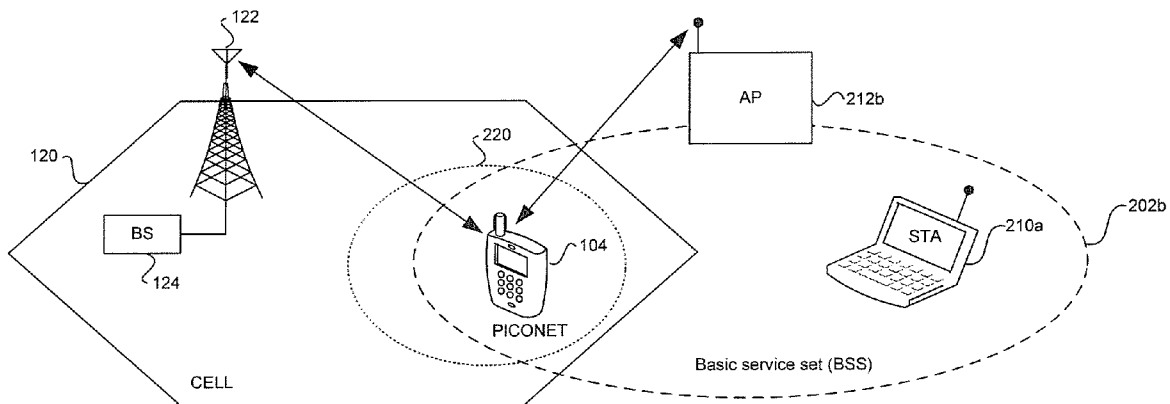




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(19) **United States**(12) **Patent Application Publication****Ibrahim et al.**(10) **Pub. No.: US 2008/0026787 A1**(43) **Pub. Date: Jan. 31, 2008**(54) **METHOD AND SYSTEM FOR A MOBILE
PICONET BASE STATION**(52) **U.S. CL. 455/552.1; 455/517**(76) **Inventors:** **Brima Ibrahim**, Aliso Viejo, CA
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H04B 7/00 (2006.01)
H04M 1/00 (2006.01)
H04Q 7/20 (2006.01)(57) **ABSTRACT**

Aspects of a method and system for a mobile piconet base station are provided. Switching and/or routing capabilities in mobile handset may enable wireless devices to communicate with each other and/or with a wireless network via the mobile handset. The mobile handset operates as a base station for wireless devices within a personal area or piconet. For voice communication, for example, communication between a wireless device within the piconet and a cellular network or a voice-over-IP (VoIP) network may be established via the mobile handset. The selection between the cellular or VoIP network may be based on rate price and/or on features available in each of the networks, for example. Communication between the wireless devices and the base station mobile handset may occur via a Bluetooth connection and/or another type of wireless technology, for example. The wireless devices may be low-cost, small form factor mobile handsets, for example.



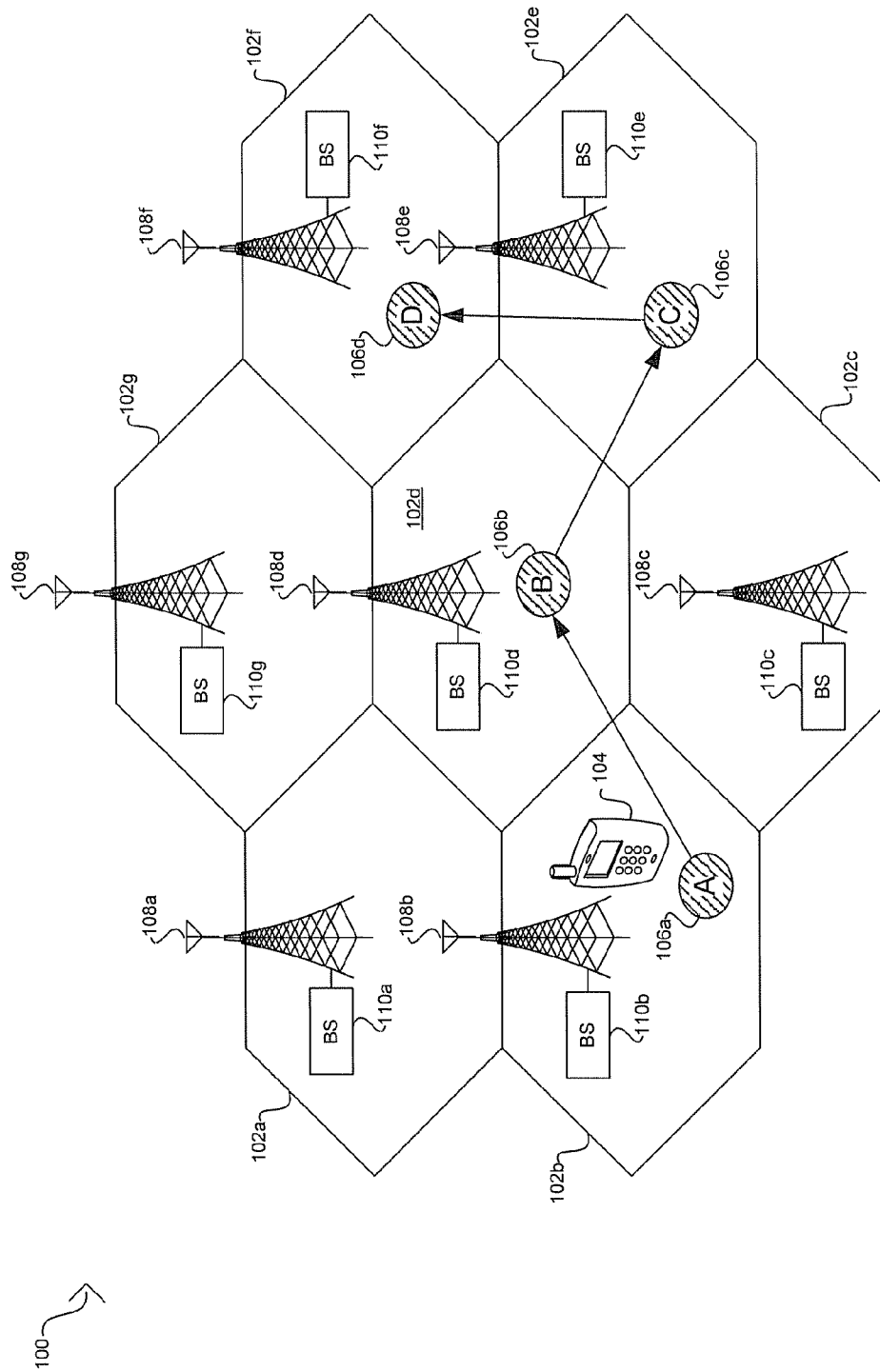


FIG. 1A

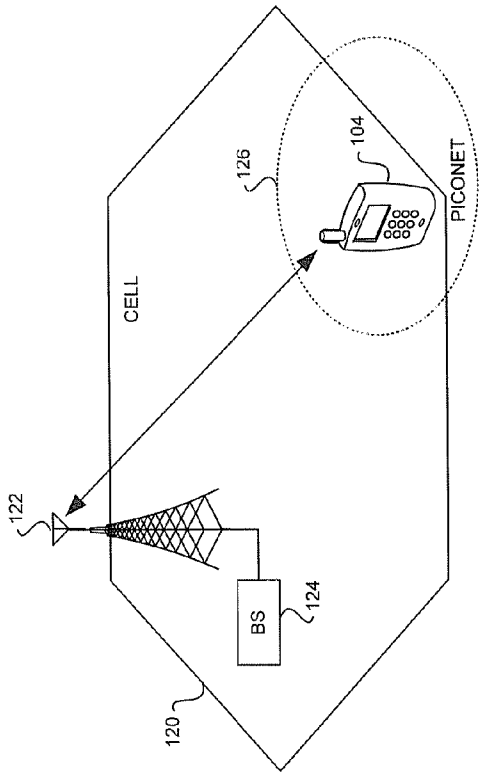


FIG. 1B

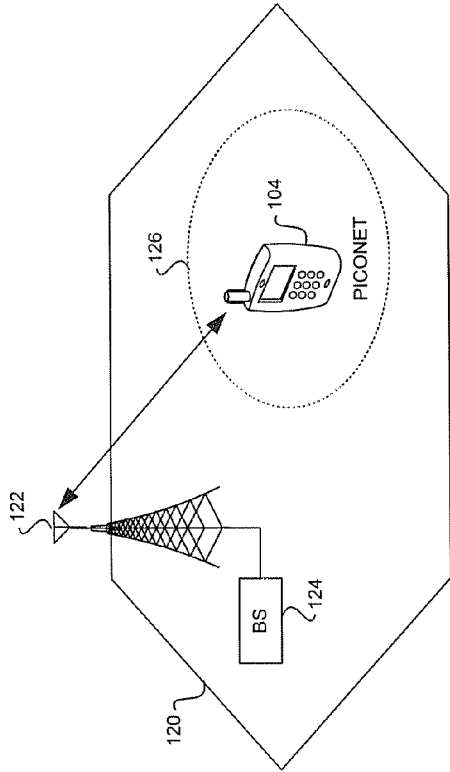


FIG. 1C

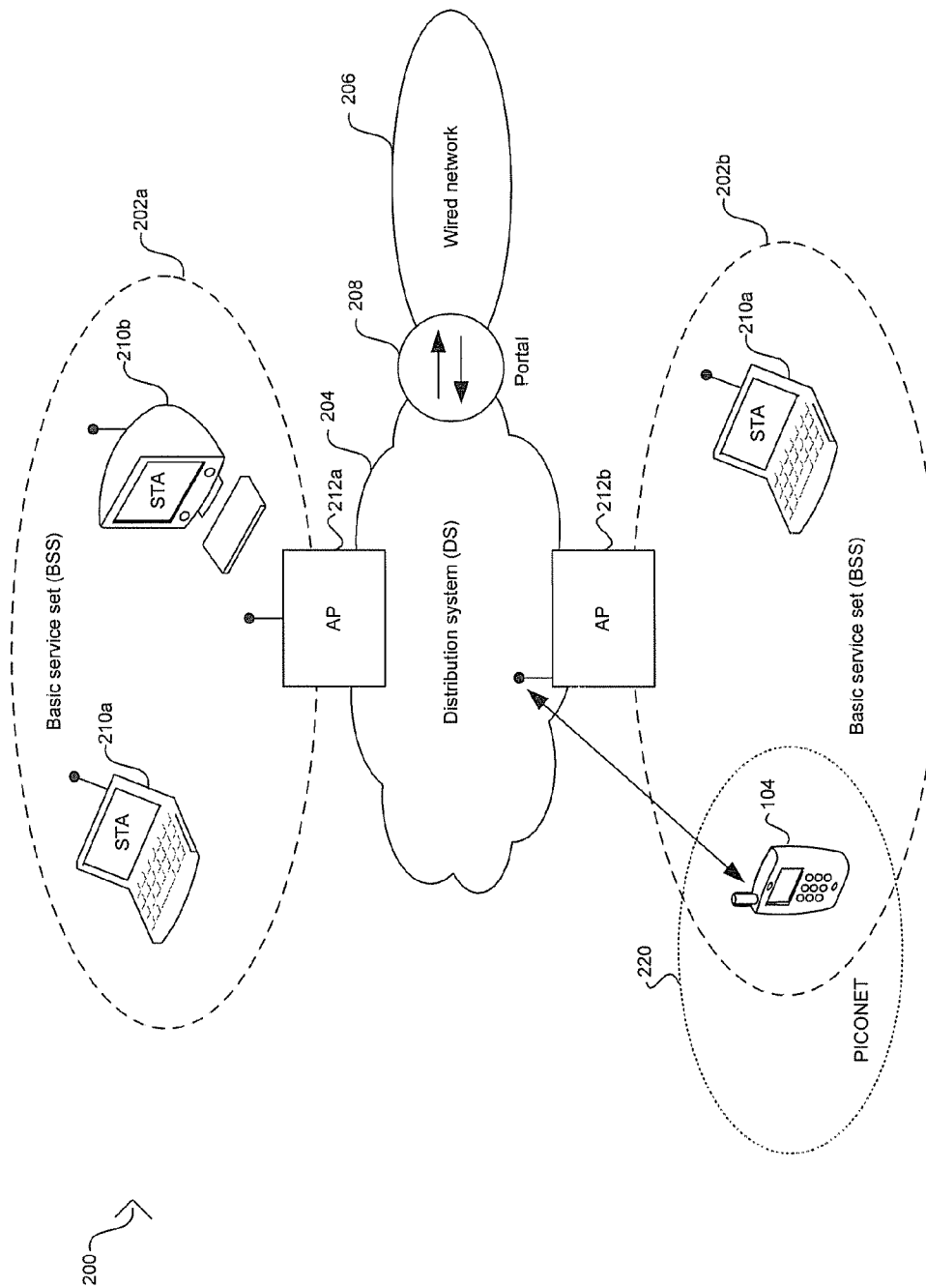


FIG. 2A

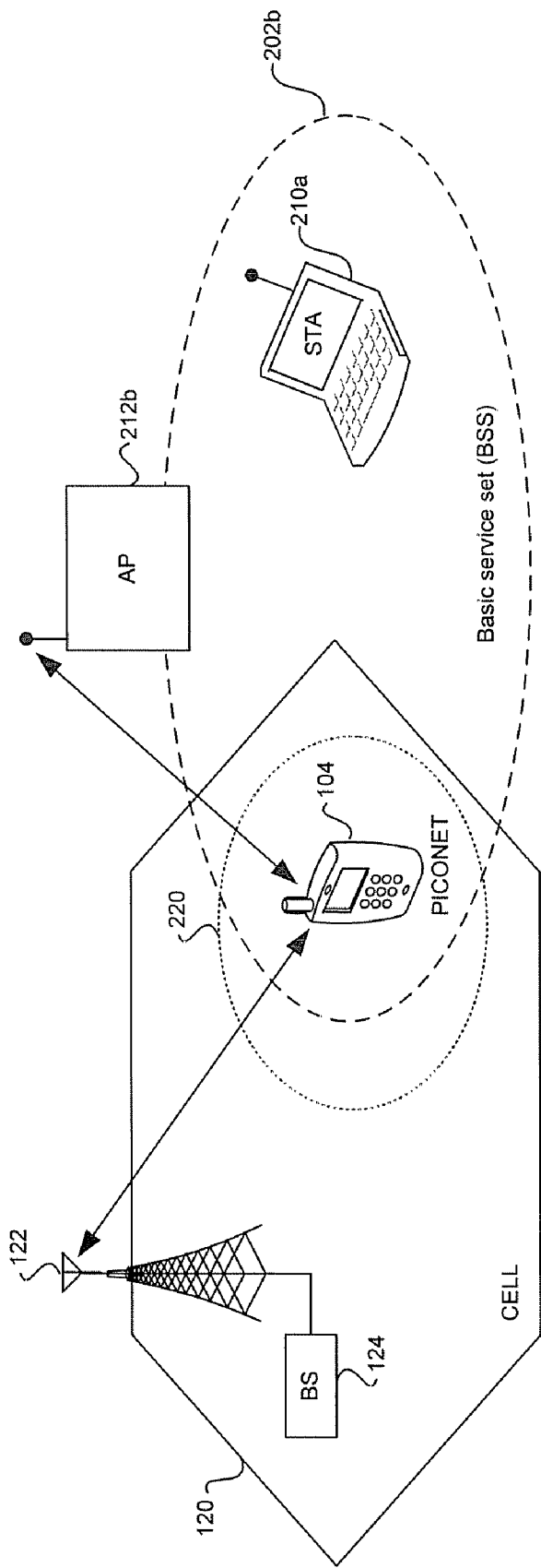


FIG. 2B

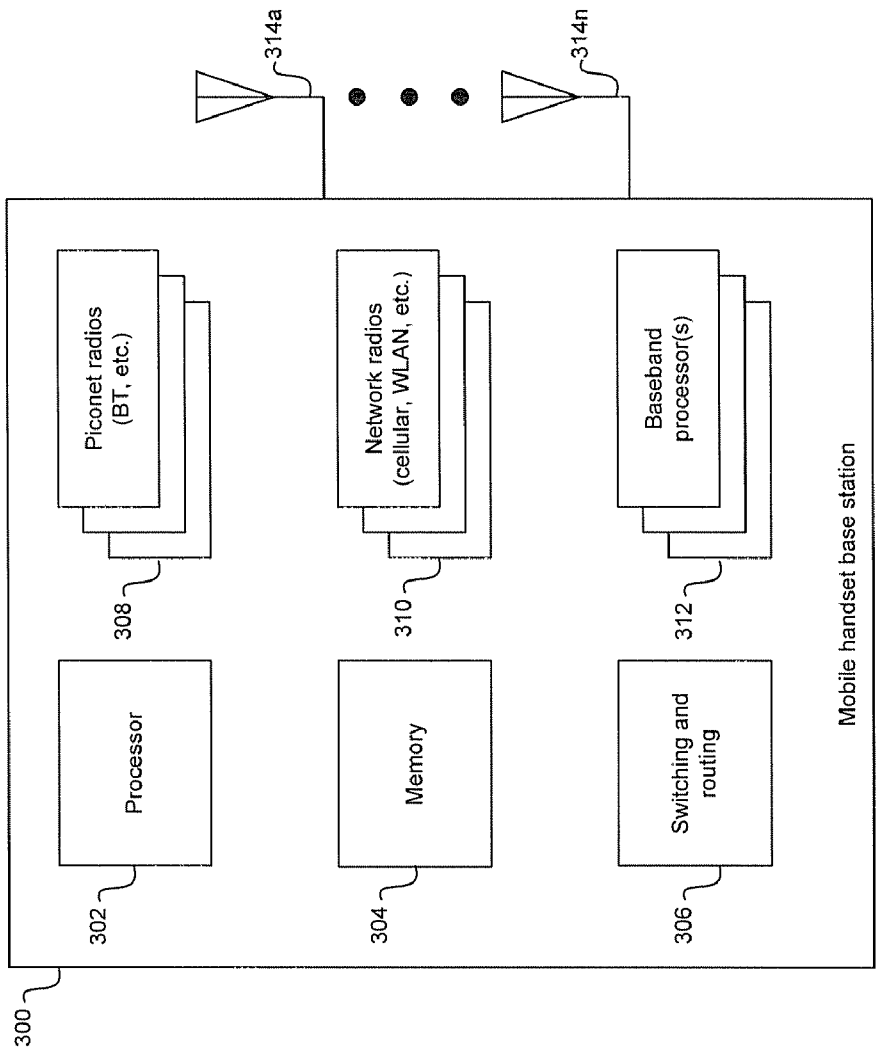


FIG. 3

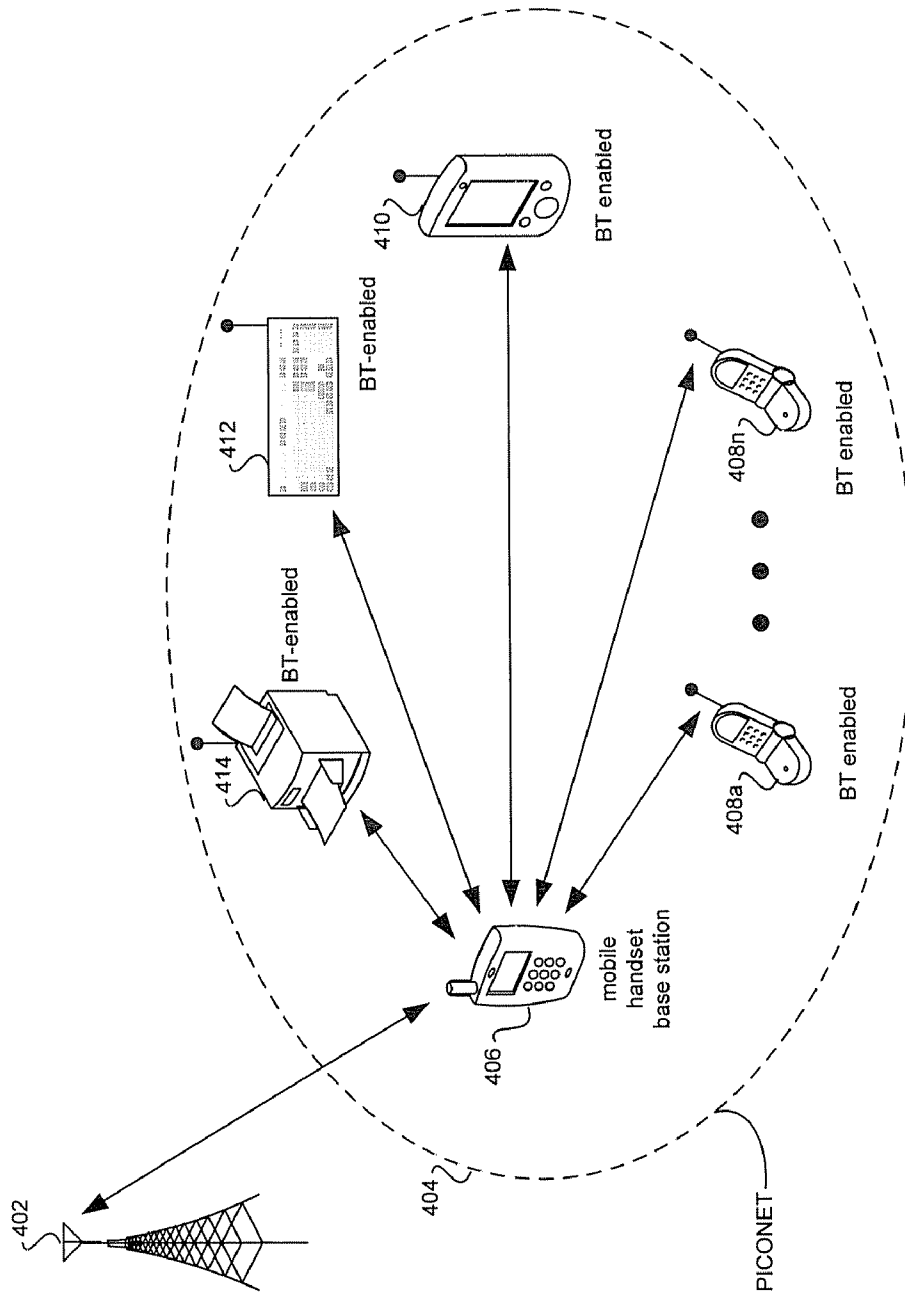


FIG. 4A

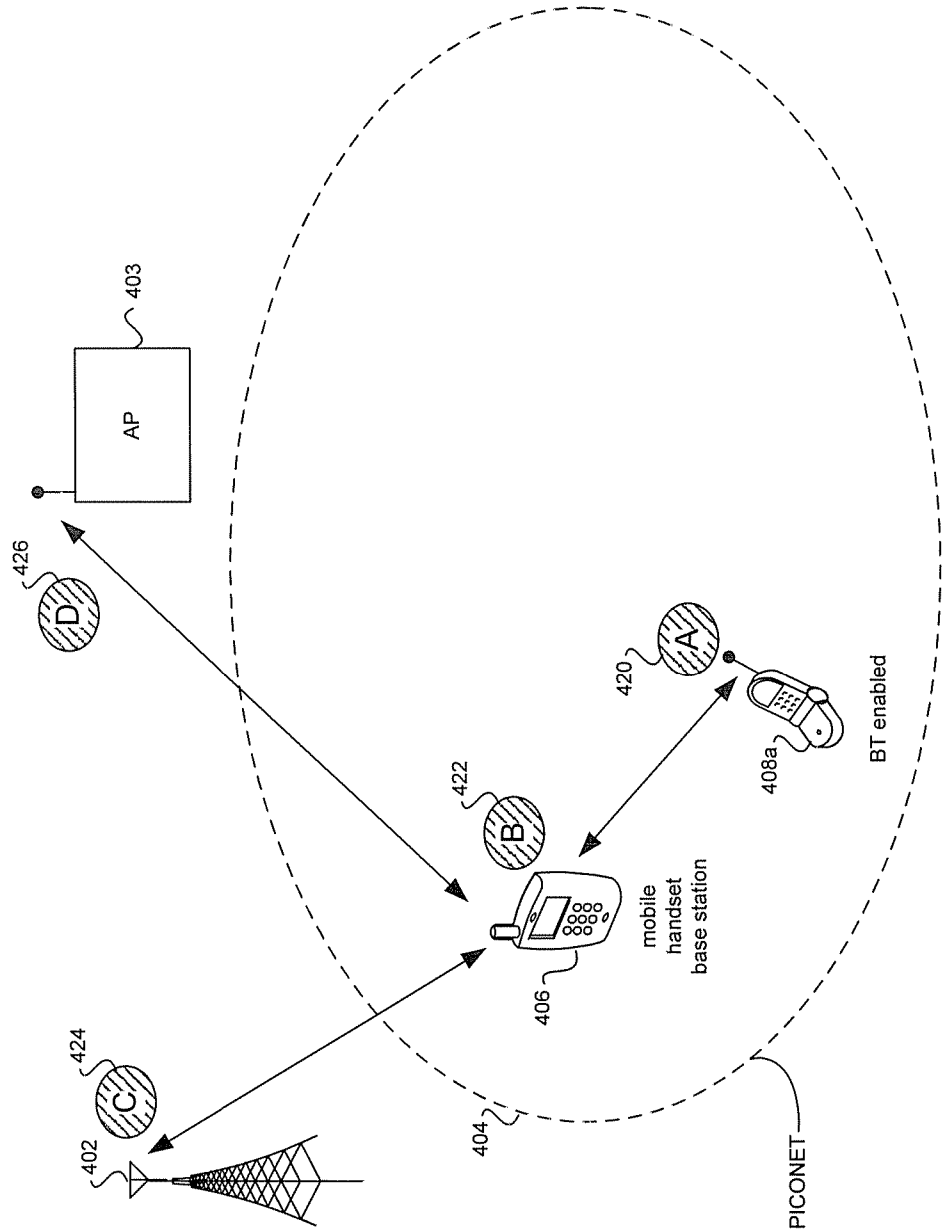


FIG. 4B

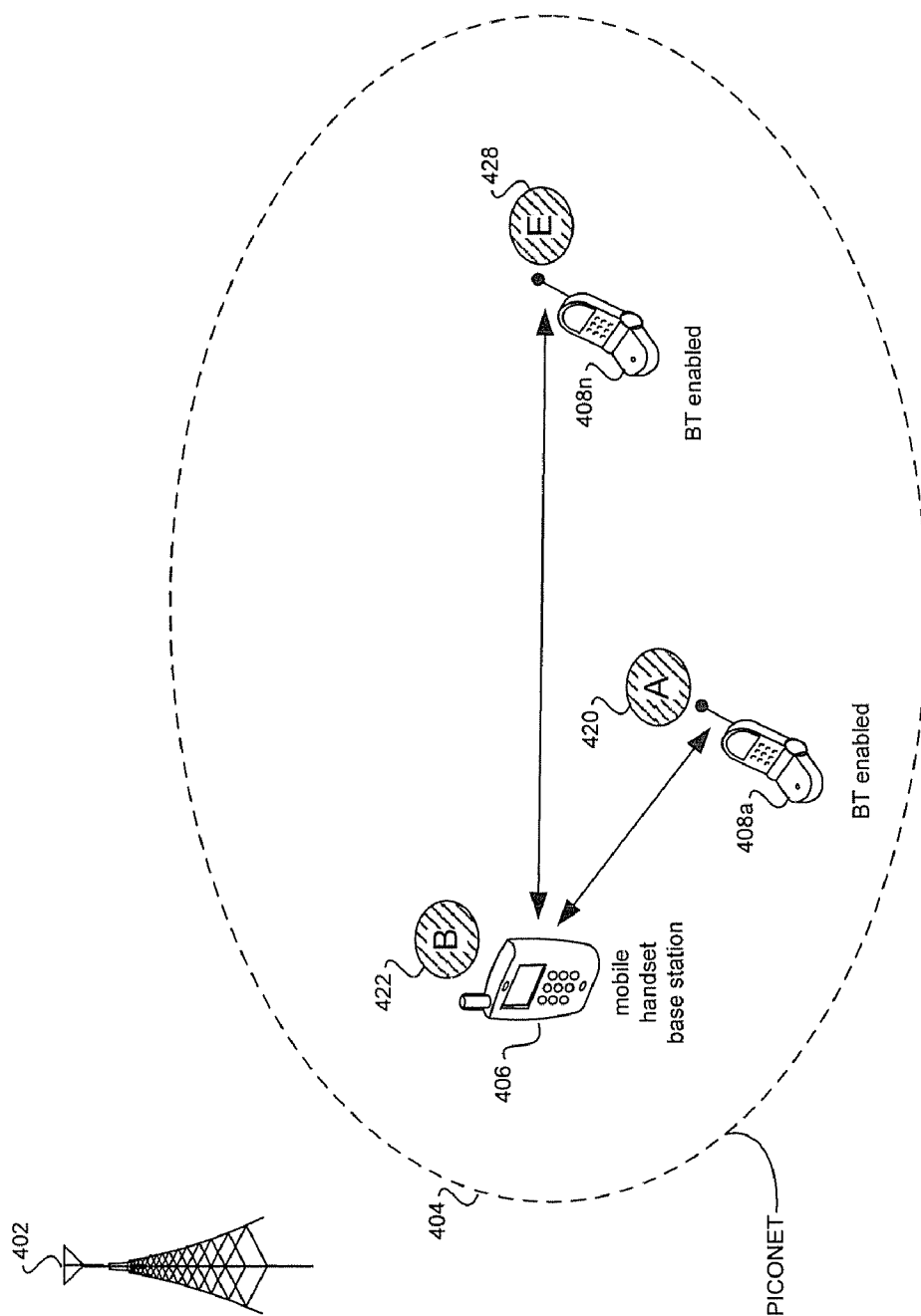


FIG. 4C

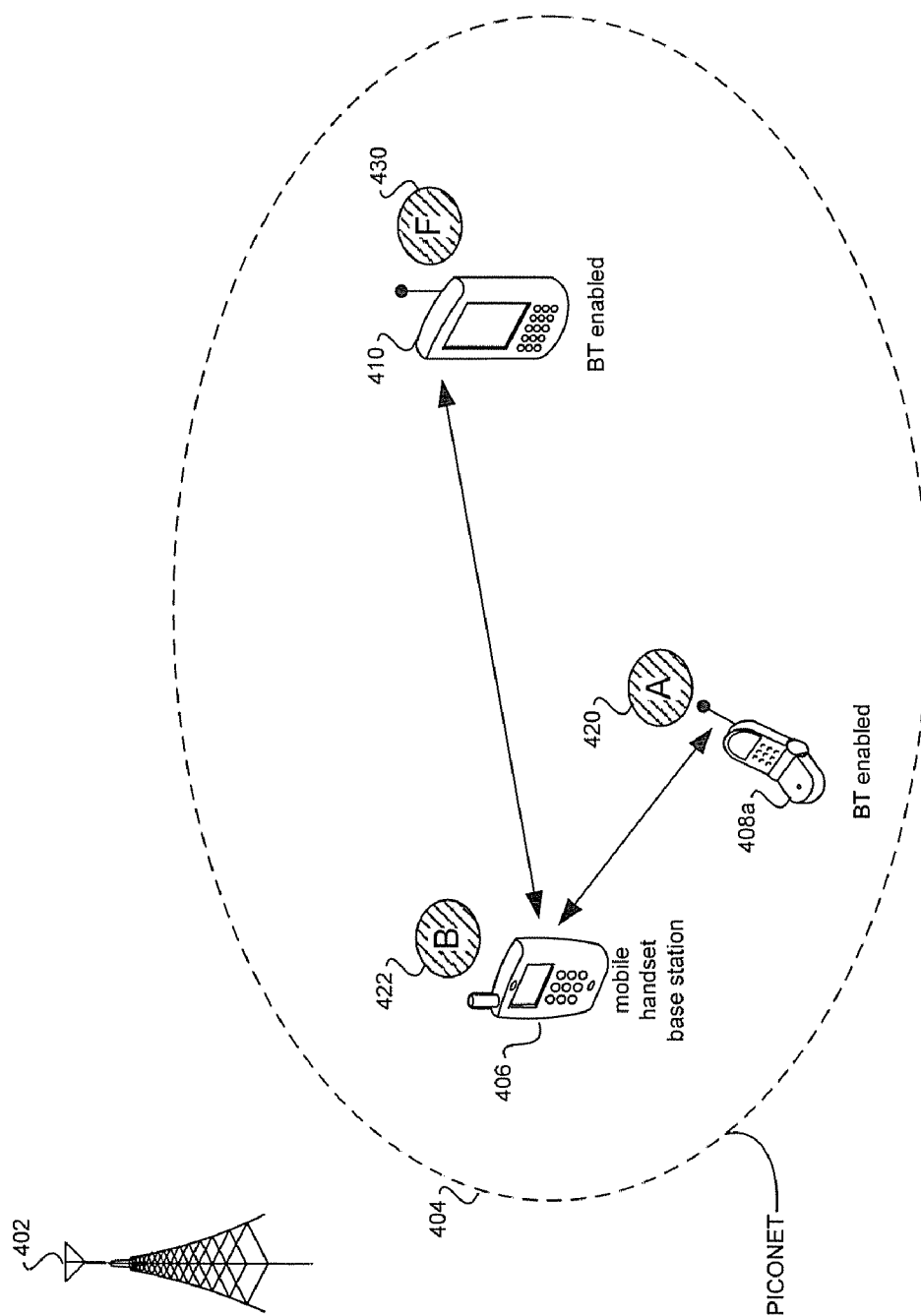


FIG. 4D

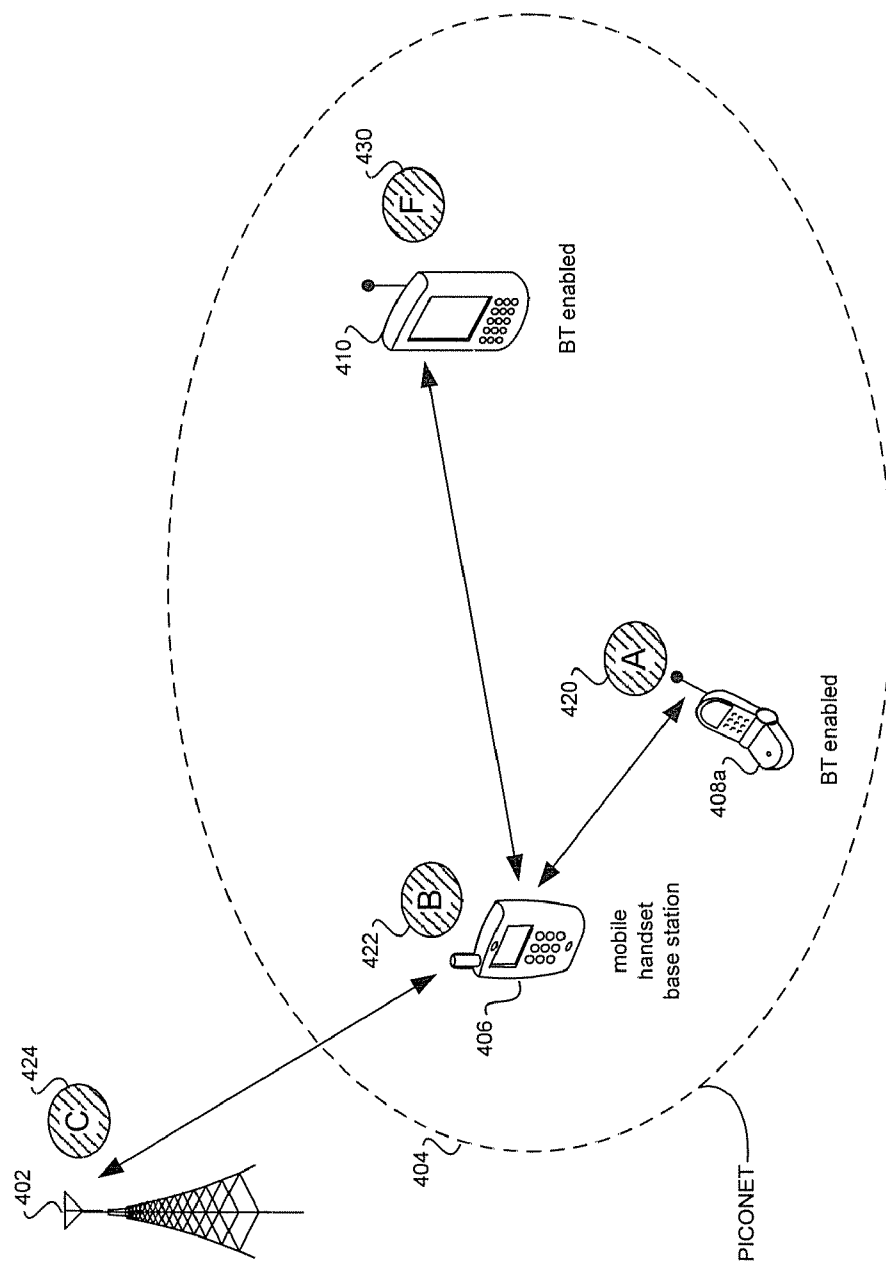


FIG. 4E

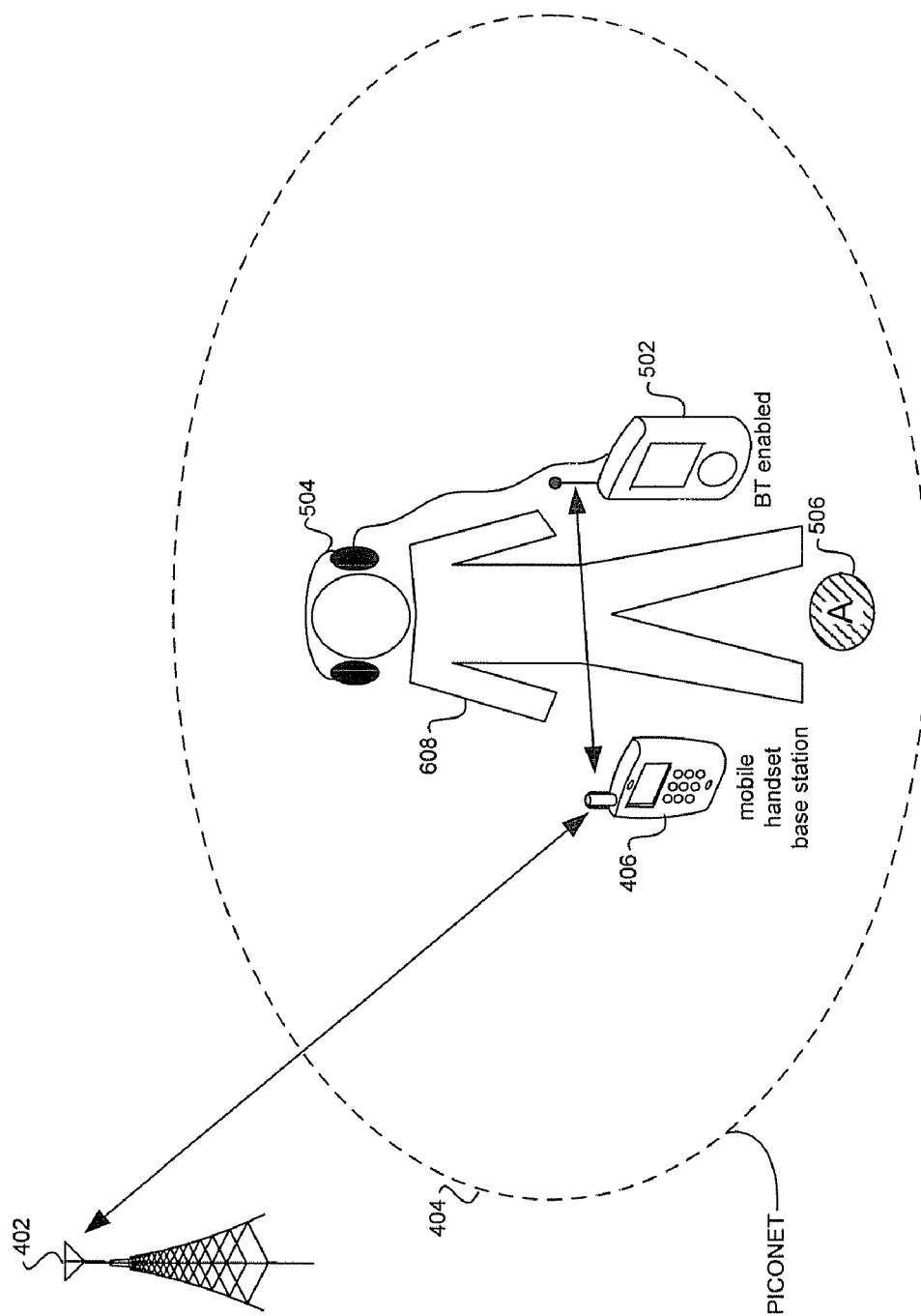


FIG. 5

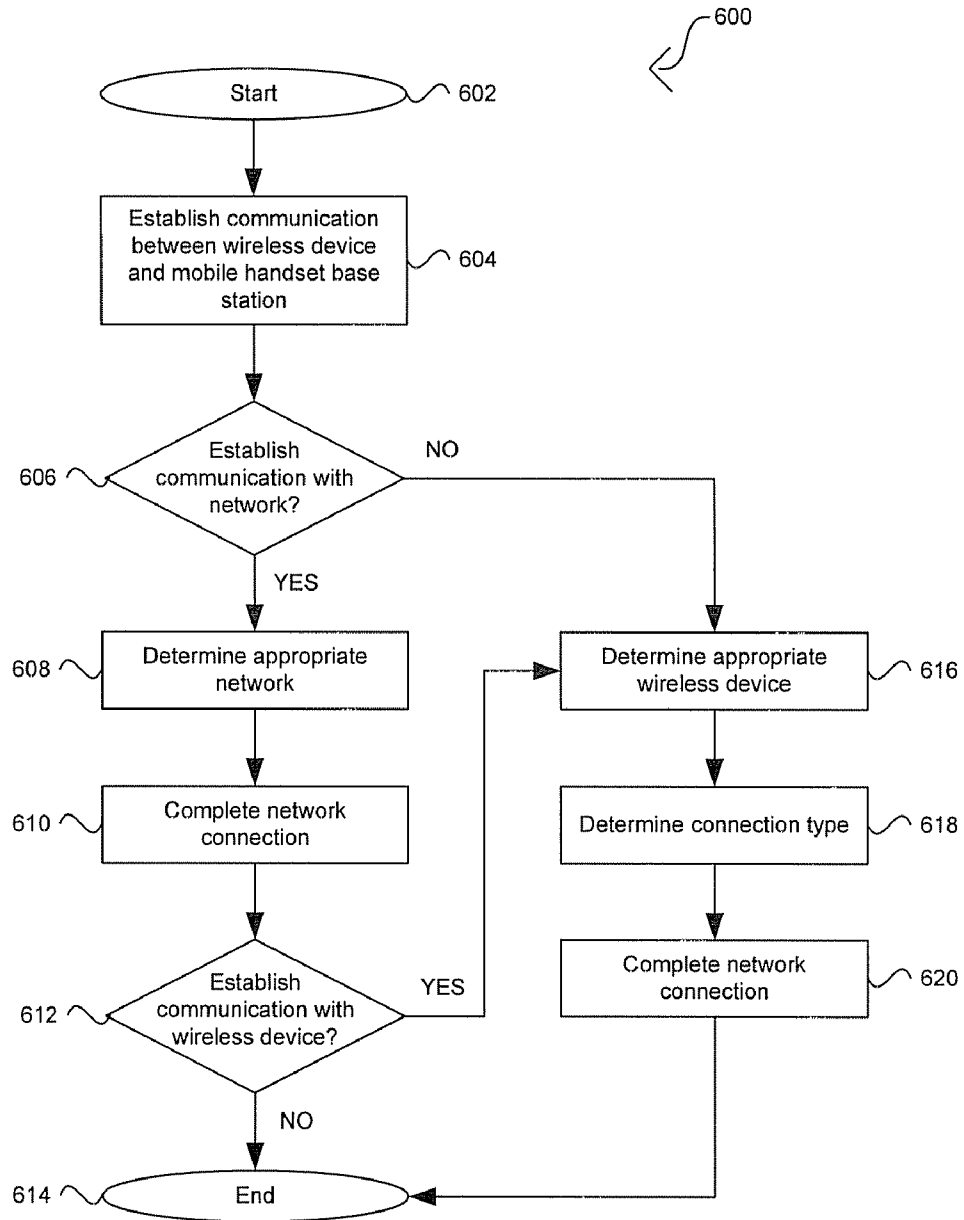
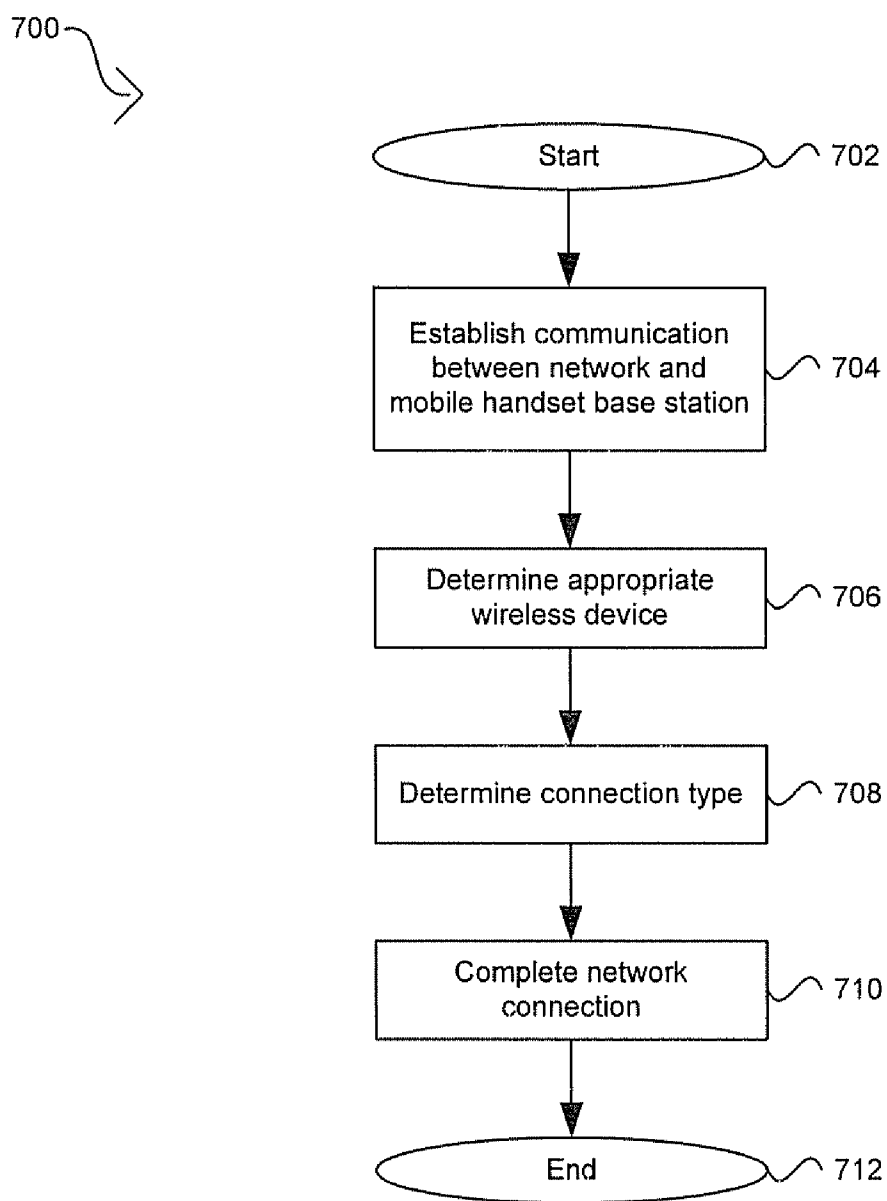


FIG. 6

**FIG. 7**

METHOD AND SYSTEM FOR A MOBILE PICONET BASE STATION

CROSS-REFERENCE TO RELATED APPLICATIONS/INCORPORATION BY REFERENCE

[0001] Not Applicable.

FIELD OF THE INVENTION

[0002] Certain embodiments of the invention relate to wireless communication networks. More specifically, certain embodiments of the invention relate to a method and system for a mobile piconet base station.

BACKGROUND OF THE INVENTION

[0003] More people everywhere in the world are using mobile phones. The continued growth in mobile phone use has been driven in part by the fact that wireless networks that support mobile phone usage have been deployed with more ease and at a lower cost than new wired networks, increasing the availability and coverage of mobile phone service. Factors such as the continued reduction in cost of the phones, the convenience and attractiveness of their small form factor, and/or the increase in features being made available in the phones themselves and by the service providers, have also played a significant role in the popularity of mobile phones. In this regard, the development of new technologies that have enabled low cost designs, small size devices, and/or added user features have been necessary in making mobile phones an attractive choice that, in some instances, has become an alternative to conventional wireline phones.

[0004] The increased processing capabilities made available by these new technologies are also enabling smarter mobile phone designs. Smart phones not only allow the user to make or receive calls, but may also operate as personal digital assistants providing features such as email, document processing, and/or task management, for example. Smart phones may also enable wireless connectivity with nearby devices such as headphones, keyboards, printers, and/or speakers, for example. In some instances, smart phones may also provide built-in music and/or video playing capabilities.

[0005] However, the growing numbers of features provided by smart phones, the need for large storage space, especially for audio and video applications, and the battery size requirements are resulting in bulkier and heavier devices, making them somewhat unattractive as substitutes for a user's existing or primary mobile phone. While smart phones tend to introduce additional features as technologies continue to improve, conventional mobile phones have instead utilized technological advances to make possible fashionable and/or small designs that are attractive as accessories to younger users. In this regard, there is a need to provide the expanding list of features and applications that are becoming available in smart phone designs in a manner that is convenient, practical, and/or attractive to a user of a conventional mobile phone.

[0006] Further limitations and disadvantages of conventional and traditional approaches will become apparent to one of skill in the art, through comparison of such systems

with some aspects of the present invention as set forth in the remainder of the present application with reference to the drawings.

BRIEF SUMMARY OF THE INVENTION

[0007] A system and/or method is provided for a mobile piconet base station, substantially as shown in and/or described in connection with at least one of the figures, as set forth more completely in the claims.

[0008] These and other advantages, aspects and novel features of the present invention, as well as details of an illustrated embodiment thereof, will be more fully understood from the following description and drawings.

BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWINGS

[0009] FIG. 1A is a diagram illustrating an exemplary cellular network coverage area, in accordance with an embodiment of the invention.

[0010] FIGS. 1B-1C are diagrams illustrating exemplary personal network regions or piconets associated with a mobile handset base station in the cellular network in FIG. 1A, in accordance with an embodiment of the invention.

[0011] FIG. 2A is a diagram illustrating an exemplary wireless local area network (WLAN) coverage area, in accordance with an embodiment of the invention.

[0012] FIG. 2B is a diagram illustrating exemplary cellular and WLAN networks for communicating with a mobile handset base station, in accordance with an embodiment of the invention.

[0013] FIG. 3 is a block diagram illustrating an exemplary system for a mobile handset base station, in accordance with an embodiment of the invention.

[0014] FIG. 4A is a diagram illustrating exemplary communication within a piconet via a mobile handset base station, in accordance with an embodiment of the invention.

[0015] FIG. 4B is a diagram illustrating an exemplary mode of operation for communicating between a wireless network and a Bluetooth-enabled handset in the piconet via a mobile handset base station, in accordance with an embodiment of the invention.

[0016] FIG. 4C is a diagram illustrating an exemplary mode of operation for communicating between or among Bluetooth-enabled handsets in the piconet via a mobile handset base station, in accordance with an embodiment of the invention.

[0017] FIG. 4D is a diagram illustrating an exemplary mode of operation for communicating between a Bluetooth-enabled handset and a Bluetooth-enabled communication device via a mobile handset base station, in accordance with an embodiment of the invention.

[0018] FIG. 4E is a diagram illustrating an exemplary mode of operation for communicating between a wireless network and a plurality of Bluetooth-enabled communication devices in the piconet via a mobile handset base station, in accordance with an embodiment of the invention.

[0019] FIG. 5 is a diagram illustrating an exemplary mode of operation that utilizes a wireless device for receiving communication sent to a mobile handset base station from a wireless network, in accordance with an embodiment of the invention.

[0020] FIG. 6 is a flow diagram illustrating exemplary steps for establishing communication between a wireless

device in the piconet and a wireless network via a mobile handset base station, in accordance with an embodiment of the invention.

[0021] FIG. 7 is a flow diagram illustrating exemplary steps for establishing communication between a wireless network and at least one wireless device in the piconet via a mobile handset base station, in accordance with an embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0022] Certain embodiments of the invention may be found in a method and system for a mobile piconet base station. Aspects of the invention may comprise switching and/or routing capabilities in mobile handset that may enable wireless devices to communicate with each other and/or with a wireless network via the mobile handset. The mobile handset operates as a base station for wireless devices within a personal area or piconet. For voice communication, for example, communication between a wireless device within the piconet and a cellular network or a voice-over-IP (VoIP) network may be established via the mobile handset. The selection between the cellular or VoIP network may be based on rate price and/or on features available in each of the networks, for example. Communication between the wireless devices and the base station mobile handset may occur via a Bluetooth connection and/or another type of wireless technology, for example. The wireless devices may be low-cost, small form factor mobile handsets, for example.

[0023] FIG. 1A is a diagram illustrating an exemplary cellular network coverage area, in accordance with an embodiment of the invention. Referring to FIG. 1A, there is shown a portion of a cellular network **100** that may comprise a first network cell **102a**, a second network cell **102b**, a third network cell **102c**, a fourth network cell **102d**, a fifth network cell **102e**, a sixth network cell **102f**, and a seventh network cell **102g**. Also shown in FIG. 1A is a mobile handset base station **104**. Associated with each of the network cells shown in the portion of the cellular network **100** may be a base station (BS) and a communication antenna. In this regard, there may be base stations **110a**, . . . , **110g** and communication antennas **108a**, . . . , **108g** that may be associated with the network cells **102a**, . . . , **102g**, respectively. In some instances, more than one communication antenna and/or base station may be associated with a network cell.

[0024] The base stations **110a**, . . . , **110g** may comprise suitable logic, circuitry, and/or code that may enable communication with a mobile terminal, such as the mobile handset base station **104**, for example, via at least one of a plurality of cellular technologies. The base stations **110a**, . . . , **110g** may enable processing and/or generation of signals necessary to establish, maintain, and/or terminate communication with a mobile terminal, such as the mobile handset base station **104**, for example. The base stations **110a**, . . . , **110g** may utilize cellular technologies such as global system for mobile communications (GSM), general packet radio service (GPRS), and/or enhanced data rates for GSM evolution (EDGE) technologies, for example. In this regard, each of the base stations in the network cells may utilize a corresponding GSM carrier frequency with a 200 kHz bandwidth, for example, to communicate with a mobile terminal in the network. The base stations **110a**, . . . , **110g**

may also utilize cellular technologies such as wideband CDMA (WCDMA), universal mobile telecommunications system (UMTS), and/or high speed downlink packet access (HSDPA) technologies, for example.

[0025] The communication antennas **108a**, . . . , **108g** may comprise suitable logic, circuitry, and/or code that may enable transmission and/or reception of signals to and/or from mobile terminals, such as the mobile handset base station **104**, for example. The communication antennas **108a**, . . . , **108g** may be communicatively coupled to the base stations **110a**, . . . , **110g**, respectively. The communication antenna **108a** may provide cellular communication coverage to mobile terminals in the geographic area or region that corresponds to the network cell **102a**. Similarly, communication antennas **108b**, . . . , **108g** may provide cellular communication coverage to mobile terminals in the geographic areas or regions that correspond to the network cells **102b**, . . . , **102g**, respectively. In some instances, there may be an overlap in the cellular communication coverage provided to a mobile terminal by adjacent or close network cells.

[0026] The mobile handset base station **104** may comprise suitable logic, circuitry, and/or code that may enable communication with the cellular network **100** over a plurality of radio access technologies, such as GSM and/or WCDMA technologies. The GSM technologies supported by the mobile handset base station **104** may be GSM, GPRS, and/or EDGE technologies, for example. The WCDMA technologies supported by the mobile handset base station **104** may be WCDMA, UMTS, and/or HSDPA technologies, for example. The mobile handset base station **104** may comprise cellular integrated circuits for receiving, processing, and/or transmitting cellular channels. The mobile handset base station **104** may enable communication via a plurality of uplink and downlink cellular channels, for example. The mobile terminal **102** may enable processing and/or generation of signals necessary to establish and/or maintain communication with network cells.

[0027] The mobile handset base station **104** may also comprise suitable logic, circuitry, and/or code that may enable communication with closely located wireless devices over a plurality of radio access technologies, such as Bluetooth, for example. The mobile handset base station **104** may also enable switching and/or routing operations to enable communication between at least a portion of the closely located wireless devices. Moreover, the mobile handset base station **104** may also enable switching and/or routing operations to enable communication between the cellular network **100** and at least a portion of the closely located wireless devices.

[0028] In operation, the mobile handset base station **104** may be located in an initial position **106a**, also labeled location A, and may receive cellular communication coverage from network cell **102b**. In this regard, the mobile handset base station **104** may communicate with the BS **110b** via the communication antenna **108b** utilizing at least one of a plurality of cellular technologies. Over time, the user of the mobile handset base station **104** may move from location A to other locations, for example. This is illustrated by moving from position A to a second position **106b**, also labeled location B, followed by a move to a third position **106c**, also labeled location C, and followed by a move to a final position **106**, also labeled location D. Cellular communication coverage may be provided to the mobile handset

base station **104** as it moves from locations B through D by the network cells **102d**, **102e**, and **102f**, respectively.

[0029] In each of the exemplary locations illustrated in FIG. 1A, the mobile handset base station **104** may enable communication among closely located wireless devices and/or between the closely located wireless devices and the cellular network **100**. In this regard, the mobile handset base station **104** may operate as a mobile base station that enables access to the cellular network **100** by closely located wireless devices that do not have direct access to the cellular network **100**.

[0030] The exemplary locations illustrated in FIG. 1A may correspond to a different mode of operation for the mobile handset base station **104**. For example, location A may correspond to the user's place of work and the mobile handset base station **104** may operate in a particular mode in location A. In the work place, the mobile handset base station **104** may provide voice communication while it may also enable the user to wirelessly communicate with a plurality of office devices such as printers and computers, for example.

[0031] In another example, location D may correspond to the user's home and the mobile handset base station **104** may operate in a different mode in location D. In the home, the mobile handset base station **104** may enable voice communication while it may also enable routing and/or switching operations for other wireless devices in the home to communicate with the cellular network **100** via the mobile handset base station **104**. In this regard, the mobile handset base station **104** may be utilized to replace cordless phones in the home while also enabling family members to use small and/or cost effective phones that communicate via the mobile handset base station **104**.

[0032] FIGS. 1B-1C are diagrams illustrating exemplary personal network regions or piconets associated with the mobile handset base station in the cellular network in FIG. 1A, in accordance with an embodiment of the invention. Referring to FIG. 1B, there is shown a network cell **120** and the mobile handset base station **104**. Associated with the network cell **120** may be a base station (BS) **124** and a communication antenna **122**. Cellular communication coverage may be provided to the mobile handset base station **104** by the network cell **120**, for example. Moreover, the mobile handset base station **104** may also enable closely located wireless devices to communicate with the network cell **120**. In this regard, a personal network region or piconet **126** may correspond to the geographic area or region where the mobile handset base station **104** provides coverage to closely located wireless devices. The geographic area or region of coverage provided by the mobile handset base station **104** may depend in part on transmission power employed by the type of communication technology utilized to communicate with closely located wireless devices, for example. For Bluetooth applications, the range of a Bluetooth-enabled device is approximately 10 m, for example.

[0033] As illustrated by FIG. 1B, the geographic area or region of coverage provided by the piconet **126** associated with the mobile handset base station **104** need not be located within the geographic area or region of coverage provided by the network cell **120**. In some instances, the region of coverage provided by the piconet **126** may overlap more than one network cell. Referring to FIG. 1C, there is shown an example where the geographic area or region of coverage provided by the piconet **126** associated with the mobile

handset base station **104** is located within the geographic area or region of coverage provided by the network cell **120**. In this exemplary embodiment of the invention, no overlap exists with the region of coverage provided by other network cells.

[0034] FIG. 2A is a diagram illustrating an exemplary wireless local area network (WLAN) coverage area, in accordance with an embodiment of the invention. Referring to FIG. 2A, the exemplary WLAN infrastructure network **200** shown may comprise a first basic service set (BSS) **202a**, a second BSS **202b**, a distributed system (DS) **204**, a wired network **206**, a portal **208**, a first access point (AP) **212a**, a second AP **202b**, a plurality of WLAN stations (STAs), and the mobile handset base station **104** illustrated in FIG. 1A. The BSSs **202a** and **202b** may represent a fundamental building block of the IEEE 802.11 (WLAN) architecture and may be defined as a group of stations (STAs) that are under the direct control of a single coordination function. The geographical area or region covered by a BSS is known as the basic service area (BSA). The DS **204** may be utilized to integrate the BSSs **202a** and **202b** and may comprise suitable hardware, logic, circuitry, and/or code that may be enabled to operate as a backbone network that is responsible for Medium Access Control (MAC) level transport in the WLAN infrastructure network **200**. The DS **204**, as specified by the IEEE 802.11 standard, is implementation independent. For example, the DS **204** may be implemented utilizing IEEE 802.3 Ethernet Local Area Network (LAN), IEEE 802.4 token bus LAN, IEEE 802.5 token ring LAN, Fiber Distributed Data Interface (FDDI) Metropolitan Area Network (MAN), or another IEEE 802.11 wireless medium. The DS **204** may be implemented utilizing the same physical medium as either the first BSS **202a** or the second BSS **202b**, for example. However, the DS **204** is logically different from the BSSs and may be utilized only to transfer packets between the BSSs and/or to transfer packets between the BSSs and the wired network **206**.

[0035] The wired network **206** may comprise suitable hardware, logic, circuitry, and/or code that may be enabled to provide wired networking operations. The wired network **206** may be accessed from the WLAN infrastructure network **200** via the portal **208**. The portal **208** may comprise suitable hardware, logic, circuitry, and/or code that may be enabled to integrate the WLAN infrastructure network **200** with non-IEEE 802.11 networks. Moreover, the portal **208** may also enable the functional operations of a bridge, such as range extension and/or translation between different frame formats, in order to integrate the WLAN infrastructure network **100** with IEEE 802.11-based networks.

[0036] The APs **212a** and **212b** may comprise suitable hardware, logic, circuitry, and/or code that may enable support of range extension of the WLAN infrastructure network **200** by providing the integration points necessary for network connectivity between the BSSs. The STA **210a** and the STA **210b** correspond to WLAN-enabled terminals that may comprise suitable hardware, logic, circuitry, and/or code that may be enabled to provide connectivity to the WLAN infrastructure network **200** via the APs. In this regard, the mobile handset base station **104** may also correspond to a WLAN-enabled terminal that may comprise suitable logic, circuitry, and/or code that may be enabled to provide connectivity to the WLAN infrastructure network **200** via the APs. The STA **210a** shown is a laptop computer and may correspond to a mobile station or terminal within

the BSS and the STA **210b** shown is a desktop computer and may correspond to a fixed or stationary terminal within the BSS. Each BSS may comprise a plurality of mobile or fixed stations and may not be limited to the exemplary implementation shown in FIG. 2A.

[0037] In addition to enabling communication with the WLAN infrastructure network **200**, the mobile handset base station **104** may also provide routing and/or switching operations that enable communication among closely located wireless devices within the region covered by the piconet **220**. Moreover, the mobile handset base station **104** may also provide routing and/or switching operations that enable communication between the closely located wireless devices and the WLAN infrastructure network **200**. As shown in FIG. 2A, the piconet **220** associated with the mobile handset base station **104** need not be located within the geographic area or region of coverage provided by the BSS **202b**. In some instances, the region of coverage provided by the piconet **220** may overlap more than one BSS.

[0038] In operation, the mobile handset base station **104** may be covered by the BSS **202a** and may establish communication with the WLAN infrastructure network **200** via the AP **212b**, for example. The wireless connection between the mobile handset base station **104** and the WLAN infrastructure network **200** may be utilized for voice and/or data communication. For voice communication, for example, the connection between the mobile handset base station **104** and the WLAN infrastructure network **200** may be utilized for voice-over-IP (VoIP) communications. The mobile handset base station **104**, in addition to enabling a user to establish voice and/or data communication with the WLAN infrastructure network **200**, may also enable users of closely located wireless devices within the piconet **220** to establish data and/or voice communication with the WLAN infrastructure network **200**.

[0039] FIG. 2B is a diagram illustrating exemplary cellular and WLAN networks for communicating with a mobile handset base station, in accordance with an embodiment of the invention. Referring to FIG. 2B, there is shown a network cell **120** associated with the cellular network **100** in FIG. 1A, a mobile handset base station **104**, and a basic service set **202b** associated with the WLAN infrastructure network **200** in FIG. 2A. The network cell **120** may comprise a communication antenna **122** and a base station **124** as illustrated in FIGS. 1B-1C. The basic service set **202b** may comprise an access point **212b** as illustrated in FIG. 2A. The mobile handset base station **104** may provide coverage service in the region defined by the piconet **220**.

[0040] The region of coverage of the network cell **120**, the basic service station **202b**, and the piconet **220** may overlap, enabling the user of the mobile handset base station **104** to communicate with either a cellular network or with a WLAN network. In this regard, the mobile handset base station **104** may be enabled to communicate with both networks concurrently, for example. Moreover, a user of closely located wireless devices within the piconet **220**, that may not be enabled to communicate directly with either the cellular network or the WLAN network, may communicate with either or both networks via the routing and/or switching operations provided by the mobile handset base station **104**. The mobile handset base station **104** may operate as a base station that enables the closely located wireless devices within the piconet **220** to establish communication links with the cellular and/or WLAN network. For example, the

closely located wireless devices may utilize a small form factor design that makes it attractive and convenient for users but that does not enable long range communication with, for example, the location of the communication antenna **122** and the AP **212**. However, the mobile handset base station **104** may be a larger device and, for example, may have a larger battery and/or may utilize stronger transmission amplifiers, that may provide sufficient transmission power to establish and/or maintain long range communication with either or both the communication antenna **122** and the AP **212b**. In this regard, the closely located wireless devices may communicate with the cellular network **100** and/or with the WLAN infrastructure network **200** via the routing and/or switching operations provided by mobile handset base station **104**.

[0041] FIG. 3 is a block diagram illustrating an exemplary system for a mobile handset base station, in accordance with an embodiment of the invention. Referring to FIG. 3, there is shown a mobile handset base station **300** that may comprise a processor **302**, a memory **304**, a switching and/or routing block **306**, at least one piconet radio **308**, at least one network radio **310**, at least one baseband processor **312**, and antennas **314a**, . . . , **314n**. In some instances, at least a portion of the components of the mobile handset base station **300** may be integrated into a single device, for example.

[0042] The processor **302** may comprise suitable logic, circuitry, and/or code that may enable controlling and/or managing operations of the mobile handset base station **300**. In this regard, user applications may be executed on the processor **302**, for example. The memory **304** may comprise suitable logic, circuitry, and/or code that may enable storing information associated with the operation of the mobile handset base station **300** and/or information associated with data received by the mobile handset base station **300**. For example, information that may be utilized for routing and/or switching operations may be stored in the memory **304**. Moreover, audio files, video files, and/or data files that may be accessed either by a network or by a closely located wireless device may be stored in the memory **304**.

[0043] The switching and/or routing block **306** may comprise suitable logic, circuitry, and/or code that may enable transmission and/or reception of data and/or voice via the mobile handset base station **300**. In this regard, the switching and/or routing block **306** may be utilized when establishing communication between or among closely located wireless devices within the piconet supported by the mobile handset base station **300** or when establishing communication between at least one of the closely located wireless devices within the piconet and at least one network.

[0044] The piconet radio **308** may comprise suitable logic, circuitry, and/or code that may enable transmitting and/or receiving signals to and/or from closely located wireless devices within the piconet supported by the mobile handset base station **300**. In this regard, the piconet radio **308** may utilize at least one of the antennas **314a**, . . . , **314n** for transmitting and/or receiving signals. The piconet radio **308** may enable processing of received signals and/or signals to be transmitted. For example, the piconet radio **308** may convert received analog signals into digital signals and/or convert digital signals into analog signals for transmission. The piconet radio **308** may enable downconverting received signals and/or upconverting signals for transmission. An example of a piconet radio **308** may be a Bluetooth radio.

Notwithstanding, a piconet radio **308** need not be limited to a Bluetooth radio and other wireless technologies may also be utilized.

[0045] The network radio **310** may comprise suitable logic, circuitry, and/or code that may enable transmission and/or reception of signals to and/or from networks supported by the mobile handset base station **300**, respectively. In this regard, the network radio **310** may utilize at least one of the antennas **314a**, . . . , **314n** for transmitting and/or receiving signals. The network radio **310** may enable processing of received signals and/or signals to be transmitted. For example, the network radio **310** may convert received analog signals into digital signals and/or may convert digital signals into analog signals for transmission. The network radio **308** may enable downconversion of received signals and/or upconversion of signals for transmission. Examples of a network radio **310** may be a cellular radio or a WLAN radio. A cellular radio may support at least one of cellular technologies such as global system for mobile communications (GSM), general packet radio service (GPRS), enhanced data rates for GSM evolution (EDGE), wideband CDMA (WCDMA), universal mobile telecommunications system (UMTS), and/or high speed downlink packet access (HSDPA) technologies. Notwithstanding, a network radio **310** need not be limited to a cellular radio or a WLAN radio.

[0046] The baseband processor **312** may comprise suitable logic, circuitry, and/or code that may enable processing of baseband signals that have been received from a piconet radio **308** or a network radio **310**. Moreover, the baseband processor **312** may also enable processing of baseband signals for transmission via a piconet radio **308** or a network radio **310**. The baseband processor **312** may perform, for example, digital signal processing operations. The baseband processor **312** may also provide control operations that may be utilized to modify the operations of a piconet radio **308** or a network radio **310**.

[0047] In operation, a communication connection, such as a Bluetooth connection, for example, may be established between the mobile handset base station **300** and a closely located wireless device via a piconet radio **308**. A communication connection, such as a cellular or WLAN connection, for example, may also be established between the mobile handset base station **300** and a network via a network radio. The baseband processor **312** may process data received and/or to be transmitted via the radios. The closely located wireless device and the network may communicate via the mobile handset base station **300** by utilizing the switching and/or routing operations available in the switching and/or routing block **306**. Data from the piconet radio **308** may be processed and the proper routing and/or switching information may be provided for communication to the network via the network radio **310**. Similarly, data from the network radio **310** may be processed and the proper routing and/or switching information may be provided for communication to the closely located wireless device via the piconet radio **308**. The memory **304** may be utilized to obtain routing and/or switching information, for example. The memory **304** may also be utilized to store audio, video, and/or data received from the closely located wireless device and/or the network. The processor **302** may control the operations of the various components of the mobile handset base station **300**.

[0048] In another embodiment of the invention, a communication connection, such as a Bluetooth connection, for

example, may be established between the mobile handset base station **300** and at least two closely located wireless device via a piconet radio **308**. The baseband processor **312** may process data received and/or to be transmitted via the radio. The closely located wireless devices may communicate via the mobile handset base station **300** by utilizing the switching and/or routing operations available in the switching and/or routing block **306**. Data received from one device by the piconet radio **308** may be processed and the proper routing and/or switching information may be provided for communication to a different device. The memory **304** may be utilized to obtain routing and/or switching information, for example. The memory **304** may also be utilized to store audio, video, and/or data received from the closely located wireless device and/or the network. The processor **302** may control the operations of the various components of the mobile handset base station **300**.

[0049] FIG. 4A is a diagram illustrating exemplary communication within a piconet via a mobile handset base station, in accordance with an embodiment of the invention. Referring to FIG. 4A, there is shown a mobile handset base station **406** with an associated geographic area or region of coverage illustrated by the piconet **404**. Also shown is a communication tower **402** associated with a network cell in a cellular network. The mobile handset base station **406** may correspond to the mobile handset base stations **104** and **300** in FIGS. 1A-3, for example. The communication tower **402** may correspond to one of the communication towers **108a**, . . . , **108g** in FIG. 1A, for example. A plurality of closely located wireless devices may be comprised within the area of coverage provided by the mobile handset base station **404**. The closely located wireless devices may comprise a plurality of mobile handsets **408a**, . . . , **408n**, a personal digital assistant (PDA) **410**, a keyboard **412**, and a printer **414**, for example. The closely located wireless devices may be Bluetooth enabled, for example. Notwithstanding the closely located wireless devices shown in FIG. 4A, the invention need not be so limited and other wireless devices and/or communication technologies may also be utilized.

[0050] The mobile handset base station **404** may communicate with a cellular network via the communication tower **402**. In this regard, the closely located wireless devices may also communicate with the cellular network via the mobile handset base station **404**. The mobile handsets **408a**, . . . , **408n** may comprise suitable logic, circuitry, and/or code that may enable communication via the mobile handset base station **406**. The mobile handsets **408a**, . . . , **408n** may be smaller, may have fewer features, and/or may utilize less power than the mobile handset base station **406**. In this regard, the smaller size and/or lower cost may enable handset manufacturers to make the mobile handsets **408a**, . . . , **408n** more attractive, stylish, and/or convenient to users while comprising a keypad that enables the mobile handsets **408a**, . . . , **408n** to operate like a regular phone. The mobile handsets **408a**, . . . , **408n** may communicate with other closely located wireless devices via the mobile handset base station **406**.

[0051] The PDA **410**, the keyboard **412**, and/or the printer **414** may comprise suitable logic, circuitry, and/or code that may enable communication via the mobile handset base station **406**. The keyboard **412** and/or the printer **414** may enable communication of data via the mobile handset base station **406**. The PDA **410** may enable communication of data, voice, and/or video via the mobile handset base station

406. The PDA **410**, the keyboard **412**, and/or the printer **414** may communicate with other closely located wireless devices via the mobile handset base station **406**.

[0052] FIG. 4B is a diagram illustrating an exemplary mode of operation for communicating between a wireless network and a Bluetooth-enabled handset in the piconet via a mobile handset base station, in accordance with an embodiment of the invention. Referring to FIG. 4B, there is shown the mobile handset base station **406**, the communication tower **402**, and the piconet **404** in FIG. 4A. Also shown is an access point (AP) **403**. The mobile handset **408a** may be in location **420**, also labeled position A, the mobile handset base station **406** may be in location **422**, also labeled position B, the communication tower **402** may be in location **424**, also labeled position C, and the AP **403** may be in location **426**, also labeled position D.

[0053] The position of the mobile handset base station **406**, that is, position B, is such that it is located within the cellular coverage provided by the communication tower **402** in position C and WLAN coverage provided by the access point **403** in position D. In this regard, the mobile handset base station **406** may communicate with either a cellular network or a WLAN network, for example. The WLAN network may be enabled to provide voice-over-IP (VoIP) communication, for example. The position of the mobile handset **408a**, that is, position A, is such that it is located within the geographic area or region of coverage of the mobile handset base station **406**, located in position A, and illustrated by the piconet **404**.

[0054] In operation, the mobile handset **408a** may be utilized to establish a phone call. The mobile handset **408a** may not be enabled to communicate directly with a network to enable the phone call to be established. The mobile handset **408a** may instead establish communication with the mobile handset base station **406** via a type of radio communication supported by both the mobile handset **408a** and the mobile handset base station **406**. In the exemplary embodiment described in FIG. 4B, the mobile handset **408a** may be Bluetooth (BT) enabled and may communicate with the mobile handset base station **406** via a Bluetooth connection.

[0055] The mobile handset base station **406** may then establish the phone call by establishing communication between the mobile handset **408a** and either a cellular network via the communication antenna **402** in position C or with a WLAN supporting VoIP via the access point **403** in position D. In this regard the mobile handset base station **406** may utilize routing and/or switching operations to establish the connection. The mobile handset base station **406** may decide whether to select the cellular network and the corresponding cellular network provider or the WLAN network based on rate information, user information, and/or other related information. For example, the mobile handset base station **406** may utilize current rates for either network, remaining minutes available to the user associated with the mobile handset base station **406**, and/or special rates or discounts available to the user of the mobile handset base station **406** to determine whether to select the cellular network or the WLAN network for establishing the phone call originated by the mobile handset **408a**. The information utilized by the mobile handset base station **406** may be stored in memory, such as the memory **304** in FIG. 3, for example.

[0056] The mode of operation described in FIG. 4B may occur, for example, when the mobile handset base station **406** is brought home and is docked for recharging and wireless devices, such as the mobile handsets **408a**, . . . , **408n**, for example, may utilize the mobile handset base station **406** to make phone calls. In this regard, the wireless devices may be enabled to communicate with the mobile handset base station **406** via at least one wireless protocol such as Bluetooth, WLAN, ZigBee, and/or ultra-wideband (UWB), for example. In some instances, the mobile handset base station **406** may enable a wireless device to establish a phone call via a personal computer (PC) by utilizing a PC-based commercially available VoIP service.

[0057] FIG. 4C is a diagram illustrating an exemplary mode of operation for communicating between or among Bluetooth-enabled handsets in the piconet via a mobile handset base station, in accordance with an embodiment of the invention. Referring to FIG. 4C there is shown the mobile handset base station **406**, the communication tower **402**, and the piconet **404** in FIG. 4A. Also shown are a first mobile handset **408a** and a second mobile handset **408n**. The first mobile handset **408a** may be in location **420**, also labeled position A, the mobile handset base station **406** may be in location **422**, also labeled position B, and second mobile handset **408n** may be in location **428**, also labeled position E. The first and second mobile handsets **408a** and **408n** are both located within the geographic region or area of coverage provided by the mobile handset base station **406** as illustrated by the piconet **404**.

[0058] In operation, the first mobile handset **408a** in position A may be utilized to establish a phone call or voice communication with the second mobile handset **408a** in position E. As a result of its small size and reduced features available, the first mobile handset **408a** may not be enabled to communicate directly with the second mobile handset **408a** to enable the phone call to be established. The first mobile handset **408a** may instead establish communication with the mobile handset base station **406** via a type of radio communication supported by both the first mobile handset **408a** and the mobile handset base station **406**. In the exemplary embodiment of the invention disclosed in FIG. 4C, the first mobile handset **408a** may be Bluetooth (BT) enabled and may communicate with the mobile handset base station **406** via a Bluetooth connection.

[0059] The mobile handset base station **406** may then establish the phone call by establishing communication between the first mobile handset **408a** and the second mobile handset **408n**. The mobile handset base station **406** may establish communication with the second mobile handset **408n** via a type of radio communication supported by both the second mobile handset **408n** and the mobile handset base station **406**. In the exemplary embodiment described in FIG. 4C, the second mobile handset **408n** may be Bluetooth (BT) enabled and may communicate with the mobile handset base station **406** via a Bluetooth connection. The mobile handset base station **406** may utilize routing and/or switching operations to establish the connection between the first and second mobile handsets **408a** and **408n**.

[0060] The mode of operation described in FIG. 4C may occur in, for example, a home where the use of multiple cordless phones in various locations within the home may be replaced by a central mobile handset base station and multiple smaller mobile handsets that may be utilized by various members of the household. Notwithstanding the

illustrative example provided in FIG. 4C, other embodiments of the invention may comprise communication between closely located wireless devices within the piconet 404 other than voice communication, the use of wireless technologies other than Bluetooth technology, and/or communication among more than two closely located wireless devices.

[0061] FIG. 4D is a diagram illustrating an exemplary mode of operation for communicating between a Bluetooth-enabled handset and a Bluetooth-enabled communication device via a mobile handset base station, in accordance with an embodiment of the invention. Referring to FIG. 4D there is shown the mobile handset base station 406, the communication tower 402, and the piconet 404 in FIG. 4A. Also shown are a mobile handset 408a and a communication device, such as the PDA 410, that is enabled for voice and/or data communication. The mobile handset 408a may be in location 420, also labeled position A, the mobile handset base station 406 may be in location 422, also labeled position B, and the PDA 410 may be in location 430, also labeled position F. The mobile handset 408a and the PDA 410 are both located within the geographic region or area of coverage provided by the mobile handset base station 406 as illustrated by the piconet 404.

[0062] In operation, the mobile handset 408a in position A may be utilized to establish a phone call or voice communication and/or data communication with the PDA 410 in position F. As a result of its small size and reduced features available, the mobile handset 408a may not be enabled to communicate directly with the PDA 410 to enable the phone call to be established. The mobile handset 410 may instead establish communication with the mobile handset base station 406 via a type of radio communication supported by both the mobile handset 408a and the mobile handset base station 406. In the exemplary embodiment of the invention disclosed in FIG. 4D, the mobile handset 408a may be Bluetooth (BT) enabled and may communicate with the mobile handset base station 406 via a Bluetooth connection.

[0063] The mobile handset base station 406 may then establish the phone call by establishing communication between the mobile handset 408a and the PDA 410. The mobile handset base station 406 may establish communication with the PDA 410 via a type of radio communication supported by both the PDA 410 and the mobile handset base station 406. In the exemplary embodiment described in FIG. 4C, the PDA 410 may be Bluetooth (BT) enabled and may communicate with the mobile handset base station 406 via a Bluetooth connection. The mobile handset base station 406 may utilize routing and/or switching operations to establish the connection between the mobile handset 408a and the PDA 410. A similar approach may be followed when establishing a connection from the PDA 410 to the mobile handset 408a, for example.

[0064] The mode of operation described in FIG. 4D may also occur in, for example, a home where the use of multiple cordless phones in various locations within the home may be replaced by a central mobile handset base station and multiple smaller mobile handsets that may be utilized by various members of the household. In this regard, a user with a communication device such as the PDA 410, for example, may also utilize the centralized wireless approach enabled by the mobile handset base station.

[0065] FIG. 4E is a diagram illustrating an exemplary mode of operation for communicating between a wireless

network and a plurality of Bluetooth-enabled communication devices in the piconet via a mobile handset base station, in accordance with an embodiment of the invention. Referring to FIG. 4E, there is shown the mobile handset base station 406, the communication tower 402, and the piconet 404 in FIG. 4A. Also shown are the mobile handset 408a and the PDA 410. The mobile handset 408a may be in location 420, also labeled position A, the mobile handset base station 406 may be in location 422, also labeled position B, the communication tower 402 may be in location 424, also labeled position C, and the PDA 410 may be in location 430, also labeled position F. The mobile handset 408a and the PDA 410 may be both located within the geographic region or area of coverage provided by the mobile handset base station 406 as illustrated by the piconet 404.

[0066] In operation, the mobile handset 408a and/or the PDA 410, that is, the closely located wireless devices in the piconet 404, may be utilized to establish a phone call. The mobile handset 408a and/or the PDA 410 may not be enabled to communicate directly with a network to enable the phone call to be established. The wireless devices may instead establish communication with the mobile handset base station 406 via a type of radio communication supported by both the mobile handset 408a and wireless devices. In the exemplary embodiment described in FIG. 4E, the mobile handset 408a and the PDA 410 may be Bluetooth (BT) enabled and may communicate with the mobile handset base station 406 via Bluetooth connections. The mobile handset base station 406 may then establish the phone call by establishing communication between the mobile handset 408a and/or the PDA 410 and the cellular network associated with the communication antenna 402 in position C. In this regard the mobile handset base station 406 may utilize routing and/or switching operations to establish the connection. Notwithstanding the illustrative example provided in FIG. 4E, other embodiments of the invention may comprise a plurality of closely located wireless devices within the piconet 404 concurrently communicating with a network via the mobile handset base station 406.

[0067] FIG. 5 is a diagram illustrating an exemplary mode of operation that utilizes a wireless device for receiving communication sent to a mobile handset base station from a wireless network, in accordance with an embodiment of the invention. Referring to FIG. 5, there is shown the mobile handset base station 406, the communication tower 402, and the piconet 404 in FIG. 4A. Also shown are a user 506, an audio or music player 502, and a headset 504. The user 506 may be in location 508, also labeled position A, and may be carrying the mobile handset base station 406, the audio or music player 502, and the headset 504. The user 506 is located within the geographic region or area of coverage provided by the mobile handset base station 406 as illustrated by the piconet 404.

[0068] In operation, the mobile handset base station 406 may receive an incoming phone call from the cellular network associated with the communication tower 422. The mobile handset base station 406 may then establish communication with the audio or music player 502 via a type of radio communication supported by both the audio player 502 and the mobile handset base station 406. In the exemplary embodiment described in FIG. 5, the mobile handset base station 406 and the audio or music player 502 may be Bluetooth (BT) enabled and may communicate via a Bluetooth connection. The phone call may then received by the

user **506** via the audio or music player **502** and the headset **504**. The user **506** need not reach for the mobile handset base station **406** when a phone call occurs but may instead receive the phone call via the audio or music player **502**. Voice-enabled wireless devices other than an audio or music player may also be utilized in a similar approach.

[0069] FIG. 6 is a flow diagram illustrating exemplary steps for establishing communication between a wireless device in the piconet and a wireless network via a mobile handset base station, in accordance with an embodiment of the invention. Referring to FIG. 6, there is shown a flow diagram **600**. After start step **602**, in step **604**, a wireless device within the piconet of a mobile handset base station, such as the mobile handset base station **104** and **406** in FIGS. 1A-5, may establish communication with the mobile handset base station. Communication between the mobile handset base station and the wireless device in the piconet may be via one of a plurality of wireless technologies, such as Bluetooth technology, for example, that may be supported by the mobile handset base station and/or the wireless device. The wireless device may be a mobile handset, for example.

[0070] In step **606**, when the wireless device is requesting communication with a network, such as a cellular network or a WLAN network, for example, via the mobile handset base station, the process may proceed to step **608**. In step **608**, the mobile handset base station may determine the appropriate network for communicating with the wireless device in the piconet. For example, for voice communication, such as a phone call, the mobile handset base station may determine whether a cellular call or a VoIP call via a WLAN may be more cost effective and may select the network based on calling rates. In step **610**, the mobile handset base station may complete the connection by establishing communication with the appropriate network. In this regard, the mobile handset base station may utilize routing and/or switching operations to establish the connection between the wireless device in the piconet and the appropriate network. In step **612**, when the wireless device need not communicate with another wireless device in the piconet, the process may proceed to end step **614**. When the wireless device does need to communicate with another wireless device in the piconet, the process may proceed to step **616**.

[0071] Returning to step **606**, when the wireless device is requesting communication with another wireless device in the piconet via the mobile handset base station, the process may proceed to step **616**. The other or target wireless device may be a mobile handset, for example. In step **616**, the mobile handset base station may determine the appropriate target wireless device for establishing communication. Information regarding the available wireless devices in the piconet may be stored in the mobile handset base station. In step **618**, the mobile handset base station may determine the appropriate wireless technology that may be utilized to communicate with the target wireless device. In this regard, there may be more than one wireless technology that may be utilized for communicating with the target wireless device and the mobile handset base station may determine the appropriate connection type based on factors such as connection strength, throughput, and/or capacity, for example. An example of a wireless technology or connection type may be a Bluetooth connection. In step **620**, the mobile handset base station may complete the connection by estab-

lishing communication with the appropriate target wireless device. In this regard, the mobile handset base station may utilize routing and/or switching operations to establish the connection between the initiating wireless device and the appropriate target wireless device. After step **620**, the process may proceed to end step **614**.

[0072] FIG. 7 is a flow diagram illustrating exemplary steps for establishing communication between a wireless network and at least one wireless device in the piconet via a mobile handset base station, in accordance with an embodiment of the invention. Referring to FIG. 7, there is shown a flow diagram **700**. After start step **702**, in step **704**, a network may establish communication with the mobile handset base station. The network may be a cellular network or a WLAN network, for example. In step **706**, the mobile handset base station may determine the appropriate target wireless device for establishing communication. Information regarding the available wireless devices in the piconet may be stored in the mobile handset base station. In step **708**, the mobile handset base station may determine the appropriate wireless technology that may be utilized to communicate with the target wireless device. In this regard, there may be more than one wireless technology that may be utilized for communicating with the target wireless device and the mobile handset base station may determine the appropriate connection type based on factors such as connection strength, throughput, and/or capacity, for example. An example of a wireless technology or connection type may be a Bluetooth connection. In step **710**, the mobile handset base station may complete the connection by establishing communication with the appropriate target wireless device. In this regard, the mobile handset base station may utilize routing and/or switching operations to establish the connection between the initiating network and the appropriate target wireless device in the piconet. After step **710**, the process may proceed to end step **712**.

[0073] As technologies continue to improve, additional features and/or connectivity may be provided via a smart phone, such as a mobile handset base station for example, while conventional mobile phones may utilize technological advances to make possible fashionable and/or small designs that are attractive as accessories to younger users. The approach described herein may enable providing the expanding list of features and applications that are becoming available in smart phone designs in a manner that is convenient, practical, and/or attractive to a user of a conventional mobile phone.

[0074] Accordingly, the present invention may be realized in hardware, software, or a combination of hardware and software. The present invention may be realized in a centralized fashion in at least one computer system, or in a distributed fashion where different elements are spread across several interconnected computer systems. Any kind of computer system or other apparatus adapted for carrying out the methods described herein is suited. A typical combination of hardware and software may be a general-purpose computer system with a computer program that, when being loaded and executed, controls the computer system such that it carries out the methods described herein.

[0075] The present invention may also be embedded in a computer program product, which comprises all the features enabling the implementation of the methods described herein, and which when loaded in a computer system is able to carry out these methods. Computer program in the present

context means any expression, in any language, code or notation, of a set of instructions intended to cause a system having an information processing capability to perform a particular function either directly or after either or both of the following: a) conversion to another language, code or notation; b) reproduction in a different material form.

[0076] While the present invention has been described with reference to certain embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted without departing from the scope of the present invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the present invention without departing from its scope. Therefore, it is intended that the present invention not be limited to the particular embodiment disclosed, but that the present invention will include all embodiments falling within the scope of the appended claims.

What is claimed is:

1. A method for wireless networking, the method comprising:

communicating via at least one of switching and routing capabilities in a mobile handset, information between a wireless device and at least one of a wireless network and an additional wireless device.

2. The method according to claim 1, comprising establishing communication between said wireless device and said additional wireless device via said mobile handset.

3. The method according to claim 1, comprising establishing communication between said wireless device and said wireless network via said mobile handset.

4. The method according to claim 3, comprising dynamically selecting said wireless network between a cellular network and a voice-over-IP (VoIP) network for voice communication.

5. The method according to claim 4, wherein said dynamically selecting between said cellular network and said VoIP network is based on cost associated with said voice communication in each of said networks.

6. The method according to claim 1, comprising communicating between said mobile handset and said wireless device via a Bluetooth connection.

7. The method according to claim 1, comprising communicating between said mobile handset and said additional wireless device via a Bluetooth connection.

8. The method according to claim 1, wherein said wireless device is a mobile handset.

9. A machine-readable storage having stored thereon, a computer program having at least one code section for wireless networking, the at least one code section being executable by a machine for causing the machine to perform steps comprising:

communicating via at least one of switching and routing capabilities in a mobile handset, information between a wireless device and at least one of a wireless network and an additional wireless device.

10. The machine-readable storage according to claim 9, comprising code for establishing communication between said wireless device and said additional wireless device via said mobile handset.

11. The machine-readable storage according to claim 9, comprising code for establishing communication between said wireless device and said wireless network via said mobile handset.

12. The machine-readable storage according to claim 11, comprising code for dynamically selecting said wireless network between a cellular network and a voice-over-IP (VoIP) network for voice communication.

13. The machine-readable storage according to claim 12, wherein said dynamically selecting between said cellular network and said VoIP network is based on cost associated with said voice communication in each of said networks.

14. The machine-readable storage according to claim 9, comprising code for communicating between said mobile handset and said wireless device via a Bluetooth connection.

15. The machine-readable storage according to claim 9, comprising code for communicating between said mobile handset and said additional wireless device via a Bluetooth connection.

16. The machine-readable storage according to claim 9, wherein said wireless device is a mobile handset.

17. A system for wireless networking, the system comprising:

a mobile handset having at least one of switching and routing capabilities, the mobile handset enables communication of information between a wireless device and at least one of a wireless network and an additional wireless device via said at least one of switching and routing capabilities.

18. The system according to claim 17, wherein said mobile handset enables establishing communication between said wireless device and said additional wireless device.

19. The system according to claim 17, wherein said mobile handset enables establishing communication between said wireless device and said wireless network.

20. The system according to claim 19, wherein said wireless network comprises a cellular network and a voice-over-IP (VoIP) network, and said mobile handset enables dynamically selecting between said cellular network and said voice-over-IP (VoIP) network for voice communication.

21. The system according to claim 20, wherein said mobile handset enables dynamically selecting between said cellular network and said VoIP network based on cost associated with said voice communication in each of said networks.

22. The system according to claim 17, wherein said mobile handset enables communication between said mobile handset and said wireless device via a Bluetooth connection.

23. The system according to claim 17, wherein said mobile handset enables communication between said mobile handset and said additional wireless device via a Bluetooth connection.

24. The system according to claim 17, wherein said additional wireless device is a mobile handset.

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