SYSTEM AND METHOD FOR ALLOCATING SESSION INITIATION PROTOCOL (SIP) IDENTIFICATIONS (IDs) TO USER AGENTS

Field of the Invention

[0001] The present invention relates to communications systems and, more particularly, the present invention relates to Internet Protocol (IP) communications systems that use Session Initiation Protocol (SIP).

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Background of the Invention

[0002] The communications systems that use Internet Protocol (IP) and related protocols have grown in the last decade such that even the most remote individuals often can obtain access to these networks. As well known to those skilled in the art, the internet and related communication technologies are session based and are not connection based communications systems, for example, as in the Public Switched Telephone System (PSTN). New communications protocols are now being defined to add new techniques for handling voice and data calls in these IP telecommunications networks.

[0004] One recent and popular communications protocol is the Session Initiation Protocol (SIP), which is a signalling protocol for initiating, managing and terminating voice, data and video sessions across packet networks that typically use the Internet Protocol, for example, the ubiquitous Internet. SIP was developed by the Internet Engineering Task Force (IETF) and is specified in IETF Request For Comments (RFC) 2543 and the subsequent 3261 standard, the disclosures which are hereby incorporated by reference in their entirety. SIP is a standard protocol for initiating interactive user sessions that could involve multimedia, including video, voice, chat, gaming and virtual reality. SIP establishes a session and negotiates the capabilities for the session, including the modification or termination of the session. Its open standard is scalable and of general purpose, using a location-independent address system feature in which a called party can be reached based on the party's name and redirection parameters. SIP is text-based, similar to HTTP and SMTP, and works in the application layer of the Open Systems Interconnection (OSI) communications model. As a result, SIP not only can establish multimedia sessions, but also SIP can establish internet telephony calls. Because SIP supports name mapping and redirection, users can initiate and receive communications from any location.

[0005] SIP is an efficient request-response protocol, in which requests typically originate from clients, and responses typically originate from servers. Uniform Resource Locators (URL's) or Uniform Resource Identifiers (URI's) can be used to identify a user agent, but E.164 telephone number addressing can also be supported. Various SIP requests are sent through a transport protocol, for example, the User Datagram Protocol (UDP), the Simple Control Transport Protocol (SCTP), or the Transfer Control Protocol (TCP).

[0006] The SIP architecture usually includes user agents, divided into a user agent client and user agent server, typically as an application software program or a separate hardware device, for example, a hand-held waveless

communications device. The user agent sends SIP requests, which a server accepts for response. Responses are transmitted back to the request. The user agent server would typically contact the client when an SIP request is received and return a response on behalf of a user agent. The SIP protocol is operative to accept, reject or redirect the request.

[0007] The SIP architecture includes proxy, redirect or registrar servers. A proxy server is an intermediary server that operates as both a server and a client. It can make requests on behalf of other clients. A redirect server accepts an SIP request, maps the address into zero or more addresses, and returns addresses to a client. The SIP redirect server usually does not initiate SIP requests or accept calls. The registrar server accepts register requests by receiving client transmitted register packets. SIP identifications (ID's) are stored on this registrar server, which contains the location of all user agents within a domain. A registrar server can retrieve and send IP addresses, including unique SIP ID's, and other pertinent information to an SIP proxy server. Typically REGISTER requests are generated by clients and establish or remove a mapping between an SIP address. These requests can retrieve existing mappings. The SIP system typically processes for a specific set of domains and can use a location database to store and retrieve location information. Different protocols can be used to contact the SIP service including Lightweight Directory Access Protocol (LDAP), Remote Authentication Dial-In-User Service (RADIUS) for authentication, and Real-Time Transport Protocol (RTP) for real-time transmission, as non-limiting examples.

[0008] A drawback of current communications using SIP involves a user agent requiring manual entry of a SIP ID on a SIP server. For example, if 1,000 SIP-based devices are purchased, they must be provisioned with an SIP ID. There are typically two tasks to perform before the device is SIP-enabled. First, the server must contain an entry that associates to the SIP ID a unique identifier for

the device, for example, an IP address, PIN number or e-mail address. This mapping usually is manually entered. On the device or software side, a user (or the software) must also know its own SIP ID, which typically is manually entered before any registration occurs with the SIP registrar server. Also, in some domains, a larger number of potential user agents may exist, which outnumber the availability of SIP ID's.

WO01/31472 A1 is directed to a mobility management protocol for supporting real-time and non-real-time multi media applications on mobile stations of 3G networks. The system presented in this document utilises as well as extends the Session Initiation Protocol (SIP) to provide for domain hand-off (i.e. roaming). This document discloses use of the SIP REGISTER method to allow a SIP registrar to obtain a new IP address from a Dynamic Host Configuration Protocol Server on behalf of the mobile.

The paper presented by R.Droms "RFC 1541 – Request for Comments, Dynamic Host Configuration Protocol, network working request for comments, xx, xx, March 1997 (1997-03) XP002198362 discloses a manner in which the Dynamic Host Configuration Protocol (DHCP) provides a framework for passing configuration information to hosts on a TCP IP network, having the capability of automatic allocation or reusable network addresses and additional configuration options.

Summary of the Invention

The invention is defined in the independent claims. Some preferred features of the invention are defined in the dependent claims.

[0009] Embodiments of the invention allow removal of the requirement for manually entering SIP ID's on an SIP server.

[0010]Embodiments of the invention allow removal of the requirement for a user agent to know its own SIP ID in order to communicate using SIP.

[0011] Embodiments of the invention allow allocation of a limited number of SIP ID's to a larger group of user agents, which are not always connected.

[0012] In an embodiment of the present invention, SIP ID's are dynamically allocated to a user agent. For example, a server, operative as a Dynamic SIP ID Allocation (SPID) server or a SIP server, for example, a registrar server as a non-limiting example, would query a look-up table of free SIP ID's. When contacted by a user agent for a SIP ID, this server would query the look-up table and allocate to the user agent one of the free SIP ID's. Once the SIP ID is allocated, it can be moved to another table containing a list of SIP ID's currently in use. When the user agent is no longer connected to the network and using SIP, the SIP ID can be returned to a free SIP ID list. This system and method allows large scale implementation of the invention to many potential user agents.

[0013] In an embodiment of the invention, the communication system includes a Session Initiation Protocol (SIP) user agent

and a server that communicates with the SIP user agent and allocates an SIP ID for the user agent for subsequent communications using SIP. A database is associated with the server and contains data relating to free SIP ID's that can be allocated to a SIP user agent. The database also includes data of allocated SIP ID's. In another embodiment of the invention, the SIP ID comprises a unique identifier for the SIP user agent. The SIP ID can be associated with an IP address, PIN number or e-mail address in a non-limiting example of the present invention.

[0014] Embodiments of the invention, allow the server to allocate the SIP ID to another user agent after a communication session is completed by the user agent using the originally allocated SIP ID. The user agent can be a hardware or software user agent. The server could be a SIP registrar server, or a non-SIP server. The user agent is typically operative for issuing a request for a SIP ID to the server, receiving the SIP ID from the server, and issuing a REGISTER command for registering and communicating by using SIP ID.

Brief Description of the Drawings

[0016]Other objects, features and advantages of the present invention will become apparent from the detailed description of the invention which follows, when considered in light of the accompanying drawings in which:

[0017]FIG. 1 is an overall block diagram of a networked communication system using SIP and showing the DSIA server of the present invention for allocating temporarily a SIP ID for the user agent for subsequent communications using SIP.

[0018]FIG. 2 is a server-side state diagram as an example of the present invention.

[0019] FIG. 3 is a client-side state diagram as an example of the present invention.

[0020]FIG. 4 is a schematic block diagram illustrating an exemplary mobile wireless communications device for use in the present invention.

Detailed Description of the Preferred Embodiments

[0021] The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout, and prime notation is used to indicate similar elements in alternative embodiments.

[0022] The present invention advantageously removes the requirement for manually entering SIP ID's on an SIP server and for a user agent to know its own SIP ID. It also allows the allocation of a limited number of SIP ID's to a larger group of user agents, who are not always connected at the same time.

[0023] Instead of using a statically assigned SIP ID, a dynamically allocated SIP ID is used and leased to a user agent by a Dynamic SIP ID Allocation (DSIA) server, which could be a SIP server or non-SIP server. For example, the DSIA server could be associated with a registrar server or other SIP server, or be a stand-alone server as part of a different network or outside the network using SIP. The DSIA server includes a database having a look-up table of free SIP ID's. When contacted by a user agent for an SIP ID, the DSIA server would query the look-up table and allocate one of its free SIP ID's to be temporarily used by the user agent. Once the SIP ID is allocated, it could be moved to another table containing a list of SIP ID's currently in use. When the user agent is no longer connected to the network and using SIP, the SIP ID would be returned to a free SIP ID table to be leased again to another user agent.

[0024] FIG. 1 shows a fragmentary block diagram of a networked communications system **10** that uses SIP for its communications protocol. Two domains, domain1.com and domain2.com **12a, 12b** are illustrated in this non-

limiting example. Each domain **12a, 12b** has one or more SIP user agents **14a, 14b, 16a, 16b**. Each domain includes a registrar server **18a, 18b** that can be operative as a registrar and location service. Each domain also includes an SIP proxy server **20a, 20b**. A SIP redirect server **22** is operative with the SIP communications system. This server **22** could be included within each domain or be separate from the domains as illustrated. In this non-limiting example, each domain **12a, 12b** includes a Dynamic SIP ID Allocation (DSIA) server **30a, 30b** that could be a separate stand-alone server or associated with a particular domain registrar server **18a, 18b**. For purposes of illustration, only a DSIA server **30a, 30b** is shown associated with each registrar server **18a, 18b**. It should be understood that only one DSIA server could be used for all domains, but in this illustrated example, a DSIA server **30a, 30b** is contained in each domain. The DSIA server **30a, 30b** could be associated with other SIP servers also. Each DSIA server **30a, 30b** is able to query a database **32a, 32b** that stores tables of free and allocated SIP ID's.

[0025] The SIP user agents **14a, 14b, 16a, 16b** could be a software client residing on a computer or hand-held device, or a hardware device itself, for example, a SIP phone, a SIP PDA, Blackberry device, or other devices that are enabled to use the present invention and are DSIA capable. The software client could reside in a laptop or other personal computer, as non-limiting examples.

[0026] For purposes of this non-limiting example, a functional description of one method of operation of the present invention is set forth. For initial registration of a user agent in accordance with the present invention, the user agent must be capable of having a dynamic SIP ID allocated to it, i.e., a DSIA-capable user agent with a DSIA client, sends a request for a SIP ID to the DSIA server, which returns a SIP ID to the DSIA client. The client passes it up to the user agent. It should be understood that the DSIA client could sit on a lower layer and pass the information up to the user agent on the same device or machine. The user agent would take this information and register its temporary

SIP ID with the SIP registrar server. Thus, the user agent in effect has a "lease" on the SIP ID, which can later be released.

[0027] In the illustrated embodiment, if the SIP user agent, for example, as a SIP enabled phone in the first domain, wanted to communicate with a SIP user agent at the second domain, for example, a multimedia handset or other handheld device, the user would invite the second user agent by issuing an appropriate INVITE command. The SIP proxy server in the first domain **12a** would recognize that the other user agent is outside its domain and query the SIP redirect server **22** for the IP address of the other user agent. The redirect server **22** would transmit the contact information to the SIP proxy server, which forwards the SIP session invitation, i.e., the INVITE command, to the SIP proxy server **20b** in the second domain **12b**, which delivers the invitation to the second user agent. This in turn would allow the second user agent to forward an acceptance along the same path.

[0028] Even though an initial registration occurs with the use of the present invention, and an initial contact is made by the user agent to obtain a SIP ID, the overall function of SIP has not changed when the invention is implemented. The SIP infrastructure is still operable with different servers acting as proxies, gateways, registrars, and redirectors, and can bridge multiple devices or environments, including linking to a Public Switched Telephone Network (PSTN) or a corporate PBX, allowing Voice over Internet (VoIP). Straightforward messages can still be used to set-up, modify, and terminate calls including the various SIP messages: INVITE, ACK, CANCEL, REGISTER, BYE, OPTIONS, and INFO, as non-limiting examples. Different responses could include: Informational (1XX), Successful (2XX), Redirection (3XX), Request failure (4XX), Server failure (5XX), and Global failure (6XX), as non-limiting examples. SIP is advantageous over H.323 as a legacy technology because of its inherent simplicity and media-blending services, for example, internet telephony.

[0029] The SIP messages are typically text based, and can reuse MIME type description in a manner that e-mail clients do. SIP can reuse existing internet services and protocols, and have extensions that are easily defined. The present invention is operable with all aspects of SIP including interfaced, SIP-enabled end points, cost/session control, media service control, service control, service creation/authoring, intelligent network/intelligent protocol internetworking, general events subscription/notification, SIP-enabled instant messaging, and wireless multimedia protocol. A user agent can access services from an SIP-enabled endpoint whether SIP CPL, CGI, or Servlex. SIP is operative with Parlay/open services architecture (OSA); JAIN and advanced intelligent network application protocol (AINAP); intelligent network application protocol (INAP); PINTs and SPIRITs services. Stateless and stateful proxies are operative with the present invention.

[0030] In accordance with the present invention, a proxy server can do different types of address resolution, including determining a target-set, for example, resolving request SIP destination addresses to a set of SIP addresses that are mapped, and DNS resolution. Different types of forking are operable, including parallel forking, sequential forking and mixed forking by using the proxy server and a redirect server.

[0031] Different SIP-based services are operable, including ad-hoc conferencing, chat, enhanced messaging, enhanced voice mail, find-me, location-based services, picture messaging, push-to-talk, session-based transfers, infotainment, and other services as suggested by those skilled in the art.

[0032] Any services enabled by SIP can be applied to mobile services. SIP is operable with third generation mobile systems and with a call state control function (CSCF) that could be equivalent to a SIP server. SIP could be interworked with the Wireless Application Protocol (WAP) by mapping between SIP and cellular signalling protocols. A WAP mobile client could

send an instant message to a SIP client. Different application programs on the interfaces, such as the call processing language (CPL), could be used for SIP as an XML-based scripting language for describing and controlling call services. SIP could also be implemented on network servers or user agent servers.

[0033] In the worldwide web, the common gateway interface (CGI) could be used for programming web services and used for service creation in a SIP environment. The CGI script could be written in PERL, TCL, C, C++, or JAVA. SIP servlets can be used that are similar to HTTP servlets and written in JAVA. Also, SIP API's could be developed with a JAIN initiative, including JAIN SIP, JAIN LITE, and SIP servlets.

[0034] Because SIP is somewhat equivalent to the Q.931 and H.225 components of H.323, both SIP and H.323 could be used as signalling protocols in IP networks. Although they are not peers, SIP and H.323 could coexist in converged networks, even though SIP resides both in the end points and above the signalling network, acting as a service intelligence. SIP application servers could reside with soft switches in the IP central office even though MGCP/MEGACO would control multimedia gateways across the network in a converged network.

[0035] Referring now to FIG. 2, the server-side state diagram of the present invention is illustrated. Different states are shown. The centrally illustrated state **100** awaits input. The SIP ID can be obtained from the free look-up table as shown in state **102** with a request SIP ID. A reserved look-up table for the SIP ID can be checked as shown at state **104**. The SIP ID can be removed from the free look-up table at state **106** and placed in the reserved look-up table. This information is sent to the DSIA client as shown at state **108**. If the reserved look-up table is checked for the SIP ID at state **102**, the SIP ID can be removed from the reserved look-up table and placed in a free look-up table as shown at state **110**.

[0036] FIG. 3 shows the DSIA client-side state diagram. The illustrated state shows the system state **200** that awaits input. A second state **202** requests the SIP ID, which is validated at state **204**. The release SIP ID State **206** permits the SIP ID to be released once a user agent is finished.

[0037] An exemplary hand-held mobile wireless communications device **1000** that can be used in the present invention is further described in the example below with reference to FIG. 4. The device **1000** includes a housing **1200**, a keyboard **1400** and an output device **1600**. The output device shown is a display **1600**, which is preferably a full graphic LCD. Other types of output devices may alternatively be utilized. A processing device **1800** is contained within the housing **1200** and is coupled between the keyboard **1400** and the display **1600**. The processing device **1800** controls the operation of the display **1600**, as well as the overall operation of the mobile device **1000**, in response to actuation of keys on the keyboard **1400** by the user.

[0038] The housing **1200** may be elongated vertically, or may take on other sizes and shapes (including clamshell housing structures). The keyboard may include a mode selection key, or other hardware or software for switching between text entry and telephony entry.

[0039] In addition to the processing device **1800**, other parts of the mobile device **1000** are shown schematically in FIG. 4. These include a communications subsystem **1001**; a short-range communications subsystem **1020**; the keyboard **1400** and the display **1600**, along with other input/output devices **1060**, **1080**, **1100** and **1120**; as well as memory devices **1160**, **1180** and various other device subsystems **1201**. The mobile device **1000** is preferably a two-way RF communications device having voice and data communications capabilities. In addition, the mobile device **1000** preferably has the capability to communicate with other computer systems via the Internet.

[0040] Operating system software executed by the processing device **1800** is preferably stored in a persistent store, such as the flash memory **1160**, but may

be stored in other types of memory devices, such as a read only memory (ROM) or similar storage element. In addition, system software, specific device applications, or parts thereof, may be temporarily loaded into a volatile store, such as the random access memory (RAM) **1180**. Communications signals received by the mobile device may also be stored in the RAM **1180**.

[0041] The processing device **1800**, in addition to its operating system functions, enables execution of software applications **1300A-1300N** on the device **1000**. A predetermined set of applications that control basic device operations, such as data and voice communications **1300A** and **1300B**, may be installed on the device **1000** during manufacture. In addition, a personal information manager (PIM) application may be installed during manufacture. The PIM is preferably capable of organizing and managing data items, such as e-mail, calendar events, voice mails, appointments, and task items. The PIM application is also preferably capable of sending and receiving data items via a wireless network **1401**. Preferably, the PIM data items are seamlessly integrated, synchronized and updated via the wireless network **1401** with the device user's corresponding data items stored or associated with a host computer system. Communication functions, including data and voice communications, are performed through the communications subsystem **1001**, and possibly through the short-range communications subsystem. The communications subsystem **1001** includes a receiver **1500**, a transmitter **1520**, and one or more antennas **1540** and **1560**. In addition, the communications subsystem **1001** also includes a processing module, such as a digital signal processor (DSP) **1580**, and local oscillators (LOs) **1601**. The specific design and implementation of the communications subsystem **1001** is dependent upon the communications network in which the mobile device **1000** is intended to operate. For example, a mobile device **1000** may include a communications subsystem **1001** designed to operate with the Mobitex™, Data TAC™ or General Packet Radio Service (GPRS) mobile data communications networks,

and also designed to operate with any of a variety of voice communications networks, such as AMPS, TDMA, CDMA, PCS, GSM, etc. Other types of data and voice networks, both separate and integrated, may also be utilized with the mobile device **1000**.

[0042] Network access requirements vary depending upon the type of communication system. For example, in the Mobitex and DataTAC networks, mobile devices are registered on the network using a unique personal identification number or PIN associated with each device. In GPRS networks, however, network access is associated with a subscriber or user of a device. A GPRS device therefore requires a subscriber identity module, commonly referred to as a SIM card, in order to operate on a GPRS network.

[0043] When required network registration or activation procedures have been completed, the mobile device **1000** may send and receive communications signals over the communication network **1401**. Signals received from the communications network **1401** by the antenna **1540** are routed to the receiver **1500**, which provides for signal amplification, frequency down conversion, filtering, channel selection, etc., and may also provide analog to digital conversion. Analog-to-digital conversion of the received signal allows the DSP **1580** to perform more complex communications functions, such as demodulation and decoding. In a similar manner, signals to be transmitted to the network **1401** are processed (e.g. modulated and encoded) by the DSP **1580** and are then provided to the transmitter **1520** for digital to analog conversion, frequency up conversion, filtering, amplification and transmission to the communication network **1401** (or networks) via the antenna **1560**.

[0044] In addition to processing communications signals, the DSP **1580** provides for control of the receiver **1500** and the transmitter **1520**. For example, gains applied to communications signals in the receiver **1500** and transmitter **1520** may be adaptively controlled through automatic gain control algorithms implemented in the DSP **1580**.

[0045] In a data communications mode, a received signal, such as a text message or web page download, is processed by the communications subsystem **1001** and is input to the processing device **1800**. The received signal is then further processed by the processing device **1800** for an output to the display **1600**, or alternatively to some other auxiliary I/O device **1060**. A device user may also compose data items, such as e-mail messages, using the keyboard **1400** and/or some other auxiliary I/O device **1060**, such as a touchpad, a rocker switch, a thumb-wheel, or some other type of input device. The composed data items may then be transmitted over the communications network **1401** via the communications subsystem **1001**.

[0046] In a voice communications mode, overall operation of the device is substantially similar to the data communications mode, except that received signals are output to a speaker **1100**, and signals for transmission are generated by a microphone **1120**. Alternative voice or audio I/O subsystems, such as a voice message recording subsystem, may also be implemented on the device **1000**. In addition, the display **1600** may also be utilized in voice communications mode, for example to display the identity of a calling party, the duration of a voice call, or other voice call related information.

[0047] The short-range communications subsystem enables communication between the mobile device **1000** and other proximate systems or devices, which need not necessarily be similar devices. For example, the short-range communications subsystem may include an infrared device and associated circuits and components, or a Bluetooth™ communications module to provide for communication with similarly-enabled systems and devices.

[0048] Many modifications and other embodiments of the invention will come to the mind of one skilled in the art having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is understood that the invention is not to be limited to the specific

embodiments disclosed, and that modifications and embodiments are intended to be included within the scope of the appended claims.

[0049] Many modifications and other embodiments of the invention will come to the mind of one skilled in the art having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is understood that the invention is not to be limited to the specific embodiments disclosed, and that modifications and embodiments are intended to be included within the scope of the appended claims.

CLAIMS

1. A communications system comprising:

a Session Initiation Protocol (SIP) user agent (14a, 14b, 16a, 16b);

a server (30a, 30b) for communicating with the SIP user agent; and

a database associated with the server operative to contain data relating to free SIP ID's that are available to be allocated to the SIP user agent, wherein said server is operative for querying the database, determining a free SIP ID that can be allocated to the SIP user agent, and communicating the SIP ID to the SIP user agent for temporary use by the SIP user agent during a communications session over an Internet Protocol (IP) based network using SIP.

2. A communications system according to claim 1, wherein the database includes data of allocated SIP ID's.

3. A communications system according to claim 1 or claim 2, wherein the SIP ID comprises a unique identifier for the SIP user agent.

4. A communications system according to claim 3, wherein the SIP ID is associated with an IP address, PIN number or email address.

5. A communications system according to any preceding claim, wherein the server is operable to allocate the same SIP ID to another user agent after a communications session is completed by the user agent on a communications network using SIP.

6. A communications system according to any preceding claim, wherein the user agent comprises one of a hardware or software user agent.

7. A communications system according to any preceding claim, wherein the server comprises a SIP registrar server.

8. A communications system according to any preceding claim, wherein the user agent is operative for issuing a request for a SIP ID to the server, receiving the SIP ID from the server, and issuing a REGISTER command for registering and communicating by using SID.

9. A method of enabling communication on an Internet Protocol (IP) based network which comprises:

establishing a communications connection between a Session Initiation Protocol (SIP) user agent (14a, 14b, 16a, 16b) and a server (30a, 30b) and requesting from the SIP user agent allocation of a SIP ID from the server;

querying a database of free SIP ID's and determining a free SIP ID that can be temporarily allocated to the SIP user agent;

allocating the SIP ID to the user agent;

terminating a communications session between the SIP user agent on a communications network using SIP; and

returning the SIP ID that had been previously allocated to the database of free SIP ID's for use by another SIP user agent.

10. A method according to Claim 9, which further comprises releasing allocated SIP ID's.

11. A method according to Claim 9 or Claim 10, which further comprises allocating a unique identifier as an SIP ID for the user agent.

12. A method according to Claim 11, which further comprises allocating from the server to the user agent an SIP ID associated with an IP address, PIN number, or email address.

13. A method according to any of Claims 9 to 12, wherein the user agent comprises one of a hardware or software agent.

14. A method according to any of Claims 9 to 13, which further comprises allocating the SIP ID from a server operative as a SIP registrar server.