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(54) **METHOD AND SYSTEM FOR NETWORK ENTITY CONFIGURATION**

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H04L 12/28 (2006.01)
G06F 15/16 (2006.01)

(52) **U.S. Cl.** **370/351**; 709/220

(58) **Field of Classification Search** ..... None
See application file for complete search history.

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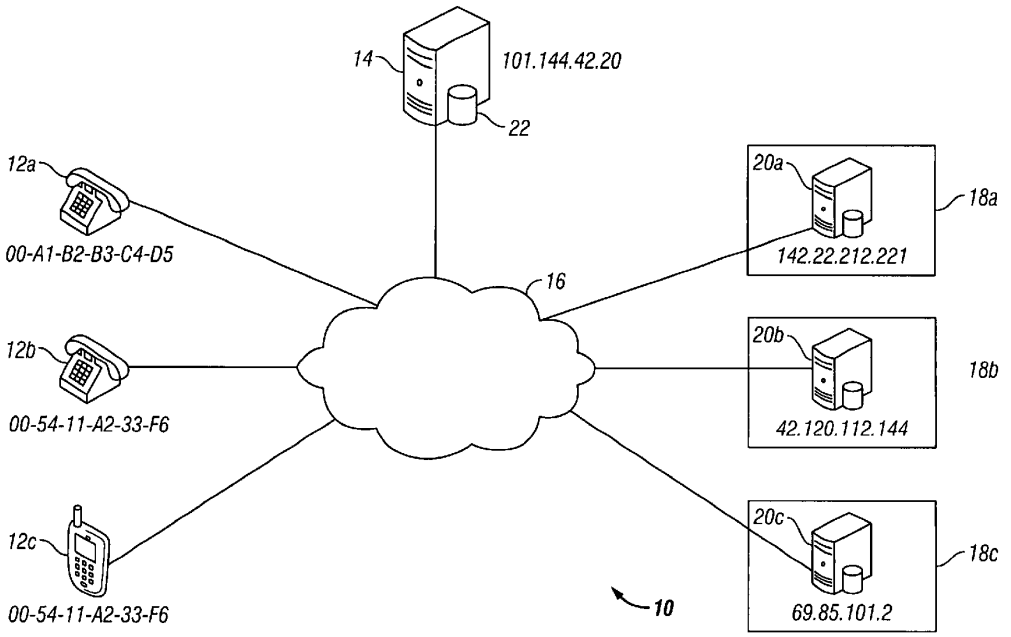
(57) **ABSTRACT**

A system for configuring a plurality of network entities by a central server, each of the network entities being associated with a unique identifier, and each of the network entities being associated with at least one service provider having configuration settings data therefor.

10 Claims, 3 Drawing Sheets



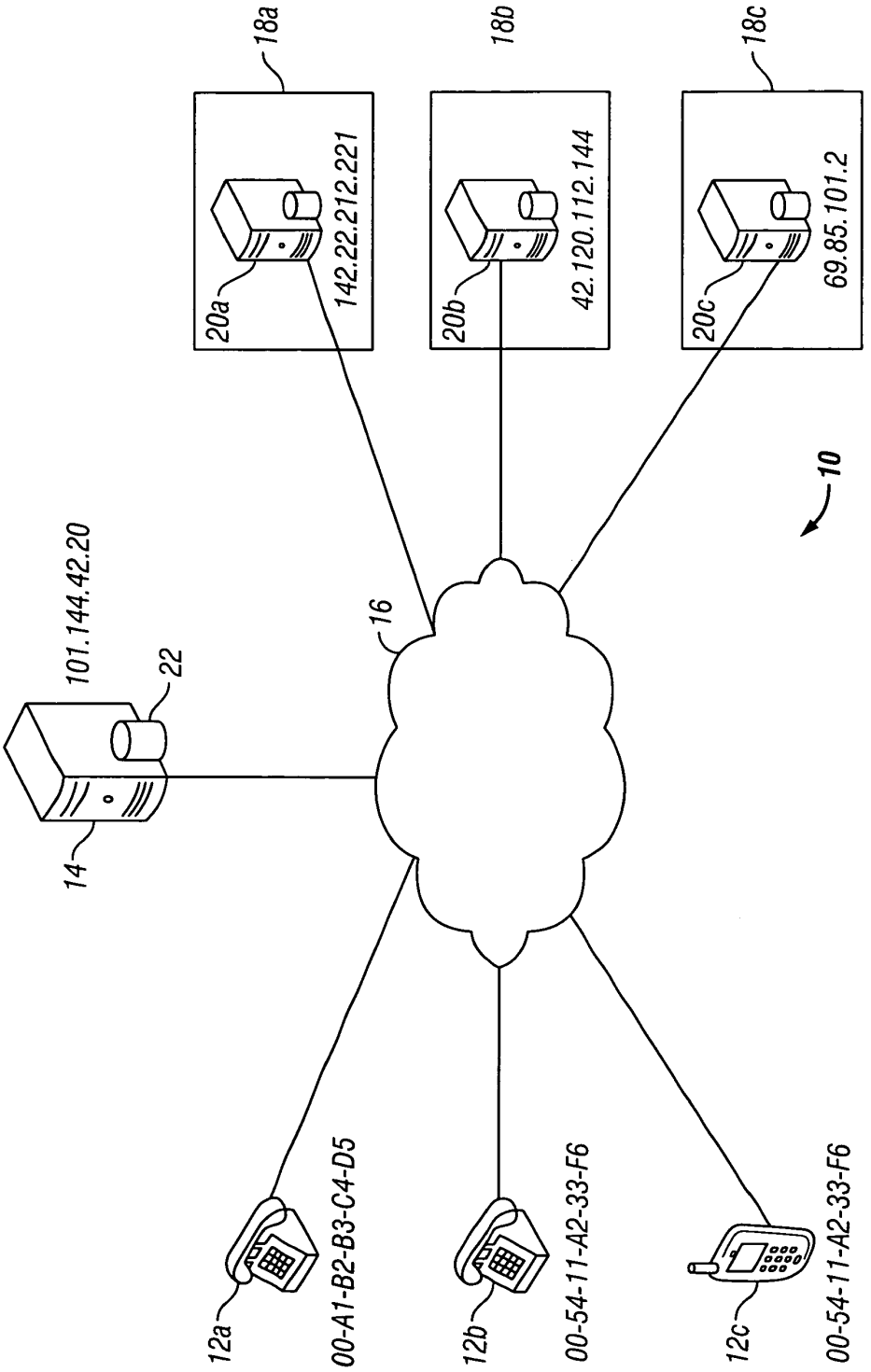

18a
18b
18c
20a
142.22.212.221
20b
42.120.112.144
20c
69.85.101.2
10
101.144.42.20
22
16
14
12a
00-A1-B2-B3-C4-D5
12b
00-54-11-A2-33-F6
12c
00-54-11-A2-33-F6

FIG. 1

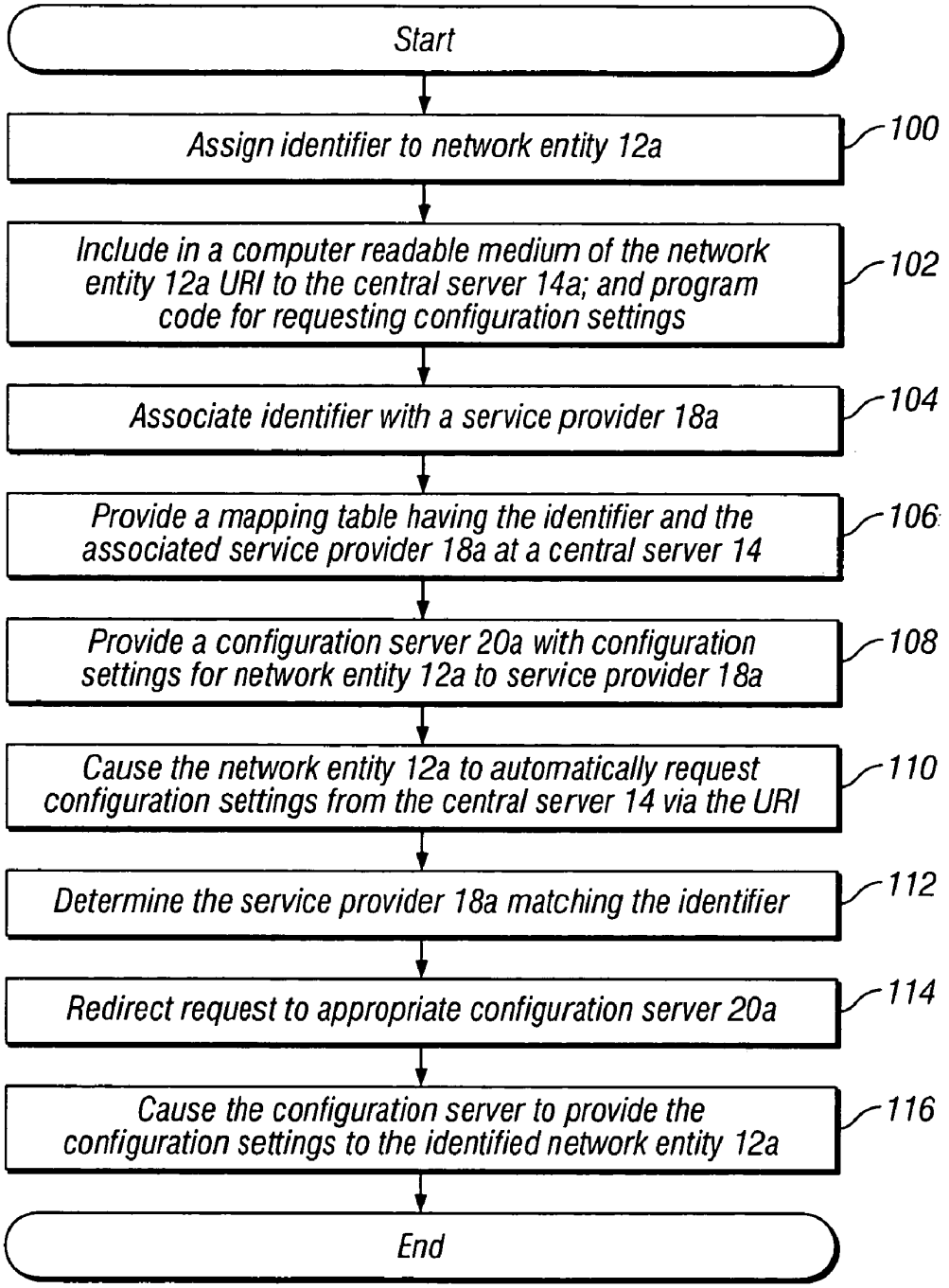

Start
Assign identifier to network entity 12a
100
Include in a computer readable medium of the network entity 12a URI to the central server 14a; and program code for requesting configuration settings
102
Associate identifier with a service provider 18a
104
Provide a mapping table having the identifier and the associated service provider 18a at a central server 14
106
Provide a configuration server 20a with configuration settings for network entity 12a to service provider 18a
108
Cause the network entity 12a to automatically request configuration settings from the central server 14 via the URI
110
Determine the service provider 18a matching the identifier
112
Redirect request to appropriate configuration server 20a
114
Cause the configuration server to provide the configuration settings to the identified network entity 12a
116
End

FIG. 2

IP Device MAC address	00-A1-B2-B3-C4-D5	00-54-11-A2-33-F6	00-54-11-A2-33-F6	.....	xx-xx-xx-xx-xx
SERVICE PROVIDER ID	SP 18a	SP 18b	SP 18c	.....	SP 18x
Configuration server(s) (IP address)	142.22.212.221 100.232.2.214 72.12.15.32 120.200.45.255 222.48.25.66	42.120.112.144 144.110.212.20	69.85.101.2	.....	yy.yyy.y.yyy

FIG. 3a

Configuration parameters for IP Device	Transport Mechanism (e.g. TFTP/FTP/HTTP/HTTPS Parameters for FTP/HTTP/HTTPS: • Username/password for FTP • Path for HTTP • Path/Client Method (SSL or TLS) for HTTPS Parameter n

FIG. 3b

METHOD AND SYSTEM FOR NETWORK ENTITY CONFIGURATION

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of priority to U.S. Provisional Application Ser. No. 60/863,616, filed 31 Oct. 2006.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to packet switched networks, and more particularly to configuring network entities with the requisite settings in order to participate within a network.

2. Description of the Related Art

IP Telephony (VoIP) is a converged voice/data technology that uses the data network to carry voice (telephone) traffic, and is rapidly revolutionizing the world of enterprise communications. Some benefits of IP telephony include the ability to manage individual phone systems, access to a plethora of features and applications, improved reliability, improved performance, substantial cost savings and unified messaging.

Another key benefit of VoIP technology is that it allows networks to be built using either a centralized or a distributed architecture. In general, centralized architectures are associated with H.248 and MGCP. These protocols were designed for a centralized device called a media gateway controller or call agent that handles switching logic and call control. The centralized device communicates with the media gateways, which route and transmit the audio/media portion of the voice calls. In centralized architectures, the network intelligence is centralized and endpoints are relatively dumb with limited or no native features. Distributed architectures are associated with H.323 and SIP protocols. These protocols allow network intelligence to be distributed between endpoints and call-control devices. Intelligence in this instance refers to call state, calling features, call routing, configuring, billing, or any other aspect of call handling. The endpoints can be VoIP gateways, IP phones, media servers, or any device that can initiate and/or terminate a VoIP call. The call-control devices are called gatekeepers in an H.323 network, and proxy or redirect servers in a SIP network.

One significant difference between a POTS (plain old telephone service) network and a VoIP network is that some architectures and intelligent subscriber gateways and/or IP phones now reside on the customer premises. These devices may be very complex and require to be configured before use, unlike a POTS phone. Therefore easier configuration of subscriber gateways, or end points becomes important as the network scales up. In a hosted PBX or IP Centrex environment users simply plug their IP phone **12***a* into the LAN, and the IP phone **12***a* is auto-configured. However, to date, the issue of auto-configuration of IP endpoints in a non-hosted PBX, or non-IP centrex environment, has not been adequately or satisfactorily addressed. Typically, in a non-hosted PBX, or non-IP centrex environment, each customer end point must be configured, managed and maintained individually, and so the user is often tasked to manually enter the configuration settings for the device, such as the service provider's configuration server address or other network settings. Also, the user must usually prearrange IP telephony services with an Internet or VoIP service provider in order to select the configuration or services options.

Therefore, the user is burdened with the task of reviewing the installation guide, or other documentation in order to correctly connect the device to the network. The installation

process is often not successful, as a certain level of knowledge of networking is assumed. Inevitably, the frustrated end-user contacts the service provider for support, and the service provider is faced with higher costs during the installation process as well as the ongoing support, operation, and upgrades. These costs are significant and can dramatically impact its profitability. Also, slower deployment leads to fewer subscriptions, lost market share, decreased ARPU, and customer churn.

For carriers delivering residential VoIP and other IP services, mass deployment represents a challenge, as a large number of devices have to be configured and supported. Typically, the devices are bought from different vendors, and so the devices generally require vendor-specific configuration settings which must be enabled in the phones for the end-user to enjoy the full functionality of the device. Also, mass deployment over the Internet is often impeded by lack of interoperability and complexity of configurations, and firewall/NAT issues.

It is an object of the present invention to mitigate or obviate at least one of the above-mentioned disadvantages.

SUMMARY OF THE INVENTION

In one of its aspects, the present invention provides a method for automatically configuring at least one network entity for participation in a network, the at least one network entity being associated with at least one service provider, the method comprising the steps of:

assigning an identifier to the at least one network entity;

associating the identifier with at least one service provider;

providing a central server having a reference table for mapping the identifiers to at least one of the service providers,

providing a configuration server associated with each of the service providers, the configuration server having configuration settings data for the at least one network entity;

including in a computer-readable medium of the at least one network entity instructions for communicating with the central server or the configuration server;

causing the at least one network entity to automatically request configuration settings data from the central server when coupled to the network, the request including the network entity's identifier;

receiving the request at the central server and determining which of the at least one of the service providers is associated with the identifier;

the central server redirecting the request to an appropriate configuration server having the configuration settings data specific to the identifier;

the configuration server providing the configuration settings data to the at least one network entity; and

whereby the at least one network entity is automatically configured without user intervention except to power-on and connect the at least one network entity to the network in order to contact the central server.

In another of its aspects, the present invention provides a system for configuring a plurality of network entities for implementation in a network with minimal end-user intervention, each of the network entities being associated with an identifier, and each of the network entities being associated with at least one service provider, the system having:

a computer-readable medium of each of the network entities having a program for executing instructions to communicatively couple each of the network entities to a central server to request configuration settings data matching the network entity's identifier, the central server including a first mapping table comprising a list of the identifiers associated

with each of the service providers, the first mapping table being used to redirect the request to a appropriate configuration server associated with each of the service providers, the configuration server including a second mapping table comprising a list of the identifiers and the configuration settings data associated therewith.

In another of its aspects, the present invention provides a network entity for participating in a packet switched network, the network entity having a identifier and being configured automatically via a central server, the network entity being associated with at least one service provider, the network entity having:

a computer-readable medium comprising URI data for the central server and a program for executing instructions to communicatively couple the network entity to the central server via the network, and to request configuration settings data matching the network entity's identifier; the request being redirected to an appropriate configuration server based on the identifier, the configuration server having configuration settings data associated with the identifier and specific to the network entity.

In another of its aspects, the present invention provides a machine-readable medium having embodied thereon a computer program for processing by a central server, the computer program for providing instructions to configure a plurality of network devices associated with a plurality of service providers, each network device having an identifier, the instructions being provided in response to requests for configuration settings data from the network devices, the request including the identifier, the machine-readable medium comprising:

a first sub-program coded to associate the identifier to at least one of the service providers to form a first mapping table for each service provider, the first sub-program coded to analyze the requests from each of the network devices, and to determine whether the first mapping table comprises the identifier;

a second sub-program coded to redirect each of the requests to an appropriate service provider based on the identifier; the configuration server including a second mapping table comprising a list of the identifiers and the configuration settings data associated therewith.

In another of its aspects, the present invention provides a redirect server to be implemented within a network having at least one network device, the redirect server for auto-configuring the network devices, the network devices being associated with different service providers, and at least one of the service providers requiring specific configuration settings data for each of the network devices, each of the network devices having an identifier, the redirect server comprising:

a machine-readable medium having embodied thereon a computer program for processing by the redirect server, the computer program coded to provide instructions for configuring the network devices, the instructions being provided in response to requests for configuration settings data from the network devices, each of the requests including the identifier, the machine-readable medium comprising:

a first sub-program coded to associate the identifier with at least one of the service providers to form a first mapping table; the first sub-program coded to analyze each of the requests from the network devices, and to determine whether the first mapping table comprises the identifier;

a second sub-program coded to redirect each of the requests to an appropriate service provider based on the identifier; the configuration server including a second mapping table comprising a list of the identifiers and the configuration settings data associated therewith.

Advantageously, by facilitating substantially hassle-free installations or configuration of IP endpoints for end-users, the operational burden of service activation, requests for support for installation or technical assistance are substantially diminished or eliminated. Consequently, service providers are presented with a competitive time-to market and a service cost advantage. Additionally, service providers have the freedom to choose any number of IP endpoints from numerous manufacturers without being concerned about the resources normally required to provision the IP endpoints using prior art methods.

BRIEF DESCRIPTION OF THE DRAWINGS

Several preferred embodiments of the present invention will now be described, by way of example only, with reference to the appended drawings in which:

FIG. **1** shows a schematic diagram of a system for configuring an IP device, in a preferred embodiment.

FIG. **2** is a flowchart outlining exemplary steps in a method for configuring an IP device; and

FIG. **3***a* is an exemplary first mapping table comprising IP device information and associated service provider.

FIG. **3***b* is an exemplary second mapping table comprising IP device information and associated configuration parameters.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

The detailed description of exemplary embodiments of the invention herein makes reference to the accompanying block diagrams and schematic diagrams, which show the exemplary embodiment by way of illustration and its best mode. While these exemplary embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, it should be understood that other embodiments may be realized and that logical and mechanical changes may be made without departing from the spirit and scope of the invention. Thus, the detailed description herein is presented for purposes of illustration only and not of limitation. For example, the steps recited in any of the method or process descriptions may be executed in any order and are not limited to the order presented.

Moreover, it should be appreciated that the particular implementations shown and described herein are illustrative of the invention and its best mode and are not intended to otherwise limit the scope of the present invention in any way. Indeed, for the sake of brevity, certain sub-components of the individual operating components, conventional data networking, application development and other functional aspects of the systems may not be described in detail herein. Furthermore, the connecting lines shown in the various figures contained herein are intended to represent exemplary functional relationships and/or physical couplings between the various elements. It should be noted that many alternative or additional functional relationships or physical connections may be present in a practical system.

The present invention may also be described herein in terms of screen shots and flowcharts, optional selections and various processing steps. Such functional blocks may be realized by any number of hardware and/or software components configured to perform to specified functions. For example, the present invention may employ various integrated circuit components (e.g., memory elements, processing elements, logic elements, look-up tables, and the like), which may carry out a variety of functions under the control of one or more micro-

processors or other control devices. Similarly, the software elements of the present invention may be implemented with any programming or scripting language such as C, C++, Java, COBOL, assembler, PERL, extensible markup language (XML), smart card technologies with the various algorithms being implemented with any combination of data structures, objects, processes, routines or other programming elements. Further, it should be noted that the present invention may employ any number of conventional techniques for data transmission, signaling, data processing, network control, and the like.

As is known in the art, Internet Protocol (IP) is a routing protocol designed to route traffic within a network or between networks. IP is described in IETF RFC-791, incorporated herein by reference. However, the present invention is not limited to IP data interfaces and other data interfaces can also be used.

FIG. **1** illustrates a system **10** for configuring a plurality of network entities **12***a*, **12***b*, **12***c* via a central server **14** with minimal end-user intervention, wherein minimal user intervention involves powering on and connecting the network entity **12***a*, **12***b*, or **12***c* to a network **16**. The network entities **12***a*, **12***b*, **12***c* may be any IP device or endpoint (end node) for participating in a packet switched network, such as, but not limited to, IP phones, H.323 phones, DECT phones, SIP-DECT phones, ATAs, mobile phones, IPTVs, projectors, PDAs, digital cameras, PC, MP3 players, set-top boxes, game consoles, gateways, soft phones, firewalls, access-points, modems, network appliances, or any combination(s) thereof. These exemplary network entities **12***a*, **12***b*, **12***c* include a data processing means comprising a processor (which may be referred to as a central processor unit or CPU, logic means, or controller) that is in communication with a machine-readable medium (computer-readable medium), input/output (I/O) devices, a network interface, and other interfaces. A computer-readable medium is any physical object that can store information in a form directly readable by a computer. Thus, magnetic, optical, and electrical storage devices are all contemplated, as well as any other method of storing information directly accessible to a computer. Hard disks, floppy disks, CD/DVD ROM drives, RAM chips, magnetic tapes, barcodes, punch cards, and the like are all examples of computer-readable media.

The network **16** can include a series of network nodes (e.g., the clients and servers) that can be interconnected by network devices and wired and/or wireless communication lines (such as, public carrier lines, private lines, satellite lines, etc.) that enable the network nodes to communicate. The transfer of data between network nodes can be facilitated by network devices, such as routers, switches, multiplexers, bridges, gateways, etc., that can manipulate and/or route data from an originating node to a server node regardless of dissimilarities in the network topology (such as, bus, star, token ring, mesh, or hybrids thereof), spatial distance (such as, LAN, MAN, WAN, Internet), transmission technology (such as, TCP/IP, Systems Network Architecture), data type (such as, data, voice, video, multimedia), nature of connection (such as, switched, non-switched, dial-up, dedicated, or virtual), and/or physical link (such as, optical fiber, coaxial cable, twisted pair, wireless, etc.) between the correspondents within the network.

Generally, the network entities **12***a*, **12***b*, **12***c* are vended to a plurality of service providers **18***a*, **18***b*, **18***c* by a manufacturer or a distributor. The network entities **12***a*, **12***b*, **12***c* are provisioned with a unique resource identifier (URI) of the central server **14** already embedded in the firmware, including other instruction codes/software programs stored in the computer-readable medium. The software application code may also be implemented in hardware via a dedicated device incorporating control logic or a controller, for example. The software application code includes software instructions to be executed by the processor. Alternatively, the software may be executed by a controller, or control logic on the device. The central server **14** is preferably remotely based and serves as a central depository of configuration information related to the network entities **12***a*, **12***b*, **12***c*, and may be communicatively coupled to a plurality of configuration servers **20***a*, **20***b*, **20***c*, or other entities on the network **16**. The central server **14** and configuration servers **20***a*, **20***b*, **20***c*, also include data processing means comprising a processor (which may be referred to as a central processor unit or CPU, logic means, or controller) that is in communication with a computer-readable medium having data and/or program code, input/output (I/O) devices, a network interface, and other interfaces. The central server **14** and configuration servers **20***a*, **20***b*, **20***c* are scalable, robust and include failover capabilities and built-in redundancies.

After the network entities **12***a*, **12***b*, **12***c* are first powered on and communicatively coupled to the network via a network interface, the network entities **12***a*, **12***b*, **12***c* automatically execute a program to contact the central server **14**, out of the box. The term "communicatively coupled" is used in its broadest sense to mean coupling in any fashion that allows information to be passed between network entities **12***a*, **12***b*, **12***c*, and other network devices within the network **16**, such as the central server **14**, configuration servers **20***a*, **20***b* or **20***c*, or other servers, gateways, routers, switches, and so forth. Thus, for example, communicatively coupled network entities **12***a*, **12***b*, **12***c* can be coupled either directly or indirectly via electromagnetic signals, such as electrically coupled, optically coupled, wirelessly coupled; and/or physically coupled. The network entities **12***a*, **12***b*, **12***c* thus send a request for configuration settings from the central server **14**. As each of the network entities **12***a*, **12***b* or **12***c* may be procured from different manufacturers (OEMs), the configuration settings thus tend to be manufacturer-specific.

Upon receipt of the configuration settings request, the central server **14** identifies the querying network entity **12***a*, **12***b*, or **12***c*, and the central server **14** responds with a URI to an appropriate configuration server **20***a*, **20***b*, or **20***c* associated with one of the service providers **18***a*, **18***b*, **18***c*, holding the actual configuration for the network entity **12***a*, **12***b*, or **12***c*. Alternatively, the central server **14** forwards the query to the appropriate configuration server **20***a*, **20***b*, **20***c* based on the identity of the network entity **12***a*, **12***b*, or **12***c*. As such, the central server **14** redirects any configuration related queries from the network entity **12***a*, **12***b*, or **12***c* to the configuration server **20***a*, **20***b*, **20***c*, therefore the central server **14** may be also be termed a "redirect server". In either case, the configuration settings are provided to the network entity **12***a*, **12***b*, or **12***c*, and so each of the network entities **12***a*, **12***b*, or **12***c* is automatically configured without requiring any manual input of settings by the user.

Referring to FIG. **2**, the flowchart shows exemplary steps for automatically configuring a network entity, such as an IP phone **12***a* supplied by a manufacturer or a network equipment provider. For convenience the ensuing description will focus on an IP phone **12***a* for participation within the packet-switched network **16**. In one exemplary situation, service providers **18***a*, **18***b*, **18***c*, may purchase the same IP phone **12***a*, having identical functions and capabilities, from one manufacturer or network equipment provider, for deployment within their own sub-network, or network **16**. Oftentimes each of the service providers **18***a*, **18***b*, or **18***c* requires differ-

ent configurations settings for the same IP phone **12***a* for full functionality on their own sub-network, or to access the service provider's resources or services. Therefore, the configuration settings are typically service provider-specific, as well as manufacturer-specific, and so there is a lack of interoperability between the service providers **18***a*, **18***b*, and **18***c*. This is often frustrating to an end-user desiring to seamlessly switch between service providers **18***a*, **18***b* or **18***c*, while using the same IP phone **12***a*.

A method for automatically configuring the IP phone **12***a* for use with at least one service provider **18***a*, **18***b* or **18***c*, is thus desirable to an end-user. An exemplary method for configuring the IP phone **12** comprises the step(s) of assigning an identifier to the IP phone **12***a*, the identifier may be a unique identifier, or a class identifier. One form of unique identification is provided by a globally unique network interface identifier (media access control (MAC) address). The unique MAC address is assigned to the IP phone **12***a* by the manufacturer or the network equipment provider (step **100**). The MAC address is associated with the IP phone **12***a*'s network interface adapter for coupling to the network **16**, and includes an encoding comprising six groups of two hexadecimal digits, for example 00-a1-b2-b3-c4-d5. The first three octets (in transmission order) 00-a1-b2 identify the manufacturer (or organization) that issued the identifier (and hence the network interface adapter) and are known as the Organizationally Unique Identifier (OUI). The next three octets, b3-c4-d5, are assigned by that organization in any suitable manner but subject to the constraint of uniqueness.

The computer-readable medium of the IP phone **12***a* is included with factory-set default configuration data, such as, DHCP settings (enabled), a URI to a central server **14** having information related to the IP phone **12***a*'s configuration settings. The URI of the central server **14** may be a public name/IP address, for example, connect.aastra.com, however, the URI may be customized as part of the branding for a partner/customer in an OEM agreement. Also, the computer-readable medium, or firmware, is coded to execute instructions for communicatively coupling the IP phone **12***a* to the central server **14** (step **102**). The IP phone **12***a* automatically initiates a discovery process, in which it sends messages over any suitable transport protocol, such as UDP, TCP, TLS, HTTP(S), FTP, or TFTP, in order to retrieve its settings from a remote central server **14**. The instructions are simply steps to be carried out by a processor, and may be provided by hardware, software, firmware, or any suitable combination thereof.

As part of the provisioning process the MAC address of the IP phone **12***a*, is associated with at least of the service providers **18***a*, **18***b*, or **18***c* (step **104**), at the central server **14**. Preferably, a central server **14** includes a database **22** for storing the records of the MAC addresses and the associated service provider **18***a*, **18***b*, or **18***c*, such as a first mapping table which is maintained in a memory associated with the central server **14** (step **106**), as shown in FIG. **3***a*. For each customer or service provider **18***a*, **18**, or **18***c*, a password protected account is created on the central server **14**. The database **22** may be populated through a web portal accessible to the service providers **18***a*, **18***b*, **18***c*, or via a suitable API. The central server **14** includes an admin web portal via certain administrative tasks may be performed, such as: Create/Modify/Delete a customer account, Create/Modify/Delete a record. For example, when a customer account is deleted, all the records linked to this account are deleted. The customer accounts are stored in the database **22**, and may include the following fields: Name, Password, Company, Contact name, Email address, Phone number, and Last login. As stated above, every MAC address added to the central server database **22***a* is linked to one customer account.

Each service provider **18***a*, **18***b*, or **18***c* is provided with a configuration server **20***a*, **20***b* or **20***c* having configuration settings for the IP phone **12***a* (step **108**). The configuration servers **20***a*, **20***b*, **20***c* are coupled to the central server **14***a*, such that queries for configuration settings may be redirected thereto based on the first mapping table. The configuration server **20***a*, **20***b* or **20***c* includes configuration settings specific to the IP phone **12***a* with specific MAC addresses. Each service provider **18***a*, **18***b* or **18***c* thus includes a second mapping table with MAC addresses and associated configuration settings data in a database associated with each of the configuration servers **20***a*, **20***b* or **20***c*. As each IP phone **12***a* is typically identified by its MAC address, the configuration files on the configuration server **20***a* may be named using this information, for example, a configuration file named iphone12a-mac-00-a1-b2-b3-c4-d5.cfg would correspond to the IP phone **12***a* having 00-a1-b2-b3-c4-d5 as its MAC address. The configuration settings may include phone specific configuration information, and platform specific configuration information, such as, but not limited to, the type of phone, carrier, service, or enterprise system information, central server(s) URIs, configuration server(s) URI, port assignments, registration information, dial plan, NTP time settings, soft-keys, XML services and applications, SIP registration information, usernames and passwords, phone book directory, speaker volume settings and so forth. Firmware upgrades/downgrades may also be provided to the IP phone **12***a* based on the MAC address. An exemplary second mapping configuration table includes: MAC address, AccountID, Date and time of last update, Transport Mechanism, Parameter 1, Parameter 2, Parameter 3, Parameter n, as shown in FIG. **3***b*.

The central server **14** includes a user Web portal to allow the customers or service providers **18***a*, **18***b*, **18***c* to configure the MAC address of the IP phones **12***a* and the associated configuration parameters. The customers or service providers **18***a*, **18***b*, **18***c* access the Web portal using an account name and password, and may perform a number of administrative operations, such as, adding a record, modifying a record, deleting a record, change the account password, or upload an excel file or a csv file with a plurality of MAC addresses when configuring a large number of IP phones **12***a*. Alternatively, an XML API may be used to add such records. The central sever **14** verifies that each MAC address to be added is unique before inclusion in the database **22**.

In execution, the IP phone **12***a* software application code causes the processor to transmit a first signal to request configuration settings associated with the IP phone **12***a* (step **110**) from the central server **14**. In step **112**, the central server **14** receives a request for configuration settings from the IP phone **12***a*. The request includes the identity data of the IP phone **12***a*, such as the unique MAC address. Upon receipt of the request, the central server **14** processes the request to determine whether the first mapping table comprises the unique MAC address associated with the request, and also determines which of the plurality of service providers **18***a*, **18***b*, **18***c* the MAC address belongs to. Once such a determination has been established, the central server **14** then redirects the request to an appropriate service provider **18***a*, **18***b* or **18***c*, as per first mapping table (step **114**). In step **116**, a configuration server **20***a*, **20***b* or **20***c*, associated with the appropriate service provider **20***a*, **20***b* or **20***c*, selects the configuration settings for the IP phone **12***a* with that specific MAC address as per second mapping table, and forwards the relevant configuration settings data to the IP phone **12***a*. As is

apparent from the above-noted exemplary steps, the IP phone **12***a* is configured for use with at least one service provider **18***a*, **18***b* or **18***c*, without the requirement for any user intervention, except to power-on the IP phone **12***a* and connect it to the network. Therefore, the service provider **18***a*, **18***b* or **18***c*, or the end-user is required to enter the configuration settings manually, thus mitigating against human error. The service providers **18***a*, **18***b*, **18***c* may thus drop ship the IP phone **12***a* at the user location, and the IP phone **12***a* is ready for use out of the box, as the IP phone **12***a* is auto-configured in the background and without user input.

In another exemplary embodiment, similar steps may be followed for automatically configuring different IP devices, such as an IP phone **12***a* from manufacturer A, an IP phone **12***b* from manufacturer B, an IP phone **12***a* from manufacturer C, and all to be provisioned by a single service provider **18***a*, wherein each phone **12***a*, **12***b*, or **12***c* includes require different configuration settings. As an example, all IP phones **12***a* from manufacturer A, e.g. Aastra Telecom, Canada, comprise the OUI 00-10-BC, and phone **12***b* from manufacturer C, e.g. MATRA, France comprise the OUI 08-00-71, and IP phones **12***c* from manufacturer C, e.g. DeTeWe-Deutsche Telephonwerke, Germany, comprise the OUI 00-30-42. The central server **14** thus includes a centralized repository having a master table associating all MAC address starting with 00-10-BC, 08-00-71 and 00-30-42, and/or including a range of remaining octets assigned by the manufacturer, to service provider **18***b*. Therefore, the service provider A includes a similar table (Table A) having a list of the resources for IP phones **12***a*, **12***b*, **12***c* OUIs starting with 00-10-BC, 08-00-71 and 00-30-42, as part of the configuration server **20***a* associated with service provider **18***a*. Therefore, a single set of resources or configuration settings may be applied to particular OUIs and/or a range of trailing octets, or for a range of MAC addresses, or for a certain class of devices **12***a*, **12***b*, and **12***c*. This arrangement thus allows for all IP phones **12***a* from manufacturer A with OUI 00-10-BC to receive the same configuration settings, while all IP phones **12***b* from manufacturer B with OUI 08-00-71 to receive the same configuration settings. Such an arrangement may be desirable to reduce the processing load on the central redirect server **14**, and may improve robustness and allows for considerable network scalability. Thus, when an end user powers on a phone **12***b* and connects it to the network **16**, the phone **12***b* immediately connects to the central server **14**, which captures the OUI part of the MAC address (08-00-71) and the trailing octets, and refers to the master table to determine whether the MAC address falls within the range of MAC addresses for any of the service providers **18***a*, **18***b*, or **18***c*. The request is subsequently forwarded to the appropriate service provider **18***b* with configuration server **20***b* which selects the appropriate configuration settings for the IP phone **12***b* using the second mapping table, and the configuration settings data is subsequently sent to the IP phone **12***b* via a suitable protocol. Mass deployment for a hosted environment may thus be substantially simplified, and service providers may offer enhanced centralized value added services.

In yet another exemplary embodiment, when booting, the IP phone **12***a* initiates the discovery process automatically to look for a configuration server **20***a* **20***b* or **20***c* to retrieve its configuration data and/or its firmware. The boot process includes checking whether DHCP option **66** (bootp) is enabled to automatically push the TFTP server address to the IP phone **12***a*, and running an auto-discovery process using mDNS. If a local configuration server can not be located or does not include the settings for that particular IP phone **12***a*, then after a predefined period (on timeout), the IP phone **12***a* initiates a search for one or more public/enterprise servers on a WAN or the Internet. These public/enterprise servers may be maintained by individuals, or groups of individuals, corporations, network equipment providers, manufacturers, organisations, and include information related to configuration settings for a plurality of OUIs, MAC addresses, class identifiers, or other identifiers. For example, configuration settings for a plurality of OUIs, MAC addresses, class identifiers, or other identifiers may be uploaded to these public/enterprise servers, and updated periodically with configuration settings or pointers to the appropriate configuration servers, which may also be public or enterprise servers a WAN or the Internet. Typically, in a managed enterprise LAN, or SOHO network, environment with DHCP being enabled, the configuration settings are provided using Option **66**/Option **67**. In addition to its IP address, the DHCP server could provide the IP phone **12***a* with a DNS server, a default gateway. It can also be configured to provide the IP address of the central server **14**. If the URI of the central server **14** is specified, the IP phone **12***a* uses any suitable protocol to contact the central server **14** on the network **16**.

In yet another exemplary embodiment, the IP phone **12***a* can be automatically configured out of the box by connecting it to the network **16**, and allowing the user to select and/or set up services via an integrated selection mechanism. The end-user may choose a plan, value-added features or quality of service. For example, based on the identifier (MAC address) contained in the configuration request, the central server **14** directs the request to the appropriate service provider **18***a* with configuration server **20***a*. Having received the request from the central server **14**, the configuration server **20***a* may require authentication of the IP phone **12***a*, and thus sends an acknowledgment of receipt to the IP phone, along with a request for a Username and/or Password, or other credentials (as provided by the service provider **18***a*). After validation of the user credentials, the configuration settings data is then sent to the IP phone **12***a*. Alternatively, the process of authentication may be performed at the central server **14**, or in conjunction with the configuration server **20***a*, if so designed. The central server **14** can also serve as a portal to partner services.

In yet another exemplary embodiment, the IP phone **12***a* includes a default "home" location, similar to a home page for an Internet browser, as part of is factory-set default configuration settings. Thus, at boot-up the IP phone **12***a* automatically seeks this default page, or when it is in an environment that does not present the IP phone **12***a* with configuration or service options. The home page presents information such as links, portals, menus, or other network connections or information to the device **12***a*. Alternatively, if the IP phone **12***a* is coupled to the network **16** and the MAC address (or other identifier/address) is not recognized by the central server **14** as being associated with a service provider **18***a*, **18***b*, or **18***c*, a menu may be presented on the IP phone **12***a*, via at least one of the I/O devices, with a choice of suitable service providers **20***a*, **20***b*, or **20***c*. These options can be extended to include not only the service provider **20***a*, **20***b*, or **20***c*, but other options and configurations within each service provider **20***a*, **20***b*, or **20***c*, such as plan, value-added features or quality of service.

In yet another exemplary embodiment, the network entity **12***a* includes a class identifier, such that the service provider/VOIP provider dictates its service offering in terms of both quality of service and value-added features based on class identifier. Therefore, the central server **14***a* and/or configuration server **20***a*, **20***b*, **20***c*, provides configuration settings for that particular class of device **12***a*. For example, certain network entities **12***a*, **12***b* may be used only in enterprise envi-

ronments, therefore the settings may include priority paths for voice over IP, such that the network connection is managed and optimized for voice traffic to allow for superior quality of service. Other features may include call transcription or enhanced privacy for voice traffic, such as Secure VoIP using suitable cryptographic schemes. Other network entities **12***c* may be classified as consumer devices, and may include default settings that allow call monitoring, linking to home alarm systems, compatibility with TiVo™ from TIVO, USA.

In yet another exemplary embodiment, an IP phone **12***a* is coupled to a network **16**, and at least central server **14***a* or configuration server **20***a*, **20***b* or **20***c* automatically detects that the IP device **12***a* is coupled to the network **16**, and provides the relevant configuration information related to automatically configuring the IP phone **12***a*.

In yet another exemplary embodiment, the IP endpoint **12***a* may be programmed (firmware and/or software program) to contact the redirect server **14**, or a plurality of redirect servers, each time it is powered on, rebooted or reset, or relocated within the same network or another network, in order receive settings data for auto-configuration, or firmware updates/downgrades.

In yet another exemplary embodiment, the redirect server **14** serves as a proxy or intermediary, by communicating with one of the configuration servers **20***a*, **20***b* or **20***c* to directly request and acquire the configuration settings data, and then forwarding the configuration setting data to the network entity **12***a*. Alternatively, the network entity **12***a* is programmed (firmware and/or software program) to contact the central server **14** to request configuration information, and the redirect server **14** responds to the network entity **12***a* with the URI to a suitable configuration server **20***a* that the network entity **12***a* should contact directly to request the configuration settings data. The configuration server **20***a* responds with the configuration information specific for that network entity **12***a*, based on the second mapping table.

In yet another exemplary embodiment, the computer-readable medium of the network entity **12***a* is included with a plurality of URIs to different redirect servers **14** and/or different configuration servers **20***a*, **20***b*, **20***c* associated with a plurality of service providers **18***a*, **18***b*, **18***c* or ITSPs, commercial voice over IP network providers, carriers, and so forth. For example, the network entity **12***a* includes URIs to all the configuration servers **20***a*, **20***b*, **20***c* associated with most of the major carriers or service providers, such as AT&T CallVantage, Verizon, bellshare, BT Group, Vonage, Skype, Packet8, Time Warner, Qwest or Comcast. As such, the program code causes the network entity **12***a* to send, or broadcast, at least one request for information related to its configuration settings, and at least one of the service providers **18***a*, **18***b*, or **18***c*, ITSPs, commercial voice over IP network providers or carriers responds with the requisite configuration information.

Benefits, other advantages, and solutions to problems have been described above with regard to specific embodiments. However, the benefits, advantages, solutions to problems, and any element(s) that may cause any benefit, advantage, or solution to occur or become more pronounced are not to be construed as critical, required, or essential features or elements of any or all the claims. As used herein, the terms "comprises," "comprising," or any other variations thereof, are intended to cover a non-exclusive inclusion, such that a process, method, article, or apparatus that comprises a list of elements does not include only those elements but may include other elements not expressly listed or inherent to such process, method, article, or apparatus. Further, no element described herein is required for the practice of the invention unless expressly described as "essential" or "critical."

The preceding detailed description is presented for purposes of illustration only and not of limitation, and the scope of the invention is defined by the preceding description, and with respect to the attached claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method for automatically configuring at least one network entity for participation in a network, said at least one network entity being associated with at least one service provider, said method comprising the steps of:

assigning an identifier to said at least one network entity, wherein said identifier being any of a unique identifier or a class identifier;

associating said identifier with at least one service provider;

providing a central server having a reference table for mapping said identifiers to at least one of said service providers,

providing a configuration server associated with each of said service providers, said configuration server having configuration settings data for said at least one network entity;

including in a non-transitory computer-readable medium of said at least one network entity comprising instructions executable by a processor to cause said processor to perform the steps of communicating with said central server or said configuration server;

causing said at least one network entity to automatically request configuration settings data from said central server when coupled to said network, said request including said network entity's identifier;

receiving said request at said central server and determining which of said at least one of said service providers is associated with said identifier;

said central server redirecting said request to an appropriate configuration server having said configuration settings data specific to said identifier;

said configuration server providing said configuration settings data to said at least one network entity; and

wherein said configuration settings data comprises device specific configuration information, and platform specific configuration information, including any of type of device, carrier, service, or enterprise system information, central server(s) uniform resource identifiers (URI(s)), configuration server(s) uniform resource identifiers (URI(s)), port assignments, registration information, dial plan, network time protocol (NTP) time settings, soft-keys, extensible markup language (XML) services and applications, session initiation protocol (SIP) registration information, usernames and passwords, phone book directory, speaker volume settings; and

whereby said at least one network entity is automatically configured without user intervention except to power-on and connect said at least one network entity to said network in order to contact said central server.

2. The method of claim **1** wherein said unique identifier is a MAC address.

3. The method of claim **1** wherein said class identifier is any of an organizationally unique identifier OUI, device type, user identifier, vendor-specified identifier, or a geographic identifier.

4. The method of claim **1** wherein said central server is coupled at least one redundant central server having a reference table for mapping said identifiers to at least one of said service providers.

5. The method of claim 1 wherein said computer-readable medium includes factory-set default configuration data having at least dynamic host configuration protocol (DHCP) settings enabled and at least one uniform resource identifier (URI) associated with said central server.

6. The method of claim 1 wherein said communication between said network entity and said central server and/or said configuration is conducted via suitable protocols including any of file transfer protocol (FTP), trivial file transfer protocol (TFTP), hypertext transfer protocol (HTTP), hypertext transfer protocol secure (HTTPs) or transmission control protocol (TCP).

7. A system for configuring a plurality of network entities for implementation in a network, each of said network entities being associated with an identifier, and each of said network entities being associated with at least one service provider, said system comprising:

a central server with a reference table for mapping said identifiers to at least one of said service providers, wherein said identifier being any of a unique identifier or a class identifier;

a configuration server associated with each of said service providers, said configuration server having configuration settings data for said at least one network entity;

a non-transitory computer-readable medium in said at least one network entity comprising instructions executable by a processor to cause said processor to perform the steps of communicating with said central server or said configuration server, and causing said at least one network entity to automatically request configuration settings data from said central server when coupled to said network, said request including said network entity's identifier; and

wherein said central server receives said request and determines which of said at least one of said service providers is associated with said identifier, and said central server redirects said request to an appropriate configuration server having said configuration settings data specific to said identifier; and

wherein said configuration settings data includes device specific configuration information, and platform specific configuration information; and

wherein said at least one network entity is automatically configured without user intervention except to power-on and connect said at least one network entity to said network in order to contact said central server.

8. The system of claim 7 wherein said central server is coupled at least one redundant central server having a reference table for mapping said identifiers to at least one of said service providers.

9. The system of claim 7 wherein said central server serves as a proxy or intermediary, by communicating with one of said configuration servers to directly request and acquire said configuration settings data associated with said identifier, and then passing said configuration setting data to said network entity having said identifier.

10. The system of claim 7 wherein said network entity is programmed to contact said central server to request configuration information, and said central server being coded to respond to said network entity with said URI to a suitable configuration server for said network entity to contact directly to request said configuration settings data.

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