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Rose et al.

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(54) **PEER-TO-PEER, INTERNET PROTOCOL TELEPHONE SYSTEM WITH PROXY INTERFACE FOR CONFIGURATION DATA**

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H04L 29/06 (2006.01)

(52) **U.S. Cl.**
CPC ***H04L 65/1069*** (2013.01); ***H04L 12/66*** (2013.01)

(58) **Field of Classification Search**
CPC H04L 12/66; H04L 65/1069
USPC 370/352, 338, 400; 709/228, 203, 205, 709/206, 217, 219, 224, 226, 229; 455/426.1, 435.1
See application file for complete search history.

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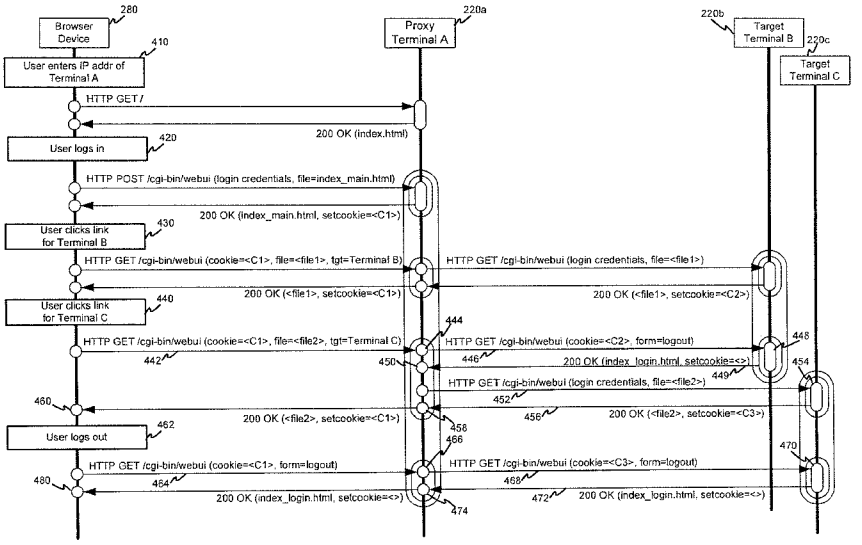
(57) **ABSTRACT**

Various embodiments provide a Peer-to-Peer (P2P, Internet Protocol (IP) telephone system. The telephone system includes a plurality of terminals coupled together via an IP network. The terminals cooperate with one another to provide telephony features without a dedicated central controller such as a PBX and/or a KSU controller. The terminals may further receive requests for configuration data residing on other terminals, relay the requests to such other terminals to obtain the request configuration, and return the requested configuration data to the requesting device.

18 Claims, 4 Drawing Sheets



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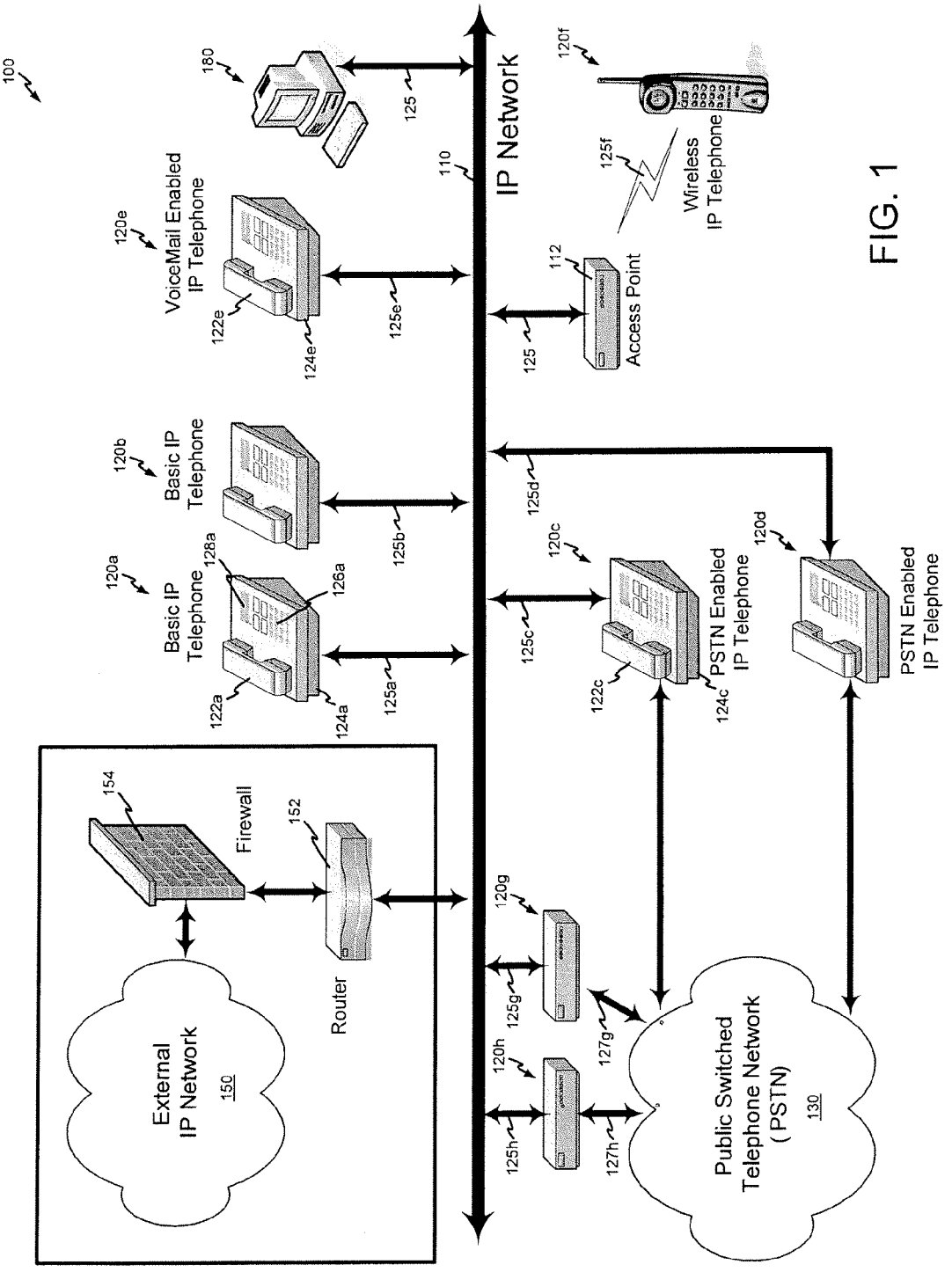
100
IP Network
110
180
125
120e
VoiceMail Enabled
IP Telephone
122e
124e
125e
120f
Wireless
IP Telephone
125f
112
Access Point
125
120b
Basic IP
Telephone
125b
120a
Basic IP
Telephone
128a
126a
122a
124a
125a
125d
120c
PSTN Enabled
IP Telephone
125c
122c
124c
120d
PSTN Enabled
IP Telephone
154
Firewall
152
Router
External
IP Network
150
120g
125g
127g
120h
125h
127h
Public Switched
Telephone Network
(PSTN)
130

FIG. 1

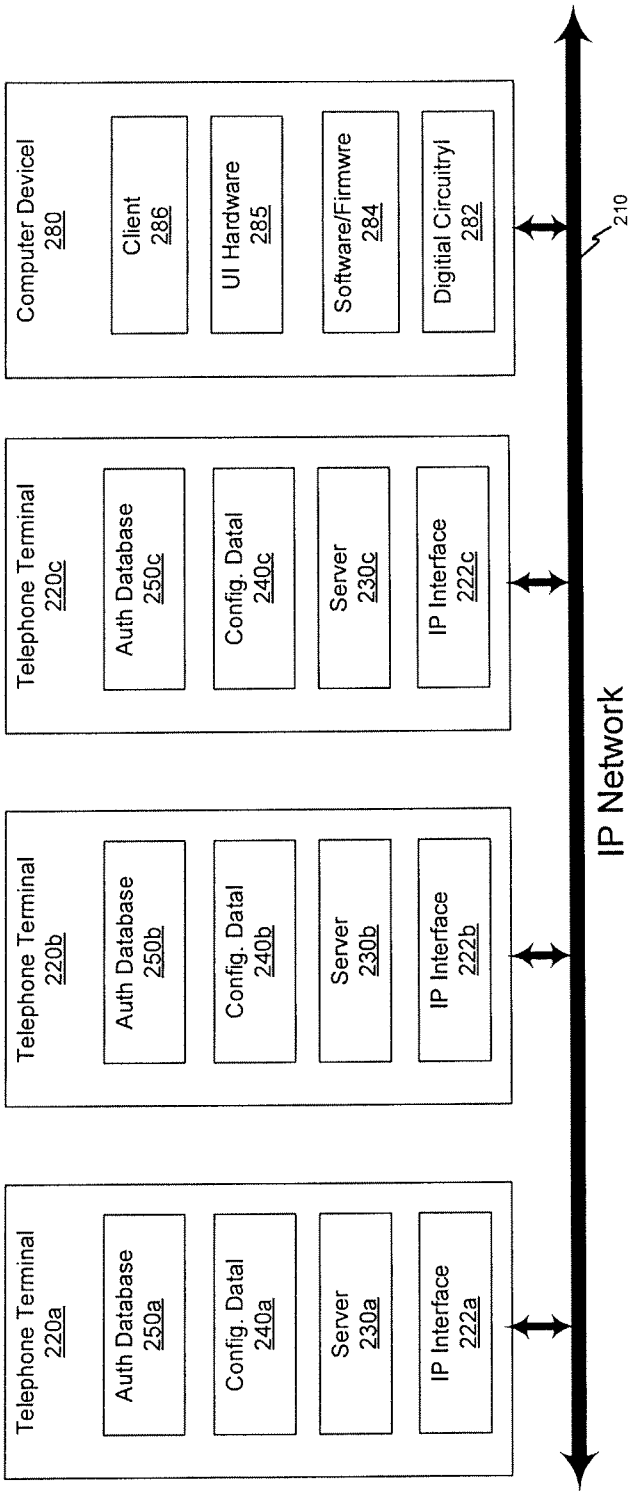
Telephone Terminal 220a
Auth Database 250a
Config. Datal 240a
Server 230a
IP Interface 222a
Telephone Terminal 220b
Auth Database 250b
Config. Datal 240b
Server 230b
IP Interface 222b
Telephone Terminal 220c
Auth Database 250c
Config. Datal 240c
Server 230c
IP Interface 222c
Computer Devicel 280
Client 286
UI Hardware 285
Software/Firmwre 284
Digitial Circuitryl 282
IP Network
210

FIG. 2

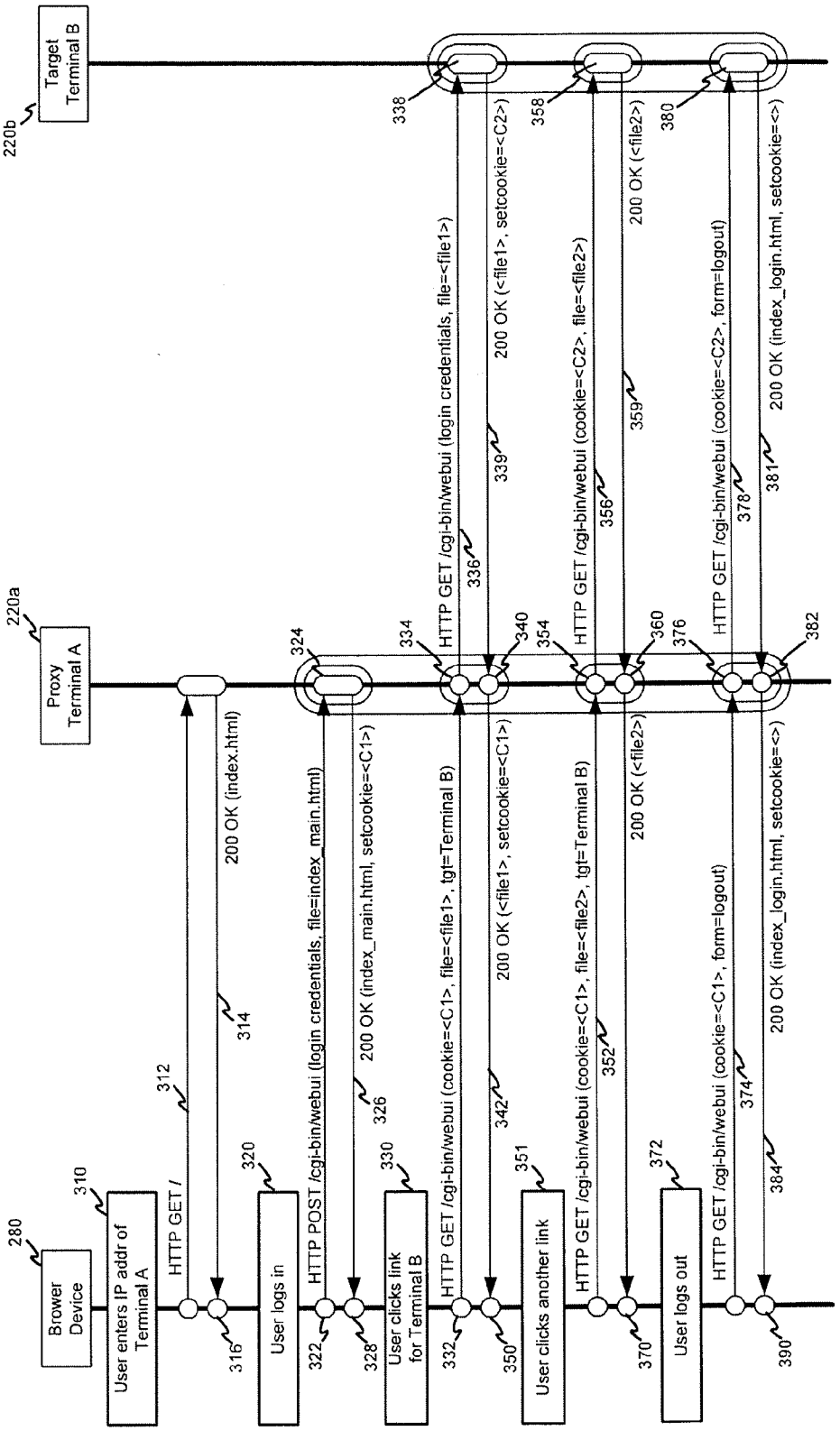
Brower Device
280
User enters IP addr of Terminal A
310
Proxy Terminal A
220a
Target Terminal B
220b
HTTP GET /
312
200 OK (index.html)
314
User logs in
316
320
HTTP POST /cgi-bin/webui (login credentials, file=index_main.html)
322
200 OK (index_main.html, setcookie=<C1>)
326
328
User clicks link for Terminal B
330
HTTP GET /cgi-bin/webui (cookie=<C1>, file=<file1>, tgt=Terminal B)
332
334
HTTP GET /cgi-bin/webui (login credentials, file=<file1>)
336
338
200 OK (<file1>, setcookie=<C1>)
340
342
200 OK (<file1>, setcookie=<C2>)
339
324
User clicks another link
350
351
HTTP GET /cgi-bin/webui (cookie=<C1>, file=<file2>, tgt=Terminal B)
352
354
HTTP GET /cgi-bin/webui (cookie=<C2>, file=<file2>)
356
358
200 OK (<file2>)
359
360
User logs out
370
372
HTTP GET /cgi-bin/webui (cookie=<C1>, form=logout)
374
376
HTTP GET /cgi-bin/webui (cookie=<C2>, form=logout)
378
380
200 OK (index_login.html, setcookie=<>)
384
381
382
390

FIG. 3

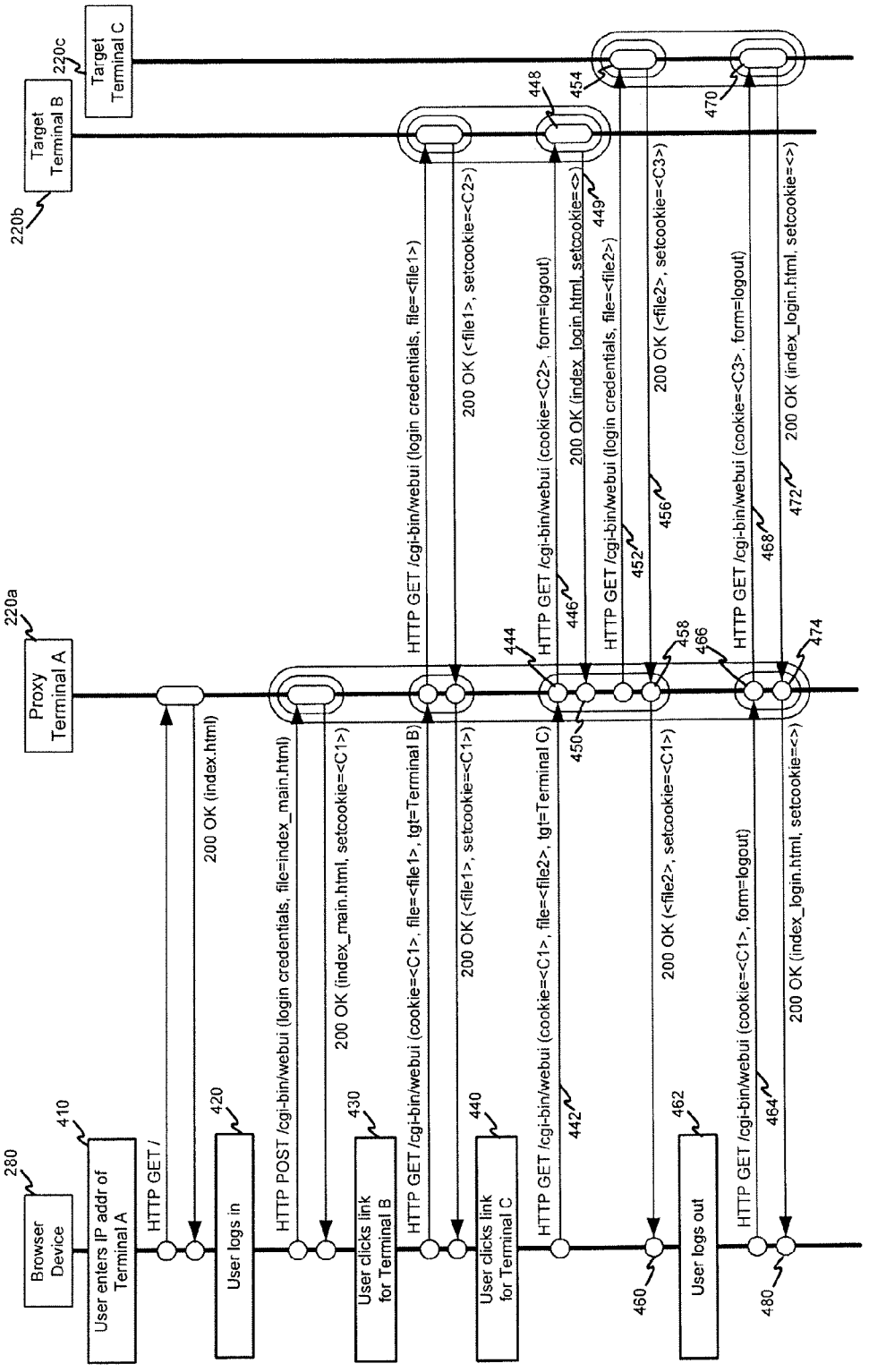
Browser Device
280
User enters IP addr of Terminal A
410
Proxy Terminal A
220a
Target Terminal B
220b
Target Terminal C
220c
HTTP GET /
200 OK (index.html)
420
User logs in
HTTP POST /cgi-bin/webui (login credentials, file=index_main.html)
200 OK (index_main.html, setcookie=<C1>)
User clicks link for Terminal B
430
HTTP GET /cgi-bin/webui (cookie=<C1>, file=<file1>, tgt=Terminal B)
200 OK (<file1>, setcookie=<C1>)
HTTP GET /cgi-bin/webui (login credentials, file=<file1>)
200 OK (<file1>, setcookie=<C2>)
User clicks link for Terminal C
440
HTTP GET /cgi-bin/webui (cookie=<C1>, file=<file2>, tgt=Terminal C)
442
444
HTTP GET /cgi-bin/webui (cookie=<C2>, form=logout)
446
200 OK (index_login.html, setcookie=<>)
448
449
HTTP GET /cgi-bin/webui (login credentials, file=<file2>)
450
452
200 OK (<file2>, setcookie=<C1>)
454
456
200 OK (<file2>, setcookie=<C3>)
458
460
User logs out
462
HTTP GET /cgi-bin/webui (cookie=<C1>, form=logout)
464
466
HTTP GET /cgi-bin/webui (cookie=<C3>, form=logout)
468
470
200 OK (index_login.html, setcookie=<>)
472
474
480

FIG. 4

PEER-TO-PEER, INTERNET PROTOCOL TELEPHONE SYSTEM WITH PROXY INTERFACE FOR CONFIGURATION DATA

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 12/987,860, filed Jan. 10, 2011, which is herein incorporated by reference in its entirety.

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FIELD

The present disclosure relates to Peer-to-Peer (P2P), Internet Protocol (IP) telephone systems, and more particularly, to proxy interfaces to configuration data in P2P, IP telephone systems.

BACKGROUND

Small enterprise environments typically desire telephone systems that provide a variety of communication features. For example, small enterprise environments typically desire telephones systems that provide internal intercom calls from one telephone terminal to another telephone terminal within the telephone system while still supporting external public switched telephone network (PSTN) calls between a telephone terminal within the system and an external telephone system connected to the PSTN. Other features desired by small enterprise environments may include call conferencing, call transferring, and voice mail functions.

A Peer-to-Peer (P2P), Internet Protocol (IP) telephone system may provide such features. However, such a P2P, IP telephone system may include configuration data that is not entirely known by any one device in the system. Some types of data may be known by all devices, but other types of data may reside on a subset of devices or on only one device. Therein, if a user interface is provided to allow an end-user to make changes to configuration data in such a system, techniques for obtaining data that may be located elsewhere in the system may be required.

SUMMARY

Aspects of the disclosed embodiments are directed to methods, systems, and apparatus, substantially as shown in and/or described in connection with at least one of the figures and as set forth more completely in the claims.

These and other advantages, aspects and novel features of the disclosed embodiments, as well as details of illustrative aspects thereof, will be more fully understood from the following description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram that illustrates a peer-to-peer (P2P), internet protocol (IP) telephone system, in accordance with an embodiment.

FIG. **2** is a simplified diagram of a P2P, IP telephone system, in accordance with an embodiment.

FIG. **3** is a chart showing interaction of a client device with a proxy terminal to obtain configuration data from the target terminal of FIG. **2**.

FIG. **4** is a chart showing interaction of a client device with a proxy terminal to obtain configuration data from two separate target terminals of FIG. **2**.

DETAILED DESCRIPTION

Aspects of the disclosed embodiments may be found in a method and apparatus that provide a user interface configured to update configuration data in a peer-to-peer (P2P), Internet Protocol (IP) telephone system. Certain embodiments provide a small enterprise telephone system comprising two or more telephone terminals that coordinate between themselves to implement private branch exchange (PBX) and/or key services unit (KSU) type functionality without the use of a central PBX and/or KSU controller. An Internet Protocol (IP) network is used to support communication and coordination between the telephone terminals. Each telephone terminal supports features and functions that may be offered as resources to the telephone system as a whole and may be shared between the various telephone terminals. One or more of the terminals may provide a network-accessible user interface (UI) that permits a user of the system to change configuration data distributed among various terminals of the system.

Due to its P2P nature, the small enterprise telephone system may be expanded with a high degree of flexibility according to the desires of a small enterprise. In particular, telephone terminals with different features may be added and/or removed from the telephone system in order to provide the small enterprise with a desired feature set. For example, telephone terminals may include but are not limited to (a) telephone terminals with corded handset, keypad and display, (b) telephone terminals with corded handset, keypad, display, and a PSTN telephone jack to support calls using a public switched telephone network (PSTN), (c) basic telephone terminals with corded handset, keypad, display, and a telephone answering device that provide voice mail functions, (d) wireless telephone terminals that connect to the IP network via a wireless IP link, and (e) PSTN gateway terminals with PSTN telephone jacks to support calls using the PSTN.

Referring now to FIG. **1**, a small enterprise telephone system **100** that uses an IP network **110** to support communication between a plurality of telephone terminals **120** (e.g., terminals **120***a-f*) is shown. Unlike conventional Voice over Internet Protocol (VoIP) telecommunications system, the telephone system **100** does not include a central controller node, such as a PBX and/or KSU controller. Rather, control and switching for the telephone system **100** is coordinated among the telephone terminals **120**.

As shown, the system **100** uses an IP network **110** to communicatively couple the plurality of telephone terminals **120** to one another. In one embodiment, the IP network **110** is implemented with a fast Ethernet network (e.g., 10/100baseT). However, the IP network **110** may be implemented using other types of IP-based networks such as, for example, wireless 802.11 wireless networks, HomePlug power-line networks, public Internet network, and the like.

FIG. **1** shows different types of telephone terminals **120**. In particular, telephone terminals **120***a*, **120***b* are depicted as basic IP telephone terminals coupled to the IP network **110** via wired IP connections **125***a*, **125***b* (e.g., a Cat 5 Ethernet cable). The basic IP telephone terminal **120***a* may include a handset **122***a* and base unit **124***a*, which provide a voice

interface and a user interface to the system **100**. In particular, the handset **122***a* may be coupled to the base unit **124***a* via a cord (not shown).

The handset **122***a* and base unit **124***a* may each include a microphone and speaker (not shown). As a result, a user may interact with the telephone system **100** via the voice interface provided by the handset **122***a* which receives voice input from a user and outputs audio signals to the user via its microphone and speaker. Alternately, a user may elect to interact with the telephone system **100** via the voice interface provided by the base unit **124***a*, which receives voice input from a user and outputs audio signals to the user via its microphone and speaker when operating in a speakerphone mode of operation.

In addition to the voice interface, the handset **122***a* and the base unit **124***a* may each include a keypad **126***a* and display **128***a* which provide a user interface to the system **100**. The keypad **126***a* may permit a user to input digits and/or other information via one or more key presses, and the display **128***a* may provide the user with textual and/or graphical information. Furthermore, the base unit **124***a* may include a network interface configured to transmit and receive IP packets over the IP network **110**. The base unit **124***a* may also include circuitry (e.g., processor, microcontroller, data storage devices, and the like), software, and/or firmware configured to conduct a telephone call over the IP network **110**.

Besides basic IP terminals **120***a*, **120***b*, the telephone system **100** may further include PSTN enabled IP telephone terminals **120***c*, **120***d* that are coupled to the IP network **110** via wired IP connections **125***c*, **125***d*. In particular, the telephone terminal **120***c* may include a handset **122***c* and base unit **124***c* that provide the telephone terminal **120***c* with functionality similar to that provided by the basic IP telephone terminals **120***a*, **120***b*. However, the handset **122***c* and base unit **124***c* further include a PSTN interface and corresponding circuitry to convert signals between the PSTN **130** and the IP network **110**. In particular, the telephone terminals **120***c*, **120***d* include circuitry configured to handle on-hook/off—hook signaling, the detection of incoming PSTN calls, the reception of call ID (CID) signals, the generation of outgoing dialing tones/pulses, and the conversion of voice signals. In one embodiment, the IP telephone functionality of the telephone terminals **120***c*, **120***d* are functionally independent of the PSTN interface functionality, thus permitting simultaneous usage of both the IP telephone functionality and the PSTN interface functionality of the terminals **120***c*, **120***d*.

As shown, the telephone system **100** may further include VoiceMail (VM) enabled IP telephone terminal **120***e* that is coupled to the IP network **110** via a wired IP connection **125***e*. The telephone terminal **120***e* includes a handset **122***e* and base unit **124***e* that provide the telephone terminal **120***e* with functionality similar to that provided by the handset and base unit of the basic IP terminal **120***a*. The base unit **124***e*, however, further includes an integrated telephone answering device, which may provide voicemail features to all of the telephone terminals **120** of the telephone system **100**.

The telephone system **100** may also include a wireless IP telephone terminal **120***e* that is coupled to the IP network **110** via a wireless IP connection **125***f* and a wireless access point **112**. The wireless IP telephone terminal **120***f* may provide functionality similar to that provided by the basic IP telephone terminals **120***a*, **120***b*. However, unlike the basic IP telephone terminals **120***a*, **120***b*, the wireless IP telephone terminal **120***f* is not tethered to the telephone system **100** by a wired IP connection, thus permitting the user of the wireless IP telephone **120***f* greater mobility.

The telephone system **100** may also include gateway terminals **120***g-h*. Each gateway terminal **120***g-h* may be connected to the IP network **110** via a respective wired connection **125***g-h* and to the PSTN **130** by one or more (e.g., four) wired connections **127***g-h*. Each gateway terminal **120***g-h* in one embodiment operates in a manner similar to the PSTN-enabled, IP telephone terminals **120***c-d* by providing PSTN connectivity to other terminals **120** of the telephone system **100**.

The telephone system **100** may further include one or more computing devices **180** such as a laptop computer, desktop computer, workstation, handheld device, and/or other device that may be coupled to the IP network **110**. The computing device **180** may include digital circuitry (e.g., processors, memory, and control logic), software and/or firmware, and user interface hardware (e.g., keyboard, mouse, display, and the like) that in combination present a user with a client suitable for interacting with a network-accessible interface of the terminals **120**.

Each telephone terminal **120** provides one or more resources that contribute to the entire functionality of the telephone system **100**. The PSTN-enabled IP telephone terminal **120***c*, for example, provides to a user of the telephone terminal **120***c* (a) a user extension resource for voice communication, (b) a user display resource for messaging purposes, and (c) a user keypad resource for user input. Moreover, the PSTN-enabled IP telephone terminal **120***c* provides a PSTN interface resource for not only the PST-enabled IP telephone terminal **120***c* but the other IP telephone terminals **120** of the telephone system **100**. Similarly, the VM-enabled telephone terminal **120***d* provides VM functionality not only to the user of the VM-enabled telephone terminal **120***d*, but also to the other IP telephone terminals **120** of the telephone system **100**.

The IP telephone terminals **120** described above are not an exhaustive set of the terminals that may be added to the telephone system **100**. Other types of P2P terminals are contemplated and may be added to the telephone system **100** in order to expand the overall functionality of the telephone system **100**. For example, the telephone system **100** may further include terminals which provide only VoiceMail functionality (e.g., a terminal similar to terminal **120***e*, but without a telephone handset), a video IP phone terminal which supports video IP communication, and other terminal configurations.

As shown, the telephone system **100** may also include an interface between the local IP network **110** and an external IP network **150** (e.g., the Internet). Such an interface may include a router **152** and/or firewall device **154**. While not essential for the operation of the telephone system **100**, such an external interface supports communication between IP telephone terminals **120** within the telephone system **100** and IP telephone terminals **120** external to the telephone system **100**, whether they be at a remote office (acting as an extension to the telephone system **100**) or at a third party site (either a VoIP service provider or an IP-based end terminal).

Due to its P2P nature, the telephone system **100** uses various non-conventional techniques to provide operation and features comparable to those available in conventional PBX and/or KSU systems. One such technique relates to discovery of terminals such as IP telephone terminals **120**. In response to a terminal **120** being connected to the telephone system **100**, the newly-added terminal **120** performs two tasks. First, the new terminal **120** discovers which other terminals **120** are already connected to the telephone system **100**, their capabilities (resource set), and their addresses so that the terminal **120** may configure itself for use in the telephone system **100**. Second, the newly-added terminal **120** announces its presence on the telephone system **100** to notify existing terminals **120** of its capabilities and address.

In one embodiment, an extension of the DHCP (Dynamic Host Configuration Protocol) is used to implement the discovery process. In such an embodiment, a newly-connected terminal **120** broadcasts on the system **100** a request for DHCP services which typically assigns an IP address to the new terminal **120**. In particular, the new terminal **120** may identify itself (e.g., a VoIP terminal) with the DHCP request. Existing terminals **120** of the telephone system **100** may also receive the broadcast DHCP request and response and update their configuration information accordingly so that they may directly communicate with the newly added terminal **120** at the addressed assigned by the DHCP server. Other terminals **120** already on the system **100** also receive the DHCP broadcast. While an extension of the DHCP protocol may be used, other embodiments may implement terminal discovery using another protocol. For example, other embodiments may use other protocols (e.g., the BOOTP protocol, the Web Proxy Autodiscovery (WPAD) protocol, the Zeroconf protocol, the Boot Service Discovery Protocol (BSDP), the Universal Plug and Play (UPnP) set of protocols, and/or a custom protocol).

As an example of a custom protocol, a newly-added terminal **120** may listen for beacon signals on the IP network **110** to determine whether a telephone system **100** is established. In response to a beacon signal, the terminal **120** may request the sender of the beacon signal (e.g., a Master Coordinator as explained in detail below in regard to FIGS. **2-4**) to join the telephone system **100**. The newly-added terminal **120** may then wait for a beacon signal that indicates system-wide configuration data has been updated. The updated system-wide configuration data may include an extension number for the terminal **120** which advises the newly-added terminal and other terminals **120** in the telephone system **100** of the resources available in the new terminal **120**.

Once terminals **120** are aware of other terminals on the system **100**, the terminals **120** may configure themselves. For example, a newly-added terminal **120** in the system **100** may be able to detect, for example, that there are other terminals **120** with extension numbers 10, 11 and 12. The newly added terminal **120** may be able to automatically configure itself to be extension number 13, and may then advise the other terminals **120** of its selected extension number. However, if the newly-added terminal **120** had been previously configured with the extension number 14, then the terminal **120** may retain this extension number. Similarly, if this newly-added terminal **120** has PSTN interface, then the existing terminals **120** may re-configure themselves to support use of this newly available PSTN telephone line. Further details regarding updating configuration data which may be used by some embodiments is presented below.

The telephone system **100** in certain embodiments supports resource sharing. As a result of such resource sharing, a small enterprise may continually expand the telephone system **100** by installing new terminals **120**. For example, if a user of terminal **120***a* desires to make a PSTN call, the terminal **120** may send a message to terminal **120***c* requesting use of its PSTN interface. Terminal **120***a*, in one embodiment, already knows that terminal **120***c* has a PSTN interface due to the discovery process. If the PSTN interface of terminals **120***c* is not already in use, then terminal **120***c* may assign the PSTN resource to terminal **120***a*. If further requests for the PSTN resource arrive at terminal **120***c* while still being assigned to terminal **120***a*, then terminal **120***c* may deny such additional requests until terminal **120***a* has completed its use of the PSTN resource. Terminal **120***a* may then forward a message to terminal **120***c* which requests terminals **120***c* to dial the appropriate telephone number for a PSTN call on the PSTN network **130** and establish a VoIP connection between the PSTN network **130** and terminal **120***a*.

In some embodiments, terminal **120***c* may still be available for calls on the IP network **110** since the PSTN interface to the PSTN network **130** and VoIP interface to the IP network **110** are implemented as independent resources in some embodiments. Furthermore, if a user at terminal **120***c* wishes to make a PSTN call while its PSTN interface is still assigned to terminal **120***a*, terminal **120***c* may request use of the PSTN interface of terminal **120***d* to facilitate this PSTN call. In this way, any IP telephone terminal **120** in the telephone system **100** has the ability to access any PSTN connection.

Other resources, such as a voice mail system, may be shared among the terminals **120** in a similar fashion. Once a terminal **120** is finished with a resource, a message is sent to the associated terminal **120** indicating the resource may be released and made available for other requests from the telephone system **100**. The terminals **120** may also implement a time-out mechanism to ensure the telephone system may recover from error conditions such as a terminal **120** being disconnected from the IP network when in control of a resource of another terminal **120**.

The telephone system **100** may further include distributed control aspects. In particular, each of the terminals **120** may include circuitry, software, and/or firmware which determine how to best facilitate a user's request. In a conventional PBX and/or KSU system, a central PBX and/or KSU server controls all resources of the telephone system. In the peer-to-peer telephone system **100**, each terminal **120** controls only those resources that are part of its hardware, and loans them to other terminals **120** based on resource requests. The distributed control enables a terminal **120** to resolve conflicts where the terminal **120** may receive simultaneous resource requests, as well as enabling terminals **120** to determine where in the telephone system **100** to seek specific resources.

As mentioned above, the telephone system **100** is a P2P telephone system in which the terminals **120** communicate directly with each other without the coordination efforts of a central controller such as a PBX and/or KSU central controller. For proper operation of the telephone system **100**, the terminals **120** include configuration data that is shared among all terminals **120** within the telephone system **100**. For example, the configuration data shared among the terminals **120** may include a list of all the telephone terminals **120** and corresponding extension numbers. It is not practical for an end-user to manually update all terminals **120** in the telephone system **100** to contain the same configuration data. Moreover, the telephone system **100** does not contain a dedicated central controller for coordinating the dispersal of such configuration data. Accordingly, each terminal **120** of the telephone system **100** in one embodiment may implement a process that automatically propagates configuration data throughout the P2P, IP telephone system **100**.

Despite such propagation of configuration data throughout the telephone system **100**, certain configuration data may only be stored in a single terminal **120** or a sub-set of terminals **120** for various reasons. In light of such locally-stored data, a user interface used to configure the telephone system **100** may desire to obtain and/or change such locally-stored configuration data. To this end, one or more of the terminals **120**, in one embodiment, are configured to provide a network-accessible UI which a user may access via a network client (e.g., a web browser client) to obtain and/or change such locally-stored configuration data. Accordingly, as shown in FIG. **1**, a computing device **180** such as a laptop computer, desktop computer, workstation, handheld device, and/or

other web-enabled device may be coupled to the IP network **110** to permit a user of such device **180** to access the network-accessible UI.

Referring now to FIG. **2**, a simplified diagram of a P2P, IP telephone system **200** is shown which highlights aspects associated with providing a network-accessible UI configured to obtain and/or change configuration data of the telephone system **200**. In particular, the telephone system **200** is shown with terminals **220***a-c* coupled to one another via an IP network **210**. Moreover, a computing device **280** is also shown coupled to the IP network **210**. Each of the 14 terminals **220***a-c* may include an IP interface **222***a* to the IP network **210**, a server **230***a-c*, configuration data **240***a-c*, and an authentication database **250***a-c*. In some embodiments, the authentication database **250***a-c* may be implemented as part of the configuration data which the terminals **220***a-c* automatically propagate among the terminals **220***a-c* of the system **200**. Moreover, the terminals **220***a-c* may be implemented in a manner similar to any of the terminals described above in regard to FIG. **1**.

Each server **230***a-c* may include a hypertext transfer protocol (HTTP) server and associated business logic to provide a network-accessible UI for obtaining and/or changing configuration data in the system **200**. To this end, each terminal **220***a-c* may include digital circuitry (e.g., processors, memory, and control logic) as well as software and/or firmware that in combination implement its server **230***a-c* and its business logic associated with the network-accessible UI. While each server **230***a-c*, in one embodiment, may include a HTTP server and associated business logic to provide the network-accessible UI, other embodiments may utilize other data transfer protocols, servers, and/or clients in order to provide the functionality of the network-accessible UI.

The computing device **280** may include digital circuitry **282** (e.g., processors, memory, and control logic), software and/or firmware **284**, and user interface hardware **285** (e.g., keyboard, mouse, display, and the like) that in combination present a user with a client **286** suitable for interacting with the network-accessible UI of the servers **230***a-c*. In one embodiment, the client **286** comprises a conventional web browser (e.g., Firefox™, Chrome™, and Internet Explorer™ browsers). However, other embodiments of the computing device **280** may provide a propriety client for accessing the network-accessible UI of the terminals **220***a-c*.

Referring now to FIG. **3**, a method for accessing configuration data of a target terminals through a proxy terminal is shown. In the interest of simplifying the description of FIG. **3**, the method is described from the standpoint of the computing device **280** accessing configuration data of target terminal **220***b* via a proxy terminal **220***a*. However, in one embodiment, any terminal **220***a-c* may play the role of proxy for another terminal **220***a-c*. For example, the computing device **280**, in another embodiment, may access configuration of target terminal **220***c* via proxy terminal **220***b*.

As shown, a user first establishes a session with the proxy terminal **220***a*. To this end, the user at **310** enters the IP address or Universal Resource Location (URL) for the proxy terminal **220***a* via the client **286** of the computing device **280**. In response to such input, the computing device **280** at **312** sends an HTTP GET request to the proxy terminal **220***a* for a default page of the proxy terminal **220***a*. In response to such a request, the server **230***a* of the proxy terminal **220***a* at **314** locates and returns the default page (e.g., index.html) which includes a form for entering login credentials of the user. At **316**, the client **286** may render the page received from the proxy terminal **220***a* and presents the page including its form for entering login credentials to the user via the user interface hardware **285**.

In response to such request for login credentials, the user at **320** may fill in the form for the login credentials (e.g., username and password). At **322**, the client **286** may submit the filled-out form to the server **230***a* which causes the login credentials (e.g., username and password) and a requested response page (e.g., index_main.html) to be sent via a HTTP POST.

The server **230***a* at **324** may process the credentials received via the HTTP POST to ensure the credentials are valid. In particular, the server **230***a* may reference authentication database **250***a* to ensure the received username and password correspond to a valid and authorized account. The server **230***a* may create an internal web session reference that remains valid for the duration of the user's interaction with the server **230***a*. In particular, the internal web session reference may remain valid until the user logs out, or until a session timeout terminates the session. To track this session for subsequent requests, the server **230***a* at **326** may return a session cookie <C1> to the client **286** along with the requested response page (e.g., index_main.html) to be rendered by the client **286**. During the remainder of the session, the client **286** may include the session cookie <C1> in all subsequent requests. When receiving subsequent requests, the server **230***a* may match the received session cookie value to the internal session reference, determine if that session is still valid, and determine whether to process the corresponding request.

At **328**, the client **286** may render the page received from the proxy terminal **220***a* and present the page to the user via the user interface hardware **285**. The user at **330** may request configuration data <file1> residing on terminal **220***b* by, for example, clicking a link in the presented page that corresponds to configuration data <file1>. At **332**, the client **286** may send an HTTP GET request to terminal **220***a* for configuration data <file1> that resides in terminal **220***b*. In particular, the HTTP GET request may identify the configuration data <file1> and target terminal **220***b* and provide the session cookie <C1>.

The server **230***a* of the terminal **220***a* at **334** may confirm the validity of the session cookie <C1>. Assuming validity of the session cookie <C1>, the server **230***a* may then establish a separate session between the terminal **220***a* and the target terminal **220***b*. In particular, the server **230***a* at **336** may send to the target terminal **220***b* an HTTP GET request comprising login credentials (e.g., username and password) and an identifier for the configuration data <file1>. At **338**, the server **230***b* of the target terminal **220***b* may use its authentication database **250***b* to confirm the validity of the received login credentials. Assuming the login credentials are valid, the server **230***b* at **339** may establish the session and return a session cookie <C2> back to the proxy terminal **220***a* along with the webpage and corresponding configuration data <file1> listed in the initial request.

At **340**, the proxy terminal **220***a* may store the session cookie <C2> within its internal reference data and associate the session cookie <C2> with the session cookie <C1>. At **342**, the proxy terminal **220***a* may attach the configuration data <file1> with the original session cookie <C1>, and pass the configuration data <file1> and session cookie <C1> back to the client **286**.

At **350**, the client **286** may update the page based upon the configuration data <fuel> received from the target terminal **220***b* via the proxy terminal **220***a*, and present the updated page to the user via the user interface hardware **285**. The user

at **351** may request other configuration data <file2> residing on terminal **220***b* by, for example, clicking another link in the presented page that corresponds to configuration data <file2>. At **352**, the client **286** may send an HTTP GET request to proxy terminal **220***a* for configuration data <file2> that resides in target terminal **220***b*. In particular, the HTTP GET request may identify the configuration data <file2> and target terminal **220***b* and provide the session cookie <C1>.

At **354**, the proxy terminal **220***a* may check and confirm the validity of the session cookie <C1>, determine the session associated with the cookie <C1> is currently involved in a proxy session with target terminal **220***b*. At **356**, the proxy terminal **220***a* may substitute the session cookie <C2> for proxy terminal **220***b* and pass the request through to the target terminal **220***b* for processing. At **358**, the target terminal **220***b* may check and confirm the validity of the session cookie <C2>. After confirming the validity of the session cookie <C2>, the target terminal **220***b* at **359** may return the webpage and requested configuration data <file2> to the proxy terminal **220***a*. The proxy terminal **220***a* at **360** may then return the received webpage and requested data file <file2> to the client **286**.

At **370**, the client **286** may update the page based upon the configuration data <file2> received from the target terminal **220***b* via the proxy terminal **220***a*, and present the updated page to the user via the user interface hardware **285**. The user at **372** may logout by, for example, clicking the link in the presented page that corresponds to a logout request. At **374**, the client **286** may send to proxy terminal **220***a* an HTTP GET request that includes the session cookie <C1> and identifies a logout form. At **376**, the proxy terminal **220***a* may check and confirm the validity of the session cookie <C1>, to determine the session associated with the cookie <C1> is currently involved in a proxy session with target terminal **220***b*. Accordingly, the proxy terminal **220***a* may substitute the session cookie <C2> for proxy terminal **220***b* and pass the logout request through to the target terminal **220***b* at **378**.

At **380**, the target terminal **220***b* may check and confirm the validity of the session cookie <C2>. After confirming the validity of the session cookie <C2>, the target terminal **220***b* may invalidate the session cookie <C2> in its internal reference data, and return a webpage and a blank session cookie to the proxy terminal **220***a* at **381**. The proxy terminal **220***a* at **382** may then invalidate the session cookie <C1> in its internal reference data, and return the received webpage and blank session cookie to the client **238** at **384**. At **390**, the client **286** may render the webpage provided by the target terminal **220***b* via the proxy terminal **220***a* and invalidate the session cookie <C1>, thus ending its session with the target terminal **220***b*.

Referring now to FIG. **4**, a method for accessing configuration data of multiple target terminals through a single proxy terminal is shown. In the interest of simplifying the description of FIG. **4**, the method is described from the standpoint of the computing device **280** accessing configuration data of target terminals **220***b*, **220***c* via a proxy terminal **220***a*. However, in one embodiment, any terminal **220***a-c* may play the role of proxy for another terminal **220***a-c*. For example, the computing device **280**, in another embodiment, may access configuration of target terminals **220***a*, **220***c* via proxy terminal **220***b*.

As shown in FIG. **4**, a user at **410** may enter the IP address or URL for the proxy terminal **220***a* into a client **286** to cause the client to request a default page from the proxy terminal **220***a*. At **420**, the user may log into the proxy terminal **220***a* by, for example, supplying login credentials via a form of the default page. As a result of logging-in, the client **286** may obtain a session cookie <C1> from the proxy terminal **220***a*. At **430**, the user may request configuration data <file1> from target terminal **220***b* which causes the proxy terminal **220***a* to establish a session with the target terminal **220***b* and obtain a session cookie <C2>. Accordingly, the above aspects of FIG. **4** may be implemented in a manner similar to corresponding aspects of FIG. **3**.

However, at **440**, a user may request configuration data <file2> residing on terminal **220***c* by, for example, clicking a link in a page presented by the client **286** that corresponds to configuration data <file2>. At **442**, the client **286** may send an HTTP GET request to terminal **220***a* for configuration data <file2> that resides in terminal **220***c*. In particular, the HTTP GET request may identify configuration data <file2> and target terminal **220***c* and may provide the session cookie <C1>.

The server **230***a* of the terminal **220***a* at **444** may confirm the validity of the session cookie <C1> and determine that the session cookie <C1> is currently associated with a session with target terminal **220***b* and not the currently-requested target terminal **220***c*. The server **230***a* may then terminate the session with target terminal **220***b* and establish a session with target terminal **220***c*. While the following describes terminating the session with target terminal **220***b* and then establishing the session with target terminal **220***c*, other embodiments may perform such tasks in reverse order or in parallel.

In particular, the server **230***a* at **446** may send to target terminal **220***b* an HTTP GET request that includes the session cookie <C2> and identifies a logout form. At **448**, the target terminal **220***b* may check and confirm the validity of the session cookie <C2>. After confirming the validity of the session cookie <C2>, the target terminal **220***b* may invalidate the session cookie <C2> in its internal reference data, and return a webpage and a blank session cookie to the proxy terminal **220***a* at **449**. The proxy terminal **220***a* at **450** may then invalidate the session cookie <C2> in its internal reference data.

The server **230***a* may then establish a separate session between the terminal **220***a* and the target terminal **220***c*. In particular, the server **230***a* at **452** may send to the target terminal **220***c* an HTTP GET request comprising login credentials (e.g., username and password) and an identifier for the configuration data <file2>. At **454**, the server **230***c* of the target terminal **220***c* may use its authentication database **250***c* to confirm the validity of the received login credentials. Assuming the login credentials are valid, the server **230***c* at **456** may establish the session and return a session cookie <C3> back to the proxy terminal **220***a* along with the webpage and corresponding configuration data <file2> listed in the initial request. The proxy terminal **220***a* at **458** may then return the received webpage and requested data file <file2> to the client **286**.

At **460**, the client **286** may update the page based upon the configuration data <file2> received from the target terminal **220***c* via the proxy terminal **220***a*, and present the updated page to the user via the user interface hardware **285**. The user at **462** may then logout by, for example, clicking a link in the presented page that corresponds to a logout request. At **464**, the client **286** may send to proxy terminal **220***a* an HTTP GET request that includes the session cookie <C1> and identifies a logout form. At **466**, the proxy terminal **220***a* may check and confirm the validity of the session cookie <C1>, and determine if the session associated with the cookie <C1> is currently involved in a proxy session with target terminal **220***c*. Accordingly, the proxy terminal **220***a* may substitute the session cookie <C3> for proxy terminal **220***c* and pass the logout request through to the target terminal **220***c* at **468**.

At **470**, the target terminal **220***c* may check and confirm the validity of the session cookie <C3>. After confirming the validity of the session cookie <C3>, the target terminal **220***c* may invalidate the session cookie <C3> in its internal reference data, and return a webpage and a blank session cookie to the proxy terminal **220***a* at **472**. The proxy terminal **220***a* at **474** may then invalidate the session cookie <C1> in its internal reference data, and return the received webpage and blank session cookie to the client **238**. At **480**, the client **286** may render the webpage provided by the target terminal **220***b* via the proxy terminal **220***a* and invalidate the session cookie <C1>, thus ending its session with the proxy terminal **220***a*.

The above-described proxy approach of an IP telephone terminal may permit another IP telephone terminal to access data of IP telephone terminals that reside behind a NAT router/firewall, wherein such data would not otherwise be accessible. Merely redirecting an IP telephone terminal to another IP telephone terminal for data may result in the IP telephone terminal attempting to access data of an IP telephone terminal residing behind a NAT router/firewall without a publicly-accessible address. In such a situation, the request for data would fail due to the intervening NAT router/firewall and no public interface. However, if an IP telephone terminal having the above proxy features is implemented behind the NAT router/firewall with a publicly accessible address, then the IP telephone terminal may fulfill the requests for data and thereby make such data behind the NAT router/firewall accessible.

Various embodiments are described herein by way of example and not by way of limitation in the accompanying figures. For clarity of illustration, exemplary elements illustrated in the figures may not necessarily be drawn to scale. In this regard, for example, the dimensions of some of the elements may be exaggerated relative to other elements to provide clarity. Furthermore, where considered appropriate, reference labels have been repeated among the figures to indicate corresponding or analogous elements.

Moreover, certain embodiments may be implemented as a plurality of instructions on a tangible computer readable medium such as, for example, flash memory devices, hard disk devices, compact disc media, DVD media, EEPROMs, and the like. Such instruction when executed by a telephone terminal or other device, may configure the telephone terminal or other device to perform tasks associated with receiving requests for configuration data residing on other telephone terminals and acting as a proxy for such requests for configuration data.

One skilled in the art would readily appreciate that many modifications and variations of the disclosed embodiments are possible in light of the above teachings. Thus, it is to be understood that, within the scope of the appended claims, aspects of the disclosed embodiments may be practiced in a manner other than as described above.

What is claimed:

1. A telephone terminal for configuring a plurality of telephone terminals of a telephone system, the telephone terminal comprising:

circuitry configured to conduct a telephone call over an Internet Protocol (IP) network; and

a server configured to:

display a network-accessible user interface on a client device by transferring aspects of the network-accessible user interface to a web browser of the client device via the IP network;

receive, from the client device via the IP network and the network-accessible user interface displayed by the web browser, a request for configuration data used to configure one or more telephone terminals of the plurality of telephone terminals;

relay the request to a second telephone terminal to obtain the requested configuration data from the second telephone terminal in response to determining that the requested configuration data resides on the second telephone terminal;

update the network-accessible user interface displayed by the web browser to present the requested configuration data to the client device via the network-accessible user interface;

establish a first session with the client device and associate a first session cookie with the first session;

establish a second session with the second telephone terminal and associate a second session cookie with the second session; and

verify that the request received from the client device includes the first session cookie and replace the first session cookie with the second session cookie, prior to relaying the request to the second telephone terminal.

2. The telephone terminal of claim **1**, wherein the server comprises a hypertext transport protocol (HTTP) server configured to present the network-accessible user interface to the client device.

3. The telephone terminal of claim **1**, wherein the server is configured to determine whether the client device has provided valid login credentials prior to returning the requested configuration data to the client device.

4. The telephone terminal of claim **1**, wherein the server is further configured to permit a user of the client device, via the network-accessible user interface displayed by the web browser, to change to the configuration data used to configure the one or more telephone terminals.

5. The telephone terminal of claim **1**, wherein the server is further configured to:

receive, from the client device via the IP network and the network-accessible user interface displayed by the web browser, another request for configuration data used to configure one or more telephone terminals of the plurality of telephone terminals;

determine that the another request for configuration data corresponds to further configuration data residing on a third telephone terminal;

relay the another request to the third telephone terminal to obtain the requested further configuration data from the third telephone terminal; and

update the network-accessible user interface displayed by the web browser to present the requested further configuration data from the third telephone terminal to the client device via the network-accessible user interface.

6. The telephone terminal of claim **1**, wherein the server is configured to terminate a session with the other IP telephone terminal and establish a session with the third telephone terminal in response to the request for configuration data residing on the third telephone terminal.

7. A method for providing configuration data to a client device via a network-accessible user interface, the method comprising:

displaying a network-accessible user interface of a first telephone terminal on the client device by transferring aspects of the network-accessible user interface to a web browser of the client device via an Internet Protocol (IP) network;

receiving, with the first telephone terminal via the IP network and the network-accessible user interface displayed by the web browser, a request from the client

device for configuration data used to configure a plurality of telephone terminals of a telephone system;

relaying the request from the first telephone terminal to a second telephone terminal to obtain the requested configuration data from the second telephone terminal in response to determining that the requested configuration data resides on the second telephone terminal;

updating the network-accessible user interface displayed by the web browser to present the requested configuration data from the second telephone terminal to the client device via the network-accessible user interface of the first telephone terminal;

establishing, between the first telephone terminal and the client device, a first session having an associated first session cookie;

establishing, between the first telephone terminal and the second telephone terminal, a second session having an associated second session cookie; and

verifying that the request received from the client device includes the first session cookie and replacing the first session cookie with the second session cookie.

8. The method of claim **7**, further comprising determining with the first telephone terminal whether the client device has provided valid login credentials prior to returning the requested configuration data to the client device.

9. The method of claim **7**, wherein:

the second telephone terminal stores a file that includes the configuration data; and

the method further comprises receiving, with the first telephone terminal, the file from the second telephone terminal in response to said relaying.

10. The method of claim **7**, further comprising permitting a user of the client device to change, via the network-accessible user interface displayed by the web browser, the configuration data used to configure the plurality of telephone terminals.

11. The method of claim **7**, further comprising:

receiving, from the client device via the IP network the network-accessible user interface of the first telephone terminal, another request for configuration data used to configure one or more telephone terminals of the plurality of telephone terminals;

determining that the another request for configuration data corresponds to further configuration data residing on a third telephone terminal;

relaying the another request to the third telephone terminal to obtain the requested further configuration data from the third telephone terminal; and

updating the network-accessible user interface displayed by the web browser to present the requested further configuration data from the third telephone terminal to the client device via the network-accessible user interface of the first telephone terminal.

12. The method of claim **7**, further comprising, in response to the request for configuration data residing on the third telephone terminal:

terminating a session between the first telephone terminal and the second IP telephone terminal; and

establish a session between the first telephone terminal and the third IP telephone terminal.

13. A non-transitory computer readable medium comprising a plurality of instructions, that in response to being executed, configure an Internet Protocol (IP) telephone terminal to:

display a network-accessible user interface on a client device by transferring aspects of the network-accessible user interface to a web browser of the client device via an IP network;

receive, from the client device via the IP network and the network-accessible user interface displayed by the web browser, a request for configuration data used to configure another one or more IP telephone terminals of a telephone system;

relay the request to another IP telephone terminal to obtain the requested configuration data from the another IP telephone terminal in response to determining that the requested configuration data resides on the another IP telephone terminal;

update the network-accessible user interface displayed by the web browser to present the requested configuration data from the another IP telephone terminal to the client device via the network-accessible user interface,

establish, with the client device, a first session having an associated first session cookie;

establish, with the another IP telephone terminal, a second session having an associated second session cookie; and

verify that the request received from the client device includes the first session cookie and replace the first session cookie with the second session cookie, prior to relaying the request to the another IP telephone terminal.

14. The non-transitory computer readable medium of claim **13**, wherein the plurality of instructions further configure the IP telephone terminal to:

determine with the first telephone terminal whether the client device has provided valid login credentials prior to returning the requested configuration data to the client device.

15. The non-transitory computer readable medium of claim **13**, wherein the plurality of instructions further configure the IP telephone terminal to:

store a file that includes the configuration data; and

receive with the first telephone terminal, the file from the second telephone terminal in response to the relay of the request to the another IP telephone terminal.

16. The non-transitory computer readable medium of claim **13**, wherein the plurality of instructions further configure the IP telephone terminal to:

permit a user of the client device to change, via the network-accessible user interface displayed by the web browser, the configuration data used to configure the plurality of telephone terminals.

17. The non-transitory computer readable medium of claim **13**, wherein the plurality of instructions further configure the IP telephone terminal to:

receive, from the client device via the IP network and the network-accessible user interface, another request for configuration data used to one or more IP telephone terminals of the telephone system;

determine that the another request for configuration data corresponds to further configuration data residing on a third telephone terminal;

terminate a session with the another IP telephone terminal;

establish a session with the third IP telephone terminal;

relay the another request to the third IP telephone terminal to obtain the requested further configuration data from the third IP telephone terminal; and

update the network-accessible user interface displayed by the web browser to present the requested further configuration data from the third IP telephone terminal to the client device via the network-accessible user interface.

18. The non-transitory computer readable medium of claim 13, wherein the plurality of instructions further configure the IP telephone terminal to:

terminate a session between the first telephone terminal and the second IP telephone terminal; and

establish a session between the first telephone terminal and the third IP telephone terminal.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 9,270,710 B2
APPLICATION NO. : 14/251507
DATED : February 23, 2016
INVENTOR(S) : Christopher Rose and Gerry Knopp

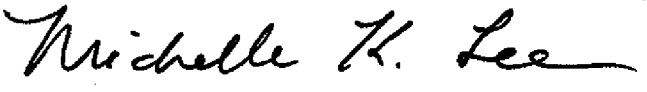
It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Specification

Column 1, In line 33, delete "s" from "phones"

Column 7, In line 48, after "of" delete "a"

Signed and Sealed this
Third Day of May, 2016



Michelle K. Lee
Director of the United States Patent and Trademark Office