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(54) APPARATUS AND METHOD FOR PROVIDING A RAPIDLY DEPLOYABLE WIRELESS NETWORK

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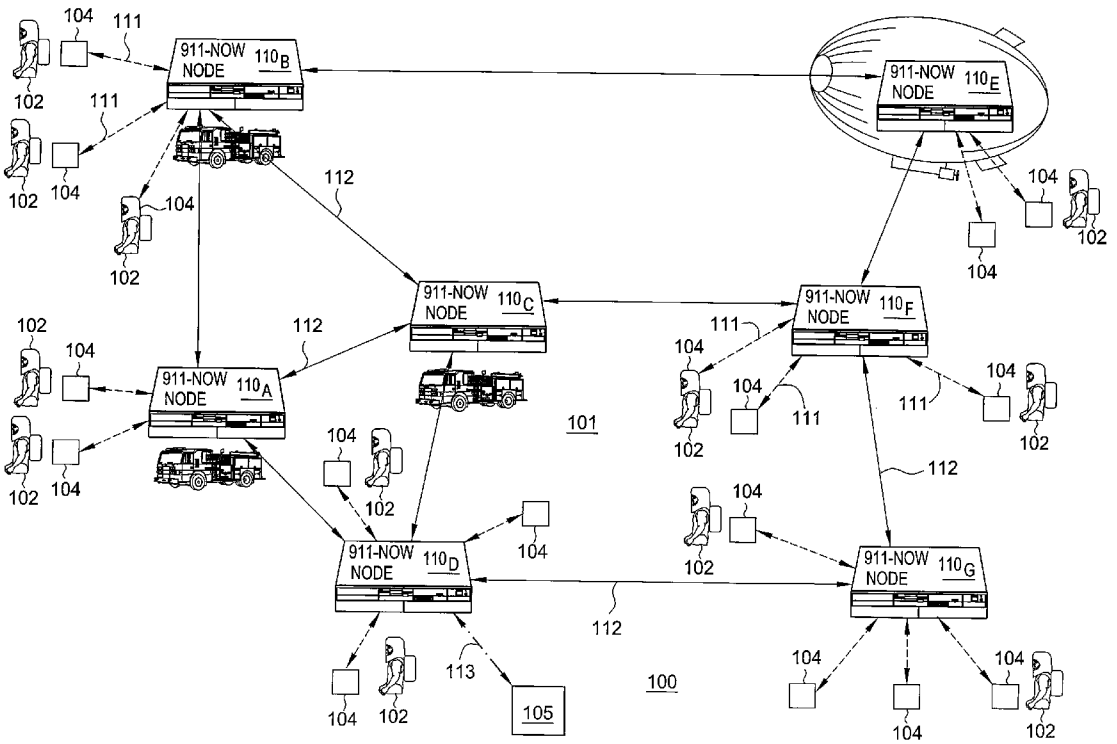
H04Q 7/20 (2006.01)

(52) **U.S. Cl.** **455/422.1**

(57) **ABSTRACT**

The invention includes apparatus and method for providing a rapidly deployable wireless network. An apparatus includes means for providing radio access network (RAN) functions, means for providing at least one core (CORE) networking function, and means for providing at least one service. The RAN functions include at least one air interface, at least one control function, and at least one network gateway function. The CORE networking functions include at least one of an AAA function, a DNS function, a DHCP function, a call/session control function, and the like. The apparatus may further include means for providing at least one additional wireless interface, including one or more of a wireless mesh interface, a wireless backhaul interface, and a wireless management interface. The apparatus is adapted for being deployed on a mobile platform. The apparatus may be used to provide a standalone wireless network independent of existing network infrastructure, or an integrated wireless network utilizing existing network infrastructure.



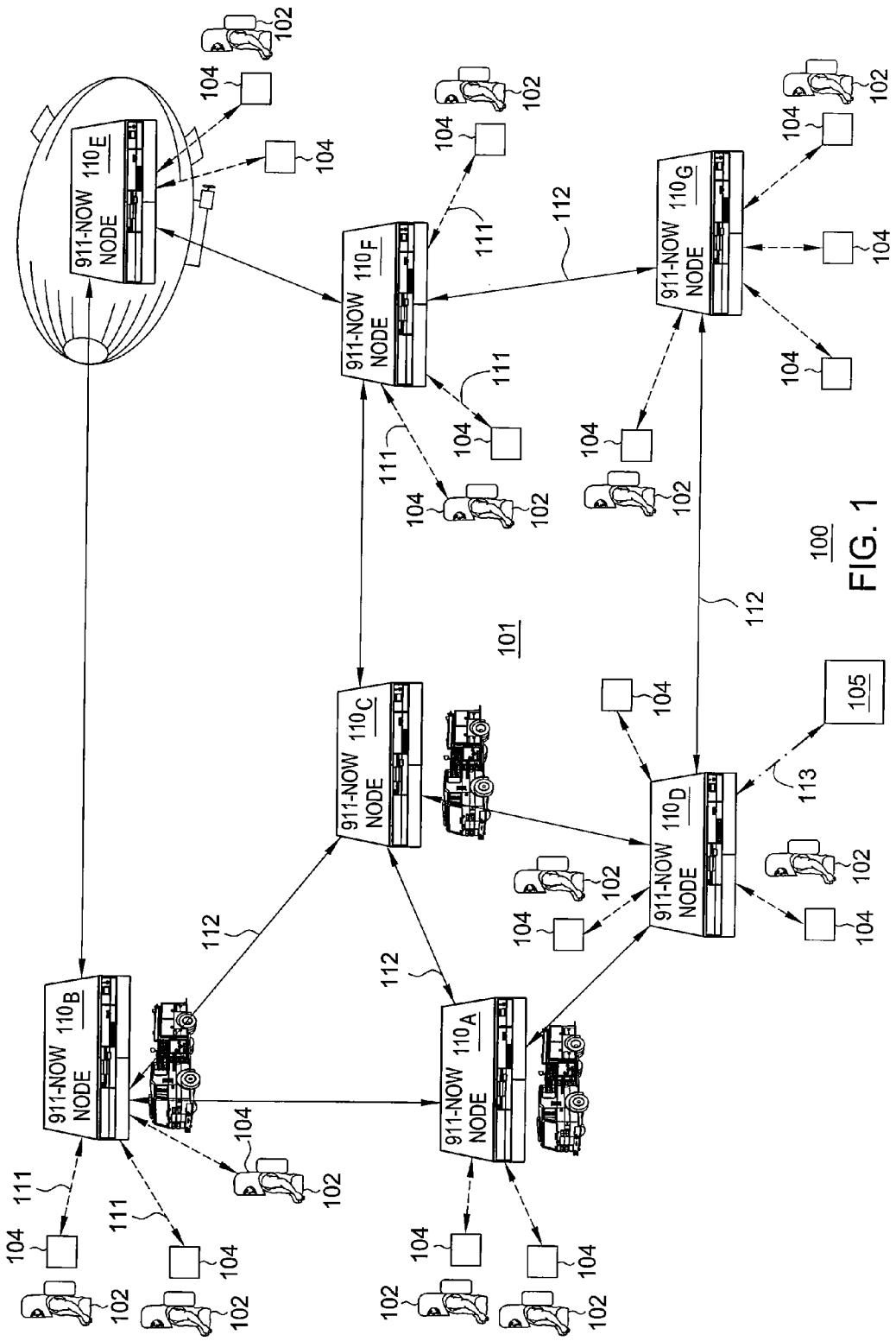

911-NOW NODE 110E
911-NOW NODE 110F
911-NOW NODE 110G
911-NOW NODE 110C
911-NOW NODE 110D
911-NOW NODE 110B
911-NOW NODE 110A
102
104
105
111
112
113
101
100

FIG. 1

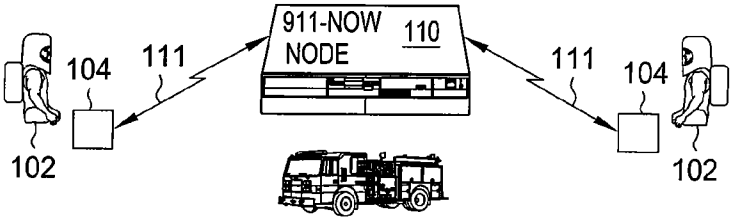

911-NOW
NODE
110
104
111
111
104
102
102

FIG. 2A

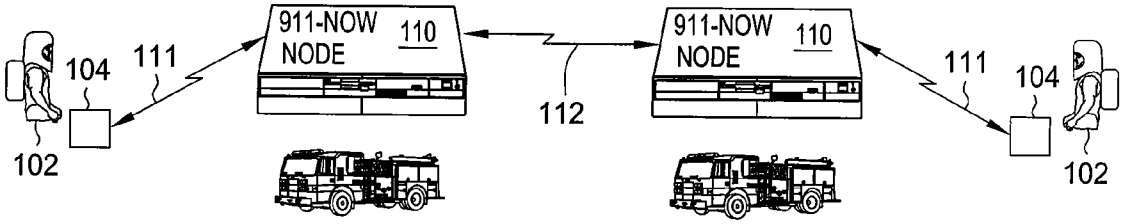

911-NOW
NODE
110
911-NOW
NODE
110
104
111
111
104
112
102
102

FIG. 2B

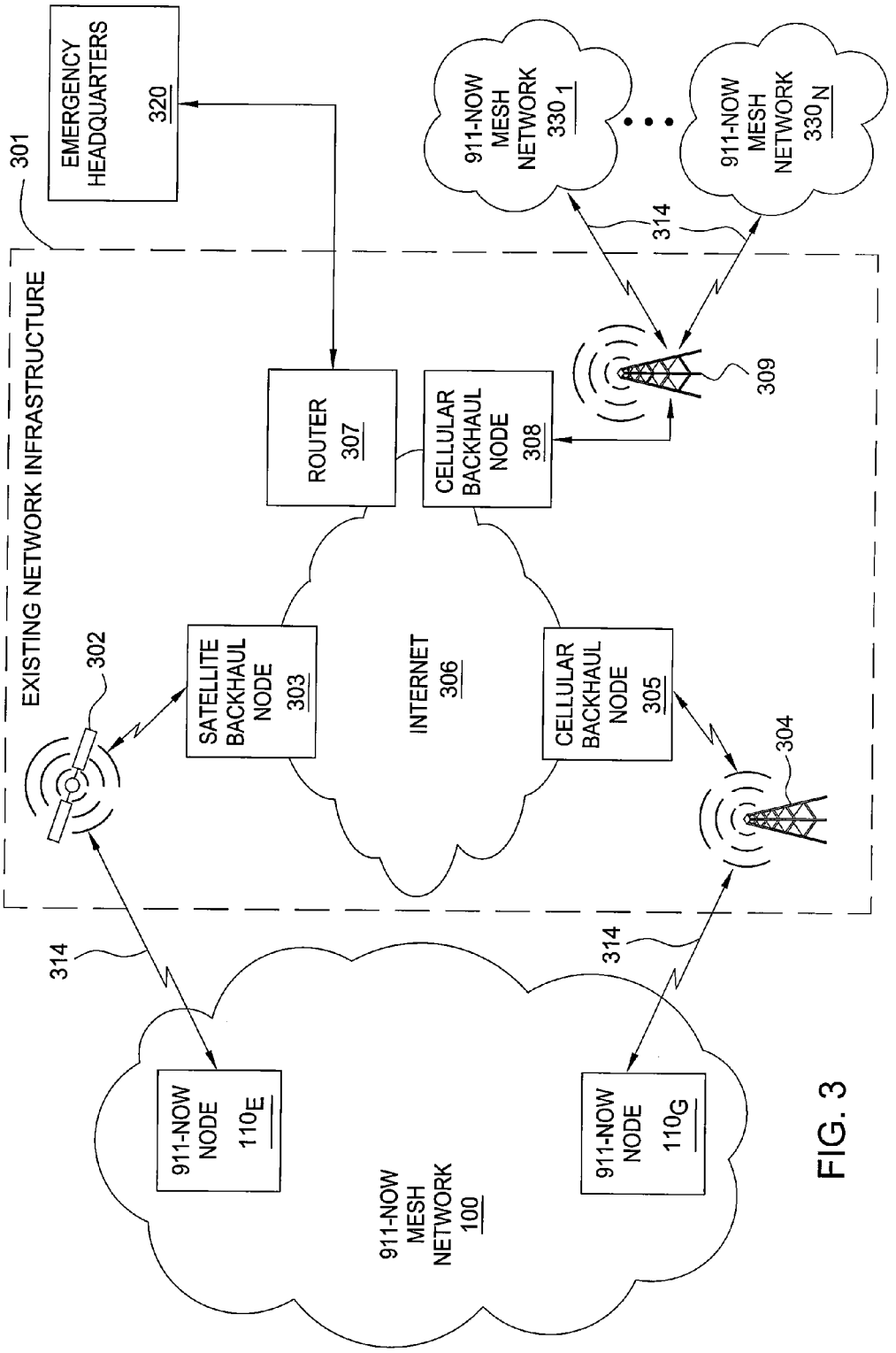

EMERGENCY HEADQUARTERS 320
301
911-NOW MESH NETWORK 330 1
911-NOW MESH NETWORK 330 N
314
309
ROUTER 307
CELLULAR BACKHAUL NODE 308
EXISTING NETWORK INFRASTRUCTURE
302
SATELLITE BACKHAUL NODE 303
INTERNET 306
CELLULAR BACKHAUL NODE 305
304
314
911-NOW NODE 110E
911-NOW MESH NETWORK 100
911-NOW NODE 110G

FIG. 3

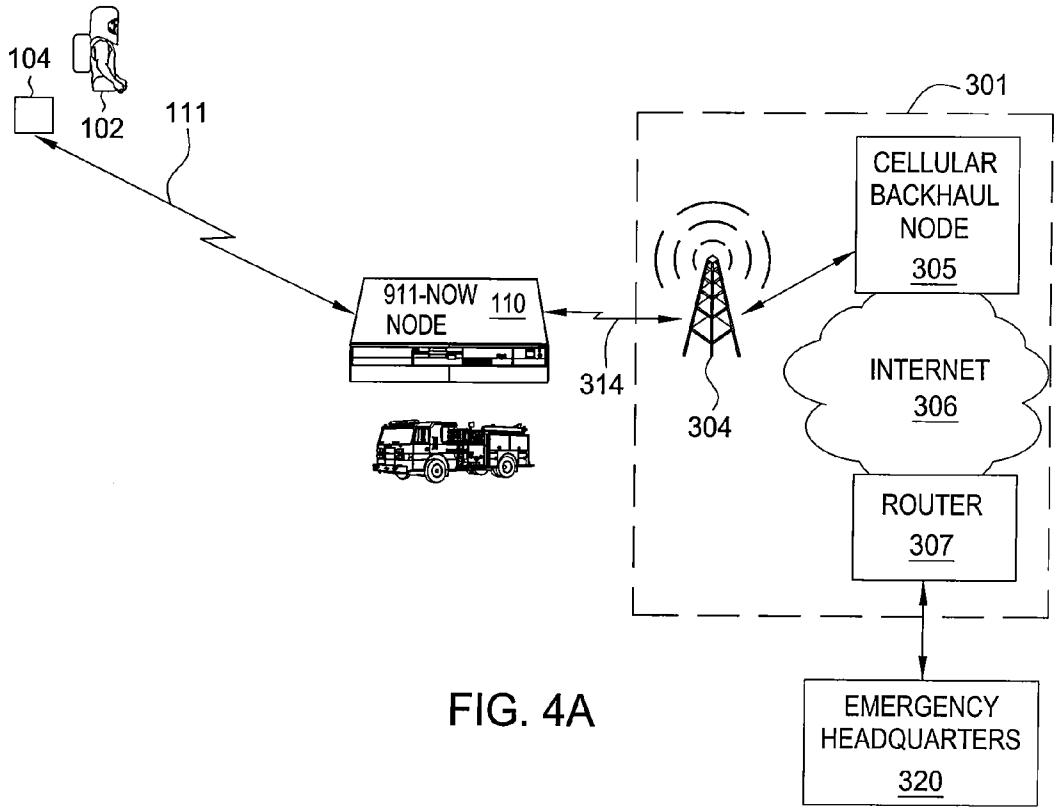

104
102
111
301
CELLULAR BACKHAUL NODE 305
911-NOW NODE 110
314
304
INTERNET 306
ROUTER 307
EMERGENCY HEADQUARTERS 320

FIG. 4A

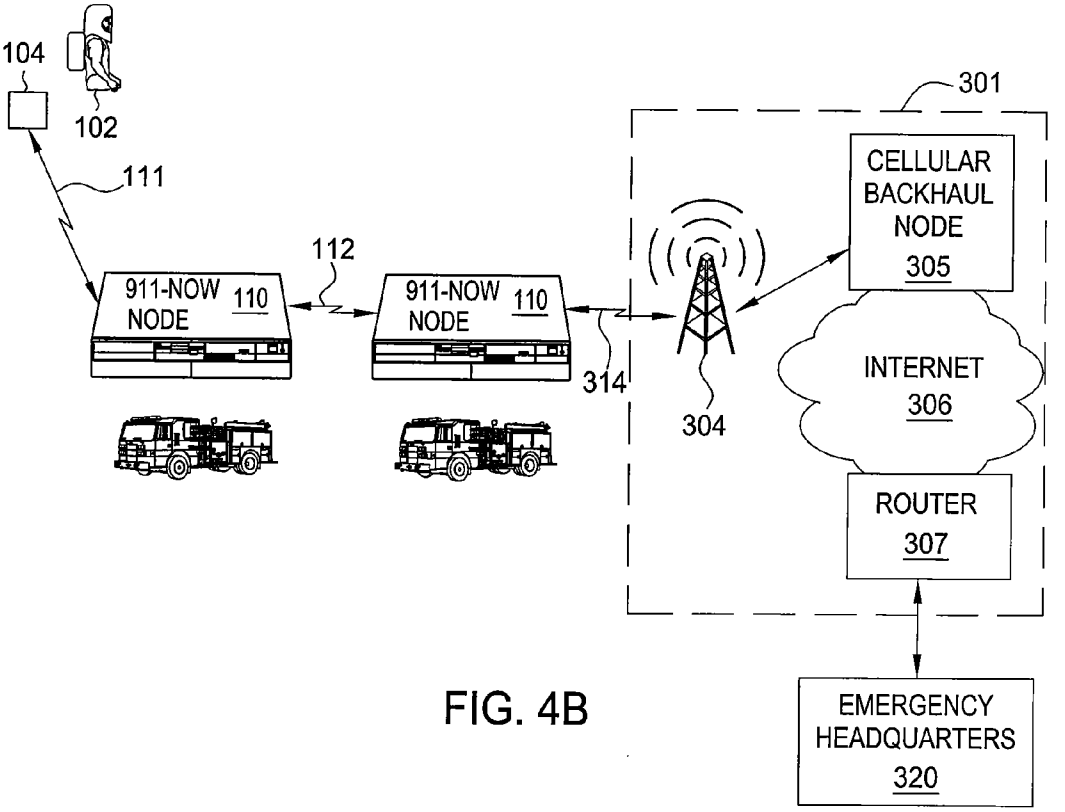

104
102
111
301
CELLULAR BACKHAUL NODE 305
112
911-NOW NODE 110
911-NOW NODE 110
314
304
INTERNET 306
ROUTER 307
EMERGENCY HEADQUARTERS 320

FIG. 4B

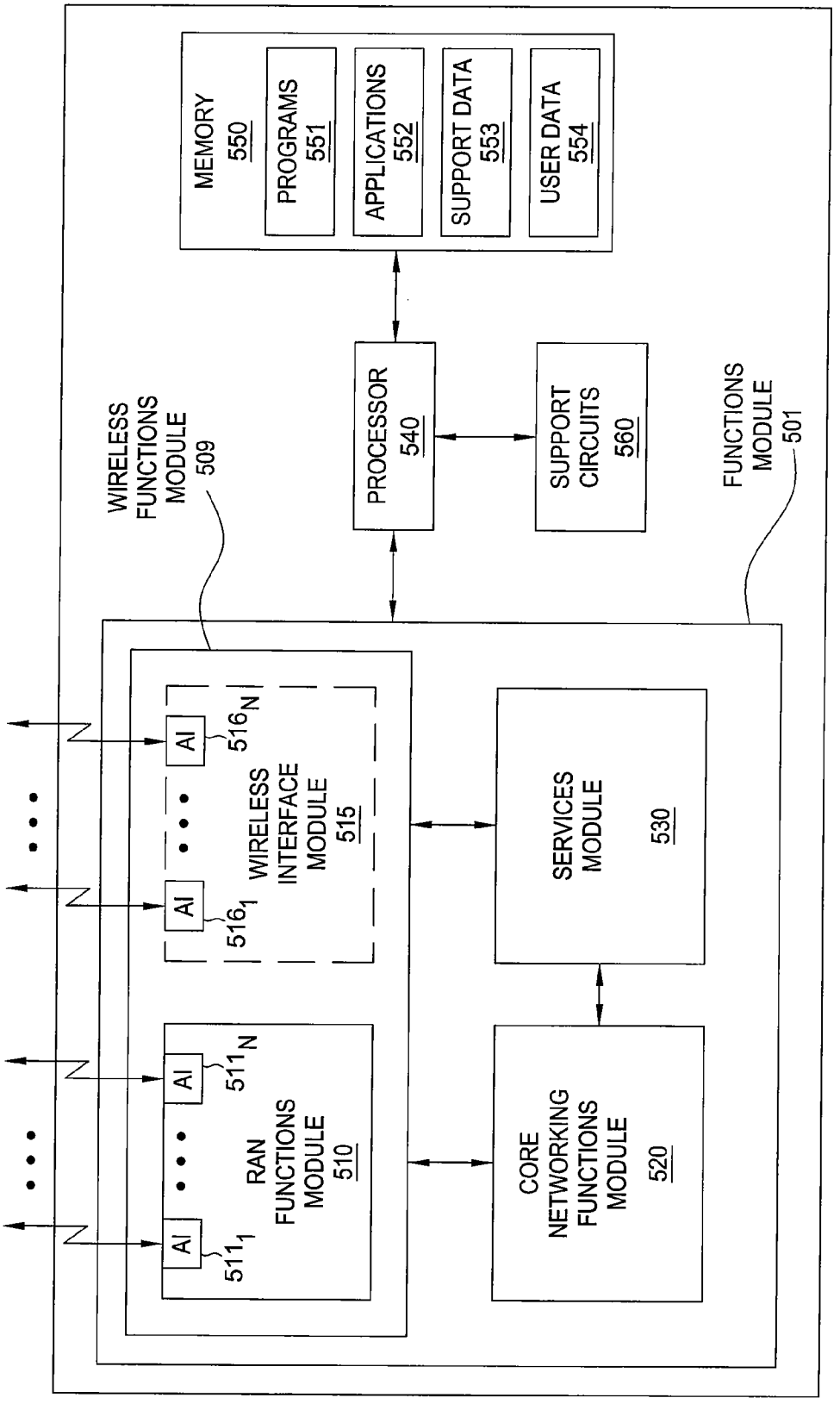

MEMORY
550
PROGRAMS
551
APPLICATIONS
552
SUPPORT DATA
553
USER DATA
554
PROCESSOR
540
SUPPORT
CIRCUITS
560
WIRELESS
FUNCTIONS
MODULE
509
FUNCTIONS
MODULE
501
AI
516_N
516_1
WIRELESS
INTERFACE
MODULE
515
SERVICES
MODULE
530
AI
511_N
511_1
RAN
FUNCTIONS
MODULE
510
CORE
NETWORKING
FUNCTIONS
MODULE
520
110

FIG. 5

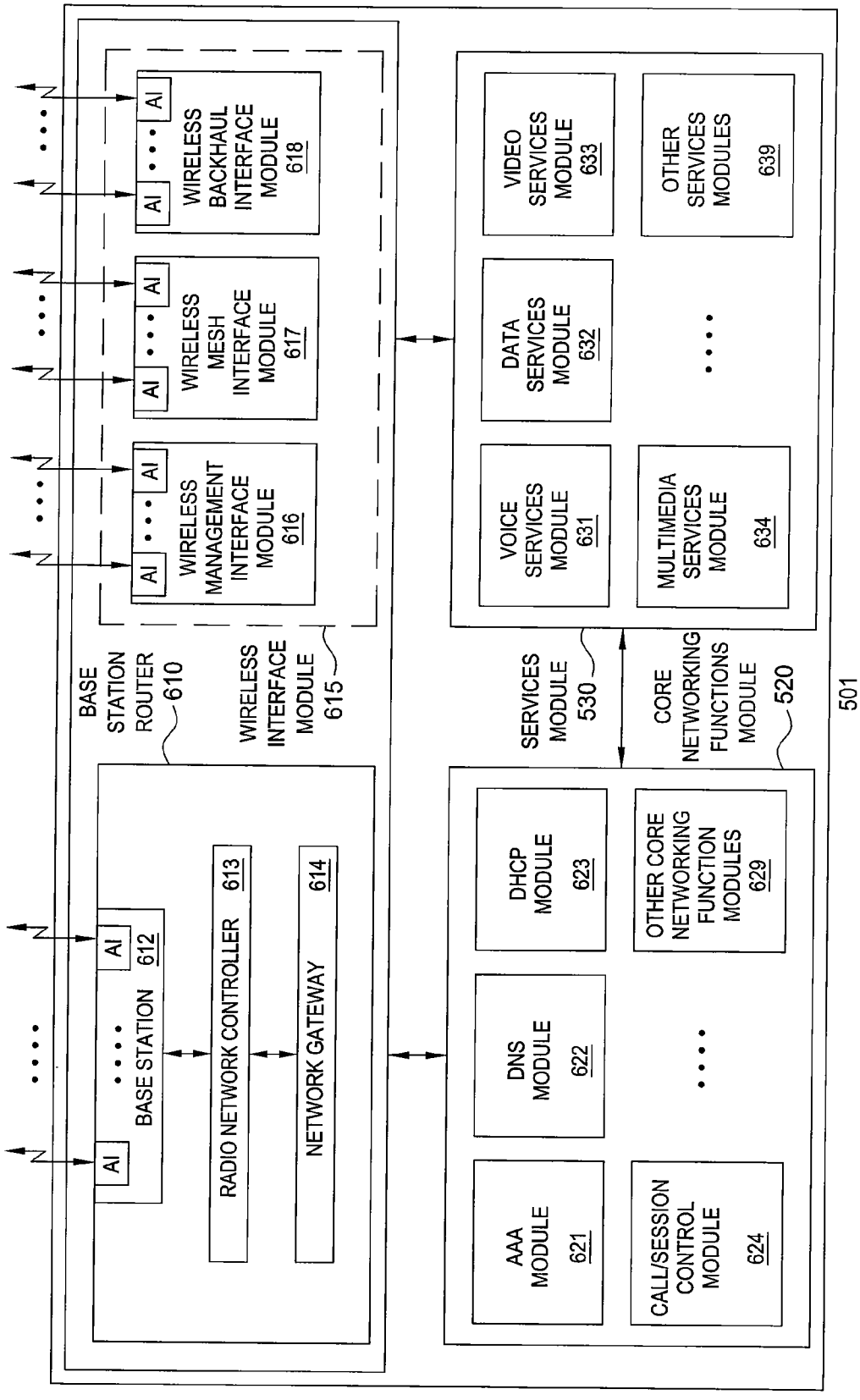
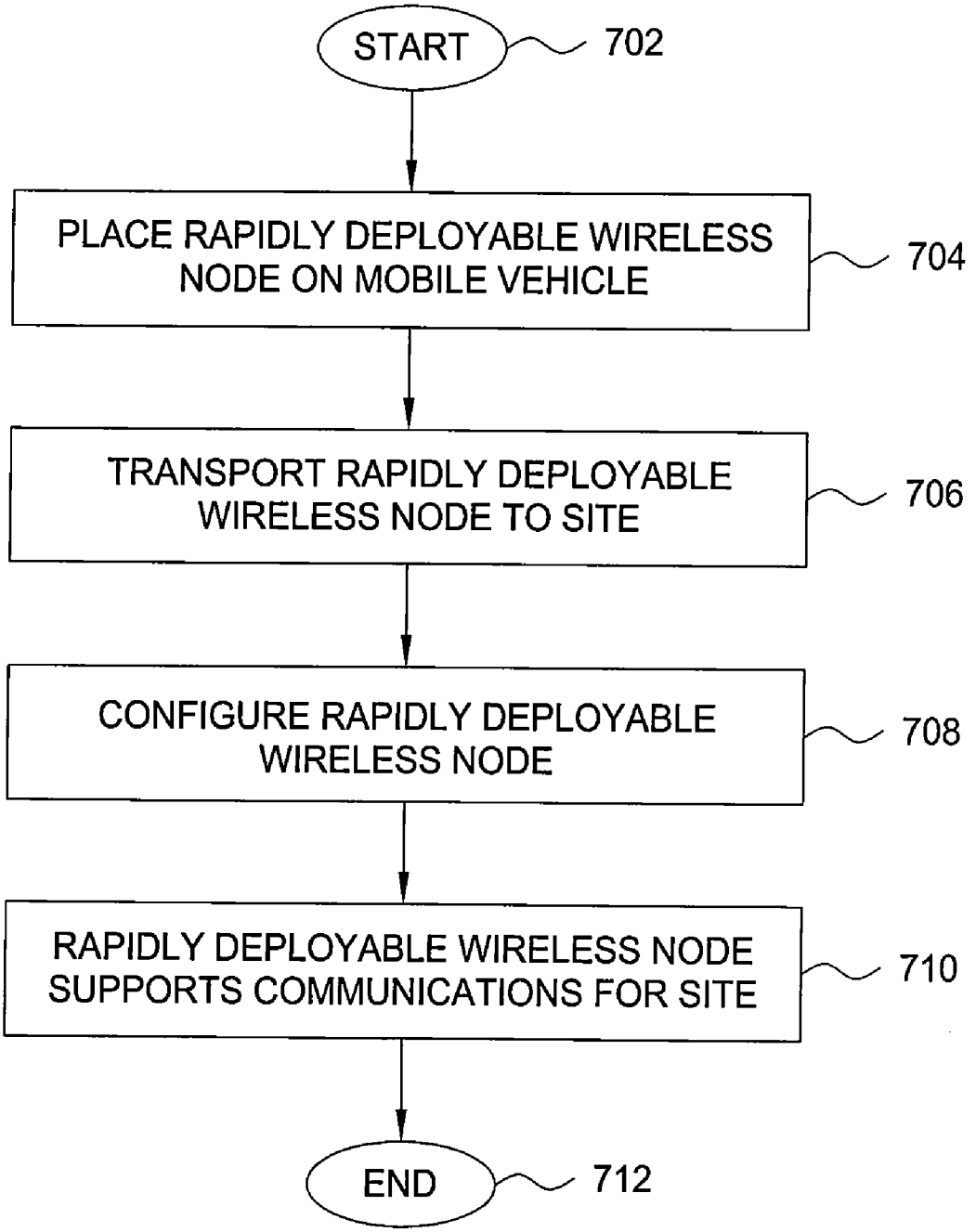

501
BASE STATION ROUTER 610
WIRELESS INTERFACE MODULE 615
SERVICES MODULE 530
CORE NETWORKING FUNCTIONS MODULE 520
AI
BASE STATION 612
RADIO NETWORK CONTROLLER 613
NETWORK GATEWAY 614
WIRELESS MANAGEMENT INTERFACE MODULE 616
WIRELESS MESH INTERFACE MODULE 617
WIRELESS BACKHAUL INTERFACE MODULE 618
VOICE SERVICES MODULE 631
DATA SERVICES MODULE 632
VIDEO SERVICES MODULE 633
MULTIMEDIA SERVICES MODULE 634
OTHER SERVICES MODULES 639
AAA MODULE 621
DNS MODULE 622
DHCP MODULE 623
CALL/SESSION CONTROL MODULE 624
OTHER CORE NETWORKING FUNCTION MODULES 629

FIG. 6


START
702
PLACE RAPIDLY DEPLOYABLE WIRELESS NODE ON MOBILE VEHICLE
704
TRANSPORT RAPIDLY DEPLOYABLE WIRELESS NODE TO SITE
706
CONFIGURE RAPIDLY DEPLOYABLE WIRELESS NODE
708
RAPIDLY DEPLOYABLE WIRELESS NODE SUPPORTS COMMUNICATIONS FOR SITE
710
END
712

700

FIG. 7

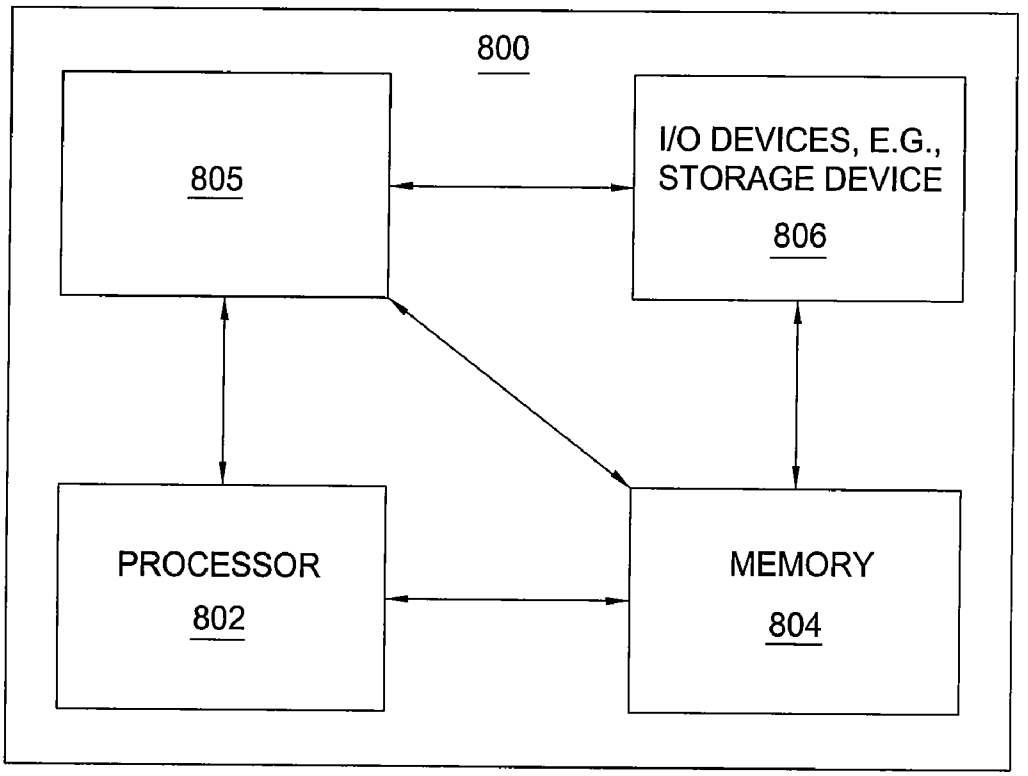

800
805
I/O DEVICES, E.G., STORAGE DEVICE
806
PROCESSOR
802
MEMORY
804

FIG. 8

APPARATUS AND METHOD FOR PROVIDING A RAPIDLY DEPLOYABLE WIRELESS NETWORK

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application Ser. No. 60/900,833 entitled "911-NOW: A Network On Wheels For Emergency Response and Disaster Recovery Operations," filed Feb. 12, 2007, which is herein incorporated by reference in its entirety.

FIELD OF THE INVENTION

[0002] The invention relates to the field of communication networks and, more specifically, to wireless networks.

BACKGROUND OF THE INVENTION

[0003] Emergency response organizations increasingly depend on wireless communication technology to provide communication during emergencies. Disadvantageously, however, emergencies often result in damage to, or sometimes even destruction of, existing network infrastructure, thereby preventing communications between emergency personnel. In other words, the existing communications infrastructure lacks survivability. Furthermore, even if portions of the existing communications infrastructure do survive the emergency, the existing communications infrastructure may not be able to handle the increased traffic load typical during emergencies. Specifically, remaining portions of the existing communication infrastructure may be overloaded as emergency personnel, and the general public, attempt various types of communications. Such deficiencies became clear during the events of Sep. 11, 2001, and again during the events of Hurricane Katrina.

SUMMARY OF THE INVENTION

[0004] Various deficiencies in the prior art are addressed through the invention of an apparatus and method for providing a rapidly-deployable wireless network. An apparatus includes means for providing radio access network (RAN) functions, means for providing at least one core (CORE) networking function, and means for providing at least one service. The RAN functions include one or more air interfaces, control functions, and network gateway functions. The CORE networking functions include at least one of an AAA function, a DNS function, a DHCP function, a call/session control function, and the like. The services include one or more applications, such as voice calls, voice conferencing, file transfers, sensor data transfers, high-speed data downloads, streaming video, video conferencing, and the like, as well as various combinations thereof. The apparatus may further include means for providing at least one additional wireless interface, including one or more of a wireless interface for mesh networking, a wireless interface for backhaul to existing network infrastructure, and a wireless interface for performing management functions.

[0005] The apparatus is adapted for being deployed on a mobile platform, such as an individual mobile platform, a vehicle-based mobile platform, or any other mobile platform which may be used to transport the apparatus to a site at which a rapidly deployable wireless network is required. The apparatus may be deployed in various situations, e.g., for emergency response situations (e.g., responding to fires, floods, tornadoes, hurricanes, terrorist attacks, and the like), civilian search and rescue operations, large-crowd events (e.g., sporting events, concerts, and the like), rapid replacement of commercial cellular networks (e.g., where part of a network of a commercial wireless service provider is unavailable), military situations, and the like, as well as various combinations thereof. The apparatus may be deployed in any other situation where a wireless network may be useful. The apparatus may be deployed to provide a standalone wireless network independent of any existing network infrastructure, or to provide an integrated wireless network utilizing existing network infrastructure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The teachings of the present invention can be readily understood by considering the following detailed description in conjunction with the accompanying drawings, in which:

[0007] FIG. **1** depicts a standalone 911-NOW communication network architecture that is independent of any existing network infrastructure;

[0008] FIGS. **2**A and **2**B depict communication scenarios for communications between users at an emergency site using the stand-alone version of the 911-NOW communication network architecture of FIG. **1**;

[0009] FIG. **3** depicts an integrated 911-NOW communication network architecture that utilizes a 911-NOW mesh network and an existing network infrastructure;

[0010] FIGS. **4**A and **4**B depict communication scenarios for communications between users at an emergency site and users at an emergency headquarters using the integrated version of the 911-NOW communication network architecture of FIG. **3**;

[0011] FIG. **5** depicts a high-level block diagram of one embodiment of a 911-NOW node;

[0012] FIG. **6** depicts a high-level block diagram of one embodiment of a functional module of the 911-NOW node of FIG. **5**;

[0013] FIG. **7** depicts a method according to one embodiment of the present invention; and

[0014] FIG. **8** depicts a high-level block diagram of a general-purpose computer suitable for use in performing functions described herein.

[0015] To facilitate understanding, identical reference numerals have been used, where possible, to designate identical elements that are common to the figures.

DETAILED DESCRIPTION OF THE INVENTION

[0016] The present invention provides a rapidly deployable network (denoted herein as a 911 network on wheels, i.e., 911-NOW). The 911-NOW network is formed using one or more 911-NOW nodes. A 911-NOW node is an integrated network node supporting RAN functions (and, optionally, one or more additional wireless interfaces), core networking functions, and services. A 911-NOW node is implemented on a mobile platform such that the 911-NOW node may be deployed to form a wireless network wherever such network may be required. By providing RAN functions (and, optionally, one or more additional wireless interfaces), core networking functions, and services, a single 911-NOW node may form a fully-functional and completely autonomous wireless network independent of existing network infrastructure. Thus, one or more 911-NOW nodes may be deployed to form a standalone wireless network that is not dependent on

existing network infrastructure, but which may utilize existing network infrastructure where such existing network infrastructure is available.

[0017] FIG. **1** depicts a standalone 911-NOW communication network architecture that is independent of any existing network infrastructure. Specifically, standalone 911-NOW communication network architecture **100** includes a plurality of 911-NOW nodes $\mathbf{110}_A$-$\mathbf{110}_G$ (collectively, 911-NOW nodes **110**) supporting wireless communications at an emergency site **101**. The standalone 911-NOW communication network architecture **100** provides a fully-functional network since each of the 911-NOW nodes **110** includes RAN functions, CORE networking functions, and services. As depicted in FIG. **1**, each of the 911-NOW nodes **110** is placed or mounted on a mobile platform and transported to emergency site **101**. The 911-NOW nodes **110** form a wireless network at emergency site **101**.

[0018] The emergency site **101** may be any location or combination of locations at which a wireless network is required. The emergency site **101** may be a localized site, a collection of localized sites, a widespread site, a collection of widespread sites, and the like, as well as various combinations thereof. For example, emergency site **101** may be a single location, multiple locations within a town or city, or even span one or more counties, states, countries, continents, and the like. The 911-NOW network is not limited by the scope of the emergency site. The emergency site **101** may be associated with any type of emergency. For example, emergency site **101** may be associated with a natural disaster (e.g., a flood, a hurricane, a tornado, and the like), a manmade disaster (e.g., a chemical spill, a terrorist attack, and the like), and the like, as well as various combinations thereof.

[0019] As depicted in FIG. **1**, emergency personnel (denoted herein as users **102** of the 911-NOW network **100**) have responded to the emergency. The users **102** are performing various different functions at different areas of emergency site **101**. For example, the users may be containing the disaster, participating in evacuation operations, participating in search and rescue operations, and the like, as well as various combinations thereof. The users **102** use equipment in responding to the emergency, including equipment capable of receiving and sending information wirelessly (denoted herein as wireless user devices **104** of users **102**). The wireless user devices **104** include communication equipment, and may include various other types of emergency equipment (depending on the type of emergency, severity of the emergency, logistics of the emergency site, and various other factors).

[0020] For example, wireless user devices **104** may include wireless devices carried by emergency personnel for communicating with other emergency personnel, receiving information for use in responding at the emergency site, collecting information at the emergency site, monitoring conditions at the emergency site, and the like, as well as various combinations thereof. For example, wireless user devices **104** may include devices such as walkie-talkies, wireless headsets, cell phones, personal digital assistants (PDAs), laptops, and the like, as well as various combinations thereof. The wireless user devices **104** may include various other equipment, such as monitors (e.g., for monitoring breathing, pulse, and other characteristics; for monitoring temperature, precipitation, and other environmental characteristics; and the like), sensors (e.g., for detecting air-quality changes, presence of chemical or biological agents, radiation levels, and the like), and various other equipment.

[0021] As depicted in FIG. **1**, a 911-NOW-based network is established at the emergency site **101** by deploying 911-NOW nodes **110** (illustratively, 911-NOW nodes $\mathbf{110}_A$-$\mathbf{110}_G$) to emergency site **101**. The 911-NOW nodes **110** may be deployed using mobile platforms. The 911-NOW nodes **110** may be deployed using standalone mobile platforms. For example, 911-NOW nodes **110** may be placed in backpacks, suitcases, and like mobile cases which may be carried by individuals. The 911-NOW nodes **110** may be deployed using mobile vehicles, including land-based vehicles, sea-based vehicles, and/or air-based vehicles. For example, 911-NOW nodes may be placed (and/or mounted) on police cars, swat trucks, fire engines, ambulances, humvees, boats, helicopters, blimps, airplanes, unmanned drones, satellites, and the like, as well as various combinations thereof. The 911-NOW nodes **110** may be deployed using various other mobile platforms.

[0022] As depicted in FIG. **1**, 911-NOW node $\mathbf{110}_A$ is deployed using a fire engine, 911-NOW node $\mathbf{110}_B$ is deployed using a fire engine, 911-NOW node $\mathbf{110}_C$ is deployed using a fire engine, 911-NOW node $\mathbf{110}_D$ is deployed as a standalone node, 911-NOW node $\mathbf{110}_E$ is deployed using a blimp, 911-NOW node $\mathbf{110}_F$ is deployed as a standalone node, and 911-NOW node $\mathbf{110}_G$ is deployed using a fire engine. The inherent mobility of 911-NOW nodes **110** enables quick and flexible deployment of a wireless network as needed (e.g., when, where, and how the wireless network is needed), thereby providing scalable capacity and coverage on-demand as required by the emergency personnel. Since each 911-NOW node **110** supports RAN functions, CORE networking functions, and various service functions, deployment of even one 911-NOW node produces a fully-functional wireless network.

[0023] By placing 911-NOW modules on mobile platforms, network scalability is automatically managed. Since the scope of an emergency situation typically dictates the response to the emergency situation (in terms of emergency personnel and equipment deployed), deployment of emergency response equipment and personnel of a scope sufficient to respond to an emergency will automatically result in deployment of sufficient 911-NOW modules to support the response to the emergency. For example, a fire requiring three fire engines will most likely not require more than three 911-NOW modules to support the firefighters and other personnel responding to the fire, a disaster requiring twenty fire engines and five ambulances most likely will not require more than twenty-five 911-NOW modules to support the firefighters and other emergency personnel responding to the fire, and so on.

[0024] In other words, using the 911-NOW network architecture, there will most likely not be a need for emergency personnel to dispatch special vehicles for purposes of scaling the scope of the 911-NOW network to match the scope of the emergency situation for which the 911-NOW network is being deployed (although such special deployments may be useful in some situations). By removing the decision of the number of 911-NOW modules required to support the response to an emergency, critical time and resources otherwise required to determine the number of required 911-NOW modules may be saved. Thus, emergency personnel do not have to worry about having sufficient resources to support any communications which may be required at the emergency site.

[0025] As depicted in FIG. **1**, the 911-NOW nodes **110** support wireless communications for wireless user devices **104** (denoted herein as wireless access communications). The wireless access communications include wireless communications between a 911-NOW node **110** and wireless user devices served by that 911-NOW node **110**. A911-NOW node **110** includes one or more wireless access interfaces supporting wireless communications for wireless user devices **104**. The wireless access communications between wireless user devices **104** and 911-NOW nodes **110** are supported using respective wireless access connections **111** established between wireless user devices **104** and 911-NOW nodes **110**.

[0026] The 911-NOW nodes **110** further support mobility of user devices **104** at emergency site **101**. More specifically, 911-NOW nodes **110** support mobility of user devices **104** such that, as users **102** move around emergency site **101**, communication sessions between wireless user devices **104** of those users **102** and 911-NOW nodes **110** are seamlessly transferred between 911-NOW nodes **110** (i.e., from a 911-NOW node currently serving the wireless user device to another 911-NOW node). The mechanism for handoff of wireless user devices **104** between 911-NOW nodes **110** may be performed in any manner, and, thus, may be based on one or more factors, such as relative signal strength, loading of the respective 911-NOW nodes **110**, and the like, as well as various combinations thereof.

[0027] As depicted in FIG. **1**, the 911-NOW nodes **110** support wireless communications between 911-NOW nodes **110** (denoted herein as wireless mesh communications). The wireless mesh communications include wireless communications between 911-NOW nodes, including information transported between wireless user devices **104**, control information exchanged between 911-NOW nodes **110**, and the like, as well as various combinations thereof. A 911-NOW node **110** includes one or more wireless mesh interfaces supporting wireless communications with one or more other 911-NOW nodes **110**. The wireless mesh communications between 911-NOW nodes **110** are supported using wireless mesh connections **112** established between 911-NOW nodes **110**.

[0028] As depicted in FIG. **1**, the following pairs of 911-NOW nodes **110** communicate using respective wireless mesh connections **112**: 911-NOW nodes $\mathbf{110}_A$ and $\mathbf{110}_B$, 911-NOW nodes $\mathbf{110}_A$ and $\mathbf{110}_C$, 911-NOW nodes $\mathbf{110}_A$ and $\mathbf{110}_D$, 911-NOW nodes $\mathbf{110}_B$ and $\mathbf{110}_C$, 911-NOW nodes $\mathbf{110}_C$ and $\mathbf{110}_D$, 911-NOW nodes $\mathbf{110}_B$ and $\mathbf{110}_E$, 911-NOW nodes $\mathbf{110}_C$ and $\mathbf{110}_F$, 911-NOW nodes $\mathbf{110}_D$ and $\mathbf{110}_G$, 911-NOW nodes $\mathbf{110}_E$ and $\mathbf{110}_F$, and 911-NOW nodes $\mathbf{110}_F$ and $\mathbf{110}_G$. As such, 911-NOW nodes **110** of FIG. **1** communicate to form a wireless mesh network. Although a specific wireless mesh configuration is depicted and described with respect to FIG. **1**, 911-NOW nodes **110** may communicate to form various other wireless mesh configurations, and mesh configurations may be modified in real-time as conditions change.

[0029] As depicted in FIG. **1**, the 911-NOW nodes **110** support wireless communications for one or more management devices **105** (denoted herein as wireless management communications). The wireless management communications include wireless communications between a 911-NOW node **110** and a management device(s) **105** served by that 911-NOW node **110**. A 911-NOW node **110** includes one or more wireless management interfaces supporting wireless communications for management device(s) **105**. The wireless management communications between management device **105** and 911-NOW node $\mathbf{110}_D$ are supported using a wireless management connection **113** established between management device **105** and 911-NOW node $\mathbf{110}_D$.

[0030] The management device **105** is operable for configuring and controlling standalone 911-NOW network **100**. For example, management device **105** may be used to configure and reconfigure one or more of the 911-NOW nodes **110**, control access to the 911-NOW nodes (e.g., authorization, authentication, and like functions), control functions and services supported by the 911-NOW nodes **110**, upgrade software run by the 911-NOW nodes **110**, perform element/network management functions for individual 911-NOW nodes or combinations of 911-NOW nodes (e.g., fault, performance, and like management functions) and the like, as well as various combinations thereof. The management device **105** may be implemented using existing devices (e.g., laptops, PDAs, and the like), or using a newly-designed device adapted to support such management functions. The management device **105** may connect to one or more 911-NOW nodes **110** directly and/or indirectly using wireline and/or wireless interfaces.

[0031] Although primarily depicted and described with respect to one on-site management device **105**, additional on-site management devices may be deployed for configuring and controlling a 911-NOW standalone network. Furthermore, the management device **105** (or one or more other management devices) may be connected to 911-NOW nodes **110** off-site for performing different functions. For example, the management device **105** may be connected to a 911-NOW node when the 911-NOW node returns to the location from which the 911-NOW node was dispatched (e.g., returns to its station) in order to perform various functions, such as post-analysis diagnostics, reconfigurations, software upgrades, management functions (e.g., fault, performance, and like management functions), and the like, as well as various combinations thereof.

[0032] The 911-NOW nodes **110** support wireless communications using one or more wireless technologies. For wireless access communications, each 911-NOW node **110** may support one or more different wireless technologies, such as Global System for Mobile Communications (GSM), General Packet Radio Service (GPRS), Evolution-Data Optimized (1xEV-DO), Universal Mobile Telecommunications System (UMTS), High-Speed Downlink Packet Access (HSDPA), Worldwide Interoperability for Microwave Access (WiMAX), and the like, as well as various combinations thereof. For wireless mesh communications, each 911-NOW node **110** may support Wireless Fidelity (WiFi) or WiMAX technology, microwave technologies, or any other wireless technology. For wireless management communications, each 911-NOW node **110** may support one or more such cellular technologies, and, further, may support WiFi technology, Bluetooth technology, or any other wireless technology.

[0033] In one example, wireless access communications are provided using 1xEV-DO, wireless mesh communications are provided using WiFi, and wireless management communications are provided using WiFi. In another example, wireless access communications are provided using UMTS, wireless mesh communications are provided using WiMAX, and wireless management communications are provided using WiFi. In another example, wireless access communications are provided using HSDPA, wireless mesh communications are provided using WiFi, and wireless

management communications are provided using Bluetooth. In other words, various different combinations of wireless technologies may be used to support different types of communications by 911-NOW nodes **110**.

[0034] As described herein, wireless communications supported by 911-NOW nodes **110** convey user information, control information, and the like, as well as various combinations thereof. For example, user information may include voice communications (e.g., voice calls, audio conferences, push-to-talk, and the like), data communications (e.g., text-based communications, high-speed data downloads/uploads, file transfers, sensor data transfers, and the like), video communications (e.g., video broadcasts, conferencing, and the like), multimedia communications, and the like, as well as various combinations thereof. The wireless communications supported by 911-NOW nodes **110** may convey various combinations of content, e.g., audio, text, image, video, multimedia, and the like, as well as various combinations thereof. For example, control information may include management information, network configuration/control information, and the like, as well as various combinations thereof. Thus, 911-NOW nodes **110** support wireless communication of any information.

[0035] Although a specific number of 911-NOW nodes **110** is depicted and described as being deployed to form a 911-NOW network, fewer or more 911-NOW nodes may be deployed to form a 911-NOW network supporting communications required to provide an effective emergency response. Similarly, although a specific configuration of 911-NOW nodes **110** is depicted and described as being deployed to form a 911-NOW network, 911-NOW nodes may be deployed in various other configurations (including different locations at one emergency site or across multiple emergency sites, different combinations of mesh connections between 911-NOW nodes, and the like, as well as various combinations thereof) to form a standalone 911-NOW network supporting RAN functions, CORE networking functions, and various services supporting multimedia communications to provide an effective emergency response.

[0036] FIGS. **2**A and **2**B depict communication scenarios for communications between users at an emergency site using the stand-alone version of the 911-NOW communication network architecture of FIG. **1**. As depicted in FIG. **2**A (a single-hop case), two (or more) users at an emergency site communicate with each other via one 911-NOW node **110** (without the communications having to traverse wireless mesh connections between 911-NOW nodes **110**). As depicted in FIG. **2**B (a multi-hop case), two (or more) users at an emergency site communicate with each other directly via multiple 911-NOW nodes. A first user **102** communicates directly with a first 911-NOW node **110** and a second user **102** communicates with a second 911-NOW node **110**, and first and second 911-NOW nodes **110** communicate (via one or more wireless mesh connections) in order to provide a communication path between the first and second users **102**.

[0037] As described herein, although one or more 911-NOW nodes **110** are capable of forming a fully-functional, standalone cellular wireless network without relying on existing infrastructure (fixed or variable), where there is existing infrastructure (that was not damaged or destroyed), the standalone 911-NOW wireless network may leverage the existing network infrastructure to form an integrated 911-NOW wireless network capable of supporting various additional capabilities (e.g., supporting communications with one or more other standalone 911-NOW wireless networks, supporting communications with one or more remote emergency management headquarters, supporting communications with other resources, and the like, as well as various combinations thereof). An integrated 911-NOW wireless network including a mesh 911-NOW network in communication with existing network infrastructure is depicted and described herein with respect to FIG. **3**.

[0038] FIG. **3** depicts an integrated 911-NOW communication network architecture including a 911-NOW mesh network and an existing network infrastructure. Specifically, the integrated 911-NOW communication network architecture **300** includes 911-NOW mesh network **100** and existing network infrastructure **301**. The existing network infrastructure **301** may include any existing communications infrastructure adapted for supporting wireless communications (e.g., including backhaul functions, networking functions, services, and the like, as well as various combinations thereof) for 911-NOW mesh network **100**.

[0039] The existing network infrastructure **301** may include wireless access capabilities (e.g., radio access networks, satellite access networks, and the like, as well as various combinations thereof), backhaul capabilities (e.g., public and/or private, wireline and/or wireless, backhaul networks supporting mobility management functions, routing functions, and gateway functions, as well as various other related functions), core networking capabilities (e.g., MA functions, DNS functions, DHCP functions, call/session control functions, and the like), services capabilities (e.g., application servers, media servers, and the like), and the like, as well as various combinations thereof. Since 911-NOW nodes **110** also supports such capabilities, in some embodiments at least a portion of these capabilities of existing network infrastructure **201** may only be relied upon when necessary.

[0040] As depicted in FIG. **3**, the existing network infrastructure **301** supports wireless backhaul connections. Specifically, the existing network infrastructure **301** supports two wireless backhaul connections from 911-NOW mesh network **100**. The existing network infrastructure **301** supports a first wireless backhaul connection **314** with 911-NOW node $\mathbf{110}_E$ using a satellite **302**, where satellite **302** is in wireless backhaul communication with a satellite backhaul node **303** at the edge of Internet **306**. The existing network infrastructure **301** supports a second wireless backhaul connection **314** with 911-NOW node $\mathbf{110}_G$ using a cellular base station **304**, where cellular base station in **304** is in wireline backhaul communication with a cellular backhaul node **305** at the edge of Internet **306**.

[0041] As depicted in FIG. **3**, the existing network infrastructure **301** further supports other connections to other locations with which users **102** of emergency site **101** may communicate. The existing network infrastructure **301** includes a router **307** supporting communications for an emergency headquarters **320** (which may include, for example, emergency personnel and/or emergency systems). The existing network infrastructure **301** includes a cellular backhaul node **308** and an associated base station **309** supporting communications for one or more other 911-NOW mesh networks $\mathbf{330}_1$-$\mathbf{330}_N$ (i.e., one or more other standalone 911-NOW networks established at remote emergency sites).

[0042] The existing network infrastructure **301** supports communications for 911-NOW mesh network **100**. The existing network infrastructure **301** may support communications between wireless user devices **104** of 911-NOW mesh net-

work **100** (e.g., complementing wireless mesh communications between 911-NOW nodes **110** of the standalone 911-NOW network **100**). The existing network infrastructure **301** may support communications between wireless user devices **104** of 911-NOW mesh network **100** and other emergency personnel and/or emergency systems. For example, existing network infrastructure **301** may support communications between wireless user devices **104** of 911-NOW mesh network **100** and an emergency headquarters **320**, one or more other 911-NOW mesh networks **330** (e.g., at emergency sites remote from emergency site **101**), and the like, as well as various combinations thereof.

[0043] As depicted in FIG. **3**, in addition to supporting one or more wireless access interfaces, one or more wireless mesh interfaces, and one or more wireless management interfaces, each 911-NOW node **110** supports one or more wireless backhaul interfaces supporting communications between 911-NOW nodes **110** and existing network infrastructure (illustratively, existing network infrastructure **301**). The wireless backhaul communications between 911-NOW nodes **110** and existing network infrastructure **301** are supported using wireless backhaul connections **314** established between 911-NOW nodes **110** and existing network infrastructure **301**. The wireless backhaul connections **314** may be provided using one or more wireless technologies, such as GSM, GPRS, EV-DO, UMTS, HSDPA, WiFi, WiMAX, microwave, satilite, and the like, as well as various combinations thereof.

[0044] Thus, the mesh networking capabilities provided by 911-NOW nodes **110**, in combination with backhaul networking capabilities provided by 911-NOW nodes **110** using wireless backhaul connections with existing network infrastructure **301**, enable communications between emergency personnel at one emergency site (e.g., between users connected to 911-NOW nodes **110** of a standalone 911-NOW mesh network), between emergency personnel at different emergency sites (e.g., between users connected to 911-NOW nodes **110** of different standalone wireless mesh networks), between emergency personnel at one or more emergency sites and emergency management personnel (e.g., users stationed at emergency headquarters **320**), and the like, as well as various combinations thereof.

[0045] FIGS. **4**A and **4**B depict communication scenarios for communications between users at an emergency site and an emergency headquarters using the integrated 911-NOW communication network architecture of FIG. **3**. Although primarily depicted and described with respect to communications between a user at an emergency site and emergency headquarters, the communication scenarios depicted and described with respect to FIG. **4**A and FIG. **4**B may also be used to support communications between users at different emergency sites, where existing network infrastructure (including existing wireless and wireline infrastructure as depicted and described with respect to FIG. **3**) provides backhaul connections between the emergency sites.

[0046] As depicted in FIG. **4**A (a single-hop case), a user **102** at emergency site **101** communicates with emergency headquarters **320** (e.g., with emergency personnel and/or emergency systems) by communicating with a 911-NOW node **110** (i.e., the 911-NOW node **110** functions as a wireless connection point for the user device **104** of user **102**). The 911-NOW node **110** at the emergency site supports wireless backhaul communications between 911-NOW node **110** and existing wireless network infrastructure **301** which, as described with respect to FIG. **3**, provides a connection to the Internet **306** in order to provide an end-to-end communication path between the wireless user device **104** of user **102** at emergency site **101** and emergency headquarters **320**.

[0047] As depicted in FIG. **4**B (a multi-hop case), a user **102** at emergency site **101** communicates with emergency headquarters **320** (e.g., with emergency personnel and/or emergency systems). The wireless user device **104** communicates with a first 911-NOW node **110** (i.e., the first 911-NOW node **110** functions as a wireless connection point for the user device **104** of user **102**). The first 911-NOW node **110** supports wireless mesh communications between the first 911-NOW node **110** and one or more other 911-NOW nodes **110** in order to transport communications between the first 911-NOW node and existing wireless network infrastructure **301** which, as described with respect to FIG. **3**, provides a connection to the Internet **306** in order to provide an end-to-end communication path between the wireless user device **104** of user **102** at emergency site **101** and emergency headquarters **320**.

[0048] Thus, 911-NOW nodes **110** may each support four different types of wireless interfaces. The 911-NOW nodes **110** support one or more wireless access interfaces by which user devices **104** may access 911-NOW nodes **110**. The 911-NOW nodes **110** support one or more wireless mesh interfaces by which 911-NOW nodes **110** communicate with other 911-NOW nodes **110**. The 911-NOW nodes **110** support one or more wireless backhaul interfaces by which 911-NOW nodes **110** communicate with existing network infrastructure (such as existing network infrastructure **301** of FIG. **3**). The 911-NOW nodes **110** support one or more wireless management interfaces by which network administrators may manage the 911-NOW-based wireless network.

[0049] FIG. **5** depicts a high-level block diagram of one embodiment of a 911-NOW node. As depicted in FIG. **5**, 911-NOW node **110** includes a functions module **501**, a processor **540**, a memory **550**, and support circuit(s) **560** (as well as various other processors, controllers, modules, storage devices, support circuits, and the like required to support various functions of 911-NOW node **110**). The functions module **501** cooperates with processor **540**, memory **550**, and support circuits **560** to provide various functions of 911-NOW node **110**, as depicted and described herein).

[0050] The functions module **501** includes a wireless functions module **509**, a core (CORE) networking functions module **520**, and a services module **530**. The wireless functions module **509** includes a radio access network (RAN) functions module **510** and, optionally, a wireless interface module **515**. The CORE networking functions module **520** provides CORE networking functions. The services module **530** provides one or more services. The RAN functions module **510** (and, when present, wireless interface module **515**) communicate with both CORE networking functions module **520** and services module **530**, and CORE networking functions module **520** and services module **530** communicate, to provide functions depicted and described herein.

[0051] As depicted in FIG. **5**, processor **540** controls the operation of 911-NOW node **110**, including communications between functions module **501**, memory **550**, and support circuit(s) **560**. The memory **550** includes programs **551**, applications **552**, support data **553** (e.g., user profiles, quality-of-service profiles, and the like, as well as various combinations thereof), and user data **554** (e.g., any information intended for communication to/from user devices associated with 911-NOW node **110**). The memory **550** may store other

types of information. The support circuit(s) **560** may include any circuits or modules adapted for supporting functions of 911-NOW node **110**, e.g., power supplies, power amplifiers, transceivers, encoders, decoders, and the like, as well as various combinations thereof.

[0052] The wireless functions module **509**, CORE networking functions module **520**, and services module **530** cooperate (in combination with processor **540**, memory **550**, and support circuits **560**, and any other required modules, controllers, and the like, which are omitted for purposes of clarity) to provide a rapidly deployable wireless node which may form: (1) a single-node, standalone wireless network; (2) a multi-node, standalone wireless network (i.e., using wireless mesh connections between 911-NOW nodes); or (3) an integrated wireless network (i.e., using wireless backhaul connections between one or more 911-NOW nodes and existing network infrastructure and, optionally, using wireless mesh connections between 911-NOW nodes).

[0053] The RAN functions module **510** provides RAN functions. The RAN functions include supporting one or more wireless access interfaces for communications associated with wireless user devices. Specifically, RAN functions module **510** supports a plurality of air interfaces (AIs) $\mathbf{511}_1$-$\mathbf{511}_N$ (collectively, AIs **511**). The AIs **511** provide wireless access interfaces supporting communications associated with wireless user devices. For example, AIs **511** may support functions typically provided by a base transceiver station (BTS).

[0054] The RAN functions module **510** provides control functions. The control functions may include any control functions typically performed by controllers in radio access networks. For example, the control functions may include functions such as admission control, power control, packet scheduling, load control, handover control, security functions, and the like, as well as various combinations thereof. For example, in one embodiment the control functions may include functions typically performed by RAN network controllers (RNCs) or similar wireless network controllers.

[0055] The RAN functions module **510** provides network gateway functions. The network gateway functions may include any functions typically performed in order to bridge RAN and CORE networks, such as IP session management functions, mobility management functions, packet routing functions, and the like, as well as various combinations thereof. For example, where intended for use with CDMA2000-based wireless technology, the network gateway functions may include functions typically performed by a Packet Data Serving Node (PDSN). For example, where intended for use with GPRS-based and/or UMTS-based wireless technology, the network gateway functions may include functions typically performed by a combination of a GPRS Gateway Support Node (GGSN) and a Serving GPRS Support Node (SGSN).

[0056] In one embodiment, RAN functions module **510** may be implemented as a base station router (BSR).

[0057] The wireless interface module **515** provides one or more wireless interfaces. The wireless interfaces provided by wireless interface module may include one or more of: (1) one or more wireless mesh interfaces supporting communications with other 911-NOW nodes; (2) one or more wireless backhaul interfaces supporting communications with existing network infrastructure; and/or (3) one or more wireless management interfaces supporting communications with one or more management devices. The wireless interface module **515** supports a plurality of air interfaces (AIs) $\mathbf{516}_1$-$\mathbf{516}_N$ (collectively, AIs **516**), which provide wireless interfaces supporting communications associated with one or more of: one or more other 911-NOW nodes, existing network infrastructure, and one or more management devices.

[0058] The CORE networking functions module **520** provides networking functions typically available from the CORE network. For example, CORE networking functions module **520** may provide authentication, authorization, and accounting (AAA) functions, domain name system (DNS) functions, dynamic host configuration protocol (DHCP) functions, call/session control functions, and the like, as well as various combinations thereof. One skilled in the art knows which functions are typically available from the CORE network. The CORE networking functions module **520** is adapted to provide core networking functions independent of any existing network infrastructure.

[0059] The services module **530** provides services. The services may include any services capable of being provided to wireless user devices. In one embodiment, for example, services module **530** may provide services typically provided by application servers, media servers, and the like, as well as various combinations thereof. For example, services may include one or more of voice services, voice conferencing services, data transfer services (e.g., high-speed data downloads, high-speed data upload, file transfers, sensor data transfers, and the like), video services, video conferencing services, multimedia services, multimedia conferencing services, push-to-talk services, instant messaging services, and the like, as well as various combinations thereof. One skilled in the art knows which services are typically available over RAN and CORE networks. The services module **530** is adapted to provide services independent of any existing network infrastructure.

[0060] FIG. **6** depicts a high-level block diagram of one embodiment of a functional module of the 911-NOW node of FIG. **5**. As depicted in FIG. **6**, functions module **501** includes wireless functions module **509**, CORE networking functions module **520**, and services module **530**. The wireless functions module **509** includes a base station router (BSR) **610** and, optionally, a wireless interface module **615**. The wireless functions module **509** communicates with CORE networking functions module **520** and services module **530**, and CORE networking functions module **520** and services module **530** communicate.

[0061] The BSR **610** includes a base station (BS) **612**, a radio network controller (RNC) **613**, and a network gateway (NG) **614**. The BS **612** includes a plurality of air interfaces (AIs) similar to AIs **511** depicted and described with respect to FIG. **5**. The BS **612** communicates with RNC **613**. The RNC **613** communicates with NG **614**. The BSR **610** supports any functions typically supported by a base station router.

[0062] The wireless interface module **615** may include one or more of: a wireless management interface module **616** including one or more AIs supporting wireless communications with one or more management devices, a wireless mesh interface module **617** including one or more AIs supporting wireless communications with one or more other 911-NOW nodes, and a wireless backhaul interface module **618** including one or more AIs supporting wireless communications with existing network infrastructure.

[0063] In one embodiment, a 911-NOW node **110** may be implemented without wireless interface module **615** (e.g., if the 911-NOW node **110** is not expected to require support for

wireless mesh, backhaul, or management communications). In other words, support for the additional wireless interfaces of wireless interface module **615** is optional.

[0064] In one embodiment, a 911-NOW node **110** is implemented such that wireless interface module **615** includes a subset of: wireless management interface module **616**, wireless mesh interface module **617**, and wireless backhaul interface module **618**. In this embodiment, the implementation of the wireless interface module **615** may be tailored depending on the type(s) of wireless interfaces that the 911-NOW node **110** is expected to need when deployed, i.e., depending on whether the 911-NOW node **110** will require wireless management, mesh, and/or backhaul capabilities.

[0065] In one embodiment, a 911-NOW node **110** is implemented such that wireless interface module **615** includes each of: wireless management interface module **616**, wireless mesh interface module **617**, and wireless backhaul interface module **618**. In this embodiment, the 911-NOW node **110** supports wireless management, mesh, and backhaul capabilities such that such additional wireless interfaces are available should the 911-NOW node **110** require such capabilities.

[0066] In one embodiment, for example, for a 911-NOW node only expected to be deployed as a single-node, standalone network, wireless interface module **615** may only include wireless management interface module **616** (since mesh and backhaul support is not required). In one embodiment, for example, for a multi-node, standalone network, wireless interface module **615** may only include wireless management interface module **616** and wireless mesh interface module **617** (since backhaul support is not required). In one embodiment, for example, for an integrated network, wireless interface module **615** may include each of wireless management interface module **616**, wireless mesh interface module **617**, and wireless backhaul interface module **618** (since management, mesh, and backhaul capabilities are all required).

[0067] The CORE networking functions module **520** includes a plurality of modules supporting CORE networking functions. As depicted in FIG. **6**, CORE networking functions module **520** includes an AAA module **621** providing AAA functions, a DNS module **622** providing DNS functions, a DHCP module **623** providing DHCP functions, a call/session control module **624** providing call control functions and/or session control functions, and may include various other modules supporting various other networking functions typically available from the core network (represented by other CORE networking functions module **629**).

[0068] The services module **530** includes a plurality of modules supporting various services. As depicted in FIG. **6**, services module **530** includes a voice services module **631**, a data services module **632**, a video services module **633**, a multimedia services module **634**, and may include various other modules supporting various other services (represented by other services module **639**). As described herein, such services modules may support various different services such as voice calls, voice conferencing, data transfers, streaming video, video conferencing, and the like, as well as various combinations thereof.

[0069] Although primarily depicted and described herein with respect to a specific configuration of a 911-NOW node including three modules providing wireless functions (including RAN functions and, optionally, additional wireless interfaces and associated interface functions), CORE networking functions, and services, respectively, 911-NOW nodes may be implemented using various other configurations for providing wireless functions, CORE networking functions, and services. Similarly, although primarily depicted and described herein with respect to a specific configuration of a functions module providing specific wireless functions, CORE networking functions, and services, functions modules of 911-NOW nodes may be implemented using various other configurations for providing wireless functions, CORE networking functions, and services.

[0070] Therefore, it is contemplated that at least a portion of the described functions may be distributed across the various functional modules in a different manner, may be provided using fewer functional modules, or may be provided using more functional modules. Furthermore, although primarily depicted and described with respect to specific wireless functions (including RAN functions and, optionally, one or more additional wireless interface functions), CORE networking functions, and services, it is contemplated that fewer or more wireless functions (including RAN functions, optionally, and one or more additional wireless interface functions), CORE networking functions, and/or services may be supported by a 911-NOW node. Thus, 911-NOW nodes are not intended to be limited by the example functional architectures depicted and described herein with respect to FIG. **5** and FIG. **6**.

[0071] FIG. **7** depicts a method according to one embodiment of the present invention. Specifically, method **700** of FIG. **7** includes a method for deploying, configuring, and using a rapidly deployable wireless node (such as a 911-NOW node depicted and described herein). Although primarily depicted and described with respect to one rapidly deployable wireless node, multiple rapidly deployable wireless nodes may be deployed, configured, and used as depicted and described with respect to FIG. **7**. Although depicted and described as being performed serially, at least a portion of the steps of method **700** of FIG. **7** may be performed contemporaneously, or in a different order than depicted and described with respect to FIG. **7**. The method **700** begins at step **702** and proceeds to step **704**.

[0072] At step **704**, a rapidly deployable wireless node is placed on a mobile vehicle. The rapidly deployable wireless node may be permanently affixed to the mobile vehicle, temporarily affixed to the mobile vehicle (i.e., affixed in a way that the rapidly deployable mobile node may be easily detached from the mobile vehicle if necessary or desired), or simply placed in the mobile vehicle (e.g., carried onto the mobile vehicle by personnel to be transported on the vehicle). The rapidly deployable wireless node supports RAN functions (and, optionally, one or more additional wireless interfaces), at least one CORE networking function, and at least one service. For example, the rapidly deployable mobile node may be a 911-NOW node depicted and described herein.

[0073] At step **706**, the mobile vehicle, including the rapidly deployable wireless node, is transported to a site. The transportation of the mobile vehicle to the site varies depending on the type of vehicle. For example, the vehicle may be driven to a site, flown to a site, and the like. The site may be any site at which a rapidly deployable wireless node may be desirable. For example, the site may be an emergency site (where the mobile vehicle is an emergency vehicle such as a fire truck, a hazmat vehicle, and the like), the site may be a battlefield site (where the mobile vehicle is a military vehicle such as a humvee, a tank, and the like), and the like, as well as various combinations thereof.

[0074] At step **708**, the rapidly deployable wireless node is configured to support communication at the site. In one embodiment, the rapidly deployable wireless node may be automatically configured to support communications at the site. At step **710**, the rapidly deployable wireless node supports communications at the site. At step **712**, method **700** ends. Although omitted for purposes of clarity, eventually, the mobile vehicle leaves the site (e.g., to provide support at a different site or to return to headquarters from which the mobile vehicle was dispatched). For example, a fire truck returns to the fire station after the fire is out, a tank returns to command headquarters after the battle is over, and the like.

[0075] FIG. **8** depicts a high-level block diagram of a general-purpose computer suitable for use in performing the functions described herein. As depicted in FIG. **8**, system **800** comprises a processor element **802** (e.g., a CPU), a memory **804**, e.g., random access memory (RAM) and/or read only memory (ROM), a 911-NOW module **805**, and various input/output devices **806** (e.g., storage devices, including but not limited to, a tape drive, a floppy drive, a hard disk drive or a compact disk drive, a receiver, a transmitter, a speaker, a display, an output port, and a user input device (such as a keyboard, a keypad, a mouse, and the like)).

[0076] It should be noted that the present invention may be implemented in software and/or in a combination of software and hardware, e.g., using application specific integrated circuits (ASIC), a general purpose computer or any other hardware equivalents. In one embodiment, the present 911-NOW process **805** can be loaded into memory **804** and executed by processor **802** to implement the functions as discussed above. As such, 911-NOW process **805** (including associated data structures) of the present invention can be stored on a computer readable medium or carrier, e.g., RAM memory, magnetic or optical drive or diskette, and the like.

[0077] The 911-NOW network enables emergency personnel to communicate mission-critical information on a rapidly-deployable, highly-flexible, secure wireless network. The 911-NOW network is a fully integrated service architecture that may be deployed as a single-cell solution for local communication or configured as an ad-hoc network of cells for widespread communication (e.g., for multiple localized or large emergency sites). The 911-NOW network supports auto-configuration, wireless mesh networking, interoperability with existing systems and technologies, network service and management function, and various other features, functions, and capabilities, thereby providing a cost-efficient solution that is scalable and flexible to emergency response needs, as well as spatial and temporal network deployment scenarios.

[0078] The 911-NOW network may be deployed in support of multiple missions in emergency response and disaster recovery operations, such as first responder communications, search and rescue operations, restoration of local cellular service, and the like, as well as various combinations thereof. In such scenarios, applications which may be supported by the 911-NOW network include basic voice communications, push-to-talk, database access capabilities, file transfer applications (e.g., to provide access to floor plans, emergency exits, elevator shafts, chemical storage rosters, hazardous material handling instructions, and the like, as well as various combinations thereof), alert messaging broadcasts, streaming video, location tracking (e.g., of people, vehicles, and the like), sensor monitoring applications (e.g., temperature, air composition, radiation, and the like), biometric monitoring applications (e.g., breathing, pulse, and oxygen tank sensors that transmit information about the health of emergency personnel, and the like).

[0079] The 911-NOW network provides numerous functions, including assured access and reliable communications anywhere and at any time, capacity and coverage on-demand for mobile incident area networks, standards-compliant air interface technologies and network interoperability through IP interfaces, efficient local communication in the absence of fixed network infrastructure including integrated services architecture for full stand-alone network operation, wireless backhaul capabilities to fixed public and/or private network (s), wide-area coverage through wireless mesh networking, reachability and robustness through flexible multi-path routing, converged multimedia communication capabilities (e.g., with voice, high-speed data, video, and like communication capabilities) and the like.

[0080] The 911-NOW network provides security features. The 911-NOW network provides triple-layered wireless network security to protect the network operator, network elements, and user devices. For example, 911-NOW nodes may include advanced security tools such as air interface complexity, cryptographic authentication, encryption, scrambling, link-layer assisted security protocols, and the like, may be implemented in the 911-NOW network in order to deter technical fraud, information eavesdropping, session hijacking, and other potential security vulnerabilities. The 911-NOW nodes may support various other security measures associated with RAN functions (and additional wireless interface functions), CORE networking functions, and services provided by 911-NOW nodes, thereby resulting in a highly secure 911-NOW network.

[0081] The described features, functions, and capabilities of the 911-NOW network thereby enable increased situational awareness at emergency sites and situational awareness of emergency sites by emergency management personnel at remote emergency management sites (i.e., headquarters), communication between emergency sites as well as between emergency sites and emergency headquarters, and various other desirable results. The operation of a 911-NOW network may be better understood with respect to FIG. **1**, which depicts an example of a 911-NOW network, as well as FIG. **2** and FIG. **3**, which depict example communication scenarios using the 911-NOW network of FIG. **1**. The operation of a 911-NOW node which enables the 911-NOW network may be better understood with respect to FIG. **4** and FIG. **5**.

[0082] Although primarily depicted and described herein with respect to using rapidly deployable nodes (such as 911-NOW nodes depicted and described herein) to deploy a wireless network in emergency response situations, rapidly deployable nodes may be used to deploy a wireless network in various other situations. In one embodiment, rapidly deployable nodes may be used in large-crowd environments. For example, rapidly deployable nodes may be deployed during large-crowd events, such as sporting events (e.g., in a city hosting the Super Bowl, in a city hosting the Olympics, and the like), concerts, and the like. In one embodiment, rapidly deployable nodes may be used as a rapid replacement network for commercial cellular networks (i.e., to replace existing network infrastructure while such infrastructure is unavailable). In one embodiment, rapidly deployable nodes may be used in military environments (e.g., to form a rapidly deployable network on the battlefield or in other situations).

[0083] Therefore, rapidly deployable nodes according to the present invention are useful for various other applications in addition to emergency response applications, and, thus, may be deployed in various other situations in addition to emergency situations. Thus, the term "emergency site", which is used herein to denote the geographical location in which one or more rapidly deployable nodes may be deployed to form a wireless network, may be more commonly referred to as a "network site" (i.e., the site at which the rapidly deployable wireless network is deployed to support wireless communications). Similarly, other terms primarily associated with emergency applications may be referred to more generally depending upon the application in which rapidly deployable nodes are deployed. In other words, any number of rapidly deployable nodes according to the present invention may be deployed to any geographical location to form a wireless network for any reason.

[0084] It is contemplated that some of the steps discussed herein as software methods may be implemented within hardware, for example, as circuitry that cooperates with the processor to perform various method steps. Portions of the present invention may be implemented as a computer program product wherein computer instructions, when processed by a computer, adapt the operation of the computer such that the methods and/or techniques of the present invention are invoked or otherwise provided. Instructions for invoking the inventive methods may be stored in fixed or removable media, transmitted via a data stream in a broadcast or other signal bearing medium, and/or stored within a working memory within a computing device operating according to the instructions.

[0085] Although various embodiments which incorporate the teachings of the present invention have been shown and described in detail herein, those skilled in the art can readily devise many other varied embodiments that still incorporate these teachings.

What is claimed is:

1. An apparatus for providing a rapidly-deployable, fully-functional, standalone cellular network, comprising:
- means for providing radio access network (RAN) functions comprising at least one air interface, at least one control function, and at least one network gateway function;
- means for providing at least one core networking function; and
- means for providing at least one service;
- wherein the apparatus is adapted for being deployed using a mobile platform;
- wherein the apparatus is adapted for providing the at least one core networking function and the at least one service independent of any existing network infrastructure.

2. The apparatus of claim **1**, wherein the at least one air interface comprises at least one interface supporting wireless access communications for user devices.

3. The apparatus of claim **1**, further comprising:
- means for providing at least one additional wireless interface.

4. The apparatus of claim **3**, wherein the at least one additional wireless interface comprises at least one interface supporting wireless mesh communications.

5. The apparatus of claim **3**, wherein the at least one additional wireless interface comprises at least one interface supporting wireless backhaul communications with an existing network infrastructure.

6. The apparatus of claim **3**, wherein the at least one additional wireless interface comprises at least one interface supporting wireless management communications with a management device.

7. The apparatus of claim **1**, wherein the means for providing RAN functions comprises a base station router (BSR).

8. The apparatus of claim **1**, wherein the at least one core networking function comprises at least one of an authentication, authorization, and accounting (AAA) function, a domain name service (DNS) function, a dynamic host configuration protocol (DHCP) function, and a call/session control function.

9. The apparatus of claim **1**, wherein the at least one service function comprises at least one of a voice application, a voice conferencing application, a data application, a video application, and a video conferencing application.

10. The apparatus of claim **1**, wherein the mobile platform comprises a vehicle.

11. A method for providing a rapidly-deployable, fully-functional, standalone cellular network, comprising:
- communicating information using a network element, wherein the network element is adapted to support radio access network (RAN) functions, at least one core networking function, and at least one service;
- wherein the RAN functions comprise at least one air interface, at least one control function, and at least one network gateway function;
- wherein the network element is adapted for being deployed using a mobile platform;
- wherein the network element is adapted for providing the at least one core networking function and the at least one service independent of any existing network infrastructure.

12. The method of claim **11**, wherein the at least one air interface comprises at least one interface supporting wireless access communications for user devices.

13. The method of claim **11**, wherein the network element is further adapted to support at least one additional wireless interface.

14. The method of claim **13**, wherein the at least one additional wireless interface comprises at least one of at least one interface supporting wireless mesh communications, at least one interface supporting wireless backhaul communications with an existing network infrastructure, and at least one interface supporting wireless management communications with a management device.

15. The method of claim **11**, wherein the at least one core networking function comprises at least one of an authentication, authorization, and accounting (AAA) function, a domain name service (DNS) function, a dynamic host configuration protocol (DHCP) function, and a call/session control function.

16. The method of claim **11**, wherein the at least one service comprises at least one of a voice application, a voice conferencing application, a data application, a video application, and a video conferencing application.

17. A method for providing a rapidly-deployable, fully-functional, standalone cellular network, comprising:
- placing a node on a mobile platform, wherein said node supports radio access network (RAN) functions, at least one core networking function, and at least one service, wherein the RAN functions comprise at least one air interface, at least one control function, and at least one network gateway function, wherein the node is adapted

for providing the at least one core networking function and the at least one service independent of any existing network infrastructure; and

directing the mobile platform to a network site at which the rapidly-deployable, fully-functional, standalone cellular network is to be formed.

18. The method of claim **17**, further comprising:

configuring the node to support communications at the network site.

19. The method of claim **18**, further comprising:

supporting communications associated with at least one wireless user device at the network site using the node.

20. An apparatus for providing a rapidly-deployable, fully-functional, standalone cellular network, comprising:

a base station router providing radio access network (RAN) functions comprising at least one air interface, at least one control function, and at least one network gateway function;

a wireless interface module providing at least one of a wireless mesh interface, a wireless backhaul interface, and a wireless management interface;

a core networking functions module providing at least one core networking function; and

a services module providing at least one service;

wherein the apparatus is adapted for being deployed using a mobile platform;

wherein the apparatus is adapted for providing the at least one core networking function and the at least one service independent of any existing network infrastructure.

21. An apparatus for providing a rapidly-deployable, fully-functional, standalone cellular network independent of existing network infrastructure, comprising:

a base station router providing radio access network (RAN) functions comprising at least one air interface, at least one control function, and at least one network gateway function;

a wireless interface module providing at least one wireless mesh interface, at least one wireless backhaul interface, and at least one wireless management interface;

a core networking module providing at least one core networking function; and

a services module providing at least one service;

wherein the apparatus is adapted for being deployed using a mobile platform;

wherein the apparatus is adapted for selecting between providing the at least one core networking function and the at least one service independent of any existing network infrastructure and providing the at least one core networking function and the at least one service using backhaul connectivity to an existing network infrastructure.

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