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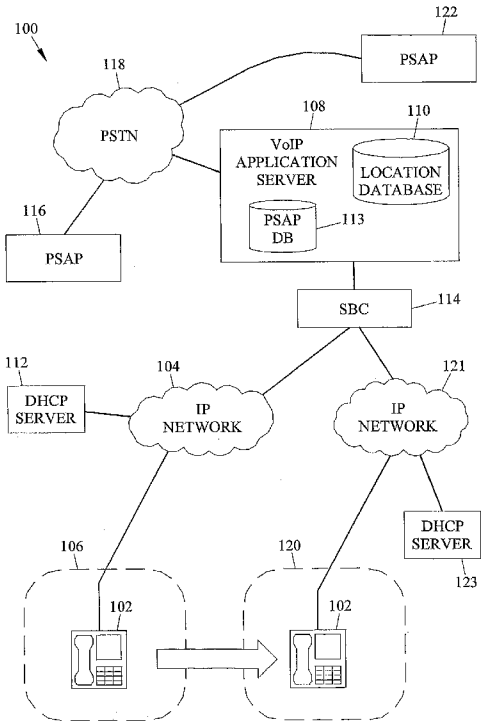
(54) Title: METHODS, SYSTEMS, AND COMPUTER PROGRAM PRODUCTS FOR EMERGENCY SERVICES DIRECTORY NUMBER REGISTRATION ASSISTANCE FOR SUBSCRIBERS USING PORTABLE INTERNET PROTOCOL (IP) COMMUNICATIONS DEVICES



(57) Abstract: Methods, systems, and computer program products for emergency services directory number registration assistance for subscribers using portable Internet Protocol (IP) communications devices are disclosed. According to one method, an IP address of a portable IP communications device is stored. An IP address of the portable IP communications device is received. It is determined whether a difference between the stored IP address and the received IP address indicated by the registration message indicates a change in geographic location of the portable IP communications device. In response to determining that the difference between the stored IP address and the IP address indicated by the received message indicates a change in geographic location of the portable IP communications device, a subscriber is prompted to update stored geographic location information for providing emergency service to the subscriber.

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DESCRIPTION

METHODS, SYSTEMS, AND COMPUTER PROGRAM PRODUCTS FOR EMERGENCY SERVICES DIRECTORY NUMBER REGISTRATION ASSISTANCE FOR SUBSCRIBERS USING PORTABLE INTERNET PROTOCOL (IP) COMMUNICATIONS DEVICES

RELATED APPLICATIONS

This application claims the benefit of U.S. Patent Application Serial No. 11/267,931 filed November 4, 2005, the disclosure of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

The subject matter disclosed herein relates generally to providing registration assistance for subscribers using portable IP communications devices. More particularly, the subject matter disclosed herein relates to emergency services directory number registration assistance for subscribers using portable IP communications devices.

BACKGROUND

Emergency services directory number service, such as E911 or 911 service in the United States or E112 service in Europe, involves providing call centers or public safety access points (PSAPs) that answer emergency calls and dispatch emergency personnel based on the calls. An important part of E911 or E112 service is identifying and dispatching the emergency personnel to the location of the emergency. In order to facilitate such identifying and dispatching, conventional PSTN switches store and provide street address information to PSAPs for 911 or 112 calls.

For voice over IP (VoIP) calls, VoIP E911 standards promulgated by the Federal Communications Commission (FCC) require that Voice over Internet Protocol (VoIP) service providers store the geographic location and identity information of subscribers so that such information may be provided to emergency personnel when a subscriber initiates a 911 call from the subscriber's portable IP communications device. FCC rules also require that

VoIP service providers transmit the location and identity information of a subscriber to a PSAP when the subscriber dials 911 from the subscriber's portable IP communications device.

In order for emergency personnel to be dispatched to the correct location, the VoIP service provider must maintain an accurate database associating a portable IP communications device with its actual geographic location. Thus, when a portable IP communications device is moved from one geographic location to another, the geographic location information in the service provider's database should be updated. Currently, a subscriber must remember to notify his or her service provider of a geographic location update when a portable IP communications device is moved from one geographic location to another. Relying on the subscriber's memory to trigger the updating of the geographic information is undesirable because the subscriber may forget to update the information. As a result, an E911 call originating from the subscriber's office may result in emergency personnel being dispatched to the subscriber's home, if the subscriber's VoIP telephone is moved from the subscriber's home to the subscriber's office without updating the stored geographic information for the subscriber. Similar problems may exist for emergency services in other countries or regions, such as E112 in Europe.

Accordingly, there exists a need for methods, systems, and computer program products for providing improved emergency services directory number registration assistance for subscribers using portable IP communications devices.

SUMMARY

According to one aspect, the subject matter described herein includes a method for providing registration to a subscriber using a portable IP communications device. As used herein, the term "portable IP communications device" refers to a communications device that uses packets for media stream communications and that is capable of being moved and operated in different geographic locations. An example of a portable IP communications device is a landline IP telephone.

As used herein, the term, "emergency services directory number service" refers to an emergency service reachable by dialing telephone directory number, such as 911 or 112, where the purpose of the service is to dispatch emergency personnel, such as police, fire, or medical personnel, to the location of the caller.

One method for providing emergency services directory number registration assistance for subscribers using portable IP communications devices includes storing an IP address of a portable IP communications device. An IP address of the portable IP communications device is received. It is determined whether a difference between the stored IP address and the received IP address indicated by the registration message indicates a change in geographic location of the portable IP communications device. A subscriber is prompted to update stored geographic location information for the subscriber if it is determined that the difference between the stored IP address and the IP address indicated by the received message indicates a change in geographic location of the portable IP communications device.

The subject matter described herein providing emergency services directory number registration assistance to IP communications devices may be implemented using a computer program product comprising computer executable instructions embodied in a computer readable medium. Exemplary computer readable media suitable for implementing the subject matter described herein includes disk memory devices, programmable logic devices, application specific integrated circuits, and downloadable electrical signals. In addition, a computer readable medium that implements the subject matter described herein may be distributed across multiple physical devices and/or computing platforms.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplary embodiments of the subject matter will now be explained with reference to the accompanying drawings, of which:

Figure 1 is a network diagram of an exemplary communications network in which emergency services directory number registration assistance is

provided for a subscriber using a portable IP communications device according to an embodiment of the subject matter described herein;

Figure 2 is a flow chart of an exemplary process for providing emergency services directory number registration assistance for a subscriber using a portable IP communications device according to an embodiment of the subject matter described herein;

Figure 3 is an exemplary message flow diagram of the transmission of messages in the network shown in Figure 1 for providing emergency services directory number registration assistance for a subscriber using a portable IP communications device according to an embodiment of the subject matter described herein;

Figure 4 is a block diagram of internal architecture of a VoIP application server and a session border controller (SBC) for providing emergency services directory number registration assistance to subscribers using portable IP communications devices according to an embodiment of the subject matter described herein; and

Figure 5 is a flow chart of another exemplary process for providing emergency services directory number registration assistance for a subscriber using a portable IP communications device according to an embodiment of the subject matter described herein.

DETAILED DESCRIPTION

Figure 1 illustrates an exemplary communications network **100** in which emergency services directory number registration assistance is provided for a subscriber using a portable IP communications device, such as a landline IP telephone **102**, according to an embodiment of the subject matter described herein. Referring to Figure 1, IP telephone **102** may be initially connected to an IP network **104** and located within a geographic region **106**. IP telephone **102** may be provided with VoIP service by a VoIP application server **108** in communication with IP network **104**. More particularly, VoIP application server **108** may maintain call state machines for calls involving IP telephone **102**, generate new call setup messages, such as INVITE messages, route calls, and update connected subscriber and routing databases. For 911 calls, IP

application server **108** may locate an appropriate PSAP and route the calls to the appropriate PSAP.

According to an embodiment of the subject matter described herein, application server **108** includes a location database **110** for storing a telephone number, a physical IP address, and geographic location information associated with IP telephone **102**. The physical IP address can be assigned by a Dynamic Host Configuration Protocol (DHCP) server **112** connected to IP network **104** when IP telephone **102** connects to IP network **104**. The telephone number is the number by which IP telephone **102** can be reached. The geographic location information can indicate a street address, a city, and a postal code at which IP telephone **102** is located. Table 1 below shows an exemplary IP telephone record stored in a location database.

Telephone Number	Physical IP Address	Geographic Location Information
123-456-7890	1.123.45.456	123 Main Street, Cary, NC 27519

Table 1: Exemplary IP Telephone Record

VoIP application server **108** may further include a PSAP database **113** that maps geographic information, such as postal codes, to PSAP contact information. Table 2 shown below illustrates an example of PSAP mappings that may be maintained by VoIP application server **108**.

Postal Code	PSAP Contact Number
27500-27599	9194601000
27600-27699	9194602000
27700-27719	9194603000

Table 2: PSAP Contact Information

Application server **108** may utilize the information in Tables 1 and 2 to determine the appropriate PSAP to contact when a call to an emergency services directory number is received. Accordingly, it is important that the subscriber's geographic information in Table 1 is kept to date.

When a call to an emergency services directory number is originated from IP telephone **102**, a call setup message including the dialed digits for the emergency service, such as "911" or "112," the physical IP address of IP telephone **102**, and the calling party telephone number is sent to application server **108** via IP network **104** and a session border controller (SBC) **114**. In response to receiving the emergency call, application server **108** performs a lookup in location database **110** for geographic location information associated with the calling party telephone number indicated in the emergency message. On locating the geographic location information in location database **110**, application server **108** may identify the PSAP using the data in Table 2 and route the call and the geographic location information associated with IP telephone **102** to a PSAP **116** via Public Switched Telephone Network (PSTN) **118**. PSAP **116** services geographic region **108** in which IP telephone **102** resides. Upon receiving a call to an emergency services directory number from IP telephone **102**, PSAP **116** may dispatch emergency personnel to the location indicated by the geographic location information.

IP telephone **102** may be moved from geographic region **106** to another geographic region **120**. Within geographic region **120**, IP telephone may be connected to SBC **114** via another IP network **121**. When IP telephone **102** is connected to IP network **121** and activated, IP telephone **102** uses DHCP to obtain a new physical IP address from another DHCP server **123**. The new physical IP address of IP telephone **102** is communicated to SBC **114** in a registration request message. SBC **114** can maintain a mapping between a logical IP address and the physical IP address of IP telephone **102**. Parties communicating with IP telephone **102** utilize the logical IP address in order to communicate messages to IP telephone **102**. SBC **114** can translate the logical IP address in received messages to the physical IP address of IP telephone **102** in order to route the messages to IP telephone **102**. Conversely, the source IP address in messages communicated from IP telephone **102** to another party through SBC **114** is translated from the IP telephone's physical IP address to the logical IP address assigned by SBC **114**.

In conventional networks, the physical IP address of the telephone is not communicated to VoIP application server **108** when a registration request is

received. However, according to an embodiment of the subject matter described herein, SBC **114** may communicate the registration request message (or a new registration request message) to IP application server **108**. The registration request message may include the physical IP address of IP telephone **102**. As will be described in more detail below, when IP telephone **102** is moved to a new geographic location, IP application server **108** may utilize the IP address in the registration message to detect the change in geographic location and prompt the subscriber to update the geographic location information.

PSAP **122** provides emergency services to geographic region **120** in which IP telephone **102** has been moved. Location database **110** should be provided with updated geographic location information for IP telephone **102** so that emergency personnel can be dispatched to the correct location if an emergency call is received from IP telephone **102**. Figure 2 is a flow chart of an exemplary process for emergency services directory number registration assistance for the subscriber when changing the location of IP telephone **102** according to an embodiment of the subject matter described herein. Based on the indication of a location change, application server **108** can request geographic location information from a subscriber associated with IP telephone **102**. Referring to Figure 2, the process starts at step **200** where IP telephone **102** is plugged into IP network **121** within geographic region **120** and activated. IP telephone **102** was previously registered at and plugged into IP network **104** within geographic region **106**, which is served by PSAP **116**. IP telephone **102** is now within geographic region **120**, which is served by PSAP **122**. Thus, location database **110** should be updated with the new geographic location information for IP telephone **102**.

Next, at step **202** of Figure 2, IP telephone **102** uses DHCP to obtain a new physical IP address from DHCP server **123**. IP telephone **102** then communicates a registration request message to SBC **114** including the new physical IP address of IP telephone **102** (step **204**).

On receiving the registration request message including the new physical IP address, SBC **114** generates and communicates a message to application server **108** including the new physical IP address and identifying IP

telephone **102** (step **206**). IP telephone **102** may be identified by its telephone number. As stated above, SBC **114** may maintain a table for mapping a logical IP address to the physical IP address of IP telephone **102**. The logical IP address and the physical IP address may both be communicated to application server **108**.

The message communicated to application server **108** may be a registration request message for IP telephone **102** or any other suitable message communicated to application server **108**. According to an embodiment, SBC **114** may communicate the new physical IP address of IP telephone **102** to application server **108** via any suitable message type or protocol. For example, SBC **114** may communicate the new physical IP address via Session Initiation Protocol (SIP), Cisco Skinny Client Control Protocol, or Media Gateway Control Protocol (MGCP), depending on the signaling protocol used in the network. Utilizing SIP, a Via header in a SIP message communicated to application server **108** may include the physical IP address of IP telephone **102**. Utilizing MGCP, an MGCP ReStart In Progress (RSIP) message may be modified with an extension for carrying the physical IP address of IP telephone **102**. Further, utilizing Cisco Skinny Client Control Protocol, a Cisco Skinny Client Control Protocol registration request message may be modified with an extension for carrying the physical IP address of IP telephone **102**.

In step **208** of Figure 2, application server **108** may receive the message from SBC **114** identifying IP telephone **102** and including the physical IP address of IP telephone **102**. As stated above, location database **110** may include a record for IP telephone **102** that identifies a telephone number, a physical IP address, and geographic location information associated with IP telephone **102**. The physical IP address may be the physical IP address obtained when IP telephone **102** was plugged into IP network **104** within geographic region **106**. Accordingly, the geographic location information associated with the former physical IP address would no longer be valid. Accordingly, in step **210**, application server **108** determines whether the stored physical IP address is different from the IP address in the received message. Application server **108** may perform a lookup in location database **110** to

determine whether the physical IP address received in the message from SBC **114** is different from the physical IP address stored for IP telephone **102** in location database **110**.

If the physical IP address in the received message is not different from the physical IP address stored in location database **110**, the received message is further processed by server application **108** (step **212**). Otherwise, if the physical IP address in the received message is different from the physical IP address stored in location database **110**, control proceeds to step **214**, where application server **108** compares the physical IP address in the received message and the physical IP address stored in location database **110** to determine whether the differences are sufficient to indicate a change in geographic location. Such an update may be necessary if IP telephone **102** is moved to a different building, a different city, a different state, or a location having a different street address. In one exemplary implementation, application server **108** can determine whether the comparison indicates that IP telephone **102** has moved to a different subnet. In this instance, if it is determined that IP telephone **102** has moved to a different subnet, the difference in the physical IP addresses is sufficient to indicate a change in geographic location. If it is determined that the difference indicates a change in geographic location, control proceeds to step **216** where the subscriber is prompted to update the geographic information.

In one exemplary implementation, a message may be sent to IP telephone **102** for requesting an update of the IP telephone's geographic location information. In another example, a call transaction may be initiated with IP telephone **102** in which a prerecorded message is played for requesting an update to the geographic location information. In yet another example, an e-mail message may be sent to the subscriber associated with IP telephone **102** for requesting the update to the geographic location information. In still another example, the geographic location information may be updated by sending an update request message to the subscriber over a web interface.

When provided with the updated geographic location information, the record in location database **110** associated with IP telephone **102** can be updated with the new geographic location information (step **218**) and the

received message processed (step **212**). In the event of an emergency services call from IP telephone **102**, application server **108** will know that PSAP **122** services the new location of IP telephone **102** and route the call and the geographic location information associated with IP telephone **102** to PSAP **122** for notifying emergency personnel of the emergency services call. By updating the geographic location information for IP telephone **102**, a message is not erroneously communicated to PSAP **116** for dispatching emergency personnel to the former location of IP telephone **102**.

Returning to step **214**, if it is determined that the difference between the IP address in the registration request message and the stored IP address does not include a change in geographic location, the physical IP address for the subscriber may be updated in location database **110** (step **220**). Similarly, after the geographic information has been updated in step **218**, the IP address may be updated in step **220**. Once the IP address has been updated, the registration process continues in step **212** where the received registration request message is processed.

An exemplary signaling message flow illustrating messages exchanged between the network components illustrated in Figure 1 in providing emergency services directory number registration assistance to a subscriber using IP telephone **102** according to an embodiment of the subject matter described herein will now be described in detail. Figure 3 is an exemplary message flow diagram of the transmission of these messages in network **100** shown in Figure 1. In this example, IP telephone **102** is moved from geographic region **106** where IP telephone **102** is plugged into IP network **104**, activated, and assigned a new physical IP address. Further, location database **110** includes a record associated with IP telephone **102**. The record includes a telephone number associated with IP telephone **102**, the physical IP address assigned by DHCP server **112**, and geographic location information indicating the location of IP telephone **102** within region **106**. IP telephone **102** is then moved to geographic region **120** and plugged into IP network **121** and activated. Referring to line 1 of Figure 3, IP telephone **102** sends a request to DHCP server **123** for a physical IP address. At line 2, DHCP server **112** transmits an

IP address message to IP telephone **102** for indicating the new IP physical address assigned to IP telephone **102**.

In line 3 of Figure 3, IP telephone **102** transmits a registration request message to IP network **121**. The registration request message may include the physical IP address assigned by DHCP server **123**. In line 4, IP network **121** may forward the registration request message to SBC **114**.

On receiving the registration request message, SBC **114** may generate another registration request message including the physical IP address assigned to IP telephone **102** by DHCP server **123**. In line 5, the generated registration request message including the new physical IP address is transmitted to application server **108**. The message communicated to application server **108** may be any suitable message that can identify IP telephone **102** and include the new physical IP address of IP telephone **102**. Further, the message may be transmitted utilizing any suitable protocol, such as SIP, Cisco Skinny Client Control Protocol, or MGCP.

Application server **108** may compare the new physical IP address in the received message to the physical IP address stored in location database **110**. If the physical IP addresses are sufficiently different, application server **108** can prompt the subscriber for a geographic location information update. The physical IP addresses are sufficiently different if the differences indicate that IP telephone **102** has been moved to a different location such that a request for geographic location information should be made. Such a request may be carried out by calling the subscriber to obtain an update. Further, application server **108** may update the record for IP telephone **102** with the new physical IP address. When new geographic location information is obtained, the record for IP telephone **102** may also be updated with the new geographic location information. As a result, when an emergency services directory number call is initiated from IP telephone **102**, location database **110** will include a record for IP telephone **102** that contains geographic location information indicating the new location of IP telephone **102** within geographic region **120**.

Figure 4 illustrates internal architecture of VoIP application server **108** and SBC **114** for providing emergency services directory number registration assistance to subscribers using portable IP communications devices according

to an embodiment of the subject matter described herein. Referring to Figure 4, SBC **114** includes a plurality of internal processing modules for routing and processing IP messages. In the illustrated example, SBC **114** includes a registration message processor **400**, IP interfaces **402** and **404**, and a phone logical-to-physical IP address mapping table **406**. IP interfaces **402** and **404** are operable to send and receive IP messages over IP signaling links. IP interfaces **402** and **404** can include a physical layer for performing physical layer functions for IP signaling links. Further, IP interfaces **402** and **404** can include an IP layer for performing IP layer functions, such as IP forwarding. IP interfaces **402** and **404** can include transport layers for performing transport layer functions, such as UDP, TCP, or SCTP functions.

IP interface **402** may receive registration request messages from IP telephones, such as IP telephone **102**. The registration request messages can include new physical IP addresses for the IP telephones. Registration message processor **400** may assign logical IP addresses to each telephone registered with IP application server **108**. Mappings between telephone identifiers, logical IP addresses, and physical IP addresses may be maintained in logical-to-physical IP address mapping table **406**. Table 3 shown below shows exemplary entries that may be included in table **406**.

Telephone ID	Logical IP Address	Physical IP Address
9194605000	100.100.100.0	192.168.0.1
9194605001	100.100.100.1	192.168.0.10

Table 3: Logical-to-Physical IP Address Mappings

For outgoing calls originating from an IP communications device connected to SBC **114**, SBC **114** may map the physical IP address stored in the source IP address field of media and signaling packets to the logical IP address stored in the table. For incoming calls originating from devices that are not connected to SBC **114**, SBC **114** may map the logical IP address stored in the destination IP address field of media and signaling packets to the physical IP address corresponding to the telephone ID stored in the table.

IP interface **402** can receive the registration request messages from IP telephones and forward the registration request messages to registration

message processor **400**. In one exemplary implementation, registration message processor **400** can modify the received registration request messages to include a new physical IP address assigned to an IP telephone. Alternatively, registration message processor **400** may generate a message specifically for communicating the new physical IP address to application server **108**. Registration message processor **400** can forward the modified or generated message to IP interface **404** for transmission to application server **108** via an IP signaling link **408**. As described above, the registration message may be formatted according to any suitable signaling protocol such as SIP, Cisco Skinny Client Control Protocol, or MGCP.

Application server **108** includes a plurality of internal processing modules for routing and processing IP messages. In the illustrated example, application server **108** includes an IP interface **410** and a PSTN interface **412** for interfacing with the IP and PSTN networks, respectively. Application server **108** also includes a processing module **414** for performing location database related services and emergency services directory number registration assistance according to the subject matter described herein.

IP interface **410** is operable to send and receive IP messages over IP signaling link **408**. IP interface **410** can include a physical layer for performing physical layer functions for IP signaling links. Further, IP interface **410** can include an IP layer for performing IP layer functions, such as IP forwarding. IP interface **410** can also include transport layers for performing transport layer functions, such as TCP, UDP, or SCTP functions. IP interface **410** is operable to receive messages from SBC **114** that include a new physical IP address of an IP telephone. IP interface **410** can pass its received messages to module **414** for further processing.

PSTN interface **412** is operable to interface with PSTN **118** for sending and receiving messages. For example, PSTN interface **412** may send and receive SS7 signaling messages to and from PSAPs **116** and **122**.

Processing module **414** of application server **108** can include an address comparator function **416** for comparing the physical IP address in the received message and a physical IP address of the IP telephone stored in location database **110** to determine whether the differences are sufficient to request a

geographic location information update from the subscriber. As stated above, such an update may be necessary if IP telephone **102** is moved to a different building, a different city, a different state, or a location having a different street address. According to an embodiment, function **416** can determine whether the comparison indicates that the IP telephone has been moved to a different subnet. In this instance, if it is determined that the IP telephone has been moved to a different subnet, an emergency services directory number registration notification function **418** may be notified and, in response to the notification, prompt a subscriber associated with IP telephone **102** to update the geographic location information stored in database **110**. The subscriber can be prompted by generating and communicating a message to the IP telephone via IP interface **410** for requesting an update of the IP telephone's geographic location information. Alternatively, a call transaction may be initiated with the IP telephone in which a prerecorded message is played for requesting an update to the geographic location information. In another example, an e-mail message may be sent to the subscriber associated with the IP telephone for requesting the update to the geographic location information. Further, the geographic location information may be updated by using a web interface in which the subscriber may enter updated geographic location information.

When a registration message with a physical IP address is received and address comparator **416** determines that the physical IP address in the message does not indicate a change in geographic location, address comparator **416** may refrain from triggering emergency services directory number registration notification function **418** to send the geographic location update prompt to the subscriber. As stated above, this determination may be performed by comparing the IP subnets in the received and stored IP addresses.

Further, processing module **414** includes an emergency call function **420**. When application server **210** receives a message indicating an emergency call originated from an IP telephone, the message is forwarded to emergency call function **420**. Function **420** can perform a lookup in location database **110** for a record associated with the IP telephone originating the

emergency call. If a matching record is found, the appropriate PSAP may be identified using PSAP database **113**, and the geographic location information in the record and the emergency services directory number call may be routed to the appropriate PSAP.

VoIP application server **108** may also communicate audit messages to IP telephone **102** for determining whether location database **110** should be provided with updated geographic location information. In response to an audit message, IP telephone **102** may communicate the current physical IP address of the IP telephone. Based on the communicated physical IP address, server **108** may determine whether IP telephone **102** has been moved and updated geographic location information should be provided. Figure 5 is a flow chart of another exemplary process for emergency services directory number registration assistance for the subscriber when changing the location of IP telephone **102** according to an embodiment of the subject matter described herein. Referring to Figure 5, the process starts at step **500** where application server **108** communicates a message to IP telephone **102** for auditing or requesting the physical IP address of IP telephone **102**. The audit or request message may include the logical IP address of IP telephone **102**. Further, the IP address of telephone **102** may be included in an extension to an Audit Endpoint (AUEP) message or an OPTIONS message. An AUEP message may be used to request device capability and current call states from IP telephone **102** for MGCP. An OPTIONS message may be used to obtain device capability in SIP. Application server **108** may periodically transmit message for requesting the physical IP address of an IP telephone.

IP telephone **102** may receive the audit message from application server **108**. In response to the audit message, IP telephone **102** generates and communicates a message to application server **108** that includes the physical IP address of IP telephone **102** and that identifies IP telephone **102** (step **502**). IP telephone **102** may be identified by its telephone number. In this example, the physical IP address may be the physical IP address of IP telephone **102** while in geographic region **106** or a new physical IP address of IP telephone **102** after being moved to geographic region **120**. The message communicated to application server **108** may be any suitable message communicated to

application server **108**. The message may be communicated to application server **108** through IP network **121** and SBC **114** as described herein.

In step **504** of Figure 5, application server **108** may receive the message from SBC **114** identifying IP telephone **102** and including the physical IP address of IP telephone **102**. Location database **110** may include a record for IP telephone **102** that identifies a telephone number, a physical IP address, and geographic location information associated with IP telephone **102**. The physical IP address may be a former physical IP address of IP telephone **102** when the IP telephone was plugged into IP network **104** within geographic region **106**. Accordingly, the geographic location information associated with the former physical IP address would no longer be valid. Accordingly, in step **506**, application server **108** determines whether the stored physical IP address is different from the IP address in the received message. Application server **108** may perform a lookup in location database **110** to determine whether the physical IP address received in the message from SBC **114** is different from the physical IP address stored for IP telephone **102** in location database **110**.

If the physical IP address in the received message is not different from the physical IP address stored in location database **110**, the received message is further processed by server application **108** (step **508**). Otherwise, if the physical IP address in the received message is different from the physical IP address stored in location database **110**, control proceeds to step **510**, where application server **108** compares the physical IP address in the received message and the physical IP address stored in location database **110** to determine whether the differences are sufficient to indicate a change in geographic location as described herein. If it is determined that the difference indicates a change in geographic location, control proceeds to step **512** where the subscriber is prompted to update the geographic information. The subscriber may then provide updated geographic location information.

When provided with the updated geographic location information, the record in location database **110** associated with IP telephone **102** can be updated with the new geographic location information (step **514**) and the received message processed (step **508**). In the event of an emergency services directory number call from IP telephone **102**, application server **108**

will know that PSAP **122** services the new location of IP telephone **102** and route the call and the geographic location information associated with IP telephone **102** to PSAP **122** for notifying emergency personnel of the emergency services directory number call. By updating the geographic location information for IP telephone **102**, a message is not erroneously communicated to PSAP **116** for dispatching emergency personnel to the former location of IP telephone **102**.

Returning to step **514**, if it is determined that the difference between the IP address in the registration request message and the stored IP address does not include a change in geographic location, the physical IP address for the subscriber may be updated in location database **110** (step **516**). Similarly, after the geographic information has been updated in step **218**, the IP address may be updated in step **516**. Once the IP address has been updated, the registration process continues in step **508** where the received registration request message is processed.

It will be understood that various details of the subject matter disclosed herein may be changed without departing from the scope of the disclosed subject matter. Furthermore, the foregoing description is for the purpose of illustration only, and not for the purpose of limitation, as the subject matter disclosed herein is defined by the claims as set forth hereinafter.

CLAIMS

What is claimed is:

1. A method for providing emergency services directory number registration assistance for a portable Internet Protocol (IP) communications device, the method comprising:
   (a) storing an IP address of a portable IP communications device;
   (b) receiving an IP address of the portable IP communications device;
   (c) determining whether a difference between the stored IP address and the received IP address indicated by the registration message indicates a change in geographic location of the portable IP communications device; and
   (d) in response to determining that the difference between the stored IP address and the IP address indicated by the received message indicates a change in geographic location of the portable IP communications device, prompting a subscriber to update stored geographic location information for providing emergency service to the subscriber.
2. The method of claim 1 wherein the portable IP communications device comprises a portable IP telephone.
3. The method of claim 1 wherein step (c) includes determining whether the difference indicates that the IP addresses are associated with the same subnet.
4. The method of claim 3 wherein, in response to determining that the IP addresses are associated with the same subnet, refraining from prompting a subscriber to update the stored geographic location information for the IP communications device.
5. The method of claim 1 comprising, in response to the prompting:
   (a) receiving updated geographic location information from the subscriber; and
   (b) storing the updated geographic location information.
6. The method of claim 5 comprising communicating the updated geographic location information to an emergency call center.

7. The method of claim 1 wherein prompting the subscriber includes initiating a call with the subscriber to obtain the geographic location information.

8. The method of claim 1 wherein prompting the subscriber includes requesting updated geographic location information from the subscriber via a web interface.

9. The method of claim 1 wherein prompting the subscriber includes sending a message to the portable IP communications device.

10. The method of claim 1 wherein receiving an IP address of the portable IP communications device includes:

(a) communicating a request message for requesting an IP address of the portable IP communications device; and

(b) receiving a response message indicating an IP address of the portable IP communications device.

11. An IP application server providing emergency services directory number registration notification assistance for an Internet Protocol (IP) communications device, the IP application server comprising:

(a) a location database for storing an IP address of a portable IP communications device;

(b) an IP interface adapted to receive an IP address of the portable IP communications device;

(c) an address comparator function adapted to determine whether a difference between the stored IP address and the IP address indicated by the received registration message that is associated with the portable IP communications device indicates a change in geographic location of the portable IP communications device; and

(d) an emergency services directory number registration notification function for prompting a subscriber to update stored geographic location information at which the subscriber receives emergency service in response to a determination that the difference between the stored IP address and the IP address indicated by

the received registration message indicates a change in geographic location of the IP communications device.

12. The IP application server of claim 11 wherein the portable IP communications device comprises a landline IP telephone.

13. The IP application server of claim 11 wherein the address comparator is operable to determine whether the stored IP address and the received IP address are associated with the same subnet.

14. The IP application server of claim 13 wherein the emergency services directory number registration notification function is operable to refrain from prompting the subscriber to update stored geographic location information in response to determining that the stored IP address and the IP address indicated by the received registration message indicates that the IP addresses are associated with the same subnet.

15. The IP application server of claim 11 wherein the communications module is operable to receive the updated geographic location information from the subscriber and operable to receive an emergency call message from the IP communications device; and
comprising an emergency call function operable to communicate the updated geographic location information to an emergency call center in response to receiving the emergency call message.

16. The IP application server of claim 11 wherein the emergency services directory number registration notification function is operable to initiate a call with the subscriber for requesting the updated geographic location information.

17. The IP application server of claim 11 wherein the emergency services directory number registration notification function is adapted to request the updated geographic location information by sending a message to the portable IP communications device.

18. The IP application server of claim 11 wherein the emergency services directory number registration notification function is operable to prompt the subscriber for the updated geographic location information via a web interface.

19. The IP application server of claim 11 wherein the IP interface is adapted to communicate a request message for requesting an IP address of the portable IP communications device and to receive a response message indicating an IP address of the portable IP communications device.

20. A computer program product comprising computer executable instructions embodied in a computer readable medium for performing steps comprising:

(a) storing an IP address of a portable IP communications device;

(b) receiving an IP address of the portable IP communications device;

(c) determining whether a difference between the stored IP address and the received IP address indicated by the registration message indicates a change in geographic location of the portable IP communications device; and

(d) in response to determining that the difference between the stored IP address and the IP address indicated by the received message indicates a change in geographic location of the portable IP communications device, prompting a subscriber to update stored geographic location information for providing emergency services directory number emergency service to the subscriber.

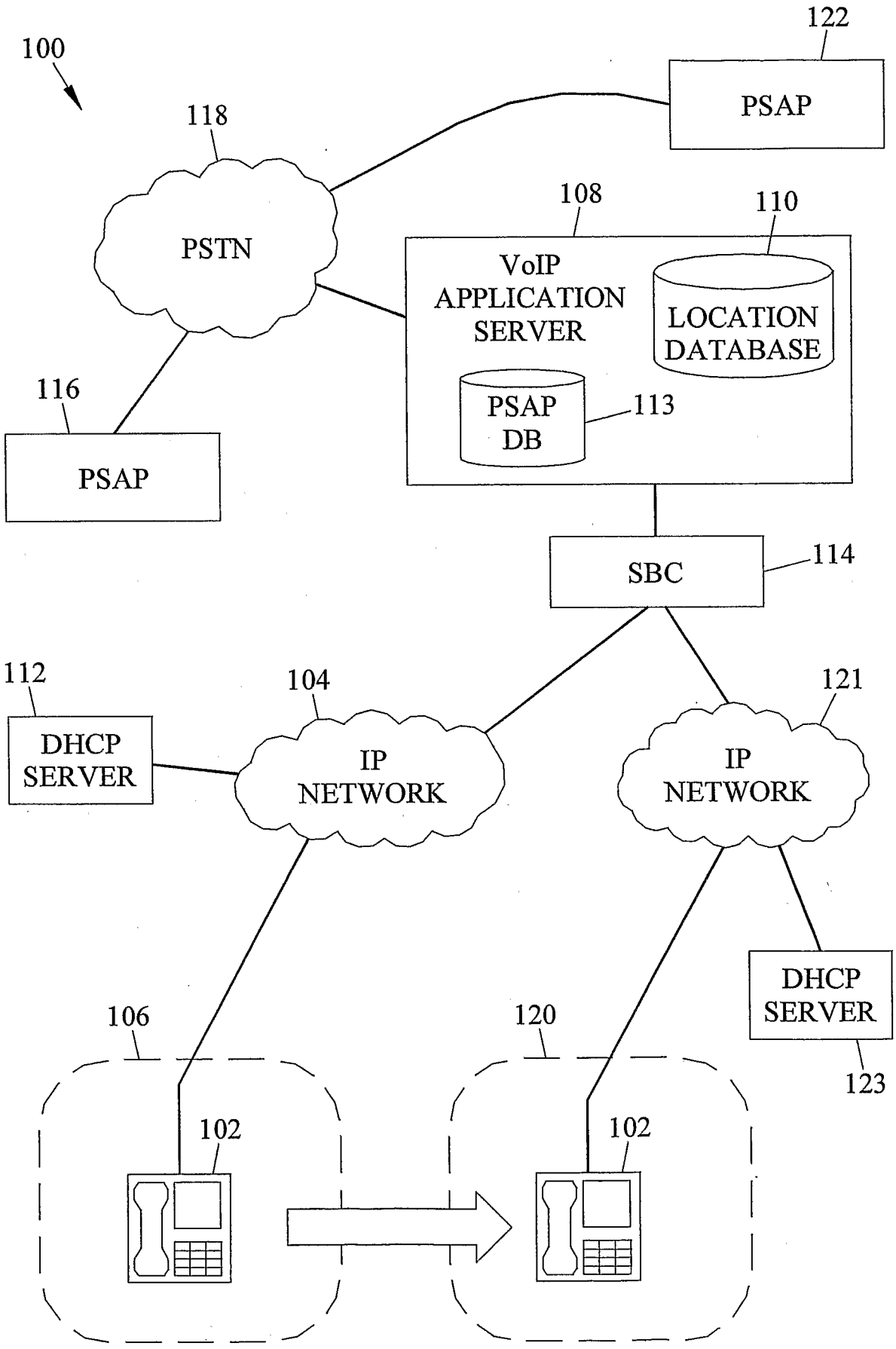
100
122
PSAP
118
PSTN
108
110
VoIP
APPLICATION
SERVER
LOCATION
DATABASE
PSAP
DB
113
116
PSAP
SBC
114
112
DHCP
SERVER
104
IP
NETWORK
121
IP
NETWORK
DHCP
SERVER
123
106
120
102
102

FIG. 1

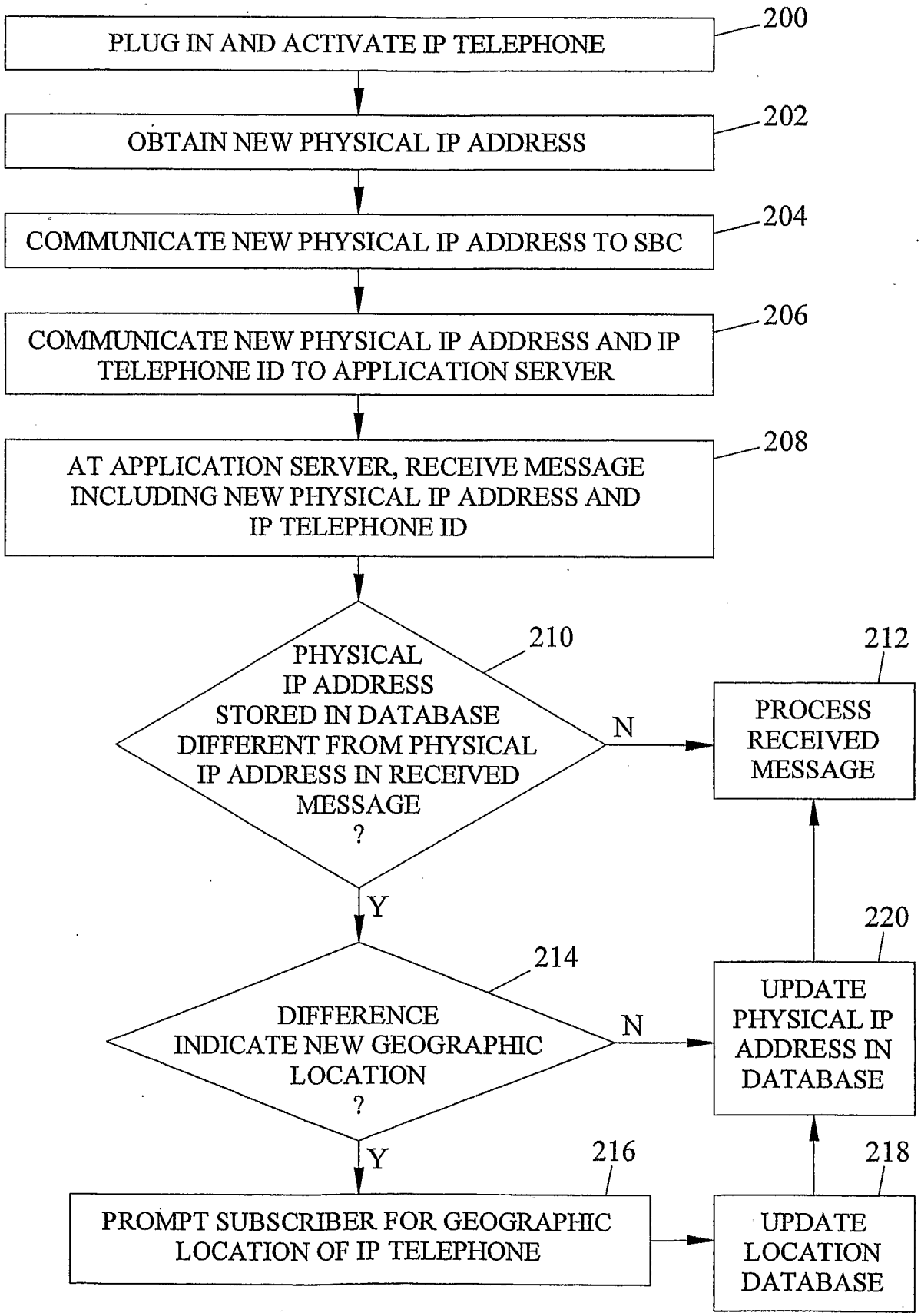
PLUG IN AND ACTIVATE IP TELEPHONE
200
OBTAIN NEW PHYSICAL IP ADDRESS
202
COMMUNICATE NEW PHYSICAL IP ADDRESS TO SBC
204
COMMUNICATE NEW PHYSICAL IP ADDRESS AND IP TELEPHONE ID TO APPLICATION SERVER
206
AT APPLICATION SERVER, RECEIVE MESSAGE INCLUDING NEW PHYSICAL IP ADDRESS AND IP TELEPHONE ID
208
PHYSICAL IP ADDRESS STORED IN DATABASE DIFFERENT FROM PHYSICAL IP ADDRESS IN RECEIVED MESSAGE ?
210
N
Y
PROCESS RECEIVED MESSAGE
212
DIFFERENCE INDICATE NEW GEOGRAPHIC LOCATION ?
214
N
Y
UPDATE PHYSICAL IP ADDRESS IN DATABASE
220
PROMPT SUBSCRIBER FOR GEOGRAPHIC LOCATION OF IP TELEPHONE
216
UPDATE LOCATION DATABASE
218

FIG. 2

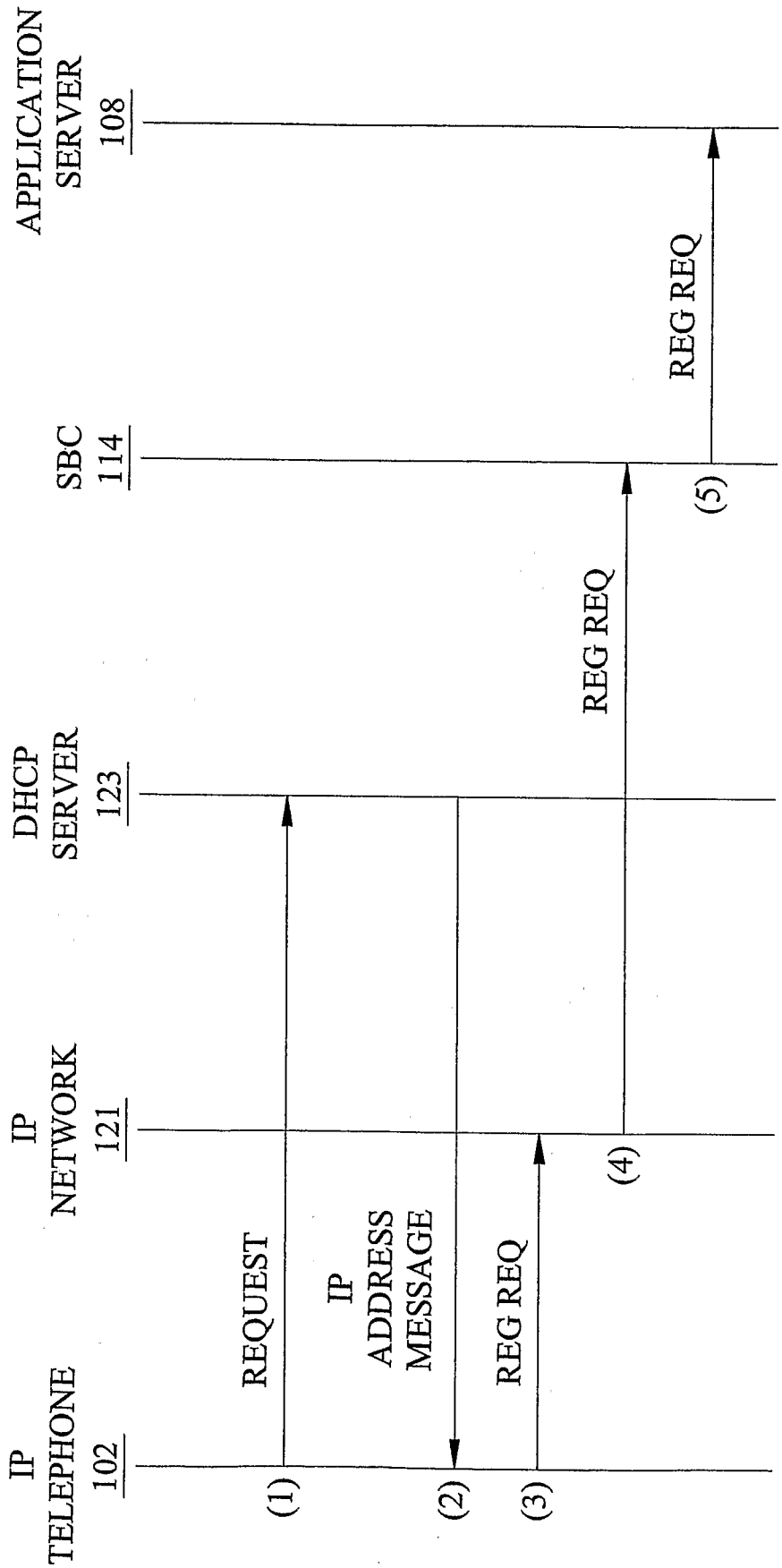
IP TELEPHONE 102
IP NETWORK 121
DHCP SERVER 123
SBC 114
APPLICATION SERVER 108
REQUEST
IP ADDRESS MESSAGE
REG REQ
REG REQ
REG REQ
(1)
(2)
(3)
(4)
(5)

FIG. 3

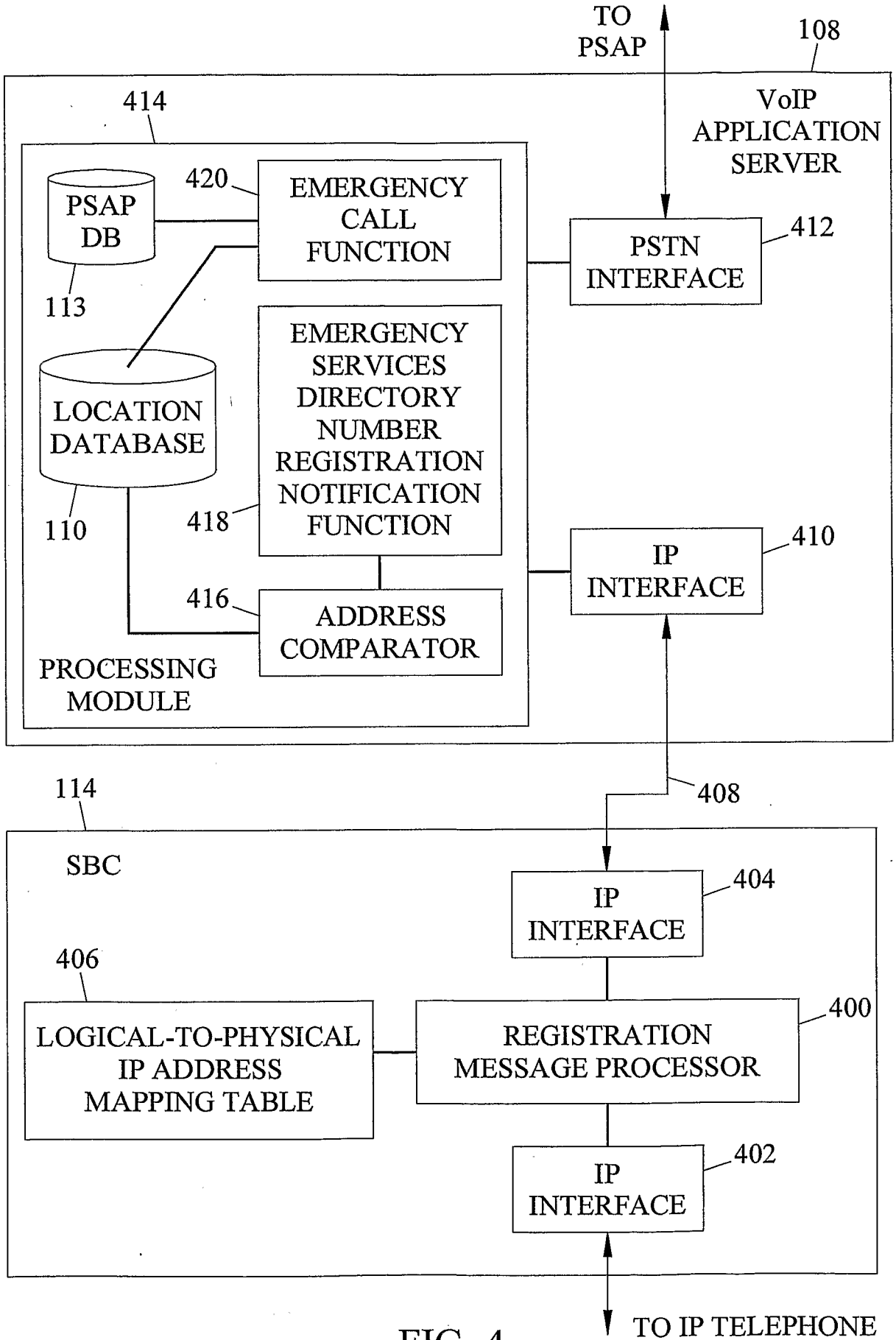
TO PSAP
108
VoIP APPLICATION SERVER
414
420
EMERGENCY CALL FUNCTION
PSAP DB
113
PSTN INTERFACE
412
EMERGENCY SERVICES DIRECTORY NUMBER REGISTRATION NOTIFICATION FUNCTION
LOCATION DATABASE
110
418
IP INTERFACE
410
416
ADDRESS COMPARATOR
PROCESSING MODULE
408
114
SBC
IP INTERFACE
404
406
LOGICAL-TO-PHYSICAL IP ADDRESS MAPPING TABLE
REGISTRATION MESSAGE PROCESSOR
400
IP INTERFACE
402
TO IP TELEPHONE

FIG. 4

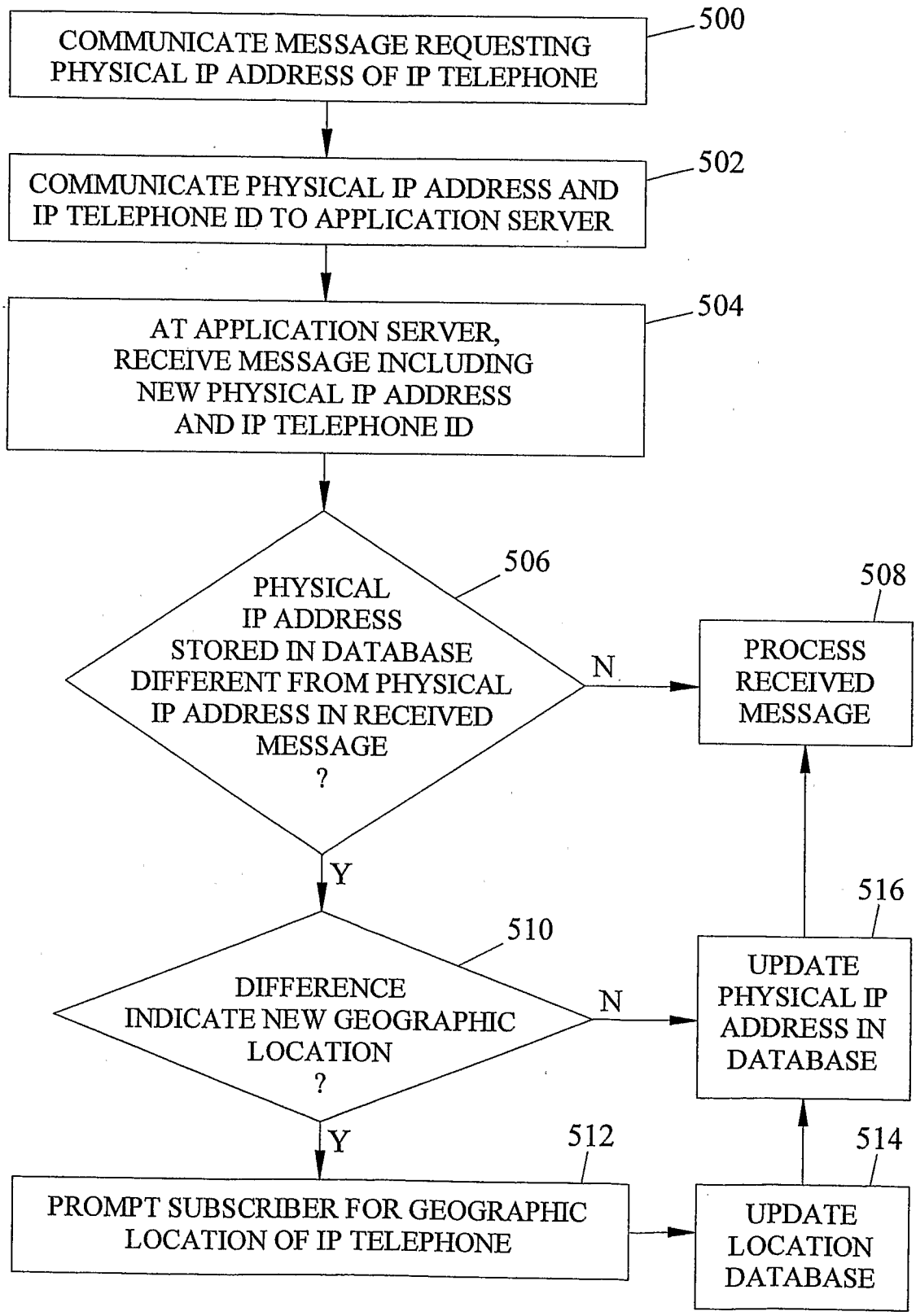
COMMUNICATE MESSAGE REQUESTING PHYSICAL IP ADDRESS OF IP TELEPHONE
500
COMMUNICATE PHYSICAL IP ADDRESS AND IP TELEPHONE ID TO APPLICATION SERVER
502
AT APPLICATION SERVER, RECEIVE MESSAGE INCLUDING NEW PHYSICAL IP ADDRESS AND IP TELEPHONE ID
504
PHYSICAL IP ADDRESS STORED IN DATABASE DIFFERENT FROM PHYSICAL IP ADDRESS IN RECEIVED MESSAGE ?
506
N
PROCESS RECEIVED MESSAGE
508
Y
DIFFERENCE INDICATE NEW GEOGRAPHIC LOCATION ?
510
N
UPDATE PHYSICAL IP ADDRESS IN DATABASE
516
Y
PROMPT SUBSCRIBER FOR GEOGRAPHIC LOCATION OF IP TELEPHONE
512
UPDATE LOCATION DATABASE
514

FIG. 5