughout the subject specification, unless context warrants particular distinction(s) among the terms. It should be appreciated that such terms can refer to human entities or automated components (e.g., supported through artificial intelligence, as through a capacity to make inferences based on complex mathematical formalisms), that can provide simulated vision, sound recognition and so forth.

Aspects, features, or advantages of the subject matter can be exploited in substantially any, or any, wired, broadcast, wireless telecommunication, radio technology or network, or combinations thereof. Non-limiting examples of such technologies or networks include broadcast technologies (e.g., sub-Hertz, extremely low frequency, very low frequency, low frequency, medium frequency, high frequency, very high frequency, ultra-high frequency, super-high frequency, terahertz broadcasts, etc.); Ethernet; X.25; power-line-type networking, e.g., Powerline audio video Ethernet, etc.; femtocell technology; Wi-Fi; worldwide interoperability for microwave access; enhanced general packet radio service; third generation partnership project, long term evolution; third generation partnership project universal mobile telecommunications system; third generation partnership project 2, ultra mobile broadband; high speed packet access; high speed downlink packet access; high speed uplink packet access; enhanced data rates for global system for mobile communication evolution radio access network; universal mobile telecommunications system terrestrial radio access network; or long term evolution advanced.

What has been described above includes examples of systems and methods illustrative of the disclosed subject matter. It is, of course, not possible to describe every combination of components or methods herein. One of ordinary skill in the art may recognize that many further combinations and permutations of the claimed subject matter are possible. Furthermore, to the extent that the terms “includes,” “has,” “possesses,” and the like are used in the detailed description, claims, appendices and drawings such terms are intended to be inclusive in a manner similar to the term “comprising” as “comprising” is interpreted when employed as a transitional word in a claim.

What is claimed is:

1. A system, comprising:

a processor, wherein the processor is comprised in a device other than a drone; and

a memory that stores executable instructions that, when executed by the processor, facilitate performance of operations, comprising:

determining that a first group of drone devices comprises a first drone device comprising a first functionality, wherein the first group of drone devices is deployed on a first mission;

in response to determining that the first drone device has transitioned from a first status to a second status, determining a second drone device that comprises a second functionality that is a same functionality as

the first functionality, wherein the second drone is a member of a second group of drone devices, and wherein the second group of drone devices is deployed on a second mission; and

initiating adapting the first group of drone devices, wherein the initiating the adapting comprises initiating adding the second drone device to the first group of drone devices.

2. The system of claim 1, wherein the initiating the adapting further comprises initiating removing the first drone device from the first group of drone devices.

3. The system of claim 1, wherein the second mission of the second group of drone devices is a different mission than the first mission of the first group of drone devices.

4. The system of claim 3, wherein the initiating the adding the second drone device to the first group of drone devices results in the second drone device being a member of the first group of drone devices and the second group of drone devices concurrently.

5. The system of claim 3, wherein the initiating the adding the second drone device to the first group of drone devices corresponds to initiating removing the second drone device from the second group of drone devices, resulting in the second drone device being a member of the first group of drone devices and not concurrently being a member of the second group of drone devices.

6. The system of claim 3, wherein the initiating the adding the second drone device to the first group of drone devices further comprises initiating merging the first group of drone devices and the second group of drone devices.

7. The system of claim 1, wherein, in response to the first drone device being determined to have returned to the first availability status, initiating removing the second drone device from the first group of drone devices.

8. The system of claim 1, wherein the determining that the first group of drone devices comprises the first drone device comprising the first functionality is based on a catalog of drone functionalities for drone devices comprising the first drone device and the second drone device.

9. The system of claim 8, wherein the catalog of drone functionalities is accessible by drone devices comprising the first group of drone devices via an over the air interface.

10. A method, comprising:

determining, by a network device communicatively coupled to a first drone mesh comprising a first drone device, that a second drone device of the first drone mesh comprises a first attribute, wherein the second drone device of the first drone mesh is active on a first mission;

in response to determining a change in a status of the second drone device, determining, by the network device, a third drone device that comprises a second attribute that is equivalent to the first attribute, wherein the third drone device of a second drone mesh is active on a second mission; and

facilitating, by the network device, adaptation of the first drone mesh, wherein the adaptation comprises adding the third drone device to the first drone mesh to facilitate the first mission.

11. The method of claim 10, wherein the adaptation further comprises removing the second drone device from the first drone mesh.

12. The method of claim 10, wherein the first drone mesh is a partially connected mesh of drone devices comprising the first drone device, the second drone device, and the third

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drone device, resulting in the third drone device being shared between the first drone mesh and the second drone mesh.

13. The method of claim 10, wherein the first drone mesh is a fully connected mesh of drone devices comprising the first drone device, the second drone device, and the third drone device, resulting from the third drone device being moved from the second drone mesh to the first drone mesh.

14. The method of claim 10, wherein the second mission is a different mission than the first mission.

15. The method of claim 14, wherein the adding the third drone device to the first drone mesh results in the third drone device being a concurrent member of the first drone mesh and the second drone mesh.

16. The method of claim 14, wherein the adding the third drone device to the first drone mesh corresponds to removing the third drone device from the second drone mesh.

17. The method of claim 14, wherein the adding the third drone device to the first drone mesh causes the third drone device to be available for use in the first drone mesh when the third drone device is not reserved from use in the second drone mesh.

18. A network device, comprising:  
a processor; and  
a memory that stores executable instructions that, when executed by the processor, facilitate performance of operations, comprising:

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receiving, by the network device, an indication of a first functionality of a first drone device, wherein the first drone device is a member of a first group of drone devices deployed on a first mission;

receiving, by the network device, an indication of a second functionality of a second drone device, wherein the second drone device is a member of a second group of drone devices deployed on a second mission;

populating a catalog of drone device attributes based on the first functionality of the first drone device and the second functionality of the second drone device; and enabling access to a portion of the catalog to facilitate determining a modification to the first group of drone devices in response to a determined change in a status of the first drone device, wherein the determining the modification comprises determining that the first functionality is the same as the second functionality, and wherein the determining the modification comprises removing the first drone device from the first group of drone devices and adding the second drone device to the first group of drone devices.

19. The network device of claim 18, wherein the network device is comprised in a network gateway device.

20. The network device of claim 18, wherein the network device is comprised in a radio access network device.

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