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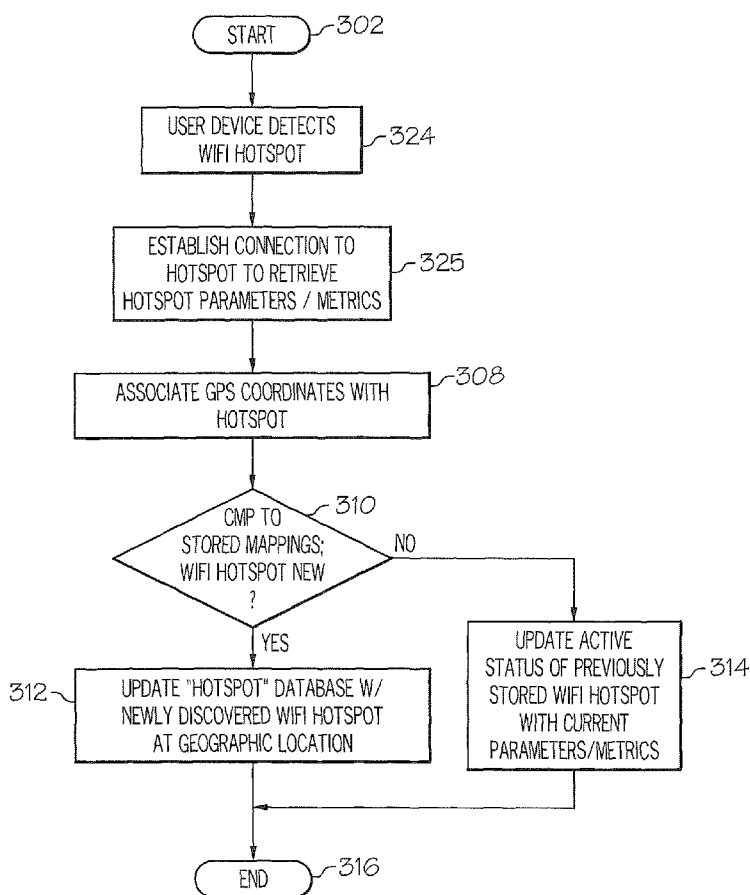
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(54) Title: ON-DEVICE MAPPING OF WIFI HOTSPOTS VIA DIRECT CONNECTION OF WIFI-ENABLED AND GPS-ENABLED MOBILE DEVICES



(57) Abstract: A WIFI-enabled and GPS-enabled user device executes a hotspot location utility, which enables the device to detect WIFI hotspots and update a locally-stored hotspot location database (LHLD) containing geographically-mapped hotspots. When a hotspot is detected, the device accesses the hotspot, retrieves identification information and usage terms from the hotspot, and measures performance metrics of the hotspot. The utility stores the identified hotspot with the current GPS coordinate as an entry within the LHLD. When a user later desires to locate hotspots within a particular geographic location, the user enters the physical address of the location, and hotspots with matching (or proximate) GPS coordinates of the entered address are presented to the user. The user may specify certain preferences for usage terms, performance metrics, and location criteria, and the utility filters all geographic hits and returns only hotspots in the geographic location that also satisfy these preferences.



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**ON-DEVICE MAPPING OF WIFI HOTSPOTS VIA DIRECT CONNECTION
OF WIFI-ENABLED AND GPS-ENABLED MOBILE DEVICES**

BACKGROUND OF THE INVENTION

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Technical Field

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The present invention relates generally to computer networks and in particular to wireless access to computer networks. Still more particularly, the present invention relates to a method, system/device and computer program product for providing up-to-date location of hotspots for wirelessly accessing computer networks.

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Description of the Related Art

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The implementation and utilization of wireless computer networks are growing at a tremendous rate as computer (and other device) users become more and more mobile. Wireless fidelity (WIFI) networks, in particular, have seen a surge in consumer use and have become the most widely utilized standard for wireless networking. WIFI networks operate according to Institute of Electrical and Electronic Engineers (IEEE) 802.11 standard, which is supported by most hardware vendors. These WIFI networks typically have an indoor range of one hundred and fifty to three hundred feet, with performance likely to degrade as the distance increases. Also, typical outdoor ranges for these WIFI networks are approximately one thousand feet. The strength and performance of the outdoor WIFI network typically also degrade as the distance increases, depending also on a number of factors such as atmosphere conditions and physical obstructions.

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In order to provide distributed wireless access to a network, network service providers typically provide a plurality of geographically-dispersed wireless access ports. These wireless access ports provide WIFI access points that allow computer users to access the Internet via laptop and/or hand-held (or portable) computers/devices, such as personal digital assistants (PDAs), smart phones, cellular phones, and the like. These WIFI access points are referred to as "hotspots" and are currently located in many airports, hotels, restaurants, coffee shops and convention centers, for example.

Particularly, the term hotspot refers to the area extending from the wireless access port within which the wireless signal is broadcasted and can be detected by a wireless-enabled/capable user device. "Hotspot" based wireless services are provided by adhoc networks using short-range wireless systems, such as Bluetooth, 802.11 and wireless local area network (WLAN) technology/protocol and provide proximity-based wireless services to mobile terminals at the associated "hotspots." The short range wireless systems are provided via a hotspot access point/port or hotspot server. Each working wireless access port thus emits a wireless signal recognized by wireless-capable mobile devices. The mobile devices then latch onto the wireless signals and are able to access the network via a series of authentication procedures with the background network, depending on whether the network is openly available (or free) or requires some form of payment or subscription.

As WIFI use continues to expand, many of the major notebook computer manufacturers (and manufacturers of other mobile devices) manufacture their devices with an embedded wireless network interface card (NIC) or the mechanism for attaching such a device post-manufacture (e.g., as a USB device). The users of these devices may then access the mobile functionality provided by the computer by subscribing to one or more of the available wireless networks and/or relying on the availability of free-use hotspot locations. However, such wireless access may then require the user have some knowledge of the location of the available wireless networks in their geographic vicinity.

One problem associated with current access to WIFI hotspots is that it is sometimes difficult for a user to locate a WIFI hotspot in a nearby geographic location. While the mobile user may be able to occasionally pick up a random wireless signal, the majority of users prefer to have some idea of where the hotspots are located so that they do not have to drive around town, searching for a wireless signal (from a particular service provider to which the user subscribes) or some random signal at a previously unknown (though publicly-available) location. Thus wireless users tend to congregate at known hotspots that are advertised in some way. For example, certain popular retailers (e.g., Starbucks and McDonald's) and other establishments install hotspots in their locations to draw patrons. However, people new to the area or unfamiliar with the area may not know where these establishments are located. Travelers to a new location fall into this category of users. In addition, not all hotspots have the same performance or cost characteristics. Some hotspots

may have a contract with a certain provider through which the user subscribes, or the hotspot may employ a pay-on-demand type service. In these cases, the user may want to know what the rates and/or contract conditions are for the service, possibly filtering the query results according to those parameters.

A practice termed "warchalking" has been emerging. Warchalking entails drawing a chalk symbol on a wall or pavement to indicate the presence of a wireless networking node. When a computer user comes across this symbol, the symbol notifies the user that the location contains a WIFI hotspot. Warchalking is, however, not a complete nor reliable system because the system is based on an ad-hoc process of the public discovering wireless fidelity nodes, whether commercial or not, and manually signaling the presence of the hotspot with chalk symbols. Also, warchalking does not eliminate the frustration of having to drive around with the hopes of finding a hotspot, particularly since most hotspot locations do not ascribe to the warchalking concept. In addition, the user may not have the time to search for warchalking symbols to find hotspot locations and may not want to risk the possibility of confidential business data being transferred across networks with unknown security features.

Because of the frustration and uncertainty in the above methods of finding hotpost locations, many online websites have began publishing the location of hotspots in particular geographic areas. Directories of hotspot locations are thus available to the user on the Internet. Thus, astute users typically access a website providing a list of available local hotspots and their corresponding street address. The user then determines where these hotspots are relative to their current location and picks one that is convenient (close by) or belongs to the service provider to which the user subscribes.

Current practices for using the Internet to track and find WIFI hotspots, such as 802.11 Access Points, are cumbersome and inefficient. Lists are frequently generated by word-of-mouth, for example, the list maintained on the Austin-Texas' Wireless Group's world-wide web (www) site: "austinwireless.net/cgi-bin/index.cgi/NodesAroundAustin." Hotspots on these lists regularly go down for long periods of time, but the lists do not reflect these extended outages since the list is not updated unless a user becomes aware of the outage and takes the time to make a manual report to the administrator of the list. Added to the unreliability of the list is the fact that these lists provide little or no information

regarding the overall quality of the connections, the bandwidth, availability, or other such statistics.

Despite this online information, a wireless mobility user may have difficulty finding a hotspot location for wireless access. Subscription users may not have brought a hard copy listing of the carrier-provided WIFI hotspot locations. Even when the locations are known, there is no guarantee that the wireless signal is still operational.

Particular web sites such as JiWire® (jiwire.com) provide a searchable database of WIFI hotspots. However, JiWire's database suffers from many of the same drawbacks as above. Also, the JiWire results are heavily biased toward T-Mobile® and Boingo® hotspots, which require either a payment or a subscription to use. This bias towards paid hotspots indicates that JiWire populates its database largely with hotspots reported to it by T-Mobile or Boingo, while other hotspots of competitors or ones that may be free are not as readily added to the JiWire database since JiWire receives no financial incentive for listing these sites. As with the Austin, Texas website, JiWire is also manually updated and thus subject to the similar limitations described above.

SUMMARY OF THE INVENTION

Disclosed are a device, a method, and a computer program product for efficiently generating a substantially accurate list of available hotspots in geographic locations on a user's WIFI-enabled device. A WIFI-enabled and GPS-enabled user device is programmed with a hotspot location utility, which enables the user device to detect WIFI hotspots and dynamically update a locally-stored database of geographically-mapped hotspots using current GPS coordinates. The hotspot location database (HLD) includes an identification of detected hotspots that are currently operating and available for wireless access. Along with each identified hotspot is information related to specific operating parameters/performance metrics of the hotspot as well as its GPS (global positional signal).

When a hotspot is detected, the utility triggers the user device to access the hotspot and retrieves information about the particular hotspot, including the name and performance metrics, such as quality of service (QoS) and connection speed. The utility then obtains the current GPS location and associates the identified hotspot with the current GPS

coordinate. Then, the utility stores the hotspot ID and parameters along with the current GPS coordinate as an entry within the HLD.

When the user later desires to locate hotspots within a particular geographic location, the user opens a GUI of the utility on his device and enters the physical address of the location. The physical address is converted to its GPS coordinate and the GPS coordinate matched against the GPS coordinates associated with hotspots stored within the database. Corresponding hotspots are then presented to the user. However, when the user specifies within the request certain preferences for performance metrics and location criteria desired, the utility filters all geographic hits and returns only hotspots in the geographic location that also satisfies these preferences. Hotspots that are identified as meeting the desired criteria are displayed within the output to the user. In addition to the street address, the presented information may include distance from the user's current location, driving/walking directions (from the user's current GPS location), and/or a map of the location.

The above as well as additional objectives, features, and advantages of the present invention will become apparent in the following detailed written description.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention itself, as well as a preferred mode of use, further objects, and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

Figure 1 illustrates a computer network having a Provider, multiple geographically dispersed hotspots and one of more enhanced mobile devices that together support the various features of the invention;

Figures 2A and 2B provide respective block diagram representations of internal components of a mobile device and a Provider according to embodiments of the present invention;

Figure 3A is a flow chart of the processes undertaken by the Provider to update a hotspot location database (HLD) when receiving hotspot location data and performance metrics from a mobile device, according to one embodiment of the invention;

Figure 3B is a flow of the processes undertaken by a user's GPS-enabled and WIFI enabled mapping device in detecting WIFI hotspots and updating a localized hotspot database with hotspot location and performance metrics according to one embodiment of the invention;

Figure 4A is a flow chart of the processes undertaken within the Provider's website to receive and respond to user's requests for hotspot locating service according to one embodiment of the invention;

Figure 4B is a flow chart of the processes undertaken at the user device to receive and respond to a user-entered request for hotspot locating service according to one embodiment of the invention;

Figure 5A is a flow chart of the processes undertaken by the Provider to register mappers to update an HLD according to one embodiment of the invention;

Figure 5B is a flow chart of the processes undertaken at a user device in updating the localized hotspot location database according to one embodiment of the invention;

Figures 6A-6B depict graphical user interfaces (GUIs) of the Provider's website utilized by users to enter hotspot location requests/queries and sign up as mappers according to embodiments of the invention;

Figure 6C illustrate an example GUI that is utilized to set the methods for updating the localized HLD on the user device according to one embodiment of the invention; and

Figure 7 is an example of an HLD with a single entry depicted according to one embodiment of the invention.

DETAILED DESCRIPTION OF AN ILLUSTRATIVE EMBODIMENT

The present invention provides a method, system/device, and computer program product for efficiently generating a substantially accurate list of available hotspots in geographic locations. Two different implementations of the invention are provided, described below in delineated **Sections I and II**. The first implementation, which is

described in **Section I** below, involves updates to a server-level (centralized) Provider that maintains up-to-date WIFI hotspot information with the aid of a plurality of mappers. The second implementation, which is described in **Section II** below, involves individual user-devices
5 programmed with a WIFI locator utility that initiates frequent updates of a locally-stored WIFI locator database with up-to-date WIFI hotspot information.

Within the descriptions of the figures, similar elements are provided
10 similar names and reference numerals throughout the figure(s). Where a later-described figure utilizes an element in a different context or with different functionality, the element is provided a different leading numeral representative of the figure number (e.g., 1xx for Figure 1 and 2xx for Figure 2). The specific numerals assigned to the elements are
15 provided solely to aid in the description and not meant to imply any limitations (structural or functional) on the invention.

Also, while the two implementations are primarily delineated within respective sections, processes relevant to both implementations may be
20 described only within **Section I** or may be similarly described within both sections. Parallel processes within both implementations may only be described in details within **Section I**. The division of the invention among **Sections I** and **II** are not meant to imply any limitations from one section to the other, but rather to enable continuity with the overall
25 flow of the description.

Section I: Provider Database Updating and Mapping Service

In the first implementation, a computer system is configured with a
30 hotspot location utility to enable the computer system to operate as a Provider. The Provider receives from specially programmed mobile devices hotspot operability/availability transmissions (HOTS), which each include an identification of a currently operating and available hotspot as well as operating parameters/performance metrics of the hotspot. The Provider
35 concurrently receives from the mobile device a current GPS (global positional signal) coordinate of the device transmitting the HOT. The Provider then associates the hotspot (or HOT) with the received GPS coordinate, and the Provider stores the HOT and associated GPS coordinate as an entry within a hotspot locator database (HLD) that comprises
40 multiple entries of HOTS and their associated GPS coordinates.

When the Provider later receives a request from a user searching for hotspots within a particular geographic location, the Provider converts the received address (geographic location) into its GPS coordinate and determines which acceptable entries of the multiple entries have a GPS coordinate (and therefore geographic location) within a given range of the particular GPS coordinate (geographic location) received from the requesting user. The Provider then provides an output of the acceptable entries to the user. In addition to the street address, the presented information may include distance from the user's current location, driving/walking directions, and/or a map of the location and performance metrics, such as such as quality of service (QoS) and connection speeds. These metrics are detected from actual connection of a mapping device to the local WIFI-hotspot to retrieve hotspot connection data. In one embodiment, the user is able to specify within the request certain preferences for performance metrics and location criteria desired for the hotspot the user wishes to locate. The Provider may then return only hotspots in the geographic location that satisfies these metrics and criteria.

In another embodiment, the Provider operates an online hotspot locating service that requests users sign up as hotspot location mappers. As a mapper, the user utilizes his/her mobile device, which is wireless-enabled and GPS-enabled to detect hotspots. When a hotspot is detected by the user's device, the device transmits the HOT including and/or along with the device's GPS coordinate. In this manner, current and substantially accurate hotspot location information is received by the Provider to update a database of available hotspots.

Referring now to the figures, **Figure 1** provides a wireless network with a Provider **140** and a plurality of discoverable hotspots according to one embodiment of the invention. Wireless network is illustrated as a computer network since a majority of WIFI networks are computer networks. As such, mobile devices **110** are illustrated and described as computer systems, although the devices may be any type of handheld or portable device. Further, other types of hybrid networks (e.g., computer network and wireless phone network) may also be enhanced with the features provided herein. Wireless network **100** includes multiple wireless access points **102a-c** connected to a background distributed information network **130** that includes servers **135** of one or more network-access service provider as well as hotspot locating provider server (Provider) **140**.

Each wireless access point **102a-c** may include a radio frequency (RF) (or Bluetooth) transceiver (not specifically illustrated), front end server **125** using 802.11 or WLAN at the front end and backend server (wireless service provider's server **135**) providing a high speed wired or wireless connection to the Internet **160**. Front end server **125** executes a standard operating system (OS) (not shown) implementing communication protocols via an antenna for short-range wireless systems, typically Bluetooth or WLAN and an antenna for cellular networks, typically Global System Mobile (GSM) or CDMA. Server **125** includes a dedicated application for establishing a session with mobile device **110** and recognizing the MAC address of mobile device **110**. Access point **102a-c** is coupled to Internet **160** through backend server (**135**) via wireless link or a wired connection.

Access points **102a-c** are geographically dispersed and may be utilized to provide mobile device **110** with wireless connections/access to wireless service providers **135** and Provider **140** whenever mobile device **110** is within a coverage area (hotspot) **104a-c** (respectively corresponding to the area around similar lettered access point). Any number of access points may be available to mobile device **110** within a geographical area, and the present invention illustrates only a single access point within each of three geographic locations, provided for illustration only. These areas/locations may be adjacent to each other or geographically dispersed (e.g., different cities) and the illustration of three seemingly congruent areas is provided solely for illustration. In conventional application, the wireless access points **120a-c** may be commercially available from several manufacturers or wireless service providers (**135**), which may require a user subscription. Other access points may be provided free of cost and/or without subscription (e.g., pre-pay or pay-as-you-use).

Figure 2B illustrates an exemplary data processing system that may be utilized as Provider **140** of **Figure 1**. For simplicity, data processing system will be referenced as Provider **140** since data processing system is illustrated having hardware and software components that together exhibit the functionality attributed/ascribed to the WIFI hotspot locator "Provider" described herein. Provider **140** comprises processor **250** coupled to memory **260**, input/output (I/O) controller **270**, and other/secondary storage **280** via system bus **255**. I/O controller **270** provides the connectivity to and/or control of input/output devices, including mouse **272**, keyboard **273** and display device **274**.

Provider **140** also comprises network interface device (NID) **275** utilized to connect Provider **140** to another computer system and/or computer network (e.g., Internet **160**, as illustrated by **Figure 1**). NID **275** provides
5 interconnectivity to the external network through a gateway or router, or similar device. NID **275** may be an Ethernet card or modem, for example, depending on the type of network (e.g., local area network (LAN) or wide area network (WAN)) to which Provider **140** is connected. In one embodiment, Provider **140** may also be extended to include a mechanism for supporting
10 wireless access ports through which hotspot data is wirelessly transmitted to Provider **140** from a mobile device **110** of a mapper (via the process described with reference to **Figure 5** below.)

Provider **140** supports a hotspot locator database (HLD), which in one embodiment is maintained within secondary storage **280**. In alternate
15 embodiments, however, and as illustrated by **Figure 1**, HLD **170** is actually a separate database, which may be directly accessed by Provider **140** or indirectly accessed Provider **140** via Internet **160** or other network (e.g., a LAN). Similarly, Provider **140** also maintains or has access to a GPS locator database **275**, whereby Provider **140** is able to convert GPS
20 coordinates into actual physical addresses and vice versa. As illustrated, GPS locator database **275** may be locally stored (on secondary storage **280**, e.g., a hard drive or removable medium of Provider **140**) or accessible via Internet **160** or other network.

25 Located within memory **260** and executed on processor **250** are a number of software components, including operating system (OS) **262** (e.g., Microsoft Windows®, a trademark of Microsoft Corp, or GNU®/Linux®, registered trademarks of the Free Software Foundation and The Linux Mark Institute, respectively) and a plurality of software applications, including database
30 utility **264**, hotspot location utility **266**, and website utility

268. Provider **140** also comprises address mapping utility **269**, which includes local maps and street addresses in a number of geographical locations in which hotspots may be found. In another embodiment, access to such services is provided by an online service such as MapQuest®.

35 Processor **250** executes these (and other) application programs (e.g., network connectivity programs) as well as OS **262**, which supports the application programs. According to the illustrative embodiment, when processor **250** executes OS **262** and one or more of the above utilities (application programs), the utility enables Provider **140** to complete a

series of functional processes, including: providing/enabling receipt of general hotspot mapping data; HLD updating with performance metrics and other parameters; GPS-to-geographic location conversion; web site interfacing, including specific hotspot locating with user-entered metrics and parameters; and other features/functionality described below and illustrated by **Figures 3-6**.

Notably, while shown as separate utilities, each of the above utilities may be sub-components (subroutines) within a single WIFI locating utility. Also, existing conventional wireless services may be enhanced with hotspot mapping and locating functionality when the WIFI locating utility is installed on the service provider's server. Thus, Provider **140** may also be a service provider's server that provides general wireless access support to subscribers and/or free users.

Figure 2A illustrates the primary hardware/software components of a computer notebook system **200**, which is assumed to be mobile device **110** of **Figure 1** and described as such, hereinafter. Mobile device **110** is described as a notebook computer system because most of the functionality provided by mobile device **110** requires the standard hardware and software components of a notebook computer as well as downloadable software utility that enable the mobile device's user to access Provider **140** or operate as a stand-alone WIFI locating device, as described below.

Mobile device **110** is illustrated having several similar hardware components (illustrated with different reference numerals) as Provider **140**, although typically smaller for increased portability. Additionally, mobile device **110** may comprise wireless transceiver for short-range wireless communication. Wireless transceiver may also be a GPS transceiver that enables mobile device **110** to connect long-range via a GPS system. Mobile device **110** also includes keyboard/keypad **218** and other selectable input devices, such as mouse **217** as well as output device, such as display **219**.

According to the described embodiment, mobile device **110** may be utilized as: (1) a requesting device by which the user requests the hotspot location from Provider **140**; (2) a mapping device by which the user detects hotspots and transmits WIFI hotspot information along with a GPS coordinate to Provider **140**; (3) a stand-alone WIFI hotspot locating device by which mobile device **110** includes some or all of the locator service

functionality (i.e., with or without requiring access to Provider **140**, as described below in **Section II**; or (4) a device having two or more of the above functionalities. To enable these functionalities, mobile device **110** includes within memory **210** several software utilities, including OS **211**,
5 browser **212**, Hotspot locator (HSL) utility **213**, and GPS utility **214**.

In one embodiment, the general hardware components of both mobile device **110** and Provider **140** are of conventional design. However, both may include additional and/or different components (not shown), such as fixed
10 disk drives, removable disk drives, CD and/or DVD drives, audio components, modems, network interface components, and the like. It will therefore be appreciated that the systems described herein are merely illustrative and that variations and modifications are possible.

Further, the techniques/functionality for mapping, locating and tracking hotspots by GPS coordinates may also be implemented in a variety of differently-configured computer systems or mobile devices. Thus, while the invention is described as being implemented in Provider **140** that is in communication with mobile device **110**, those skilled in the art appreciate
15 that various different configurations of computer systems exist and that the features of the invention are applicable regardless of the actual configuration of these computer systems.

Specifically, with respect to mobile device **110**, the invention is
25 applicable to not only a notebook or laptop computer system but may also be implemented in a portable and/or hand held device such as a personal digital assistant (PDA), cell phone, or other hand-held devices, so long as the device is portable, supports wireless and GPS functionality and has the requisite utilities that may be executed by the internal processor to
30 enable wireless connectivity to hotspots, mapping of hotspots and associated performance metrics, GPS coordinate tracking, and reporting of discovered hotspots, and the other functional features described herein.

According to the invention, hotspot location data may be collected in a
35 variety of ways. The described embodiment involves a user (referred to herein as a "mapper") loading hotspot mapping software onto the user's GPS-enabled/equipped and WIFI (802.11/802.16)-enabled/equipped mobile device **110** (e.g., laptop or PDA). This embodiment recognizes the trend in wireless device technology to include within the wireless devices GPS and
40 802.11 hardware capabilities. As these technology improvements become

standard on personal digital assistants (PDA's), cellular phones, and laptops, their use as mappers for Provider **140** becomes increasingly feasible. The hotspot mapping software triggers the mapping device to constantly scan for hotspots, identify the access ports and initiate corresponding Internet connectivity through these access ports. Information (such as operating parameters/ performance metrics) regarding the discovered connections are gathered, and that information, along with the GPS coordinates of mobile device **110** are then transferred in real-time via an established connection to Provider **140**.

In a second embodiment, the information is collected and stored in a local database of mobile device **110** and transmitted to Provider **140** at the user's discretion (e.g., when a link to Provider **140** is later established) or at some pre-set period. For those mappers who do not have a properly equipped mobile device, Provider's support personnel may issue the user a special portable device that is equipped with wireless (e.g., 802.11, 802.16) and GPS functionality.

According to the described embodiment and as illustrated within graphical user interface (GUI) of **Figures 6A-6B**, users of the hotspot locating service are recruited as mappers. As shown by **Figure 5A**, Provider **140** recruits a network of users with mobile devices capable of generating and transmitting HOTs. Recruiting may involve advertising/promoting some incentive to wireless users with GPS-enabled and 802.11-enabled wireless devices to act as mappers while they drive/move around. Users who agree to provide this mapping service (and perhaps those who provide a pre-established amount of HOT information) may then be awarded the advertised incentive(s), such as discounts on the querying services of Provider **140**, coupons, and actual monetary payments.

The information received by Provider **140** is referred to herein as a hotspot operating/availability transmission (HOT) and includes WIFI identification (ID), performance metrics and operating status, and availability of the WIFI access at that location. Thus, the specific name of the hotspot may be provided, particularly when the hotspot is affiliated with a known service provider to whom users may subscribe. Alternatively, Provider **140** may generate a name for a hotspot not specifically identified or which has a shared, generic name similar to other hotspots in vicinity of the current hotspot.

Turning to **Figure 5A**, and beginning at block **502** which depicts the Provider prompting users to sign up to be mappers. The prompt may be a strategically placed advertisement **650** on Provider's website interface **620** which is presented within web browser **600**. Website **620** provides online access to the WIFI hotspot locating service available through Provider **140**. Other websites (e.g., those promoting wireless products or wireless access) may also provide the advertisement to visitors of these sites. Assuming the user responds to the prompt within advertisement **650** to sign up as a mapper, Provider's website utility **268** generates a second web page (not shown) within which Provider **140** obtains from the user the configuration parameters of the user's mobile device and establishes a "mapper" account, as depicted at block **504**.

In one embodiment, only users whose mobile devices support both wireless and GPS functionality are selected to become mappers. In one alternate embodiment, a user whose mobile device is not equipped with GPS capability is provided a separate GPS unit via the mail. Provider **140** then makes WIFI hotspot location mapping utility **213** available to the user, which the user downloads (from the website) to his mobile device to enable the device to operate as a hotspot mapper, as shown at block **506**. Again, Provider **140** may mail the location utility on a disk to the user (e.g., for "manual" installation on a laptop) rather than direct download from the website. Once loaded on the user's mobile device, the utility self-installs and activates a background scanning function to locate hotspots and collect performance metrics for the various hotspots detected by mobile device **110**, as indicated at block **508**.

In one embodiment, the user's device would then report this information in real-time via Internet/wireless connectivity to Provider **140**, which receives this information/data along with the associated GPS coordinates as a HOT, as indicated at block **510**. Provider **140** maintains a hotspot lookup/locating database (HLD) that correlates GPS coordinates with WIFI hotspots via the process illustrated by **Figure 3A**, which is described below. As shown at block **512**, Provider **140** gives the advertised incentive to the user once the information is received from the user's mapping device. Finally, as indicated at block **514**, Provider **140** then presents geographic location data and associated performance metrics of hotspots within geographic locations to requesting users via the process depicted by **Figures 4A** and **6B**, which are described below.

Enabling local download/installation of the local version of HSL utility enables the invention to be implemented at the user-level as further described within **Section II** below. The user downloads or loads a user-level HSL utility (referred to below as LHSL) on the user's mobile device, and the utility executes and provides most of the functionality described herein within the user's mobile device. Provider **140** may thus provide individual user licenses to the user-level HSL utility and also periodically retrieve hotspot location information from the user's mobile device. In this way, once the utility is downloaded to the user's mobile device, the user device may operate completely independent of the Provider when locating a hotspot in a particular geographic location. However, an alternate embodiment entails Provider **140** maintaining the HLD such that each user has to access the HLD at Provider **140** to obtain the hotspot listing for the user's current location. The user's locally-stored HLD (referred to below as LHDL) may then be automatically uploaded in an exchange of HLD information whenever the user requests WIFI location information or whenever the user logs into Provider's website. Provider **140** thus receives current WIFI location information from thousands and potentially millions of WIFI users, who have simply enhanced their GPS-enabled mobile devices by loading the user-level HSL utility.

As previously mentioned, Provider **140** executes a hotspot location utility that maintains a database of available hotspots and their GPS coordinates. Compilation of the initial hotspots and associated coordinates within the database may be completed by an administrator (of Provider **140**) or system developer. Beginning with this initial database, Provider **140** updates and maintains current hotspot information utilizing the process illustrated by **Figure 3A**. The process commences at block **302** and proceeds to block **304** at which the Provider receives hotspot location and connection information from a mapping device within the WIFI hotspot.

Concurrently with receiving the HOT, Provider **140** also receives from mobile device **110** a GPS coordinate, as shown at block **306**. Provider **140** then associates the GPS coordinate with the HOT, as indicated at block **308**. In an alternate embodiment, the GPS coordinate is included within the HOT. Provider **140** then checks at block **310** whether the GPS coordinate and identified WIFI hotspot is a new WIFI hotspot (i.e., not one already stored within the HLD). When the WIFI hotspot is new, Provider **140** updates the HLD with an entry of this newly discovered/identified hotspot along with its associated GPS coordinate, as provided at block **312**.

By correlating GPS coordinates with live connections of wireless devices, Provider **140** is able to build a substantially accurate and current database of hotspots that other users are able to access. Returning to decision block **310**, if the WIFI hotspot is not new, Provider **140** updates the active status of the existing entry within the database and the corresponding performance metrics, as shown at block **314**. Once the database has been updated, the process ends, as shown at block **316**.

Figure 7 illustrates an exemplary HLD with an entry **700** that includes various ones of the multiple metrics that may be maintained by Provider **140** within the database.

In an alternate embodiment, rather than store the GPS coordinates, the coordinates are converted into their corresponding geographical locations (addresses) and then Provider **140** stores all HOTs with their corresponding addresses. Then, when a request is received that includes an address, the Provider looks up that address and maps around that address to determine hotspots stored within the database that are within proximity to that address. The user query may be made from a variety of devices, including laptops, PDA's, and cellular phones.

As utilized herein, the performance metrics refer to the bandwidth; availability (time of day, for example); minimum, maximum, and average latency; range from access point; wireless signal attenuation characteristics; and other similar type parameters that define the quality, strength, and usability of a hotspot. Other metrics may be "cost" associated, such as pre-pay, pay-as-you-use, free access, and/or subscription only access, for example. Additional metrics including date/time of discovery of hotspot (i.e., first mapping in HLD), date of last update, historical user ratings, and others may be included.

Further, some service providers (e.g., T-Mobile) present a sign-on web page to users who attempt to browse the web by connecting through the hotspot for the first time. In one embodiment of the invention, these web pages may also be detected and registered in the Provider's database, along with other statistical information, so that patrons of that service provider may also receive additional sign-on information about connection criteria for the particular hotspot(s) of that service provider.

Statistical information regarding the connections can be derived from the mobile device's wireless connection and other interactions within the

hotspot. Such information may include the time periods in which the connection was active, the strength of the signal, the average connection bandwidth and latency, access ports that were closed off, and the overall availability and quality of the WIFI service at that location.

5 This information within the HOT is measured by the mapping device (wireless client). For example, a mapping device measures network latency over the connection by sending packets to other hosts on the Internet and measuring the round-trip time for the packet to return. The mapping device
10 also compares round-trip times against those obtained over other hotspots in the region to gauge relative performance. Similar mapping methods may be implemented, although less reliably so, for bandwidth measurements, both peak and sustained. Each hotspot may provide one or more of the above metrics to the wireless device, which then forwards this information
15 within the HOT to Provider **140**. Operating characteristics and performance metrics (speed, strength, availability, bandwidth, congestion, protocol, etc.), as well as hotspot and service identification, cost, timing metrics and other information may be thus stored within an entry of the HLD.

20 The above described methods of updating the HLD involve a push of information from mapping device (**110**) to Provider **140**. In an alternate embodiment, Provider **140** also supports a method by which information is pulled from mapping device **110**. In this latter embodiment, Provider **140** monitors existing HOT entries within the database to ensure that the
25 associated hotspot is still operational and/or to periodically update the stored performance metrics of the hotspot. Thus, in addition to receiving hotspot location information from wireless device **110**, Provider **140** may also directly request information from the mapping devices **110** within certain geographic locations. That is, Provider **140** may automatically
30 request mapping devices **110** within a particular geographic location initiate a sweep of a given geographic location associated with a particular GPS coordinate to determine whether previously recorded WIFI hotspots are still located in those locations and what performance metrics are presently associated with those hotspots.

35 The pull operation may be triggered by receipt of a HOT (by Provider **140**) at a GPS coordinate that is in vicinity to a GPS coordinate of a previously stored HOT. In this way, a previously mapped WIFI hotspot that is no longer transmitting/broadcasting a signal in the particular location
40 in which mobile device **110** of a mapper is present may be marked as non-functional/down (or potentially down). This status is reflected in

the HLD and the entry may be tagged for deletion within a pre-set time unless a new HOT is received for that hotspot before expiration of the pre-set time.

5 Users who wish to utilize the hotspot locator service may do so by querying Provider **140**. Different embodiments are provided by which a user may submit a query to locate a WIFI hotspot. One method involves submitting the query within a web browser via the Internet. In this embodiment, Provider **140** maintains a website via website utility **268**. An
10 example website interface for entering a hotspot query is illustrated by **Figure 6A**. A user with access to the Internet opens browser **600** and enters the universal resource locator (URL) of Provider **140** in address field **610**. Once submitted, the web browser returns Provider's web interface, of which website **620** is an example. As shown, browser **600**
15 includes within address field **610** the Provider's URL, which is indicated as "WIFIlocatorprovider.com." Web site **620** includes a series of fields within which the user enters the query for a hotspot in a specific location. In addition to these query fields, website **620** also prominently displays advertisement prompt **620** for new mappers with the promise of some
20 consideration/incentives, as described above. One embodiment of the process by which the user enters a query utilizing these fields of website **620** is illustrated by **Figure 4**, which is now described.

The process begins at block **402** and proceeds to block **404** at which the
25 user opens website **620** of Provider **140**. Once website **620** opens, the user enters location criteria into address fields **630**, which may include any combination of the street address and/or city, state, and zipcode of the location in which the user desires to find a hotspot, as shown at block **406**. Also, in range field **633**, the user may enter a range (distance)
30 within which the user desires to locate the hotspot. For example, the user may desire to find the list of hotspots within a particular radius (e.g., three (3) miles) from the user-entered address in address field **630**. Additionally, the user may also input a specific WIFI provider and/or type of plan (free, pay-per-use, subscription) desired in provider
35 plan fields **635**. Finally, the user may enter specific filters on performance metrics such as supported bandwidth, upload/download speeds, and others, in performance/connection field **637**.

By using the above described web portal, Provider **140** may receive revenue
40 through advertisements, subscriptions, and/or one-time query payments.

Payment for utilization of the location service may be made by entry into payment field **640** of a credit card or other form of payment. Once all inputs have been made, the user selects search button **645** to initiate the search by Provider **140**.

When Provider **140** receives the user selection of search button **645**, Provider **140** retrieves the location/address entry and converts the address into a GPS coordinate at block **407**. Then, as provided at block **408**, Provider **140** utilizes the resulting GPS coordinate along with the other parameters entered by the user (i.e., preferences) to locate matching hotspot(s) within the HLD. In the illustrative embodiment, the query is parameterized according to certain user preferences (**633**, **635**, **637**). For example, the user may be willing to use a pay/subscription service, such as T-Mobile, if it means that the user will have to drive less distance or if the connection will be more reliable. Notably, if the user entered preferences, including additional search parameters or performance metrics, Provider **140** also screens those hotspots in the range of available hotspots to determine which ones satisfy the user's preferences (i.e., which identified hotspots have or exhibit the particular parameters/metrics requested).

A determination is made at block **409** whether any hotspot exists within the database that is within the geographic location and which also meets the additional user preferences. If such a hotspot is identified within the database, Provider **140** outputs the name of the hotspot, its address and driving/walking directions from the user-entered address, if a street address was provided, as indicated at block **410**. Then the process ends at block **412**.

However, when no hotspots are found within the database meeting these criteria, Provider **140** outputs a message that no hotspot was found (block **413**) and returns the user to the search page (website **620**) to change and/or update the search request, as shown at block **414**. In one embodiment, when no matching hotspot is found during the initial search, the range is increased beyond the user's preference or beyond an initial default value. Thus for example, a second citywide search of the database may be completed if no hotspot is identified meeting a search criteria that limits the searchable area to one (1) mile from the entered physical address. In another embodiment, when the user preferences are not found

within available hotspots, the user is provided with the available hotspots and a message indicating that the preferences can not be met.

An exemplary output of a located hotspot is illustrated by **Figure 6B**, which depicts browser **600** with a different user interface of website **620**. The illustrative output includes hotspot name and address **660**, a street map **655** plotting the direction from current user location, and driving (or walking) directions **670**. Notably, the output also includes performance metrics **675** of the provided hotspot(s), such as speed of connection, type/availability of service, and others. Those skilled in the art appreciate that any number of metrics (available within the database HLD) may be provided within the output and that the particular metrics illustrated are for example only and not meant to imply any limitations on the invention. As with **Figure 6A**, website **120** displays advertisement **650** prompting the user to sign up as a mapper. User selection of this advertisement initiates the process provided by **Figure 5A**, which is described above.

In the illustrative embodiment, a topographical view (street map) **655** of available hotspots surrounding the user entered address may also be generated. In the topographical view of a region, the hotspots can then be represented according to their overall quality, perhaps through color coding or other methods by which such information is displayed. Hotspots may also be displayed with a hidden text output of the QoS data, which is revealed when the user moves the cursor over the area.

Because of the manner in which hotspot location data is collected, as described above, hotspot coverage is up-to-date and reliable. The data is based on actual readings made by wireless networking hardware, rather than haphazard word-of-mouth reporting. In implementation, mail carriers and pizza delivery workers may be utilized as mappers. The company that provides the database hosting and querying service may then compensate companies or individuals for carrying the GPS/802.11 mapping device in vehicles as their employees travel around. Such compensation may be in form of free advertising on the website or some other monetary or non-monetary compensation. Further, in-vehicle computers such as provided by NeverLost™ may be utilized as mappers (or requesters) without requiring a user interface per se. the system would then detect the user's current location via the device's GPS coordinates without need for a web interface like that provided by Figure 7.

II. User Device With Localized WIFI Location Functionality

The second implementation of the invention provides a GPS-enabled and WIFI-enabled mobile device (such as a laptop, smart phone, PDA, or in-vehicle computer) that includes locally-executed HSL (LHSL) utility (and associated locally-stored LHLD), which enables the device to independently generate and update the LHLD and to provide hotspot locating service utilizing the LHLD. With this implementation, a user is able to retrieve a list of up-to-date, location-based WIFI hotspots given a particular user request indicating the geographic location and the specific criteria desired for a hotspot request.

According to one embodiment, hotspot locating utility is a separate, add-on utility that enhances an existing user device and/or server. Hotspot locating utility may be obtained via off-the-shelf purchase (e.g., on a CD ROM) or downloaded as an add-on utility (from an online supplier website) or as an upgrade to existing server utility (from the server's support website), for example.

In one embodiment, the LHSL utility is executed in real-time with a user of the device entering a request (on the device) for a hotspot meeting certain location parameters and performance metrics. The LHSL utility ascertains based on the user provided location parameter (with the user's current GPS coordinates as a default location) which hotspots stored within the LHLD is within the given geographic location (meeting the specific performance metrics). The LHSL may further provide an indication of the hotspot among multiple found that is the closest hotspot and the best way for the user to get within range of that hotspot. Driving directions to the hotspot may also be presented to the user on his device, perhaps through a system such as OnStar.

The LHSL utility makes the device continually monitor the surrounding location(s) for WIFI hotspots, and updates the LHLD with current WIFI-hotspot data for the present location. Further, in one embodiment, the utility initiates automatic exchange(s) of updated WIFI-hotspot information with other devices (e.g., Provider 140 or another user device) so that both devices maintain updated HLDs. Connection to the other similar devices may be via peer-to-peer channels, while connection to Provider 140 maybe via the Internet. When connection is via the Internet, data transfer/exchange may be triggered whenever an Internet connection is detected).

Figure 1 illustrates the various methods of communication from an example user device, mobile device **110**. As shown, mobile device **110** may communicate with Provider **140** via wireless access point **120b** or Internet **160**. Mobile device **110** may also communicate with service provider **135** via access point **120b**. Lastly, mobile device **110** may communicate with another mobile device **111** via a peer-to-peer network **180**.

Mobile device **110** is depicted as a computer notebook, having similar hardware and computer software as notebook **200** of **Figure 2A**. As described above, notebook **200** includes many standard hardware components found in conventional notebook computers, e.g., processor **205**, memory **210**, I/O devices (mouse/touchpad **217**, keyboard **218**, display **219**, and I/O port **216** (e.g., USB port, a CD drive, etc.)). Additional hardware components relevant for completing the specific functional features of the invention include wireless transceiver **233**, GPS tracker **235**, and storage **208** within which a local HLD is stored and updated. Notably, the LHSL utility **213** may be loaded on to notebook **200** via the I/O port device **216** (e.g., hard disk or CD ROM), which may also store the initial LHLD downloaded to storage **208** during installation of LHSL utility **213**.

Referring now to **Figure 3B**, which illustrates the process of updating of a user device's HLD **209** according to one embodiment. The process begins at block **302** and proceeds to block **324**, which illustrates the user device detecting a WIFI hotspot. Whenever a hotspot is detected, the user device establishes a connection to the hotspot as shown at block **325**. During the connection, the user device retrieves operating parameter data from the particular access point and front end server. This information along with the hotspot's name and service provider's information are then associated with the current GPS location of the user device according to the processes illustrated by blocks **308-316**, which were previously described with reference to **Figure 3A**.

Figure 4B illustrates the process of handling a user request for hotspot location information. Receipt of this request may be via a local application graphical user interface (GUI) such as provided by **Figure 6A**. Unlike the process of **Figure 4A**, the user enters the request on an application GUI local to the user device and the results are determined via a local process utilizing the LHLD and presented to the user. That

is, the user does not need to connect to an external device (e.g.,
Provider **140**) to obtain the location information, as that information is
stored within the user's devices storage **209**. In one embodiment, the user
pre-defines "filters" with minimum quality-of-service (QoS) expectations.
5 When such filters are in place, the utility will simply not display
hotspot locations for hotspots that do not satisfy the minimum QoS
requirements.

Updating the local HLD with current WIFI hotspot data may be completed via
10 one or more of a series of processes. **Figure 5B** illustrates how these
processes may be implemented for a particular user device. **Figure 6C**
illustrates an example GUI, which may be utilized by a user to select
which of the several processes are undertaken by the particular user
device.

15 As illustrated by **Figure 6C**, when initiated by user input/selection, the
LHSL utility opens a HLD datashare GUI **680** within display **219**. Within HLD
datashare GUI **680** are a series of selectable options related to the manner
in which the user desires the updates to the database to be conducted.
20 Three options are provided, described as peer-to-peer **682**, Provider HLD
684, and service providers **686**. Selection boxes for each option include
automatic update box **688** and manual update box **690**. When automatic update
is selected, the LHSL utility causes the user device to continuously scan
the airwaves for detection of a peer device or for a hotspot to which the
25 user device may connect to the Internet and ultimately the service
provider and/or Provider **140**. When the user has selected "manual update"
for each option, no update occurs to the database until manual update
button **696** is selected. Manual update button **696** is provided to initiate
the manual update of the database by one (or more) of the selected
30 option(s) for which manual update is checked by the user.

In addition to these two selections, an additional pair of selection boxes
is made available for each option, namely, share data **692** and receive-only
294. When share data **692** is selected, the user device shares its local
35 HLD entries with the other device to which the user device is connected.
Date and time information is utilized to ensure that the most up-to-date
version of a particular hotspot entry is saved to both databases when the
databases contain a same hotspot entry detected at different times. Thus,
within the user device's HLD, existing entries are updated if old/stale
40 and new entries are added to the HLD. In one embodiment, timestamps are

provided with each entry to indicate the date of the first detection of the hotspot and/or date of most recent update.

5 In contrast, when receive-only **294** is selected by the user, the utility executing on the user's device prevents the other device from retrieving/copying the data stored within the local HLD. This selection may be utilized in situations where the local data is proprietary and/to the data is valuable (financially or otherwise) and should not be provided to/exchanged with the other device. The invention contemplates an
10 implementation in which a Provider compensates in some way for each new hotspot location, where particular locations (such as one that is highly requested by other users) may yield some compensation to the user providing that HOT to the Provider. For other reasons as well, enabling another device access to the HLD information may not be desired by the
15 user.

Referring now to **Figure 5B**, which illustrates the operation of the LHSL utility in providing the updates to the local database utilizing one or more of the above mentioned options. The process begins at block **550** and
20 proceeds to block **552** at which the utility initiates monitoring functions for the user device. This process/embodiment assumes an automatic monitoring option has been selected rather than a user-directed/manual monitoring. This may involve triggering the hardware to detect wireless access points, detecting a peer device within communication range, and/or
25 (soft) detecting connection of the user device to the Internet. A first determination is made at block **554** whether a connection to the Internet is detected. If no Internet connection is detected, a next determination is made at block **556** whether a peer device is detected. If no peer device is detected, the utility continues monitoring as shown at block **558**.

30 If, however, a peer device is detected, the user device connects to the peer device, as indicted at block **582**, and then the utility updates the local database with new/updated WIFI hotspot information from the peer device's database, as shown at block **584**. For purposes of the invention,
35 a peer device is assumed to be one which not only allows peer-to-peer communication but more importantly one which also maintains a LHLHD. Data received from the peer device's LHLHD are tagged as peer-data, as indicated at block **586**.

A determination is then made at block **588** whether the share option (**692**) is selected, which allows sharing of information from the local database. If the share option (**692**) is selected, the information from the local database is forwarded to the peer device at block **590**. In one embodiment, particular tags are assigned to information when the information is stored so that only true updates are passed during such communication. This reduces the amount of time required for the update operation to be completed when both HLDs maintain overlapping data.

Returning now to decision block **554**, when an Internet connection is detected, a next determination is made at block **560** whether the automatic update via the Provider option is selected. When that option is selected, the utility connects (perhaps via the Internet) to Provider **140**, as depicted at block **562** and then proceeds to update the LHLHD with information from the Provider's HLD, as shown at block **564**. At block **566**, a determination is made whether the share option (**692**) is enabled. When the shared option (**692**) is enabled, the utility forwards the local HLD information to Provider **140** to update Provider's HLD, as indicated at block **568**.

At decision block **560**, when automatic update via the Provider is not selected (perhaps in the embodiments where there is no "Provider"), the utility checks at block **570** whether the WIFI service provider has hotspot location data. Assuming such data is available from the WIFI service provider, the utility proceeds to update the local HLD with this available data, as illustrated at block **572**. Then, the updated data is tagged to indicate its source as being a service provider as shown at block **574**.

Indicating the source of the data allows the utility to assign a level of confidence that may be provided when later providing that HLD entry in response to a user request. Locations that are detected by the user device are more likely to be provided with higher level of confidence, while those received from a secondary source (such as service provider) are given much lower level of confidence.

As introduced above, one embodiment provides a hybrid of the above two implementations (Sections I and II), by which Provider **140** enables download of LHSL utility (**213**) to implement a user-level hotspot location service, substantially independent of Provider **140**. A user downloads or loads a user-version (or user-level) HSL utility on the user's mobile

device, and the utility executes and provides most of the functionality described herein within the user's mobile device. Provider **140** may thus provide individual user licenses to the user-version hotspot locating utility **213** and may also periodically exchange hotspot location information from the user's device. In this way, the user's mobile device may be substantially independent of Provider **140** when performing updates to its local HLD within a particular geographic location.

However, an alternate embodiment entails only Provider **140** maintaining the HLD for non-local hotspots such that each user has to access the Provider's HLD to obtain the current "local" hotspot listing when the user enters a different geographic location (other than his/her home location) with his device. The user's current LHLHD may then be automatically uploaded in an exchange for current HLD information when the user requests hotspot location information for the new location or when the user logs into Provider's website from the new location. In one embodiment, the exchange of HLD data is automatically triggered when the Provider's HSL utility recognizes the user as being in a different location (GOS coordinate) from the user's home location.

As a final matter, it is important that while an illustrative embodiment of the present invention has been, and will continue to be, described in the context of a fully functional computer system with installed management software, those skilled in the art will appreciate that the software aspects of an illustrative embodiment of the present invention are capable of being distributed as a program product in a variety of forms, and that an illustrative embodiment of the present invention applies equally regardless of the particular type of signal bearing media used to actually carry out the distribution. Examples of signal bearing media include recordable type media such as floppy disks, hard disk drives, CD ROMs, and transmission type media such as digital and analogue communication links.

While the invention has been particularly shown and described with reference to a preferred embodiment, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention.

CLAIMS

1. A computer device comprising:
a processor;
5 local storage accessible to the processor and processor operations;
a locally-executed hotspot locating (LHSL) utility executing on the
processor and which comprises program code that when executed by the
processor performs the functions of:
responsive to a detection of a wireless hotspot by the wireless
10 transceiver, identifying a current GPS coordinate of the computer device;
linking the current GPS coordinate with an identifier (ID) of the
detected wireless hotspot; and
automatically updating a locally-stored hotspot location database
(LHLD) stored on the local storage with an entry corresponding to the
15 detected hotspot and linked GPS coordinate.
2. The device of Claim 1, wherein said device is a mobile user device
further comprising:
a system interconnect;
20 a global positioning system (GPS) receiver coupled to the system
interconnect that records a current GPS location of the mobile device; and
a wireless transceiver coupled to the system interconnect and which
is capable of detecting hotspots, supporting wireless connection to the
hotspots, and receiving operating characteristics and performance metrics
25 of the hotspots when wireless connectivity is established by the LHSL
utility.
3. The device of Claim 1 or 2, said hotspot locating utility further
comprising code that when executed by the processor performs the functions
30 of:
automatically initiating a connection to a wireless access point
associated with the detected hotspot; and
dynamically retrieving information about the hotspot during the
connection, said information comprising operating characteristics and
35 performance metrics of the hotspot and associated service from among:
name/identification (ID) of the hotspot; name of the hotspot service
provider/vendor; cost associated with accessing the hotspot; availability
of the hotspot, including general total uptime and periods of availability
for access; bandwidth of the wireless link to the hotspot; estimated
40 bandwidth of the link from the hotspot to the background network; average

time to establish a connection to the hotspot, guaranteed minimum download speed and minimum upload speed; maximum, minimum and average latency added by the hotspot link; accessibility range of the hotspot; wireless signal attenuation characteristics exhibited by the hotspot; overall quality of service (QoS) of the hotspot, determined utilizing parameters that define the quality, strength, and usability of the hotspot; overall historical and current user rating of the hotspot.

4. The device of Claim 3, wherein said code that provides the function of dynamically retrieving comprises code for:

accessing the hotspot;

transmitting one or more test packets to a backend network connected to an access device of the hotspot, said test packets causing a return packet to be generated by one or more hosts within the backend network and transmitted back to the device; and

determining operating characteristics and performance metrics of the hotspot and associated service based on the connection to the hotspot and the transmission and return of the test packets, or optionally

said program code that provides the function of automatically updating comprises code for:

when the detected hotspot is previously identified within an existing entry of the LHLD, updating only the operating parameters and performance metrics of the existing entry whereby duplicate entries are avoided and the existing entry contains updated and current information; and

storing within the existing entry a time of a last update, wherein each entry is assigned a entry creation time and a most current update time that is adjusted as updates to the existing entry occur.

5. The device of Claim 3, wherein said code that provides the function of updating the LHLD comprises code for:

storing the operating parameters and performance metrics within the entry for the hotspot; and

providing said operating parameters and performance metrics to a user when said user later requests a listing of hotspots that that results in an output the entry, and optionally

said code further comprising code for:

measuring the round-trip time for the test packets to return to determine network latency over the hotspot connection;

mapping bandwidth measurements, both peak and sustained, for the hotspot;

storing said network latency and bandwidth measurements within the hotspot entry;

comparing round-trip times of the detected hotspot against other round-trip times obtained for other hotspots in the geographical area to gauge relative performance; and

providing said latency, said relative performance and said bandwidth to a user when said user later requests a listing of hotspots that results in an output of the entry.

6. The device of any one of Claims 1 to 5, further comprising program code that when executed performs the functions of:

receiving a request for one or more hotspots within a particular geographic location;

determining which acceptable entries of the multiple entries within the HLD have a geographic location in proximity to the particular geographic location;

identifying those entries having proximate geographical locations as acceptable entries; and

providing an output of the acceptable entries to the user.

7. The device of Claim 6, further comprising program code that when executed performs the functions of:

(a) when said request includes user-preferences for operating characteristics and performance metrics associated with the acceptable hotspot, comparing the user preferred operating characteristics and performance metrics to the stored operating characteristics and performance metrics for each of the entries deemed acceptable based on their proximity to the specific geographical location; and

presenting for output only those entries that are both proximate to the specific geographic location and exhibit similar operating characteristics and performance metrics as the user-preferences;

wherein when no entry that is proximate to the specific geographic location also exhibits similar operating characteristics and performance metrics, said code comprises code for displaying a result that indicates that no entries proximate to the specific geographic location exhibits the user-preferences; and/or

(b) displaying a user interface within which a user may enter said request, said user interface being displayed locally on the device;

wherein said receiving of the request occurs when the user enters and submits the request within the user interface; and

wherein said providing displays said output via a graphical display associated with said user interface, and wherein for each returned acceptable entry, the output comprises one or more of: hotspot and service identification information; usage terms for the hotspot; system requirements for accessing the hotspot; known performance metrics and operating characteristics of the hotspot; street address; driving directions from an origination point entered by the user within the request; and, when graphics output is supported by the user interface, a map of the location of the hotspot.

8. The device of Claim 2, wherein said device includes a mechanism for generating and transmitting HOTS (hotspot operability transmissions) including corresponding GPS locations to a remote Provider, optionally said utility comprises program code that when executed performs the functions of:

when the second device is a peer device, dynamically establishing said connection as a peer-to-peer connection; and

when a share option is turned on within the device, said utility executes code that provides the function of automatically sharing the device's LHLID with the second device.

9. The device of Claim 2, further comprising:
a mechanism for establishing communication with a second device; and
wherein said LHLID utility further comprises code that when executed performs the functions of:

when the second device includes stored hotspot location data:
establishing a connection to communicate with the second device;
ascertaining that the hotspot location data on the second device is stored in a supported format for sharing;

updating the device's LHLID with hotspot location data from the second device that is more recent than the hotspot data currently stored within the device's LHLID; and

tagging the hotspot location data received from the second device as originating from the second device.

10. A computer program product comprising:

a computer readable medium; and

program code for a hotspot location utility on the computer readable medium that when executed by a processor performs the functions of:

responsive to a detection of a wireless hotspot by the device on which said utility is executing:

identifying a current GPS coordinate of the device;
linking the current GPS coordinate with an identifier (ID) of the detected
wireless hotspot; and

5 automatically updating a locally-stored hotspot location database
(LHLD) on the device with an entry corresponding to the detected hotspot
and linked GPS coordinate.

11. The computer program product of Claim 12, wherein said device is a
mobile device comprising a system interconnect, a global positioning
10 system (GPS) receiver coupled to the system interconnect that receives
current GPS location of the mobile device, and a wireless transceiver
coupled to the system interconnect and which is capable of detecting
hotspots and establishing wireless communication with the hotspots,
wherein said hotspot locating utility further comprises code that when
15 executed by the processor performs the following functions:

automatically initiating a connection to a wireless access point
associated with the detected hotspot; and

dynamically retrieving information about the hotspot during the
connection, said information comprising operating characteristics and
20 performance metrics of the hotspot and associated service from among:
name/identification (ID) of the hotspot; name of the hotspot service
provider/vendor; cost associated with accessing the hotspot; availability
of the hotspot, including general total uptime and periods of availability
for access; bandwidth of the wireless link to the hotspot; estimated
25 bandwidth of the link from the hotspot to the background network; average
time to establish a connection to the hotspot, guaranteed minimum download
speed and minimum upload speed; maximum, minimum and average latency added
by the hotspot link; accessibility range of the hotspot; wireless signal
attenuation characteristics exhibited by the hotspot; overall quality of
30 service (QoS) of the hotspot, determined utilizing parameters that define
the quality, strength, and usability of the hotspot; overall historical
and current user rating of the hotspot.

12. The computer program product of Claim 11, wherein:

35 said program code that provides the function of dynamically retrieving
information comprises code for:

accessing the hotspot;

transmitting one or more test packets to a backend network connected
to an access device of the hotspot, said test packets causing a return
40 packet to be generated by one or more hosts within the backend network and
transmitted back to the device;

measuring the round-trip time for the test packets to return to determine network latency over the hotspot connection;

mapping bandwidth measurements, both peak and sustained, for the hotspot; and

5 determining operating characteristics and performance metrics of the hotspot and associated service based on the connection to the hotspot and the transmission and return of the test packets;

wherein said code that provides the function of updating the LHLD comprises code for:

10 storing the operating parameters and performance metrics, including said network latency and bandwidth measurements, within the hotspot entry for the hotspot;

when the detected hotspot is previously identified within an existing entry of the LHLD, updating only the operating parameters and performance metrics of the existing entry whereby duplicate entries are avoided and the existing entry contains updated and current information;

15 storing within the existing entry a time of a last update, wherein each entry is assigned a entry creation time and a most current update time that is adjusted as updates to the existing entry occur;

20 comparing round-trip times of the detected hotspot against other round-trip times obtained for other hotspots in the geographical area to gauge relative performance; and

25 providing said operating parameters and performance metrics, including said latency, said relative performance and said bandwidth, to a user when said user later requests a listing of hotspots that that results in an output the entry.

13. The computer program product of Claim 10 to 12, further comprising program code that when executed performs the functions of:

30 receiving a request for one or more hotspots within a particular geographic location;

determining which acceptable entries of the multiple entries within the HLD have a geographic location in proximity to the particular geographic location;

35 identifying those entries having proximate geographical locations as acceptable entries;

40 when said request includes user-preferences for operating characteristics and performance metrics associated with the acceptable hotspot, comparing the user preferred operating characteristics and performance metrics to the stored operating characteristics and

performance metrics for each of the entries deemed acceptable based on their proximity to the specific geographical location;

presenting for output only those entries that are both proximate to the specific geographic location and exhibit similar operating characteristics and performance metrics as the user-preferences; and

wherein when no entry that is proximate to the specific geographic location also exhibits similar operating characteristics and performance metrics, said code comprises code for displaying a result that indicates that no entries proximate to the specific geographic location exhibits the user-preferences.

14. The computer program product of Claim 13, further comprising program code that when executed performs the functions of:

displaying a user interface within which a user may enter said request, said user interface being displayed locally on the device;

wherein said receiving of the request occurs when the user enters and submits the request within the user interface; and

wherein said providing displays said output via a graphical display associated with said user interface, and wherein for each returned acceptable entry, the output comprises one or more of: hotspot and service identification information; usage terms for the hotspot; system requirements for accessing the hotspot; known performance metrics and operating characteristics of the hotspot; street address; driving directions from an origination point entered by the user within the request; and, when graphics output is supported by the user interface, a map of the location of the hotspot; optionally

said utility further comprises program code that performs the functions of:

when a share option is turned on within the device, said utility executes code that provides the function of automatically sharing the device's LHLID with the second device;

wherein when the second device is a Provider, said utility includes code that when executed performs the functions of generating and transmitting HOT (hotspot operability transmission) signals including GPS locations to the Provider;

updating the device's LHLID with hotspot information from the second device that is more recent than the hotspot information within the device's LHLID; and

tagging a source of any information received from the second device as originating from the second device.

15. The computer program product of Claim 11, wherein said hotspot locating utility further comprises code that when executed performs the functions of:

5 displaying a HLD datashare GUI that provides user selectable options for determining how the device should receive updates of hotspot location data from other devices;

receiving user selections within the HLD datashare GUI;

configuring a share functionality of the HSL utility based on the received user selections;

10 establishing communication with a second device;

when the second device includes stored hotspot location data:

establishing a connection to communicate with the second device;

ascertaining that the hotspot location data on the second device is stored in a supported format for sharing; and

15 updating the device's LHLD with hotspot location data from the second device that is more recent than the hotspot data currently stored within the device's LHLD.

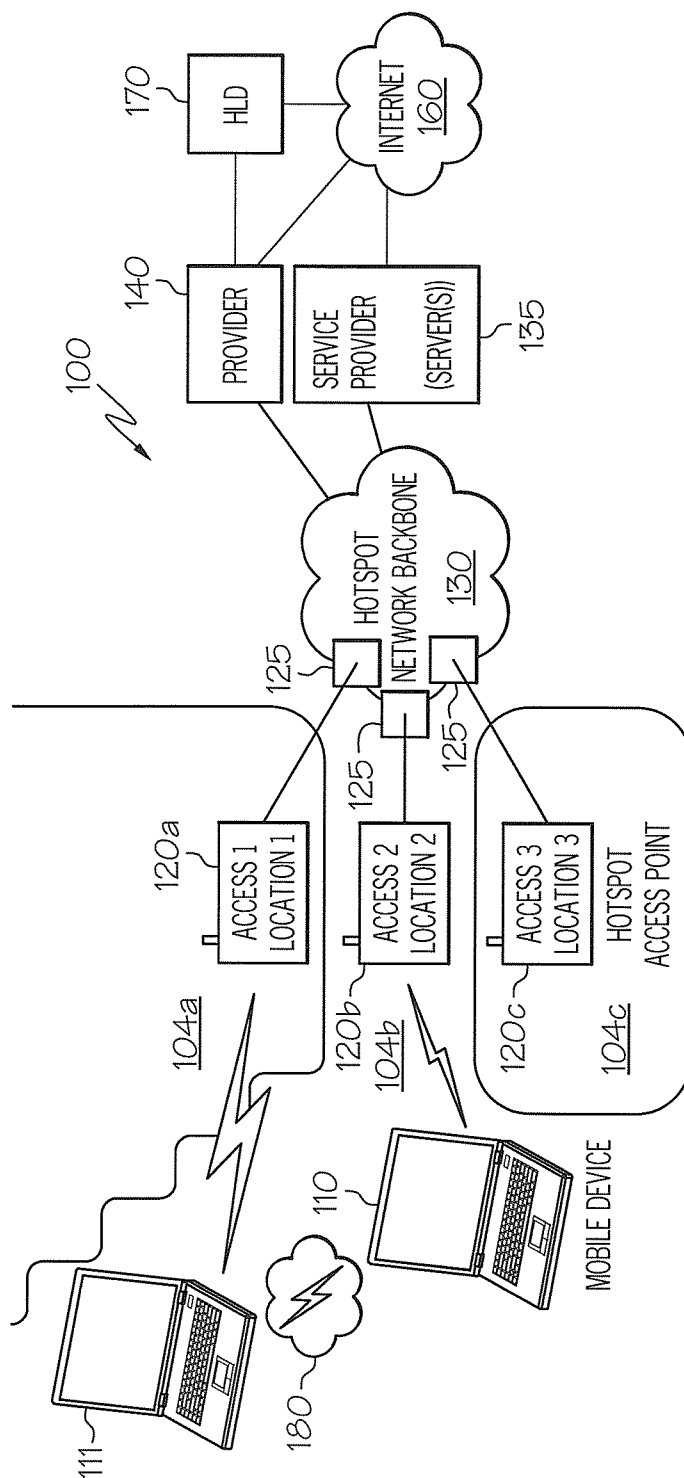


FIG.1

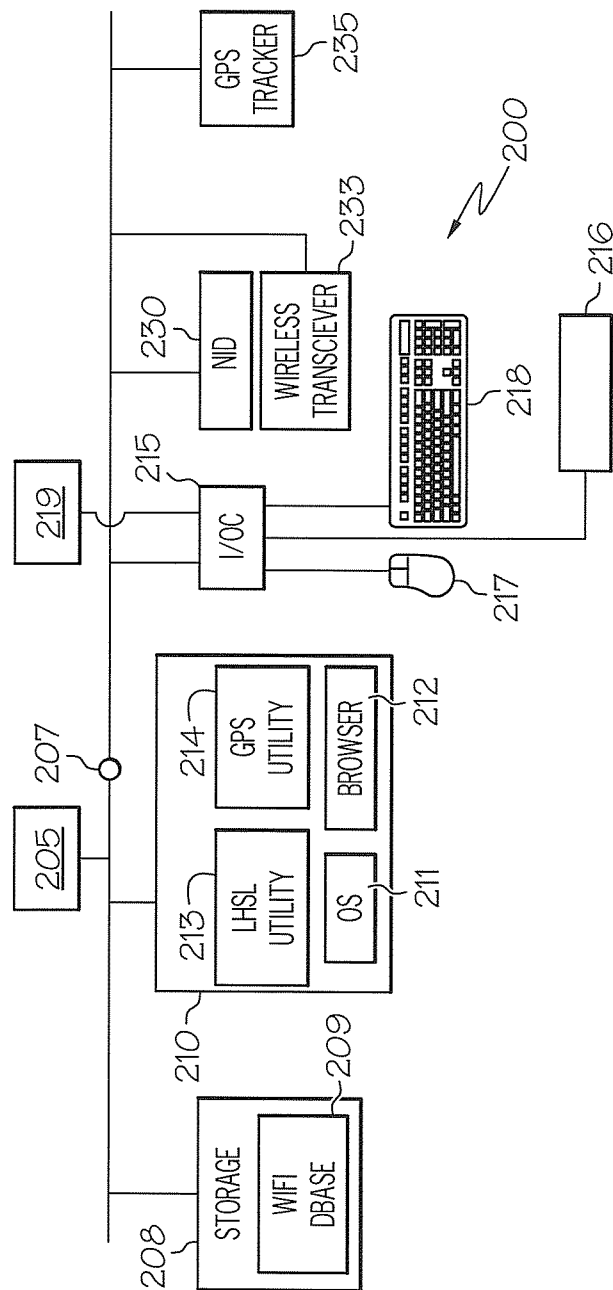


FIG. 2A

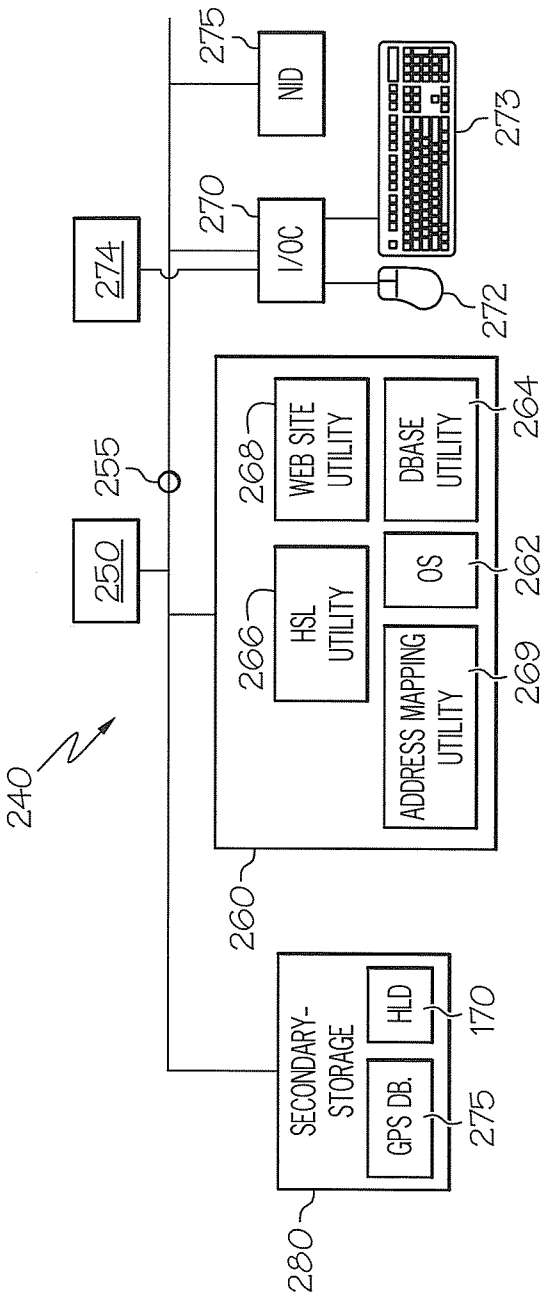


FIG. 2B

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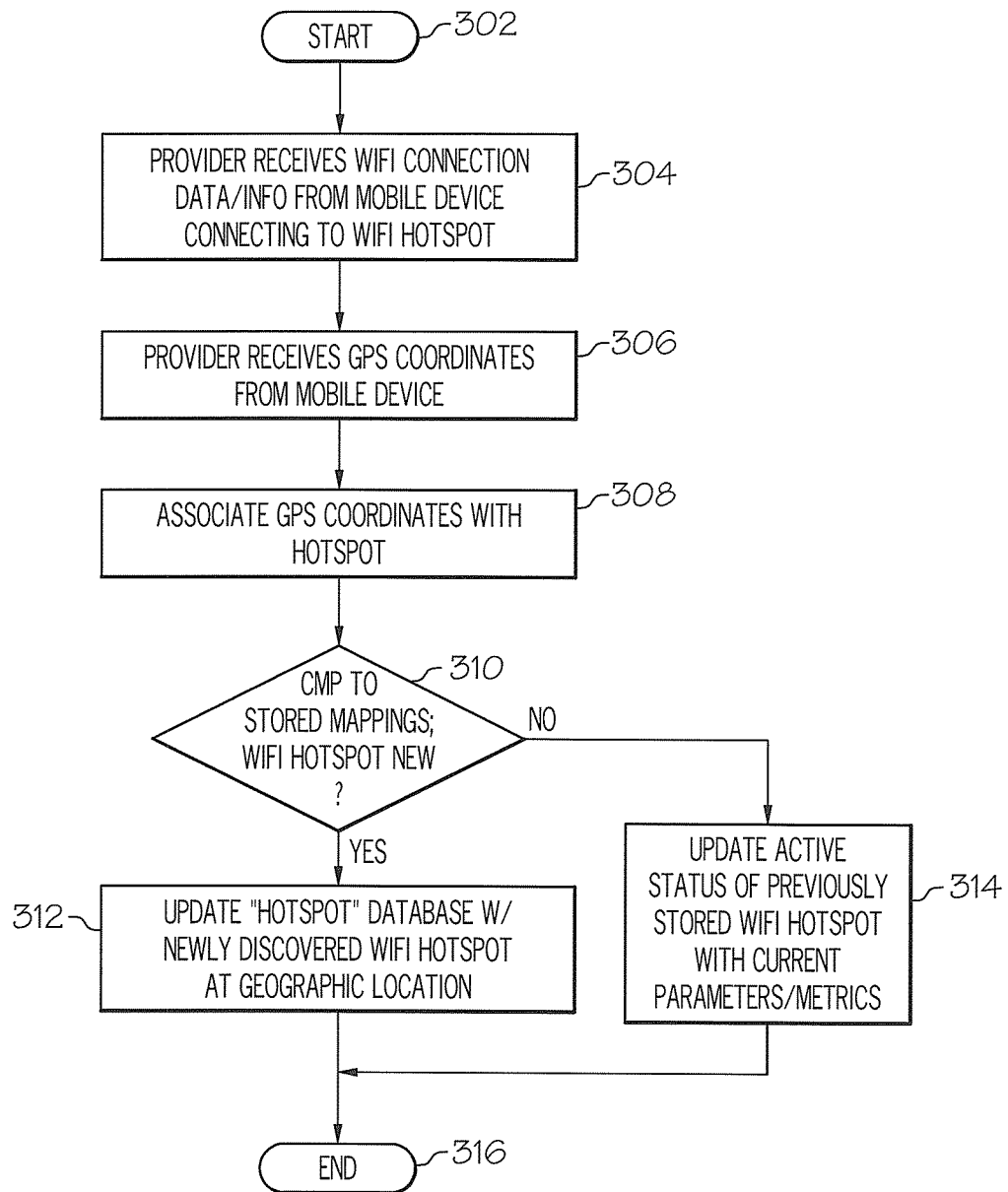


FIG. 3A

5 / 13

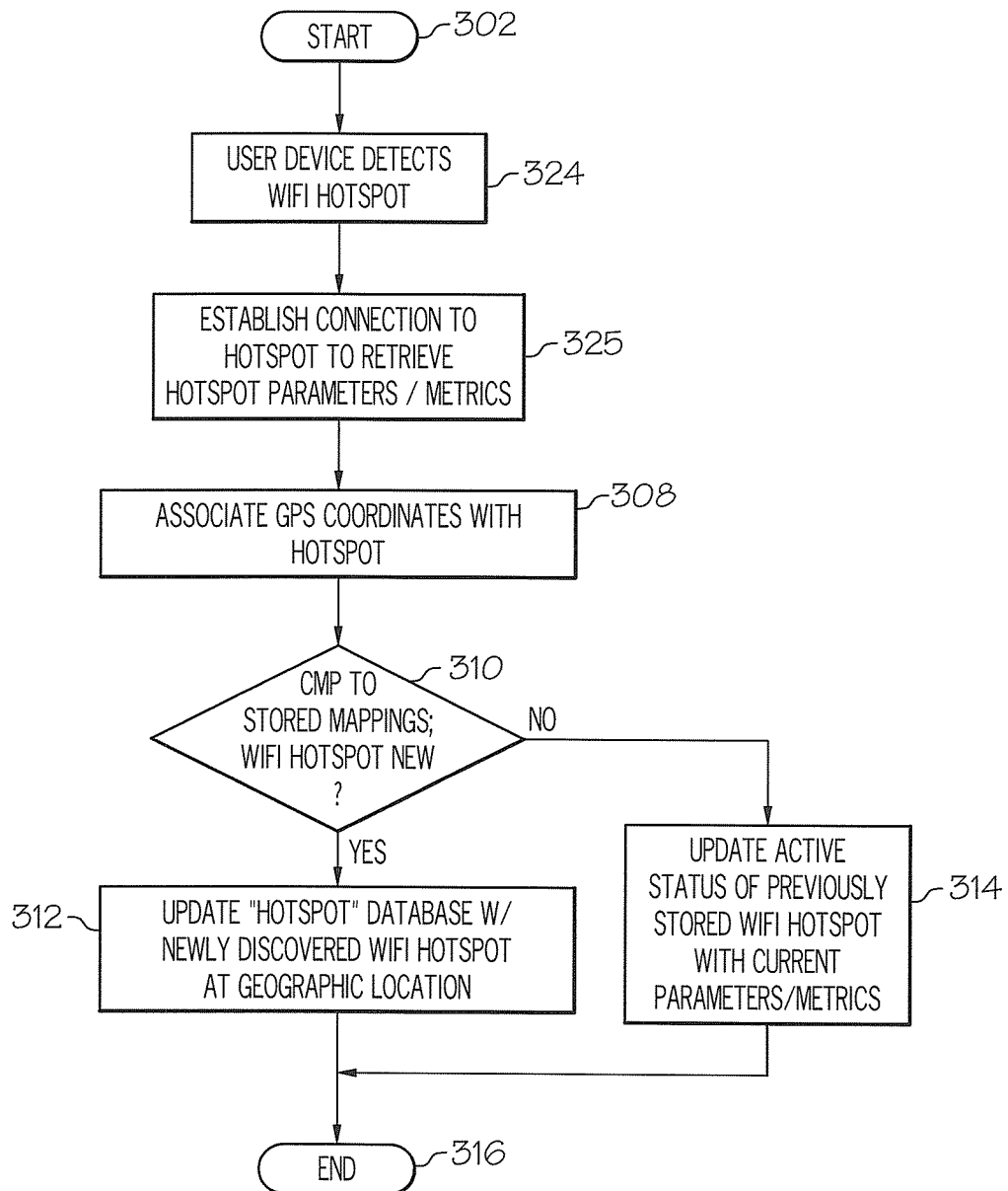


FIG. 3B

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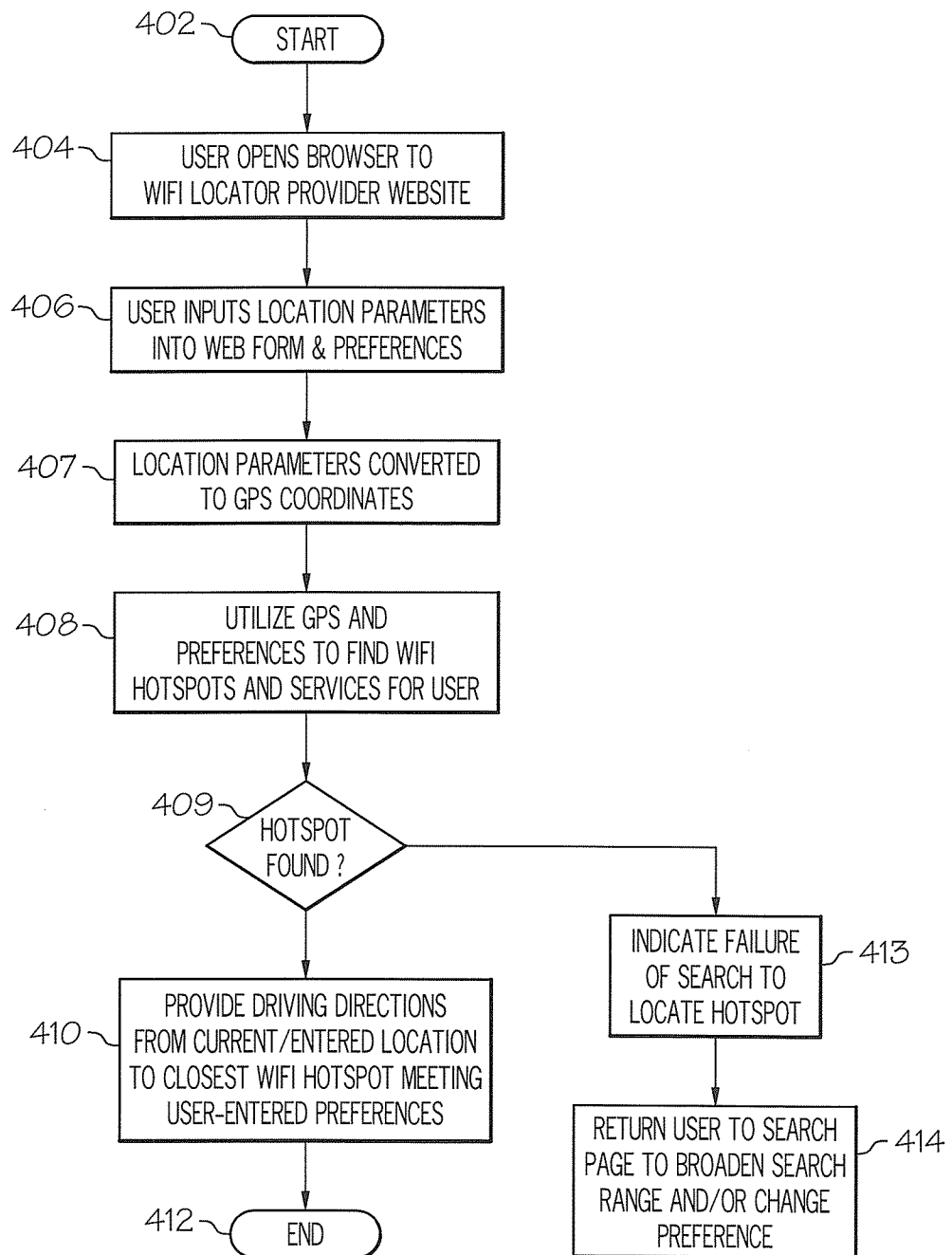


FIG. 4A

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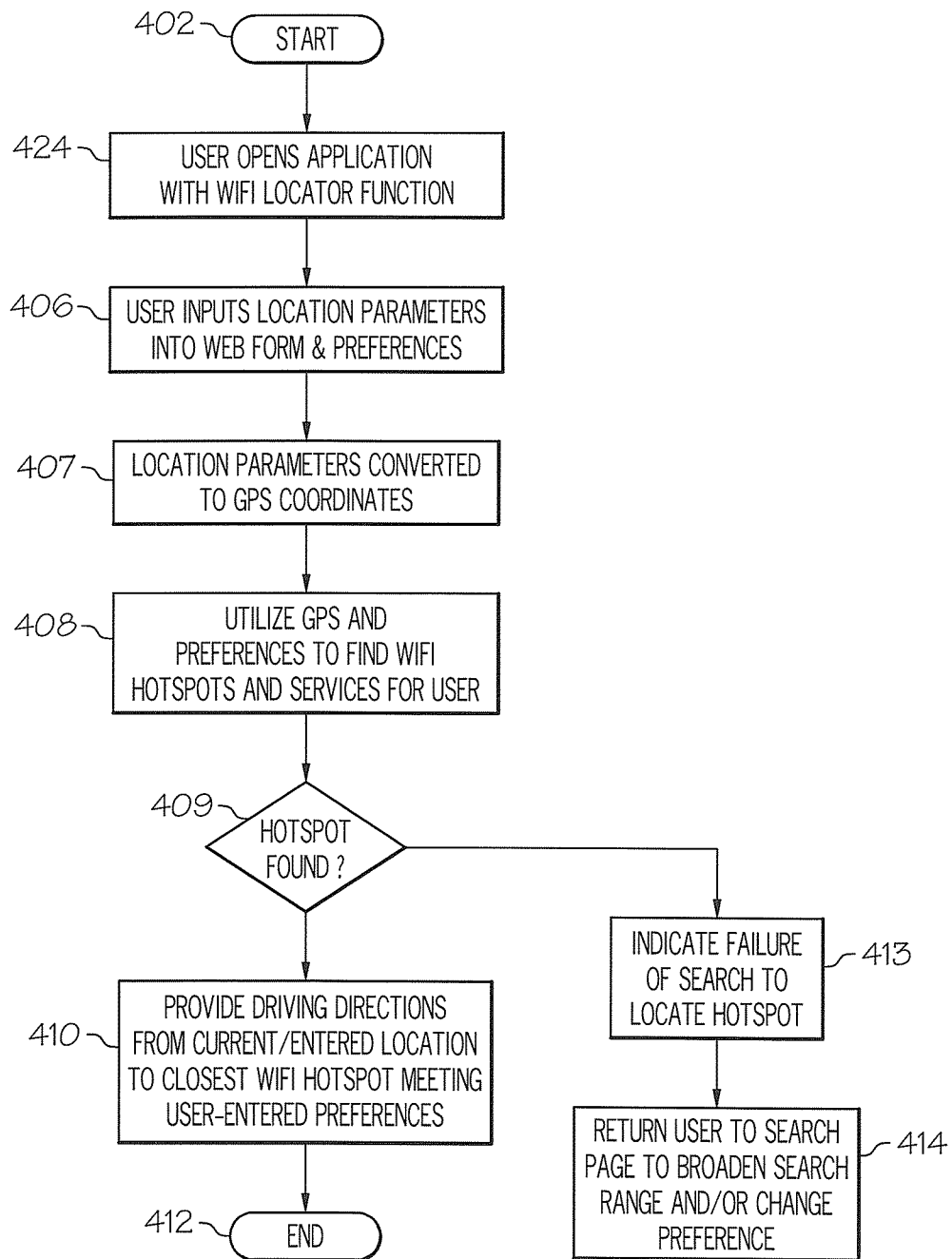


FIG. 4B

8 / 13

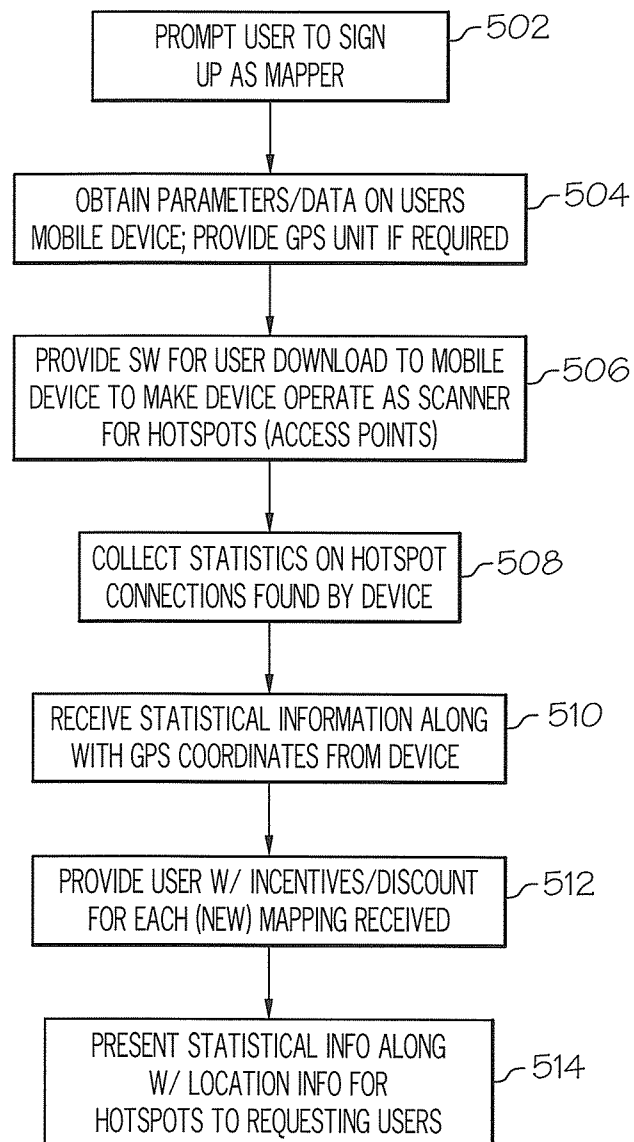


FIG. 5A

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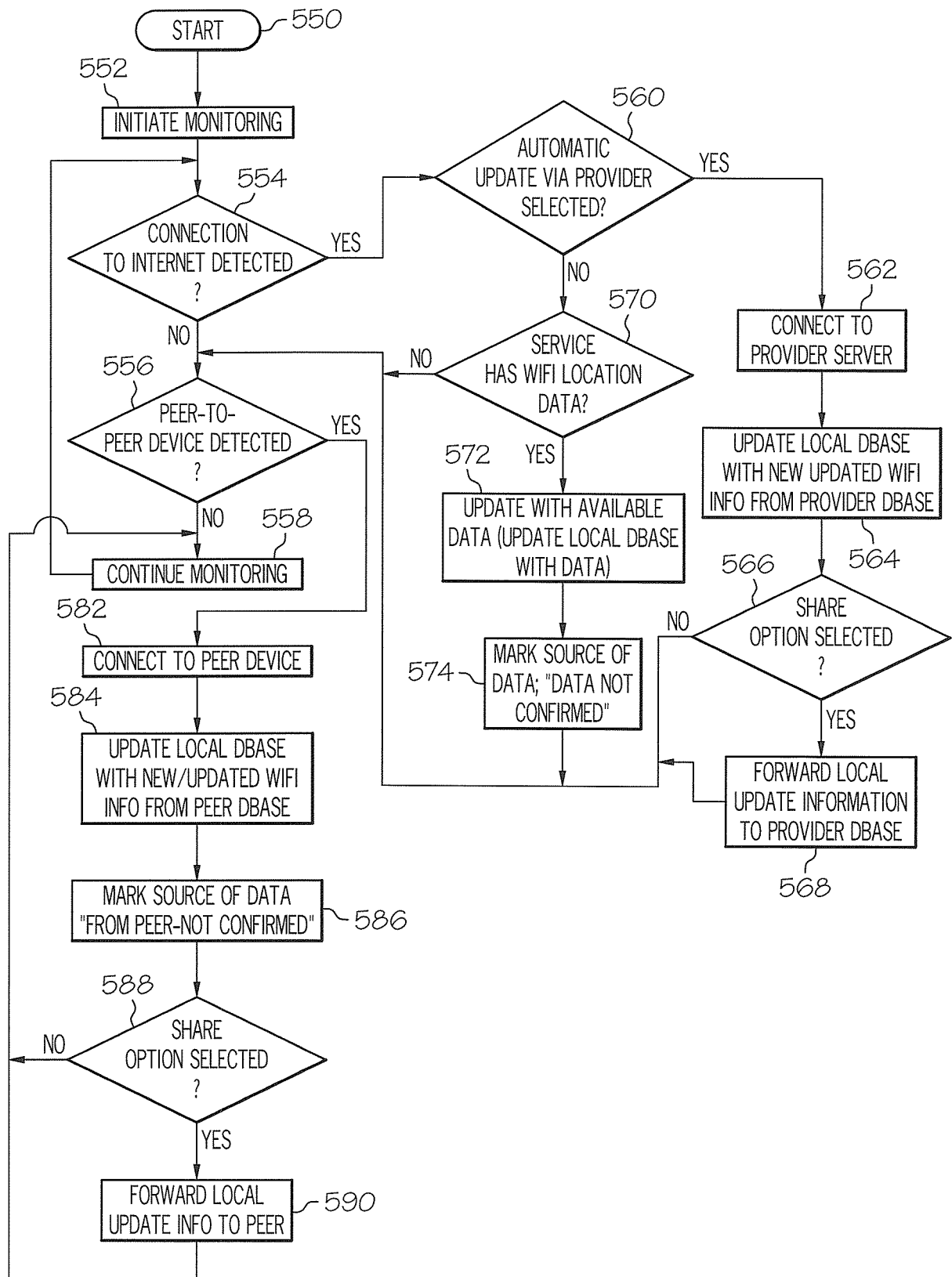


FIG. 5B

600

Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Search Favorites History

Address <http://www.wifilocationprovider.com>

620

610

MAPPER LOGIN 625

ENTER CURRENT/DESIRED LOCATION:

630

ADDR 1 ADDR 2

CITY ZIP STATE

ENTER RANGE: 633

ENTER DESIRED WIFI PARTICULARS:

635

PROVIDER: PLAN TYPE:

PERFORMANCE/CONNECTION SPEED: 637

ENTER PAYMENT METHOD: 640

SEARCH 645

CLICK HERE TO SIGN UP AS MAPPER AND RECEIVED "INCENTIVES" 650

Done Internet

FIG. 6A

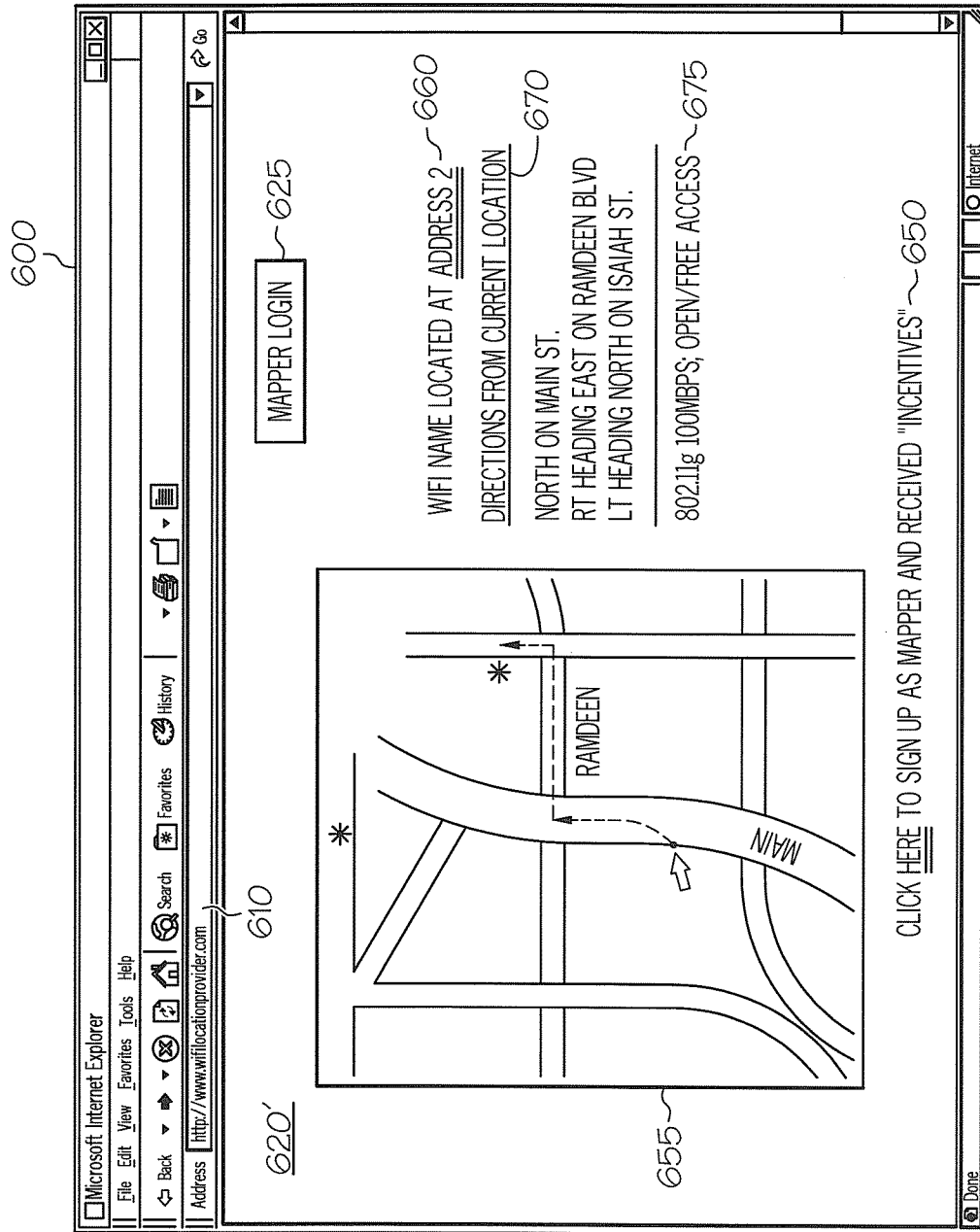


FIG. 6B

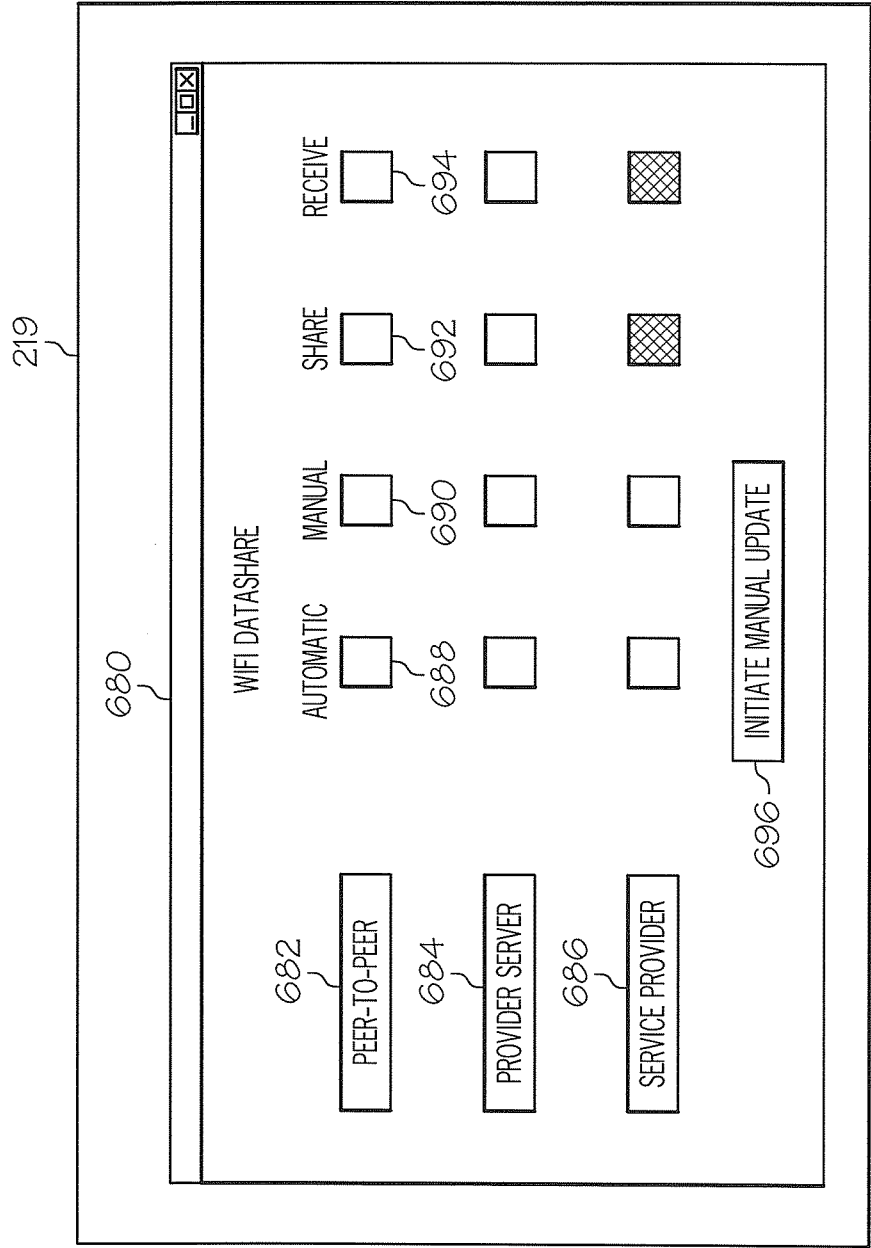


FIG. 6C

170 {

ENTRY NUMBER	NAME	GPS COORD.	DATE	1ST DATE	CONNECTION SPEED	DOWNLOAD SPEED	% UPTIME	DOWNTIME	RELIABILITY	CAST	LOGIN	...
700 { 1	M-MOBILE	137,2 256.9	-	-	11 MBPS	5 MBPS	95%	11:00PM -3:00PM	90%	FREE	FREEWI	-
• • •												
• • •												
• • •												

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2007/050498

A. CLASSIFICATION OF SUBJECT MATTER

INV. H04L12/28

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)

H04L H04Q

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2004/052041 A (KOREA ELECTRONICS TELECOMM [KR]; KIM JIN-KYEONG [KR]; KIM DAE-SIK [KR]) 17 June 2004 (2004-06-17) abstract page 3, line 6 - page 4, line 2 page 7, line 6 - page 8, line 1 page 9, line 9 - line 12 page 11, line 9 - page 12, line 13 figures 2,4,6	1-15
X	US 2004/106379 A1 (TOSHIKI ZEN, KANAGAWA [JP]; YOSHIKAZU KOBAYASHI, KANAGAWA [JP]) 3 June 2004 (2004-06-03) abstract paragraph [0015] - paragraph [0017] paragraph [0023] - paragraph [0031] paragraph [0061] ----- -/--	1-15

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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- *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
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- *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
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- *&* document member of the same patent family

Date of the actual completion of the international search

26 May 2007

Date of mailing of the international search report

14/06/2007

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2007/050498

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2007/050498

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US 2004039817	A1	26-02-2004	NONE	