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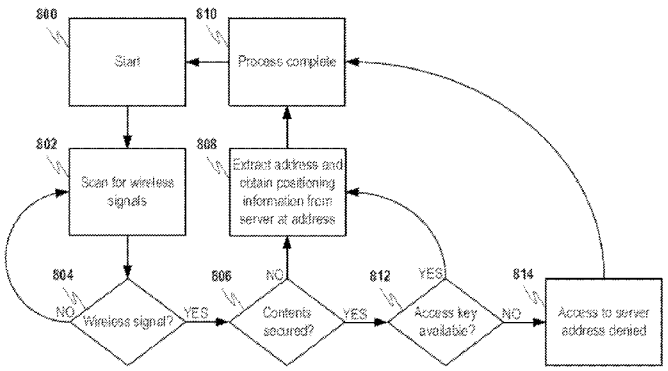
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[Continued on next page]

(54) **Title**: SERVER ADDRESS DISTRIBUTION

FIG. 8



(57) **Abstract**: A system for conveying information usable in positioning. Apparatuses may receive wireless signals, for example, when entering into an area that is serviced by a localized positioning system. Upon receiving at least one wireless signal in an apparatus (804), the apparatus may determine if information in the at least one wireless signal can be accessed (812). If it is determined that the information in the at least one wireless signal can be accessed, the apparatus may further access a server utilizing the information in the at least one wireless signal and may receive positioning information into the apparatus from the server (808).

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SERVER ADDRESS DISTRIBUTION

BACKGROUND

1. Field of Invention:

[0001] The present invention relates to wireless communication, and in particular, to the provision of information usable for performing positioning operations in communication signals.

2. Background:

[0002] The desire for apparatuses to serve in a multitude of roles is driving designers to incorporate more and more functionality into emerging devices. Wireless-enabled apparatuses are not only limited to the traditional conveyance of audio information, such as during telephonic operations, but may also convey video and other types of information for supporting a multitude of applications. For example, various applications may provide functionality on the surface that relies upon underlying wireless interaction for support. Obvious examples of such applications include programs that allow users to communicate directly with other users or resources, such as email, messaging services, Internet browsers, etc. There are also categories of applications that may provide services not directly related to user communication with other users or resources, but that still rely on underlying wireless exchange of information. Positioning-related services encompass a growing segment of applications that provide location services to users, such as mapping, route determination, tracking, etc., that rely upon wireless interaction for execution.

[0003] Positioning-related services may include known user-related applications, such as visual representations of locations or routes that may be displayed for users while underlying wireless communication is used to determine current apparatus position, direction, orientation, etc. However, other uses such as user/object tracking, location-specific social networking and commercial messaging, enhanced visual recognition, etc. are now becoming available that makes the ability to determine apparatus position a desirable feature to provide in mobile apparatuses. Positioning may be implemented using a variety of available technologies. For example, devices may incorporate global positioning system (GPS) receivers to receive signals from satellites for formulating an

absolute (fixed) coordinate position. Terrestrial technologies (e.g., earth based cellular signals or short-range wireless interaction), while not as exact, may also be relied upon to resolve an absolute or relative (e.g., with respect to a signal source) apparatus position.

[0004] While incorporating positioning technologies in a variety of apparatuses may be possible, the implementation may not always be practical. Positioning operations may create a strain on apparatus resources as the rate at which position information needs to be updated may vary depending on the resolution needed, the rate of position change, etc. Apparatuses that have ample processing and energy resources may still rely upon controls that limit processing and energy consumption. It is therefore foreseeable that the implementation of positioning services in apparatuses that may have more limited resources will present a challenge to designers. For example, desired applications such as user/object tracking may utilize mobile battery-powered apparatuses as beacons, sensors, etc. These devices may have extremely limited processing and communication ability, may not possess adequate size for dedicate positioning hardware and/or software, may not have the power capacity to support dedicated positioning operations, etc.

[0005] Moreover, the architecture of localized positioning systems (e.g., in a building) is currently not governed by any standard. This means that while, in general, localized positioning systems may be based on similar information structures, the manner in which information may be delivered and processed depends on how a certain positioning system has been implemented. Examples of information used in these systems may comprise maps, the identification of certain signal emitters or "beacons" for synchronizing navigation, information about various points of interest within the navigation area, etc. This information may be both available and desirable for apparatuses to use when positioning, but the manner of availability may not be readily apparent.

SUMMARY

[0006] Various example embodiments of the present invention may be directed to at least a method, apparatus, computer program product and system for conveying information usable in positioning. Apparatuses may receive wireless signals, for example, when entering into an area that is serviced by a localized positioning system. Upon receiving at least one wireless signal in an apparatus, the apparatus may determine if information in the at least one wireless signal can be accessed. If it is determined that the

information in the at least one wireless signal can be accessed, the apparatus may further access a server utilizing the information in the at least one wireless signal and may receive positioning information into the apparatus from the server.

[0007] In some cases the at least one wireless signal may be encrypted, and determining if the information in the at least one wireless signal can be accessed may depend upon whether the apparatus has a key usable for decrypting the at least one wireless signal. The information in the at least one wireless signal may include at least an address (e.g., a universal resource locator, or URL, address, an Internet Protocol, or IP, address, or another form of navigable identification information) for a server from which positioning information may be obtained. The manner in which the address is delivered to the receiving apparatus may depend on the type of wireless communication employed. For example, the at least one wireless signal may actually comprise one or more Bluetooth name request (LMP_name_req) packets whose combined contents may comprise the address. Alternatively, the at least one wireless signal may be a Bluetooth Low Energy beacon packet, wherein the server address is contained within the protocol data unit (PDU) of the beacon packet. The at least one packet may also be at least one Wi-Fi beacon packet including the server address in an information element (IE) in the payload of the packet.

[0008] The address of the server may be utilized by the apparatus to obtain positioning information. For example, the positioning information may comprise an absolute or relative coordinate position corresponding to the source of the at least one wireless signal. Positioning information may also comprise map information corresponding to an area including the source of the at least one wireless signal. The positioning information may be utilized by the apparatus to perform various positioning related functionality including, for example, determining the current position of the apparatus, displaying the current position of the apparatus with respect to a map, determining a route to follow in order for the user/apparatus to arrive at a certain destination, etc.

[0009] The foregoing summary includes example embodiments of the present invention that are not intended to be limiting. The above embodiments are used merely to explain selected aspects or steps that may be utilized in implementations of the present invention. However, it is readily apparent that one or more aspects, or steps, pertaining to

an example embodiment can be combined with one or more aspects, or steps, of other embodiments to create new embodiments still within the scope of the present invention. Therefore, persons of ordinary skill in the art would appreciate that various embodiments of the present invention may incorporate aspects from other embodiments, or may be implemented in combination with other embodiments.

DESCRIPTION OF DRAWINGS

[0010] The invention will be further understood from the following description of various example embodiments, taken in conjunction with appended drawings, in which:

[0011] FIG. 1A discloses example apparatuses, systems, configurations, etc. that may be utilized when implementing the various embodiments of the present invention

[0012] FIG. 1B discloses further detail regarding an example apparatus configuration that may be utilized when implementing the various embodiments of the present invention.

[0013] FIG. 2A discloses an example operational scenario in accordance with at least one embodiments of the present invention.

[0014] FIG. 2B discloses information that may be exchanged in the operational scenario of FIG. 2A in accordance with at least one embodiments of the present invention.

[0015] FIG. 3 discloses an example of a Bluetooth interaction including a name request in accordance with at least one embodiment of the present invention.

[0016] FIG. 4 discloses an example modified Bluetooth name request interaction in accordance with at least one embodiment of the present invention.

[0017] FIG. 5 discloses an example modified Bluetooth Low Energy (Bluetooth LE) packet in accordance with at least one embodiment of the present invention.

[0018] FIG. 6 discloses an example modified Wi-Fi packet in accordance with at least one embodiment of the present invention.

[0019] FIG. 7 discloses another example modified Wi-Fi packet in accordance with at least one embodiment of the present invention.

[0020] FIG. 8 discloses a flowchart of an example communication process in accordance with at least one embodiment of the present invention.

DESCRIPTION OF EXAMPLE EMBODIMENTS

[0021] While the invention has been described below in terms of a multitude of example embodiments, various changes can be made therein without departing from the spirit and scope of the invention, as described in the appended claims.

I. Example system with which embodiments of the present invention may be implemented

[0022] An example of a system that is usable for implementing various embodiments of the present invention is disclosed in FIG. 1A. The system comprises elements that may be included in, or omitted from, configurations depending, for example, on the requirements of a particular application, and therefore, is not intended to limit present invention in any manner.

[0023] Computing device 100 may be, for example, a laptop computer. Elements that represent basic example components comprising functional elements in computing device 100 are disclosed at 102-108. Processor 102 may include one or more devices configured to execute instructions. In at least one scenario, the execution of program code (e.g., groups of computer-executable instructions stored in a memory) by processor 102 may cause computing device 100 to perform processes including, for example, method steps that may result in data, events or other output activities. Processor 102 may be a dedicated (e.g., monolithic) microprocessor device, or may be part of a composite device such as an ASIC, gate array, multi-chip module (MCM), etc.

[0024] Processor 102 may be electronically coupled to other functional components in computing device 100 via a wired or wireless bus. For example, processor 102 may access memory 104 in order to obtain stored information (e.g., program code, data, etc.) for use during processing. Memory 104 may generally include removable or embedded memories that operate in a static or dynamic mode. Further, memory 104 may include read only memories (ROM), random access memories (RAM), and rewritable memories such as Flash, EPROM, etc. Code may include any interpreted or compiled computer language including computer-executable instructions. The code and/or data may

be used to create software modules such as operating systems, communication utilities, user interfaces, more specialized program modules, etc.

[0025] One or more interfaces 106 may also be coupled to various components in computing device 100. These interfaces may allow for inter-apparatus communication (e.g., a software or protocol interface), apparatus-to-apparatus communication (e.g., a wired or wireless communication interface) and even apparatus to user communication (e.g., a user interface). These interfaces allow components within computing device 100, other apparatuses and users to interact with computing device 100. Further, interfaces 106 may communicate machine-readable data, such as electronic, magnetic or optical signals embodied on a computer readable medium, or may translate the actions of users into activity that may be understood by computing device 100 (e.g., typing on a keyboard, speaking into the receiver of a cellular handset, touching an icon on a touch screen device, etc.). Interfaces 106 may further allow processor 102 and/or memory 104 to interact with other modules 108. For example, other modules 108 may comprise one or more components supporting more specialized functionality provided by computing device 100.

[0026] Computing device 100 may interact with other apparatuses via various networks as further shown in FIG. 1A. For example, hub 110 may provide wired and/or wireless support to devices such as computer 114 and server 116. Hub 110 may be further coupled to router 112 that allows devices on the local area network (LAN) to interact with devices on a wide area network (WAN, such as Internet 120). In such a scenario, another router 130 may transmit information to, and receive information from, router 112 so that devices on each LAN may communicate. Further, all of the components depicted in this example configuration are not necessary for implementation of the present invention. For example, in the LAN serviced by router 130 no additional hub is needed since this functionality may be supported by the router.

[0027] Further, interaction with remote devices may be supported by various providers of short and long range wireless communication 140. These providers may use, for example, long range terrestrial-based cellular systems and satellite communication, and/or short-range wireless access points in order to provide a wireless connection to Internet 120. For example, personal digital assistant (PDA) 142 and cellular handset 144 may communicate with computing device 100 via an Internet connection provided by a provider of wireless communication 140. Similar functionality may be included in

devices, such as laptop computer 146, in the form of hardware and/or software resources configured to allow short and/or long range wireless communication. Further, any or all of the disclosed apparatuses may engage in direct interaction, such as in the short-range wireless interaction shown between laptop 146 and wireless-enabled apparatus 148. Example wireless enabled apparatuses 148 may range from more complex standalone wireless-enabled devices to peripheral devices for supporting functionality in apparatuses like laptop 146.

[0028] Further detail regarding example interface component 106 disclosed with respect to computing device 100 in FIG. 1A is now discussed regarding FIG. 1B. As previously set forth, interfaces 106 may include interfaces both for communicating data to computing apparatus 100 (e.g., as identified at 150) and other types of interfaces 170 including, for example, user interface 172. A representative group of apparatus-level interfaces is disclosed at 150. For example, multiradio controller 152 may manage the interoperation of long range wireless interfaces 154 (e.g., cellular voice and data networks), short-range wireless interfaces 156 (e.g., Bluetooth and WLAN networks), close-proximity wireless interfaces 158 (e.g., for interactions where electronic, magnetic, electromagnetic and optical information scanners interpret machine-readable data), wired interfaces 160 (e.g., Ethernet), etc. The example interfaces shown in FIG. 1B have been presented only for the sake of explanation herein, and thus, are not intended to limit the various embodiments of the present invention to utilization of any particular interface. Embodiments of the present invention may also utilize interfaces that are not specifically identified in FIG. 1B.

[0029] Multiradio controller 152 may manage the operation of some or all of interfaces 154-160. For example, multiradio controller 152 may prevent interfaces that could interfere with each other from operating at the same time by allocating specific time periods during which each interface is permitted to operate. Further, multiradio controller 152 may be able to process environmental information, such as sensed interference in the operational environment, to select an interface that will be more resilient to the interference. These multiradio control scenarios are not meant to encompass an exhaustive list of possible control functionality, but are merely given as examples of how multiradio controller 152 may interact with interfaces 154-160 in FIG. 1B.

II. Example operational environment

[0030] While positioning within a structure (e.g., building) has been utilized for the sake of explanation herein, the various embodiments of the present invention are not limited only to use in this specific scenario. Almost any situation where traditional positioning techniques do not provide adequate performance (e.g., speed, resolution, etc.) may experience improvement through the following example embodiments and/or implementations of the present invention.

[0031] Assisted global positioning (A-GPS) and other electronic positioning solutions based on wireless communication may perform acceptably and may provide extensive coverage outdoors where the signal quality and number of satellites/base stations are typically very good. This performance may be bolstered by accurate maps featuring terrain features, roads, traffic conditions and other related information have been mapped exhaustively and are constantly maintained from satellite images, aerial photography, feedback from user communities, etc. Together, the available positioning solutions and the feature-rich maps may provide excellent user experiences (e.g., such as in instances including vehicle and pedestrian navigation use).

[0032] The situation becomes totally different when the navigation is brought indoors. Known positioning technologies have very limited capabilities indoors, and thus, usually fail. There are many reasons for these failures. Initially, existing positioning/mapping solutions may be expensive and difficult to implement. Map information does not exist for many public/private structures, and the provision of this information requires extensive modeling visualization and/or mapping that is currently only provided by private companies. Further, since many emerging systems are proprietary, there is no standard operation for obtaining the information that may be needed to utilize the system. Some systems may be able to provide the information to a user via wired or wireless communication upon entry into an area, but these provisions require system-specific knowledge in order to execute system-specific procedures prior to system utilization.

[0033] Partial floor plan 200 disclosed in FIG. 2 will help to explain various challenges to traditional electronic positioning that may be experienced within a structure (e.g., building). User 206 may possess at least one of the apparatuses disclosed with respect to FIG. 1A and 1B, the at least one apparatus being enabled for wireless communication. Information received from satellites 202 and long-range transmission

204 (e.g., cellular signals) may be effectively received and utilized by the user's apparatus for positioning when outside. However, various structures (e.g., walls, conduits, windows, doors, power electronics, office equipment, etc.) within building 200 may significantly reflect, or totally block, such signals. As a result, User/apparatus 206 (e.g., a user in possession of a mobile/portable apparatus having some or all of the characteristics such as disclosed in the examples described in FIG. 1A-1B) may be forced to rely upon wireless signals sourced within building 200 in order to perform positioning. For example, wireless signals 210 may be received from wireless access points (AP) 208, 212, 214 and 216 may provide at least the wireless communication of data as shown in floor plan 200. In additional to providing data communication (e.g., access to LAN or WAN resources such as the Internet), these access points may also provide positioning information. Various methods for determining position may be employed, each with differing amounts of accuracy. For example, signal 210 may indicate that user/apparatus 206 is within communication range of AP 208. However, positioning using such estimation is inexact, especially within the small confines of a building. Position determination may be improved using methodologies such as triangulation based on concurrent connections to more than one AP, Direction-of-Arrival (DoA) estimation, Direction of Departure (DoD) estimation, or another position estimation algorithm in order to determine the relative direction towards, and possibly an approximate distance from, the emitter of a signal.

[0034] These example positioning techniques may be able to provide distance and/or direction from the source of a signal, but without a frame of reference this information may be useless to the average apparatus user. There may be many signals within a building or structure, and not all of these signals may be useful for navigation. Moreover, determining the position of sources associated with received signals will inform on the relative position of the signal source with respect to the receiver (e.g., the apparatus of user 206), but may not enlighten the user as to his/her location within the structure. As a result, the apparatus performing positioning may need information that identifies signal sources (e.g., access points or positions beacons) that may be useful in positioning, and may also include a frame of reference in which the signals may be placed (e.g., a map of the building or other structure). This information may allow user 206 to employ his/her apparatus in determining his/her position with respect to other known positions, and thus, to approximate his/her location in the building or structure, the location of a destination

(e.g., restroom, emergency exit, conference room, etc.), a suggested route to a destination, etc.

III. Examples of positioning information

[0035] The benefits of information pertaining to a space (e.g., relative positions of signal emitters within the navigable space and frame of reference information) are readily apparent, but the methods by which this information is obtained is not. There is currently no standard manner by which to obtain this information. Users are therefore forced to understand the nuances of each proprietary positioning to be used, even if being employed for the first time. The various embodiments of the present invention, as disclosed herein, seek to resolve at least this issue by standardizing how positioning information in a localized positioning situation may be obtained.

[0036] Now referring to FIG. 2B, the example of FIG. 2A has been further refined to focus upon an example interaction 210 between user 206 and AP 208. The example of FIG. 2B presumes that positioning resources are activated in the apparatus of user 206. For example, the positioning resources may always be active but maintained in a sleep/energy conservation state until wireless signals are sensed by the apparatus. Otherwise, resources may be activated alone or in part by the direct intervention of user 206 (e.g., user 206 knows that he/she has entered into an areas where positioning is available, and so he/she activate resources in the apparatus). The apparatus of user 206 may then listen for beacon signals broadcast by AP 208, and may receive signals as show in interaction 210. As shown in FIG. 2B, the signal broadcast by AP 208 may comprise general information usable, for example, in providing access to a LAN or WAN (e.g., the Internet). However, the wireless signals disclosed at 210 may also comprise positioning information usable by a receiving apparatus for performing positioning operations like current position determination/mapping, target position determination/mapping, route mapping, etc.

IV. Examples of positioning information conveyance

[0037] In accordance with various embodiments of the present invention, the manner by which positioning information is conveyed to an apparatus may depend upon the type of wireless communication being employed in the conveyance. In a basic example implementation, wireless communication may be utilized to convey only the location (e.g., URL address, IP address or other navigable identification information) of a

server from which the positioning information may be obtained. The user apparatus may then utilize it's own resources (e.g., access to wireless LAN or WAN connections) in order to retrieve the positioning information. Using this configuration the burden to convey what may be substantial information (e.g., access point locations, maps, descriptive material about the location) may be shifted from the wireless positioning system to the user apparatus, which may allow the positioning system to service a greater number of users. Distributing positioning information utilizing a separate link to the Internet may also allow for more flexible security and/or data retention configurations.

[0038] Further to the above example implementation, the interaction in which the server address for obtaining positioning information may be conveyed to a user apparatus may depend upon the wireless communication being employed. Some examples of different approaches to conveying this information are disclosed in FIG. 3-7. In FIG. 3 a Bluetooth wireless interaction is disclosed wherein a formal connection is negotiated between AP 300 and User apparatus 302. AP 300 may begin by broadcasting ID packets informing other Bluetooth apparatuses in the area that AP 300 is available for connection and/or has data to transmit. User apparatus 302 may then respond with an ID packet including identification and other information usable for establishing a Bluetooth connection. AP 300 may then provide a Frequency Hopping Sequence (FHS) packet to inform user apparatus 302 of the channel hop pattern it needs to follow in order to stay linked to AP 300. A formal connection may then be requested (LMP_host connection_req) by AP 300 and then accepted (LMP_accepted) by user apparatus 302. At 304 an optional data interaction is highlighted wherein a "user-friendly" name may be exchanged between devices, for example, so that users may readily identify connected devices using recognizable names (e.g., "My Headset," "Access Point 1," etc). Name request process 304 may exchange names up to 248 bytes long. A name may be requested by user apparatus 302 using LMP_name_req messages, and AP 300 may provide the requested name using LMP_name_res messages. Name response messages are DM1 type Bluetooth packets that have a limited data payload of only 17 bytes. As a result, multiple request/response exchanges may be required in order to convey the entire name. The connection setup process may then be complete through the exchange of LMP_setup_complete messages.

[0039] While name request interaction 304 is typically utilized to exchange Bluetooth device names, FIG. 4 discloses an example of how this functionality may be used, in accordance with at least one embodiment of the present invention, for conveying server address information. As shown in the example of FIG. 4, AP 300 may be a ceiling-mounted AP configured to operate as, among other things, a positioning beacon. Part of the information advertised by AP 300 may be a user-friendly name. However, in FIG. 4 the user-friendly name may actually be an address for a server from which positioning information may be obtained. Interaction 304 discloses the server address being conveyed from AP 300 to apparatus 302 in a series of Bluetooth request and response messages. The number of request/response messages in the interaction may depend on the length of the server name, which must be less than 248 bytes. In particular, since response message is limited to 17 bytes, the number of response messages will depend on how many 17 byte payloads it takes to deliver the entire server address. After each response user apparatus 302 may indicate the next set of data to send using an offset indicated in the request message.

[0040] Once the full address is received in user apparatus 302, the same or a separate connection may be utilized in order to obtain the positioning information. For example, if AP 300 is also configured to provide Internet access, user apparatus 302 may utilize the existing connection in order to access the server. Otherwise, user apparatus 302 may have other wireless links available, such as a long-range cellular data connection, that may allow user apparatus 302 to obtain the positioning data via another separate connection. Regardless of how the positioning information may be accessed, security features may exist in order to prevent unauthorized use of the information. In one example configuration, the server name information may be encrypted, and may only be decrypted if the receiving apparatus comprises a key. Keys may be distributed, for example, via a wired or wireless connection to the internet made before or at the time when a user enters into the positioning environment. In at least one example implementation a website may be viewed by visitors prior to entering a building. The website may instruct the visitors to register in order to download a key enabling electronic positioning during visits to the building. This online registration may allow the building owner and/manager to restrict use of positioning to only certain visitors and to have a log of people who may visit the building during a period of time. Also, registration may include questions that allows a building owner to collect statistics about visitors such as the number of visitors expected

during a period of time, identification of the businesses being visited by the visitors and/or the reasons for the visits, etc. It may also be possible for server address information to be provided during online registration, which would eliminate the later requirement of obtaining such information from the actual positioning system. While there are some benefits to administering positioning information in this manner, limiting the delivery of positioning information only to online delivery may make standardization more difficult and may introduce new burden to users in that visits to new locations must be planned, including whether the locations support wireless positioning and whether positioning information may be obtained at the locations, etc., which may decrease the overall flexibility of obtaining this information "on-the-fly," and thus, may negatively impact the user experience. Alternatively, registration may be moved to later in the process, such as when user apparatus 302 is accessing the server using the address provided by AP 300. In this manner, positioning information may only be obtained if the user has appropriate clearance and/or is willing to register before visiting.

[0041] Another example of how server address information may be conveyed to user apparatus 302, in accordance with at least one embodiment of the present invention, is disclosed in FIG. 5. In this example Bluetooth Low Energy (Bluetooth LE) wireless communication is being used to convey the server address. As shown in FIG. 5, after a receive period (Rx) during which AP 300 may perform received signal strength indication (RSSI) sensing in order to ensure that a predetermined advertising channel is actually available, advertising packet 400 may then be transmitted (Tx). The transmission of advertising packet 400 may be followed by a minimum transmit to receive (Tx to Rx) transition and a listening period during which AP 300 may listen for responses to the advertisement message. Advertising packet 400 may typically comprise an 8-bit preamble, a 32-bit sync word, a protocol data unit (PDU) including the packet payload, and a 24-bit cyclic redundancy check (CRC) value that may be used by user apparatus 302 to verify packet integrity. In at least one example configuration, the PDU of packet 400 may be modified to include the server address information as disclosed at 402. Modifications may include altering the 16-bit header of the PDU (e.g., by changing a predetermined bit indicator or "flag") to reflect that the contents of the payload includes the server address, and then including the server address in the payload. Upon receipt of advertising packet 400, user apparatus 302 may realize that the payload of the PDU comprises the server address based on an indicator in the header, and may then utilize the server address to

obtain positioning information from the server. The example security aspects described above in the Bluetooth example may also be applied in Bluetooth LE.

[0042] An example server address conveyance method based on IEEE 802.11 standard communications (e.g., "Wi-Fi"), in accordance with at least one embodiment of the present invention, is disclosed in FIG. 6. An example Wi-Fi beacon packet 600 is disclosed in FIG. 6 to comprise a Media Access Control (MAC) header including a 2-bit frame control field, a 2-bit duration control field, a 2-bit DA field, a 2-bit SA field, a 6-bit BSS ID field and a 2-bit Sequence control (Seq-ctrl) field. Beacon packet 600 may further comprise a frame body 602 made up of both required fields and optional Information Elements (IEs) up to 2312 bits in size. The packet may be concluded with a 4-bit FCS field. Frame Body 602 may further comprise an 8-bit timestamp, a 2-bit beacon interval, a 2-bit capability info field, a variable length SSID and optional IEs. An example of an optional IE structure is disclosed at 604, and may include a 1-bit header, a 1-bit length, and a variable payload. While this example utilizes the "Vendor Specific Information" IE to convey the server address, the various embodiments of the present invention are not limited to this implementation. As will be seen with respect to FIG. 7, other IEs may be employed to carry server address information to apparatuses desiring positioning information.

[0043] Beacon packet 600 may be transmitted on a periodic basis to maintain network connections between networked apparatuses. For example, beacon packet 600 may help to keep networked addresses synchronized with the operation of AP 300. In addition to performing this functionality, other information may be conveyed in the form an IE that is also contained within the beacon packet. For example, the Vendor Specific Information IE may typically be utilized to convey information concerning the operation of devices made by certain vendor. However, in this instance this field may instead convey server address information to a receiving apparatus (e.g., user apparatus 302) so that the receiving apparatus may obtain positioning information. In accordance with at least one embodiment of the present invention, a predetermined flag or code may be set in beacon packet 600 in order to alert a receiving device that a server address has been included in the packet. FIG. 7 discloses a similar configuration in that beacon packet 700 is also a Wi-Fi beacon packet including frame body 702 having the same elements as disclosed at 602 in FIG. 6. However, in the example of FIG. 7 "IP Option 19 – Address Extension" IE is

being re-tasked to convey the server address. This IE is normally utilized to carry the additional bytes to convert IPv4 address to IPv7 addresses. However, in this instance it may instead carry server address information. An indicator or flag may be configured in a beacon packet 700 that is carrying a server address in the IP Option 19 IE so that receiving apparatuses may be aware of the availability of this information. Further, security configuration options, such as discussed above with respect to FIG. 3, may also be applied in the example Wi-Fi operational scenario in order to control access to the positioning system and/or to record the identity of system users.

[0044] A flowchart of an example process, in accordance with at least one embodiment of the present invention, is disclosed in FIG. 8. The process may initiate in step 800 and may be followed by an apparatus scanning for wireless signals in step 802. Scanning for wireless signals may occur automatically in an apparatus that is configured to receive wireless signals from other apparatuses (e.g., access points, positioning beacons, etc.) or may be manually activated by the user of the apparatus. The apparatus may continue to scan for wireless signals in steps 802 and 804 until a determination is made in step 804 that at least one wireless signal has been received. In accordance with at least one embodiment of the present invention, the at least one wireless signal may further include a indicator, flag, bit setting, etc. that a receiving apparatus may utilize to associate the signal with a positioning system. This may allow the receiving apparatus to filter out simple data and other unrelated signals from signals being broadcast for use in positioning.

[0045] The process may then proceed to step 806 where a determination is made as to whether the content of the at least one wireless signal are secured. For example, some packets that are received by the apparatus may be encrypted, and thus, the content of the packet may be available only upon decryption of the packet. If it is determined in step 808 that the contents of the packet are unsecured, then the process may proceed to step 808 where a server address may be extracted from the contents of the received wireless signal and positioning information may be obtained from a server at the server address. The server address may only describe the location of the server. While not shown, it is further possible that other security measures may be implemented that may control access to the server. Such security measures may require codes that are automatically provided by the apparatus, or alternatively, user intervention in the form of username, passwords, etc., that are supplied to the server in the form of a login in order to obtain the positioning

information from the server. After the positioning information is obtained from the server, the process may be complete in step 810 in that the apparatus is now able to utilize the positioning information in performing positioning functions such as determining and/or mapping the current location of the user/apparatus, determining and/or mapping the location of a target, determining and/or mapping a route to a target, etc. The process may then reinitiate in step 800.

[0046] On the other hand, if in step 806 it is determined that the contents of the at least one received wireless signal is secured (e.g., at least one received packet is encrypted), then a further determination may be made as to whether a key exists in the apparatus for decrypting the encrypted information. If it is determined in step 812 that a key does exist in the apparatus, then the process may return to step 808 in order to obtain positioning information. Otherwise, access to the server address may be denied in step 814, and the process may be complete in step 810.

[0047] The various embodiments of the present invention are not limited only to the examples disclosed above, and may encompass other configurations or implementations.

[0048] For example, example embodiments of the present invention may encompass apparatuses comprising means for receiving at least one wireless signal in an apparatus; means for determining if information in the at least one wireless signal can be accessed; and if it is determined that the information in the at least one wireless signal can be accessed, means for accessing a server using the information in the at least one wireless signal and receiving positioning information into the apparatus from the server.

[0049] At least one other example embodiment of the present invention may include electronic signals that cause an apparatus to receive at least one wireless signal; determine if information in the at least one wireless signal can be accessed; and if it is determined that the information in the at least one wireless signal can be accessed, access a server using the information in the at least one wireless signal and receive positioning information into the apparatus from the server.

[0050] At least one other example embodiment of the present invention may include a method comprising receiving at least one wireless signal in an apparatus; determining if information in the at least one wireless signal can be accessed; and if it is determined that the information in the at least one wireless signal can be accessed,

accessing a server using the information in the at least one wireless signal and receiving positioning information into the apparatus from the server.

[0051] The above example method may be further described, wherein the information in the at least one wireless signal is encrypted; and determining if the information in the at least one wireless signal can be accessed comprises determining if the apparatus comprises key information usable to decrypt the information in the at least one wireless signal.

[0052] The above example method may be further described, wherein the at least one wireless signal is one or more Bluetooth LMP_Name_Response packets and the information in the at least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server.

[0053] The above example method may be further described, wherein the at least one wireless signal is at least one Bluetooth Low Energy beacon packet and the information in the at least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server contained in the protocol data unit of the at least one Bluetooth Low Energy beacon packet.

[0054] The above example method may be further described, wherein the at least one wireless signal is at least one Wi-Fi beacon packet and the information in the at least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server contained in an information element within the at least one beacon packet.

[0055] The above example method may be further described, wherein the positioning information comprises an absolute or relative coordinate position corresponding to the source of the at least one wireless signal.

[0056] The above example method may be further described, wherein the positioning information comprises map information corresponding to an area including the source of the at least one wireless signal.

[0057] At least one other example embodiment of the present invention may include a computer program product comprising computer executable program code recorded on a non-transient computer readable storage medium, the computer executable program code comprising code configured to cause an apparatus to receive at least one

wireless signal; code configured to cause the apparatus to determine if information in the at least one wireless signal can be accessed; and code configured to cause the apparatus to, if it is determined that the information in the at least one wireless signal can be accessed, access a server using the information in the at least one wireless signal and receive positioning information into the apparatus from the server.

[0058] The above example computer program product may be further described, wherein the information in the at least one wireless signal is encrypted; and the code configured to cause the apparatus to determine if the information in the at least one wireless signal can be accessed further comprises code configured to cause the apparatus to determine if the apparatus comprises key information usable to decrypt the information in the at least one wireless signal.

[0059] The above example computer program product may be further described, wherein the at least one wireless signal is one or more Bluetooth LMP_Name_Response packets and the information in the at least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server.

[0060] The above example computer program product may be further described, wherein the at least one wireless signal is at least one Bluetooth Low Energy beacon packet and the information in the at least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server contained in the protocol data unit of the at least one Bluetooth Low Energy beacon packet.

[0061] The above example computer program product may be further described, wherein the at least one wireless signal is at least one Wi-Fi beacon packet and the information in the at least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server contained in an information element within the at least one beacon packet.

[0062] The above example computer program product may be further described, wherein the positioning information comprises an absolute or relative coordinate position corresponding to the source of the at least one wireless signal.

[0063] The above example computer program product may be further described, wherein the positioning information comprises map information corresponding to an area including the source of the at least one wireless signal.

[0064] At least one other example embodiment of the present invention may include an apparatus comprising at least one processor and at least one memory including executable instructions, the at least one memory and the executable instructions being configured to, in cooperation with the at least one processor, cause the apparatus to perform at least the following: receive at least one wireless signal; determine if information in the at least one wireless signal can be accessed; and if it is determined that the information in the at least one wireless signal can be accessed, access a server using the information in the at least one wireless signal and receive positioning information into the apparatus from the server.

[0065] The above example apparatus may be further described, wherein the information in the at least one wireless signal is encrypted; and the at least one memory and the executable instructions being configured to, in cooperation with the at least one processor, cause the apparatus to determine if the information in the at least one wireless signal can be accessed comprises the at least one memory and the executable instructions being further configured to, in cooperation with the at least one processor, cause the apparatus to determine if the apparatus comprises key information usable to decrypt the information in the at least one wireless signal.

[0066] The above example apparatus may be further described, wherein the at least one wireless signal is one or more Bluetooth LMP_Name_Response packets and the information in the at least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server.

[0067] The above example apparatus may be further described, wherein the at least one wireless signal is at least one Bluetooth Low Energy beacon packet and the information in the at least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server contained in the protocol data unit of the at least one Bluetooth Low Energy beacon packet.

[0068] The above example apparatus may be further described, wherein the at least one wireless signal is at least one Wi-Fi beacon packet and the information in the at least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server contained in an information element within the at least one beacon packet.

[0069] The above example apparatus may be further described, wherein the positioning information comprises an absolute or relative coordinate position corresponding to the source of the at least one wireless signal.

[0070] The above example apparatus may be further described, wherein the positioning information comprises map information corresponding to an area including the source of the at least one wireless signal.

[0071] At least one other example embodiment of the present invention may include a system comprising an apparatus, a beacon transmitter, and a server; the apparatus receiving at least one wireless signal from the beacon transmitter; the apparatus further determining if information in the at least one wireless signal can be accessed, and if it is determined that the information in the at least one wireless signal can be accessed, the apparatus further accessing the server using the information in the at least one wireless signal received from the beacon transmitter and receiving positioning information from the server.

[0072] Accordingly, it will be apparent to persons skilled in the relevant art that various changes in forma and detail can be made therein without departing from the spirit and scope of the invention. The breadth and scope of the present invention should not be limited by any of the above-described example embodiments, but should be defined only in accordance with the following claims and their equivalents.

WHAT IS CLAIMED:

1. A method, comprising:

receiving at least one wireless signal in an apparatus;

determining if information in the at least one wireless signal can be accessed; and

if it is determined that the information in the at least one wireless signal can be accessed, accessing a server using the information in the at least one wireless signal and receiving positioning information into the apparatus from the server.

2. The method of claim 1, wherein the information in the at least one wireless signal is encrypted; and

determining if the information in the at least one wireless signal can be accessed comprises determining if the apparatus comprises key information usable to decrypt the information in the at least one wireless signal.

3. The method of claim 1, wherein the at least one wireless signal is one or more Bluetooth LMP_Name_Response packets and the information in the at least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server.

4. The method of claim 1, wherein the at least one wireless signal is at least one Bluetooth Low Energy beacon packet and the information in the at least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server contained in the protocol data unit of the at least one Bluetooth Low Energy beacon packet.

5. The method of claim 1, wherein the at least one wireless signal is at least one Wi-Fi beacon packet and the information in the at least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server contained in an information element within the at least one beacon packet.

6. The method of claim 1, wherein the positioning information comprises an absolute or relative coordinate position corresponding to the source of the at least one wireless signal.

7. The method of claim 1, wherein the positioning information comprises map information corresponding to an area including the source of the at least one wireless signal.

8. A computer program product comprising computer executable program code recorded on a non-transient computer readable storage medium, the computer executable program code comprising:

code configured to cause an apparatus to receive at least one wireless signal;

code configured to cause the apparatus to determine if information in the at least one wireless signal can be accessed; and

code configured to cause the apparatus to, if it is determined that the information in the at least one wireless signal can be accessed, access a server using the information in the at least one wireless signal and receive positioning information into the apparatus from the server.

9. The computer program product of claim 8, wherein the information in the at least one wireless signal is encrypted; and

the code configured to cause the apparatus to determine if the information in the at least one wireless signal can be accessed further comprises code configured to cause the apparatus to determine if the apparatus comprises key information usable to decrypt the information in the at least one wireless signal.

10. The computer program product of claim 8, wherein the at least one wireless signal is one or more Bluetooth LMP_Name_Response packets and the information in the at least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server.

11. The computer program product of claim 8, wherein the at least one wireless signal is at least one Bluetooth Low Energy beacon packet and the information in the at

least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server contained in the protocol data unit of the at least one Bluetooth Low Energy beacon packet.

12. The computer program product of claim 8, wherein the at least one wireless signal is at least one Wi-Fi beacon packet and the information in the at least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server contained in an information element within the at least one beacon packet.

13. The computer program product of claim 8, wherein the positioning information comprises an absolute or relative coordinate position corresponding to the source of the at least one wireless signal.

14. The computer program product of claim 8, wherein the positioning information comprises map information corresponding to an area including the source of the at least one wireless signal.

15. An apparatus, comprising:

at least one processor; and

at least one memory including executable instructions, the at least one memory and the executable instructions being configured to, in cooperation with the at least one processor, cause the apparatus to perform at least the following:

receive at least one wireless signal;

determine if information in the at least one wireless signal can be accessed; and

if it is determined that the information in the at least one wireless signal can be accessed, access a server using the information in the at least one wireless signal and receive positioning information into the apparatus from the server.

16. The apparatus of claim 15, wherein the information in the at least one wireless signal is encrypted; and

the at least one memory and the executable instructions being configured to, in cooperation with the at least one processor, cause the apparatus to determine if the information in the at least one wireless signal can be accessed comprises the at least one memory and the executable instructions being further configured to, in cooperation with the at least one processor, cause the apparatus to determine if the apparatus comprises key information usable to decrypt the information in the at least one wireless signal.

17. The apparatus of claim 15, wherein the at least one wireless signal is one or more Bluetooth LMP_Name_Response packets and the information in the at least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server.

18. The apparatus of claim 15, wherein the at least one wireless signal is at least one Bluetooth Low Energy beacon packet and the information in the at least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server contained in the protocol data unit of the at least one Bluetooth Low Energy beacon packet.

19. The apparatus of claim 15, wherein the at least one wireless signal is at least one Wi-Fi beacon packet and the information in the at least one wireless signal is at least one of a Universal Resource Locator (URL) address or an Internet Protocol (IP) address for the server contained in an information element within the at least one beacon packet.

20. The apparatus of claim 15, wherein the positioning information comprises an absolute or relative coordinate position corresponding to the source of the at least one wireless signal.

21. The apparatus of claim 15, wherein the positioning information comprises map information corresponding to an area including the source of the at least one wireless signal.

22. A system, comprising:

an apparatus;

a beacon transmitter; and

a server

the apparatus receiving at least one wireless signal from the beacon transmitter;

the apparatus further determining if information in the at least one wireless signal can be accessed, and if it is determined that the information in the at least one wireless signal can be accessed, the apparatus further accessing the server using the information in the at least one wireless signal received from the beacon transmitter and receiving positioning information from the server.

FIG. 1A

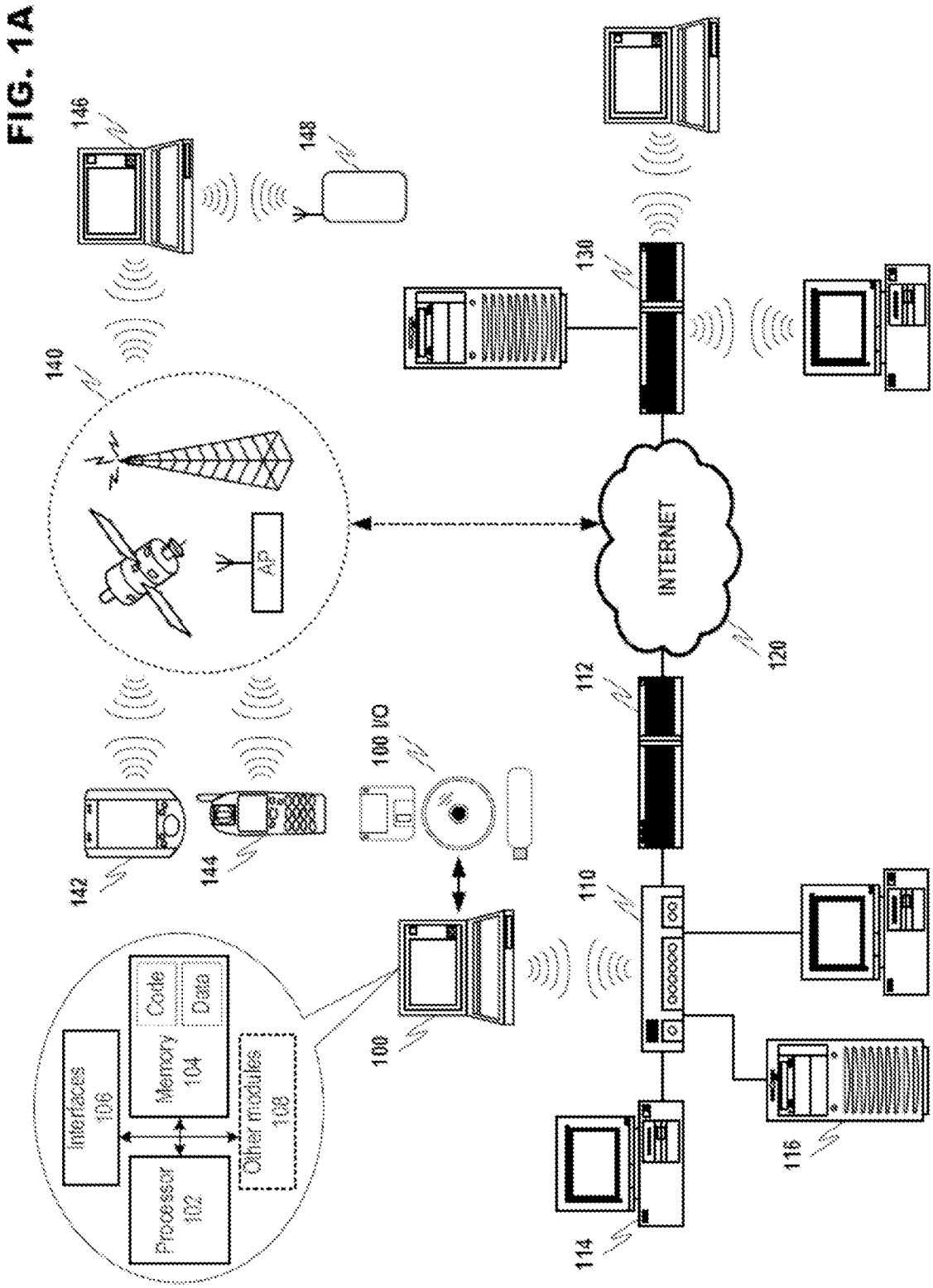

146
148
138
140
AP
INTERNET
120
112
100 I/O
142
144
110
160
Code
Data
Memory
104
Interfaces
106
Other modules
108
Processor
102
114
116

FIG. 1B

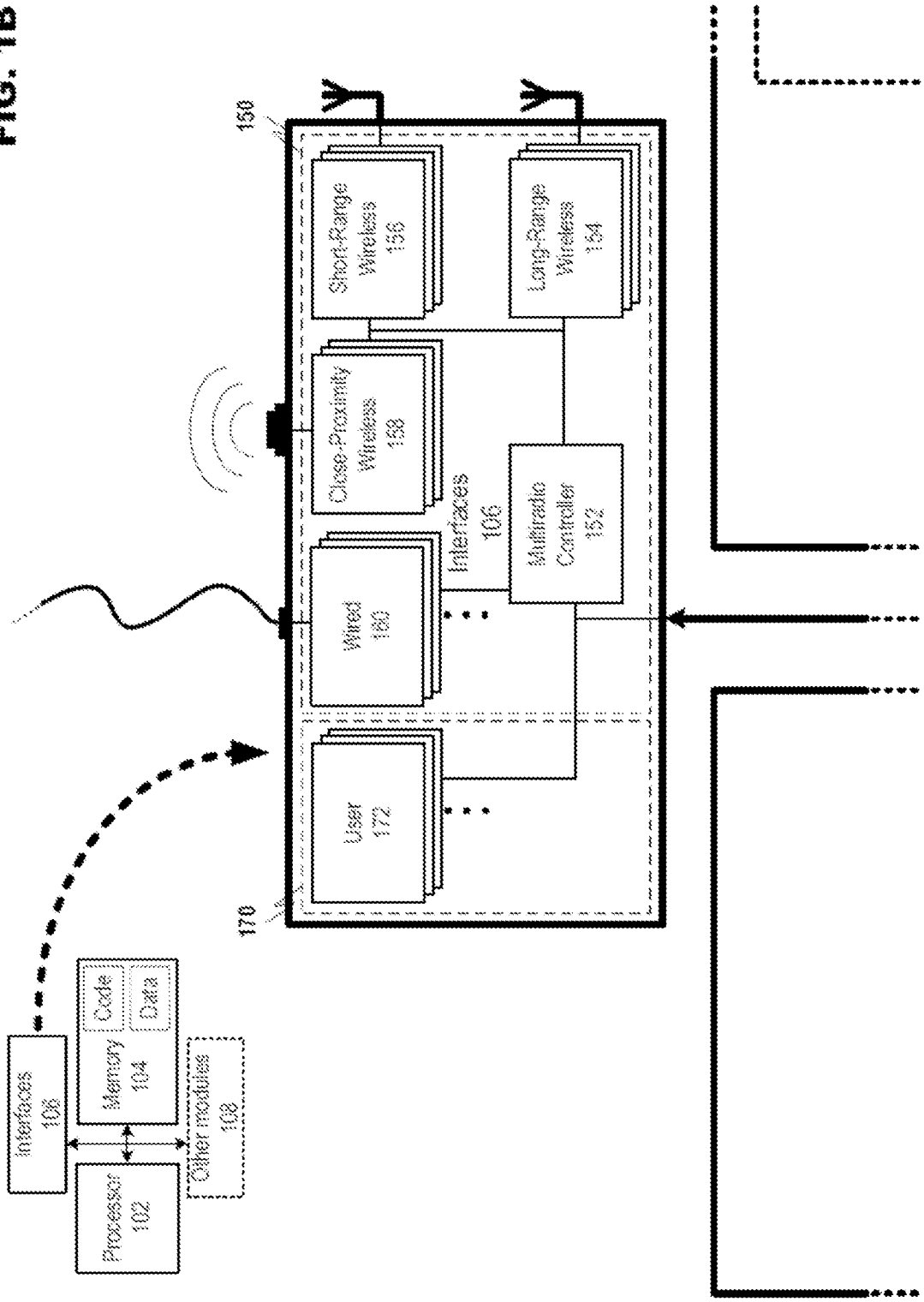

150
Short-Range Wireless 156
Long-Range Wireless 154
Close-Proximity Wireless 158
Interfaces 106
Multiradio Controller 152
Wired 160
User 172
170
Interfaces 106
Memory 104
Code
Data
Other modules 108
Processor 102

FIG. 2A

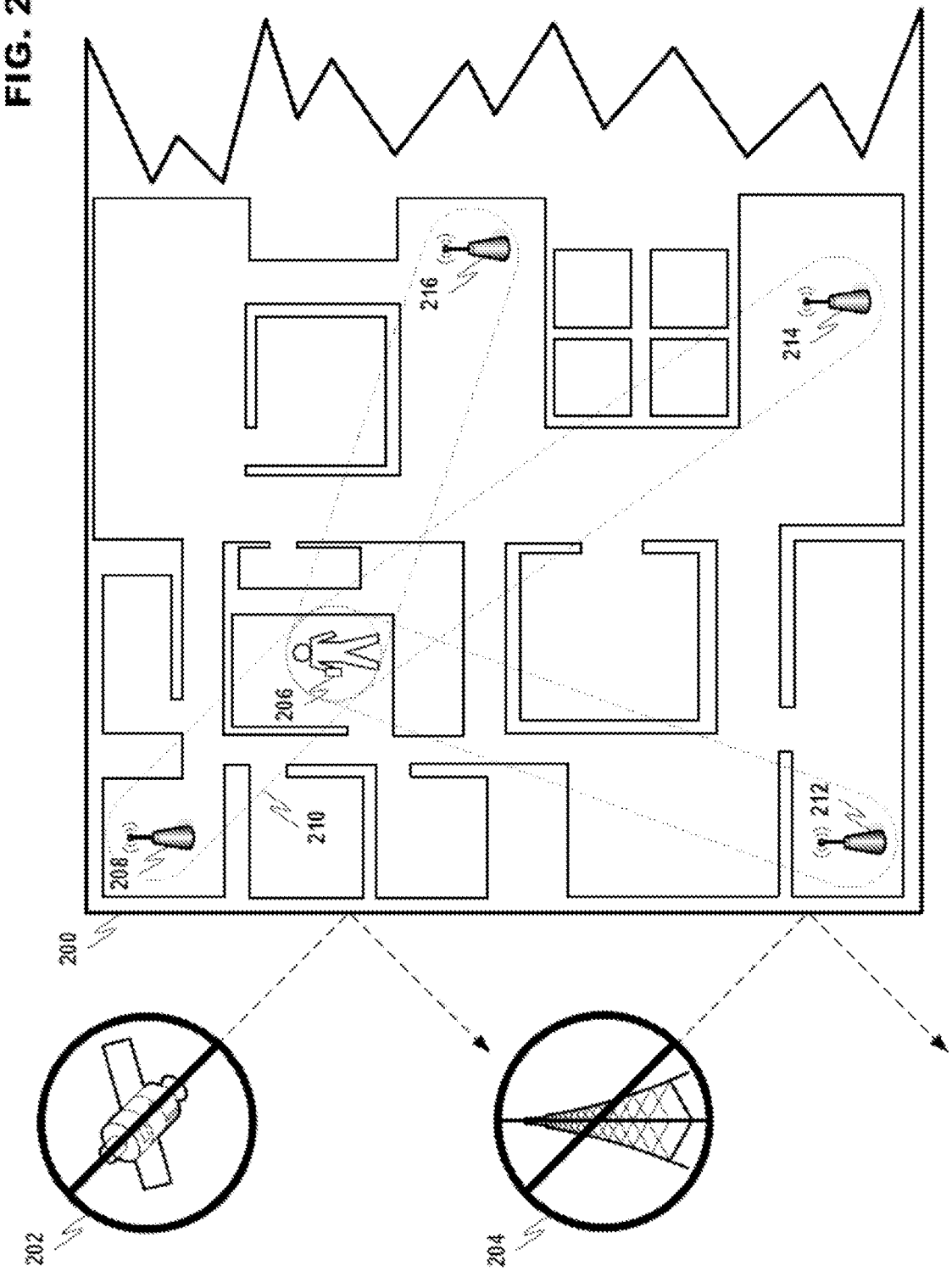


FIG. 2B

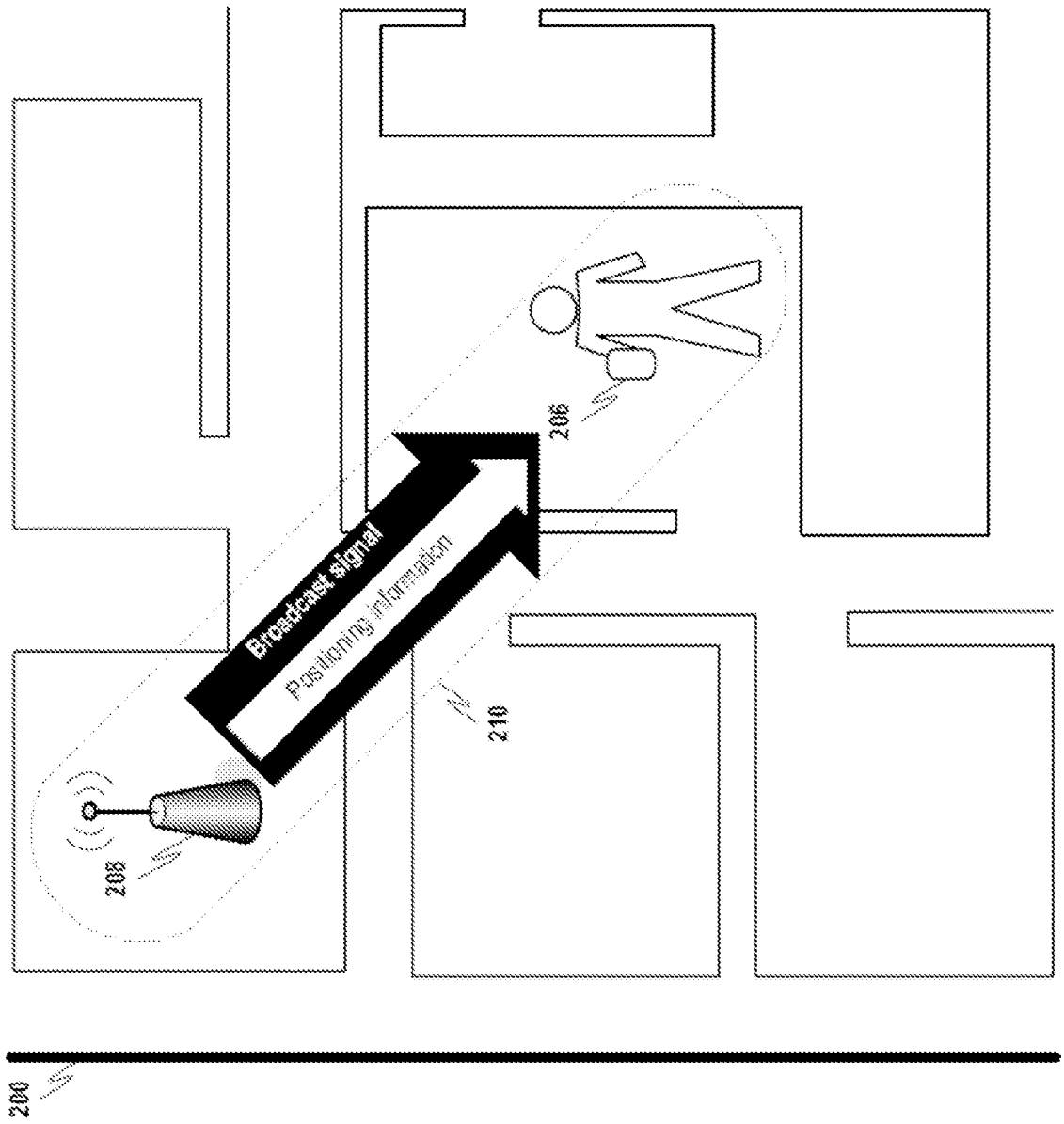


FIG. 3

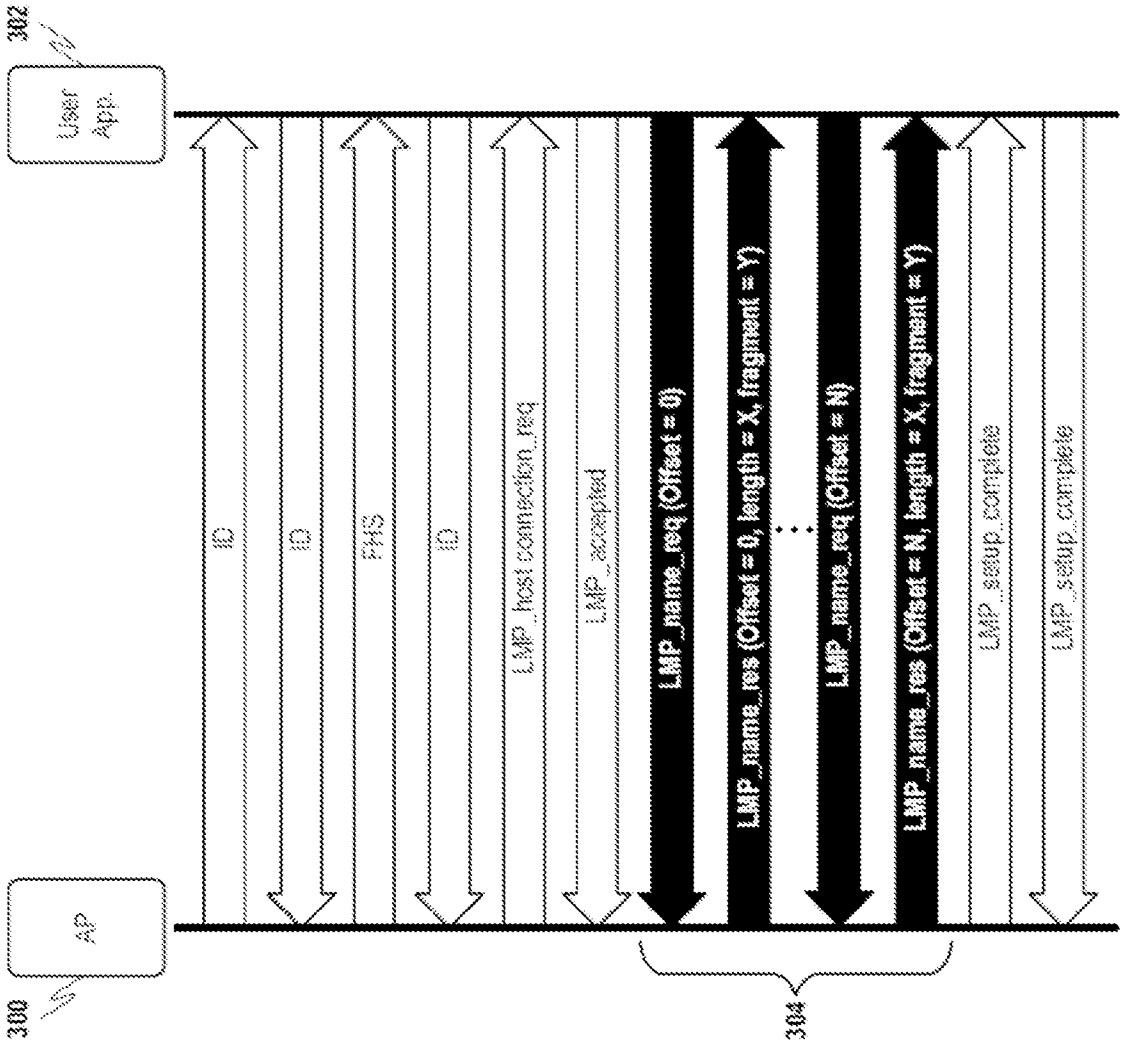

302
User App.
AP
300
ID
ID
PHS
ID
LMP_host connection_req
LMP_accepted
LMP_name_req (Offset = 0)
LMP_name_res (Offset = 0, length = X, fragment = Y)
LMP_name_req (Offset = N)
LMP_name_res (Offset = N, length = X, fragment = Y)
LMP_setup_complete
LMP_setup_complete
304

FIG. 4

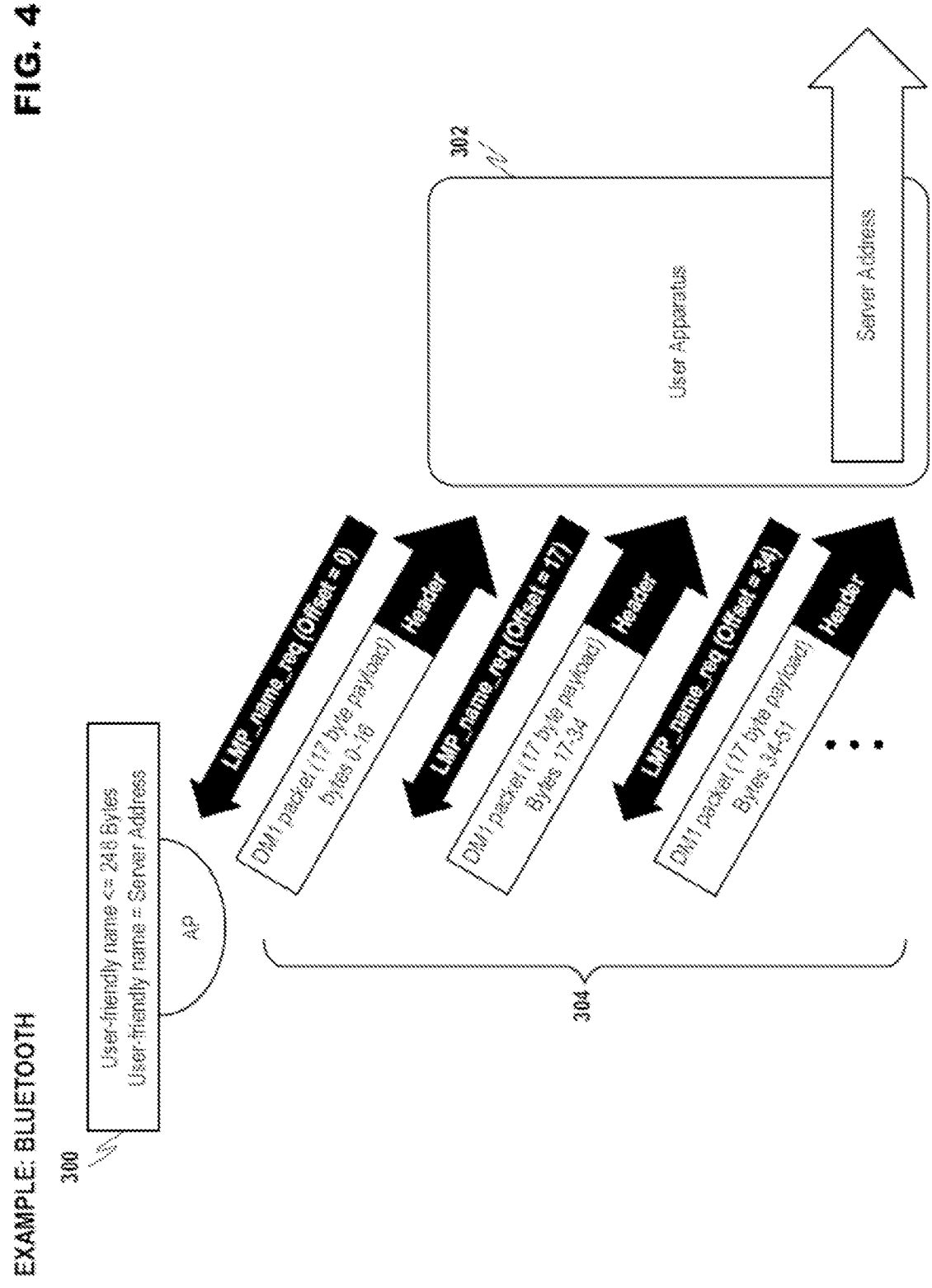

EXAMPLE: BLUETOOTH
300
User-friendly name <= 248 Bytes
User-friendly name = Server Address
AP
LMP_name_req (Offset = 0)
DM1 packet (17 byte payload)
Bytes 0-16
Header
LMP_name_req (Offset = 17)
DM1 packet (17 byte payload)
Bytes 17-34
Header
LMP_name_req (Offset = 34)
DM1 packet (17 byte payload)
Bytes 34-51
Header
304
302
User Apparatus
Server Address

FIG. 5

EXAMPLE: BLUETOOTH LOW ENERGY (BLUETOOTH LE)

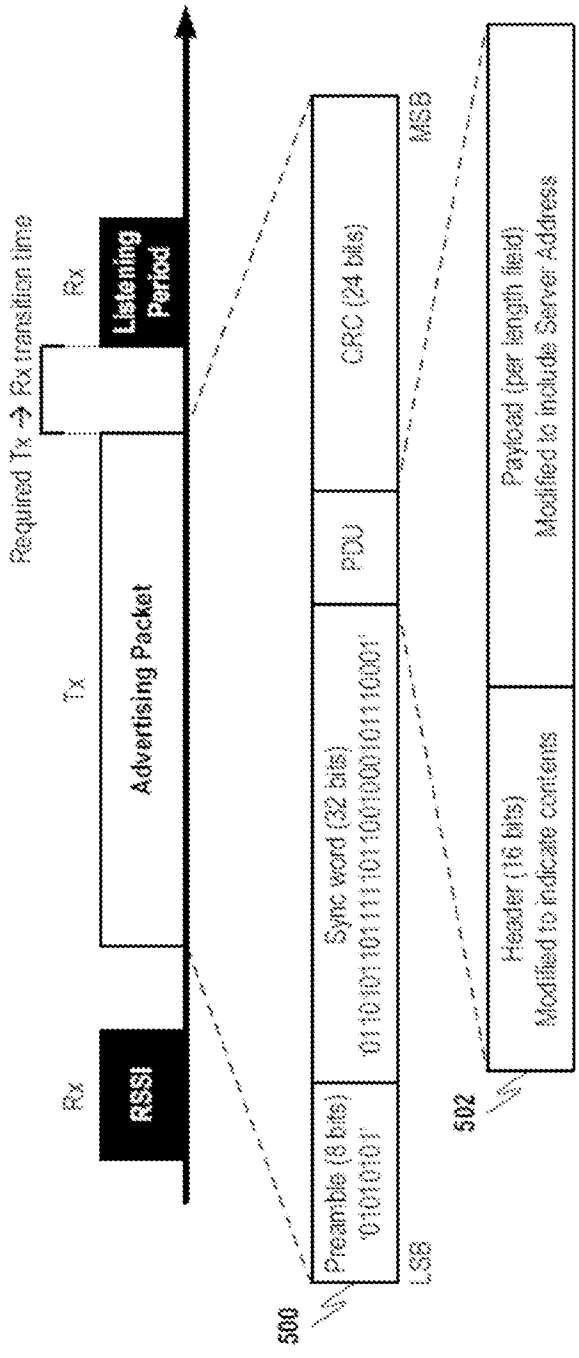


FIG. 6

EXAMPLE: WI-FI

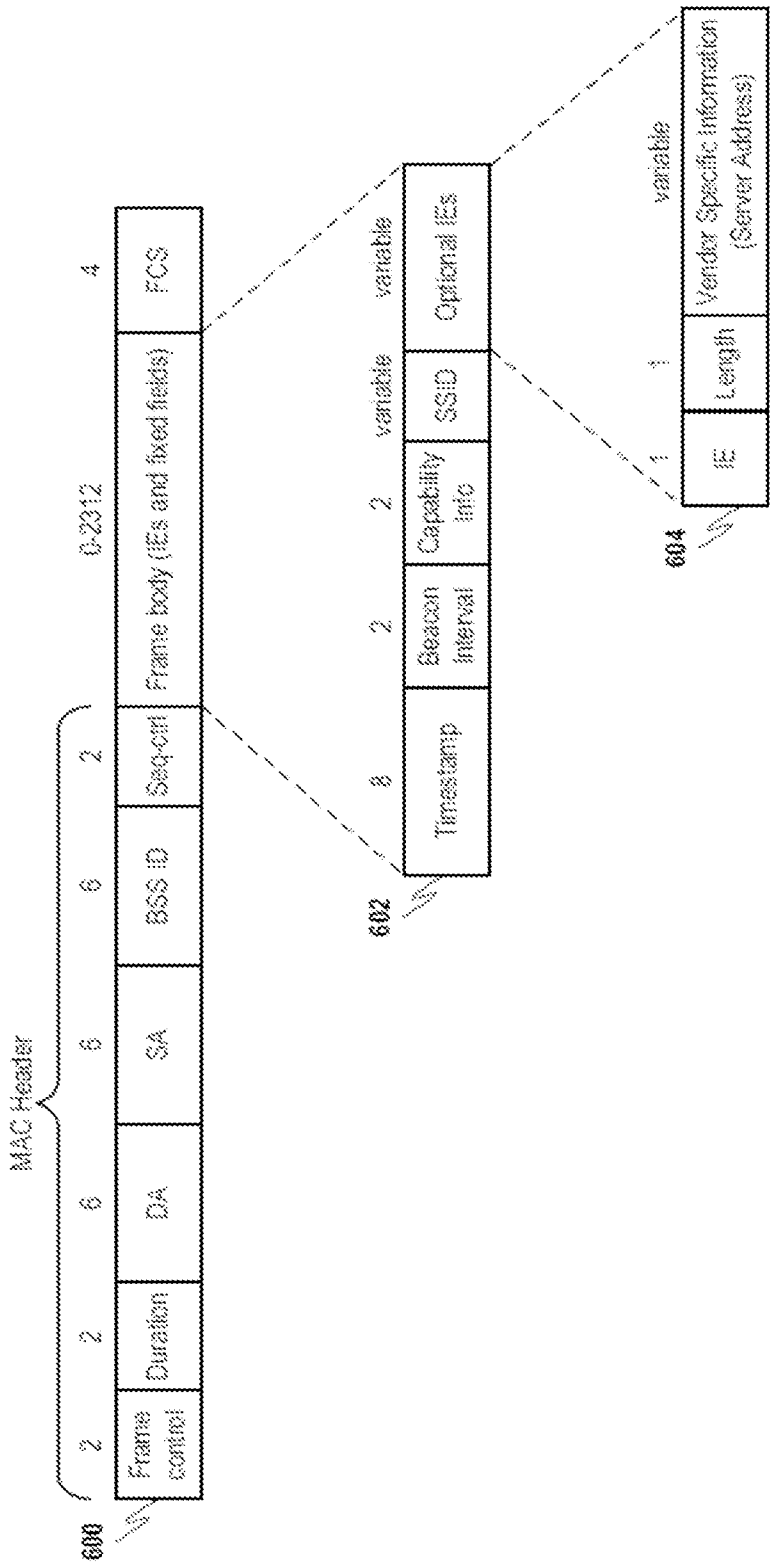


FIG. 7

EXAMPLE: WI-FI, OPTION 19 – ADDRESS EXTENSION

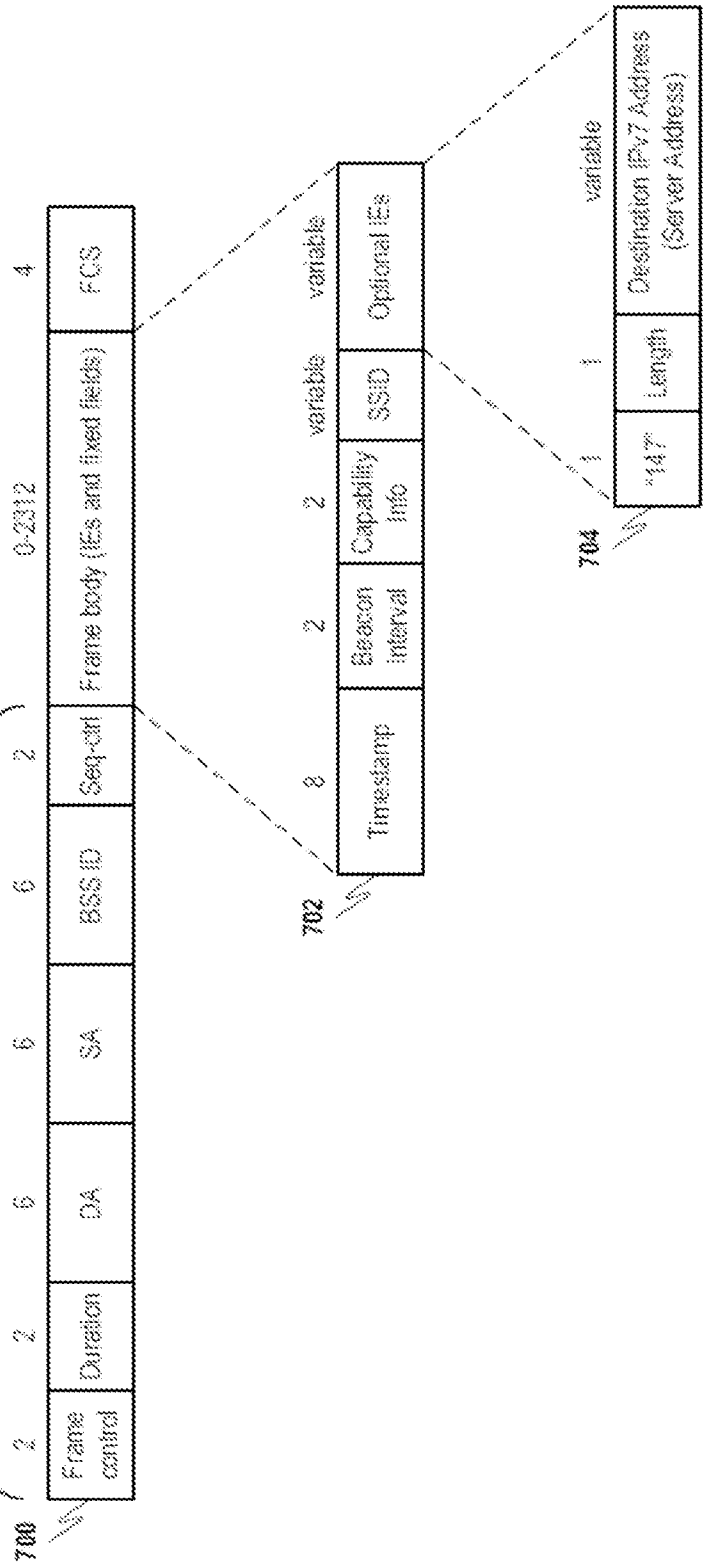
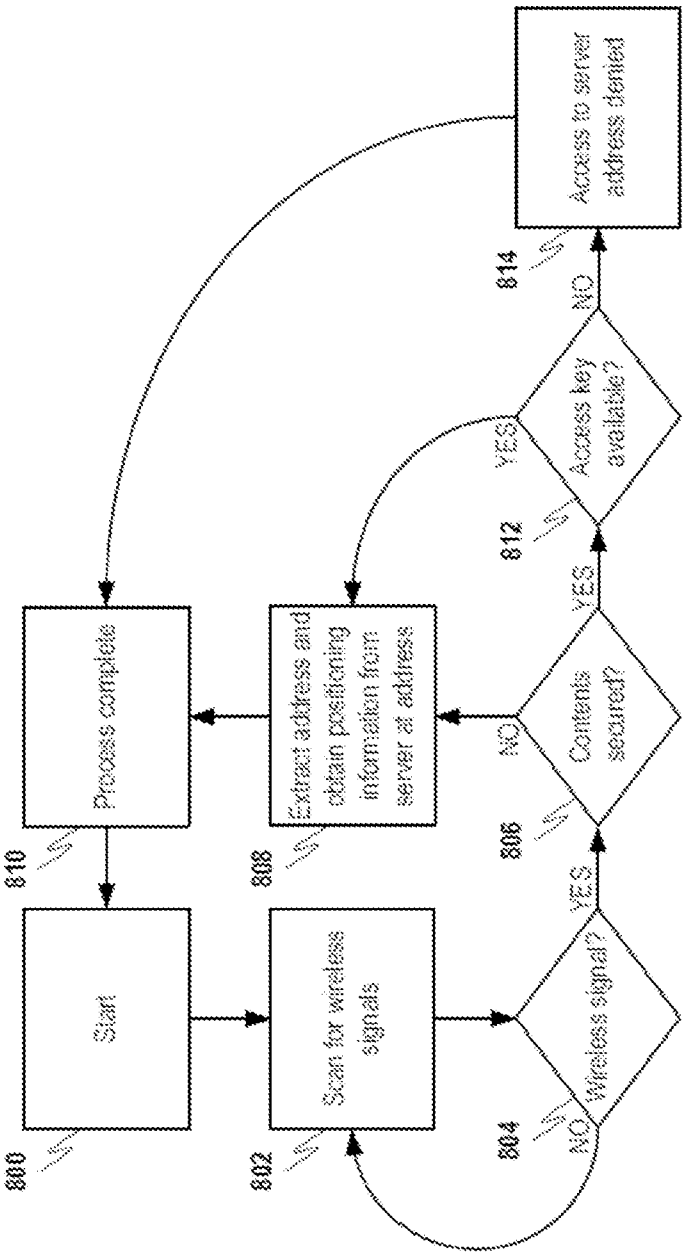


FIG. 8


Start
800
Scan for wireless signals
802
Wireless signal?
804
NO
YES
Contents secured?
806
NO
YES
Extract address and obtain positioning information from server at address
808
Access key available?
812
YES
NO
Process complete
810
Access to server address denied
814

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2012/050189

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H04W, G06F, G01S, G01C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI, INSPEC, XPIEE, XPI3E

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 7024552 B1 (CASWELL, D. L. et al.) 04 April 2006 (04.04.2006) col. 3, lines 43-50; col. 4, lines 61-67; col. 5, lines 50-56; col. 8, lines 23-28; col. 10, lines 22-47; col. 10, lines 56-58	1-22
X	US 2002132614 A1 (VANLUIJT, B. A. G. et al.) 19 September 2002 (19.09.2002) par. [0036]-[0037] and [0060]	1, 8, 15, 22
A	US 2010266125 A1 (TANAKA, Y. et al.) 21 October 2010 (21.10.2010) par. [0081]-[0082], [0090], [0106] and [0109]	1-22

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
05 June 2012 (05.06.2012)	11 June 2012 (11.06.2012)

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2012/050189

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
US 7024552 B1	04/04/2006	None	
US 2002132614 A1	19/09/2002	TW 574803B B	01/02/2004
		JP 2004523970 A	05/08/2004
		WO 02076024 A1	26/09/2002
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US 2010266125 A1	21/10/2010	WO 2009041033 A1	02/04/2009
		CN 101796768 A	04/08/2010
		JP 2009089005 A	23/04/2009
		JP 2009089003 A	23/04/2009

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2012/050189

CLASSIFICATION OF SUBJECT MATTER

Int.Cl.
H04W 64/00 (2009.01)
G06F 17/30 (2006.01)
G01S 5/02 (2010.01)
G01S 1/02 (2010.01)