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(54) SYSTEMS AND METHODS FOR PROVIDING A GENERIC INTERFACE IN A COMMUNICATIONS ENVIRONMENT

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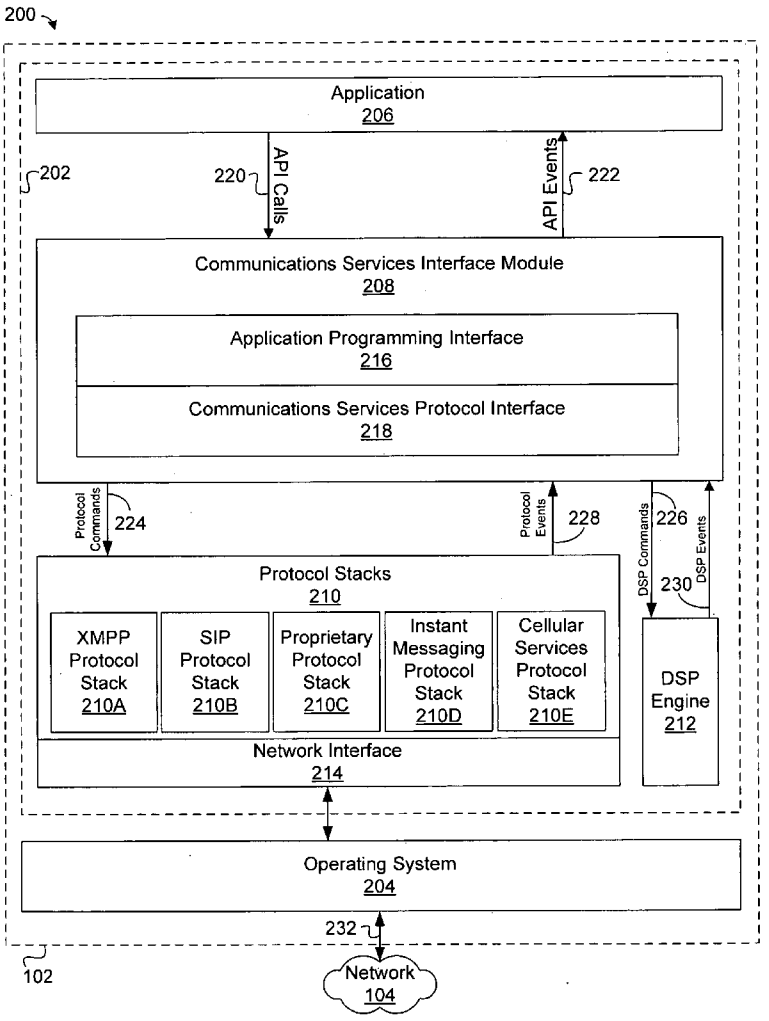
(52) **U.S. Cl.** **719/328**

(57) **ABSTRACT**

Systems and methods for providing a generic interface in a communications environment are provided. A communications services interface may receive a first and second application function call specifying a first and second communications channel, respectively. The first and second communications channels may utilize a first and second communications protocol, respectively, to communicate over a network. The communications services interface may send a first protocol command and a second protocol command to control communications over the first and second communications channels, respectively. The first and the second protocol commands may be responsive to the first and second application function calls, respectively. The second application function call may have a same syntax as the first application function call, and the second communications protocol may be different than the first communications protocol.



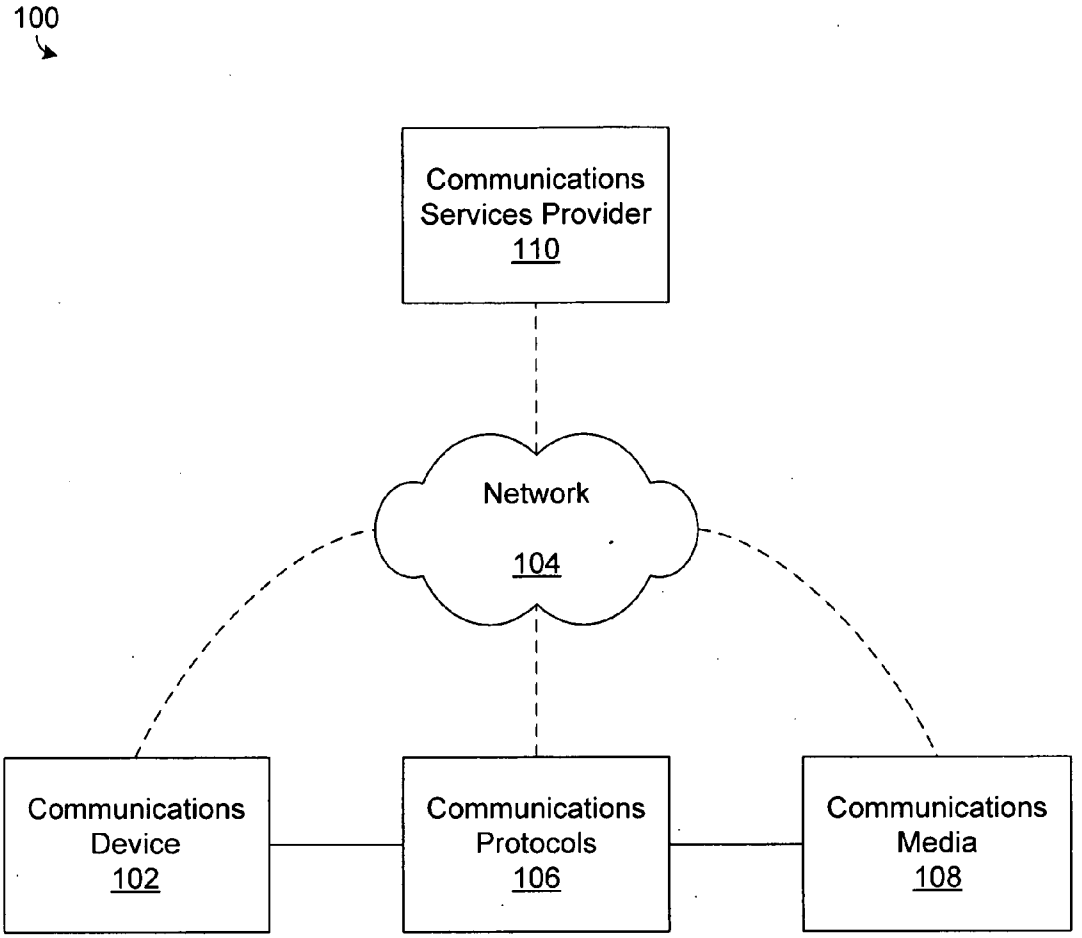

100
Communications Services Provider 110
Network 104
Communications Device 102
Communications Protocols 106
Communications Media 108

FIG. 1

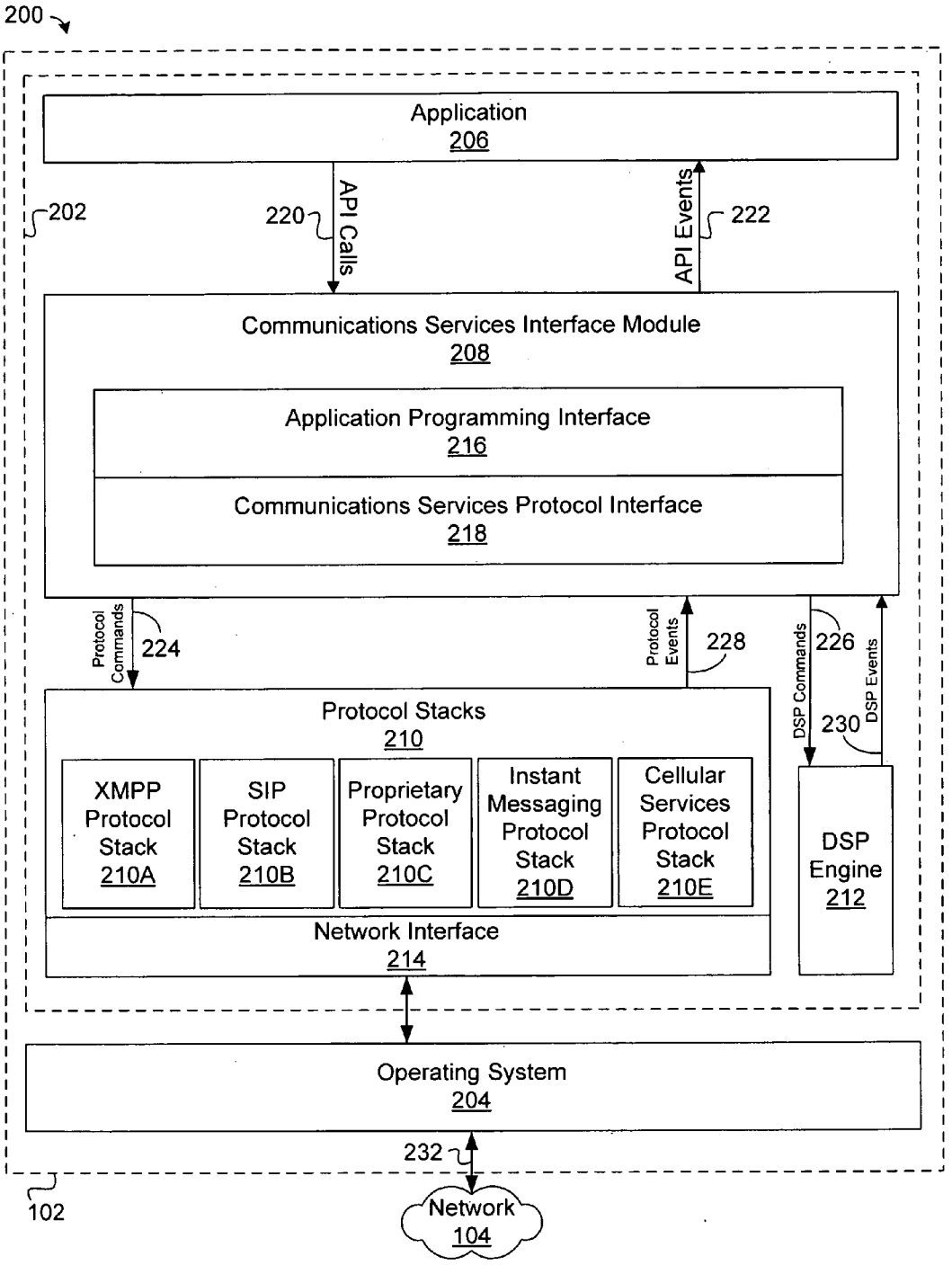

200
Application
206
202
220
API Calls
API Events
222
Communications Services Interface Module
208
Application Programming Interface
216
Communications Services Protocol Interface
218
Protocol Commands
224
Protocol Events
228
DSP Commands
226
DSP Events
230
Protocol Stacks
210
XMPP Protocol Stack
210A
SIP Protocol Stack
210B
Proprietary Protocol Stack
210C
Instant Messaging Protocol Stack
210D
Cellular Services Protocol Stack
210E
DSP Engine
212
Network Interface
214
Operating System
204
232
102
Network
104

FIG. 2

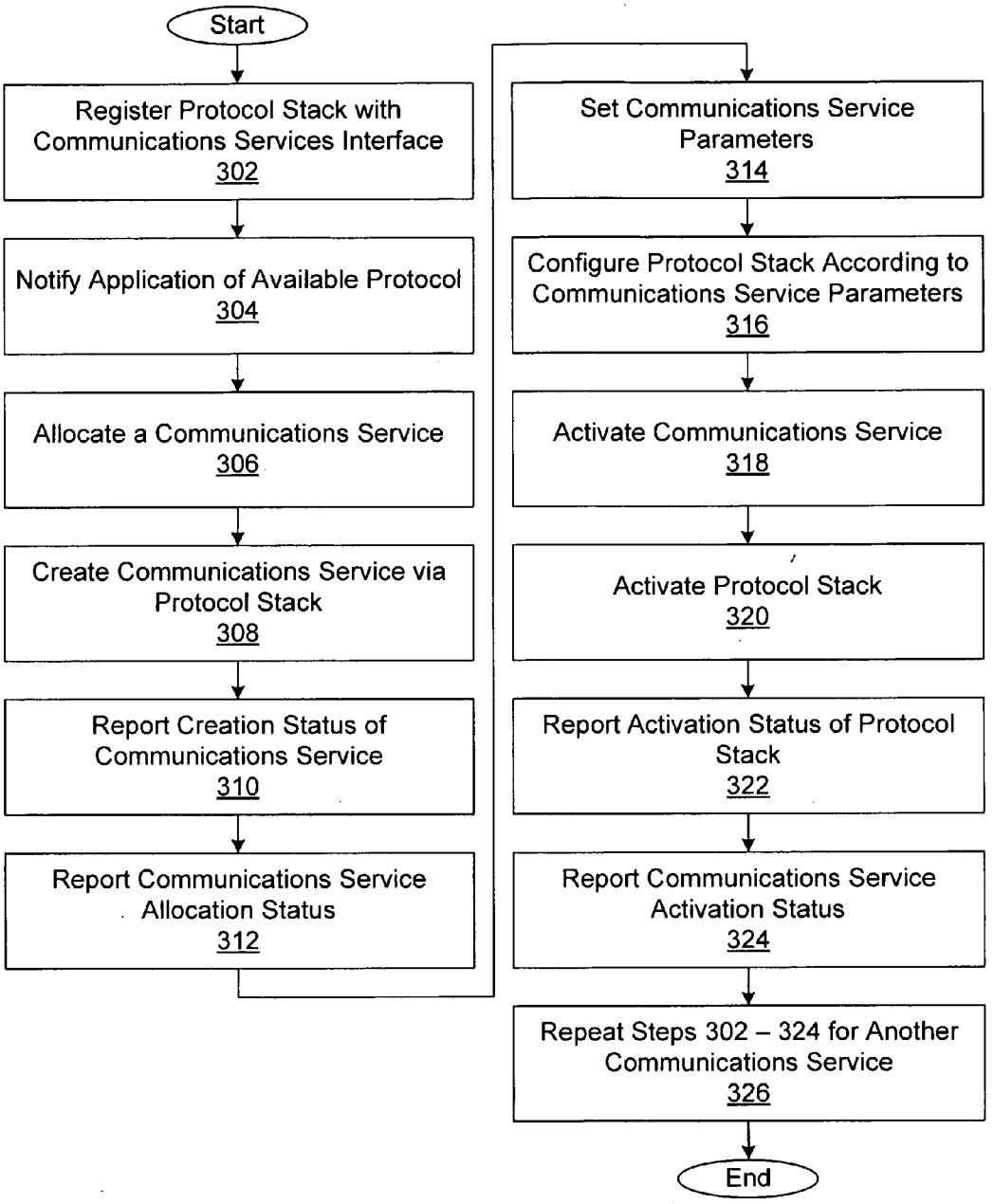

Start
Register Protocol Stack with Communications Services Interface 302
Notify Application of Available Protocol 304
Allocate a Communications Service 306
Create Communications Service via Protocol Stack 308
Report Creation Status of Communications Service 310
Report Communications Service Allocation Status 312
Set Communications Service Parameters 314
Configure Protocol Stack According to Communications Service Parameters 316
Activate Communications Service 318
Activate Protocol Stack 320
Report Activation Status of Protocol Stack 322
Report Communications Service Activation Status 324
Repeat Steps 302 – 324 for Another Communications Service 326
End

FIG. 3

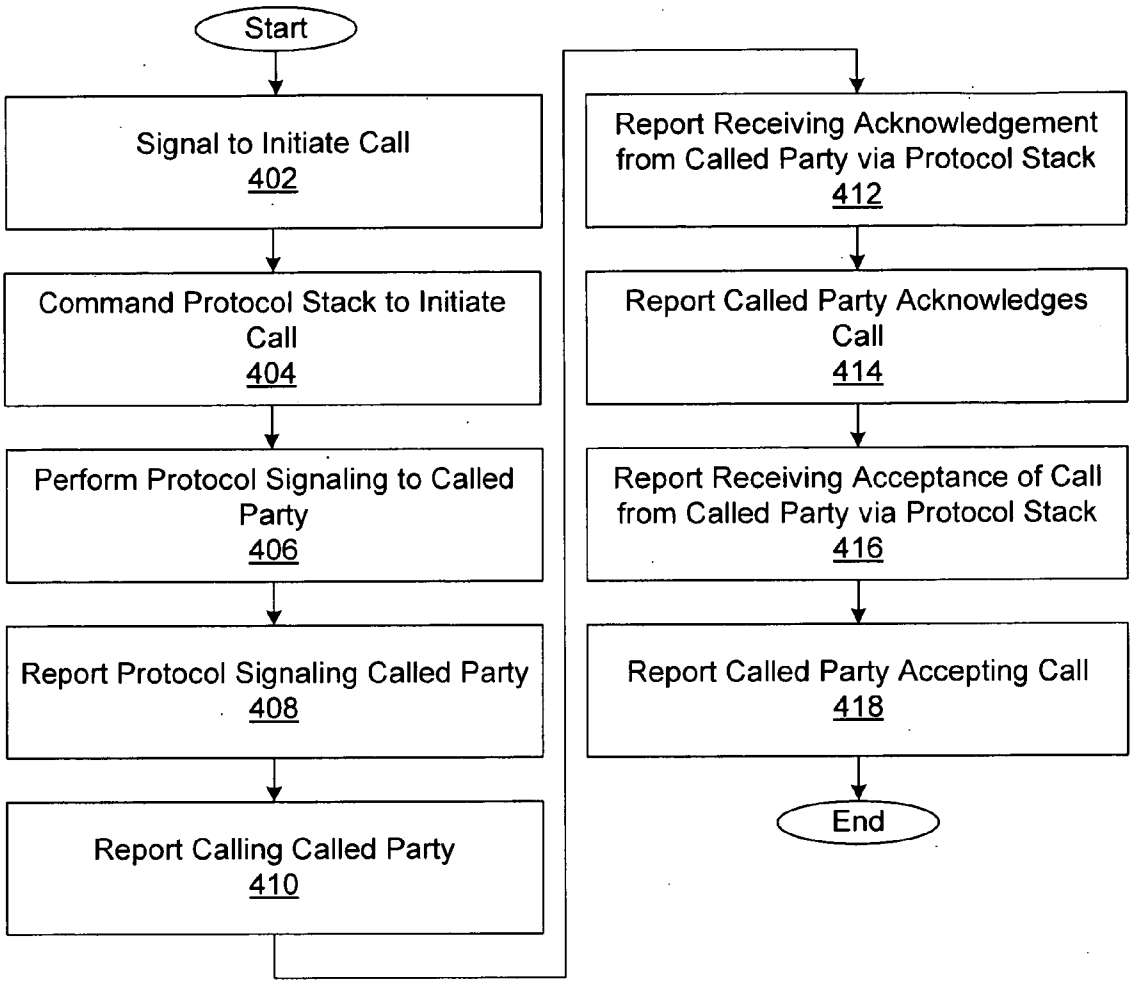

Start
Signal to Initiate Call
402
Command Protocol Stack to Initiate Call
404
Perform Protocol Signaling to Called Party
406
Report Protocol Signaling Called Party
408
Report Calling Called Party
410
Report Receiving Acknowledgement from Called Party via Protocol Stack
412
Report Called Party Acknowledges Call
414
Report Receiving Acceptance of Call from Called Party via Protocol Stack
416
Report Called Party Accepting Call
418
End

FIG. 4

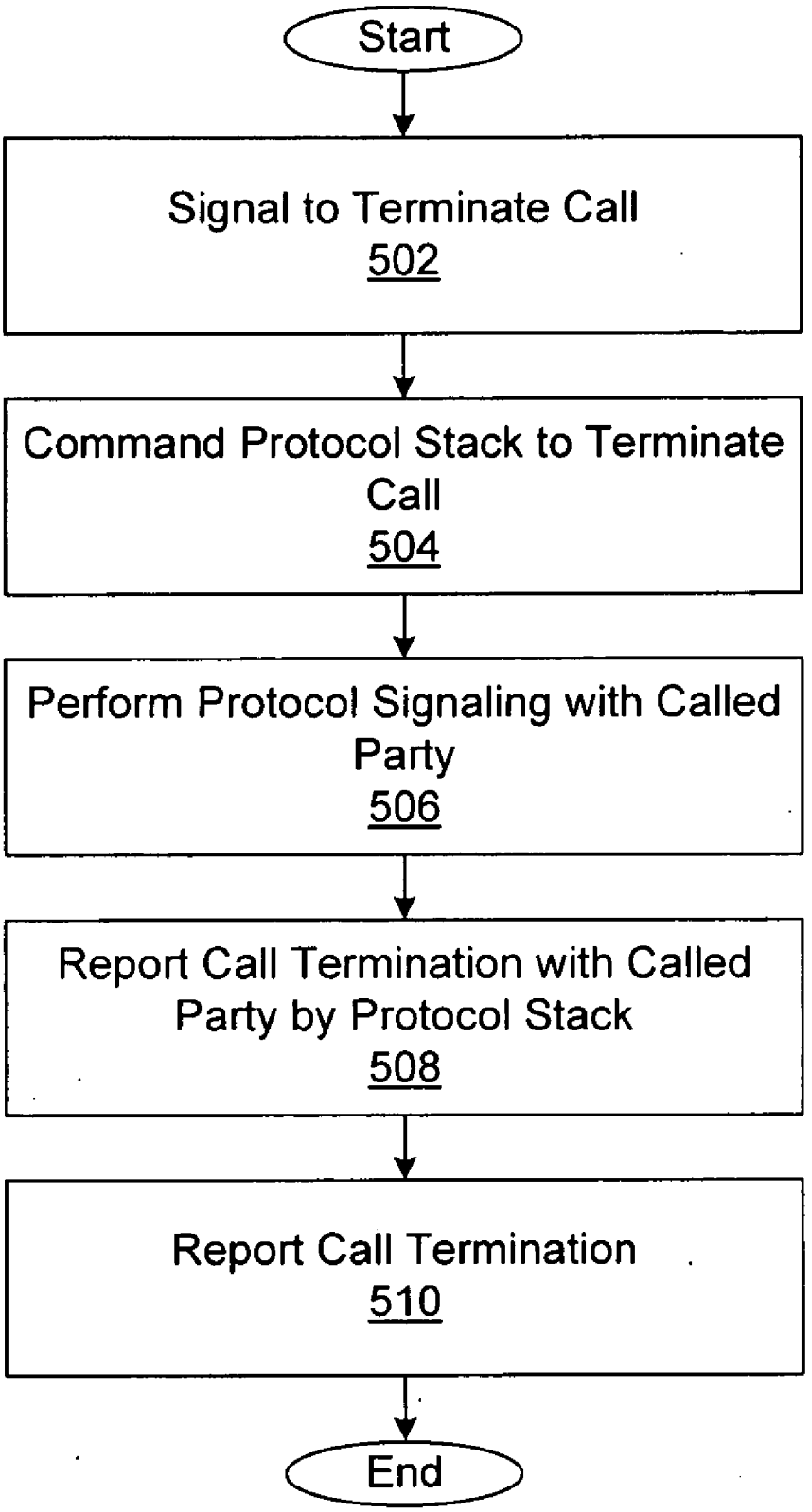

Start
Signal to Terminate Call
502
Command Protocol Stack to Terminate Call
504
Perform Protocol Signaling with Called Party
506
Report Call Termination with Called Party by Protocol Stack
508
Report Call Termination
510
End

FIG. 5

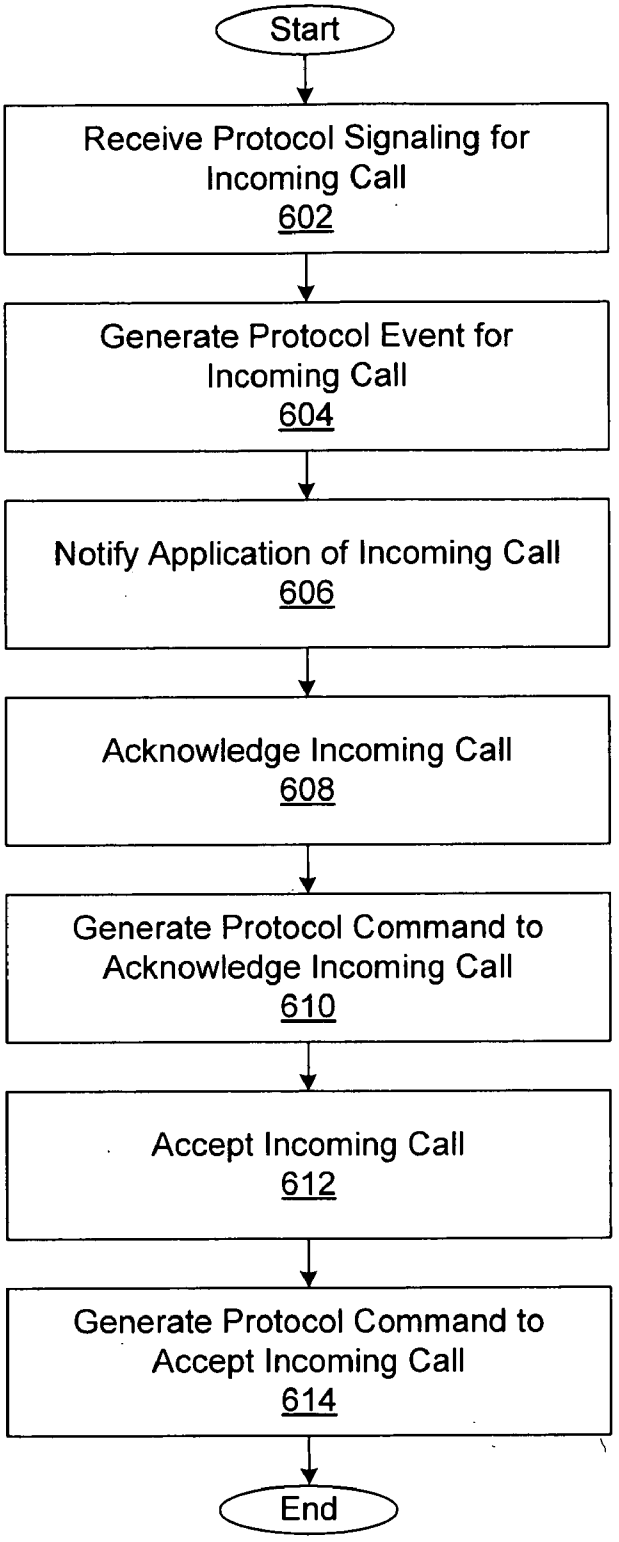

Start
Receive Protocol Signaling for Incoming Call
602
Generate Protocol Event for Incoming Call
604
Notify Application of Incoming Call
606
Acknowledge Incoming Call
608
Generate Protocol Command to Acknowledge Incoming Call
610
Accept Incoming Call
612
Generate Protocol Command to Accept Incoming Call
614
End

FIG. 6

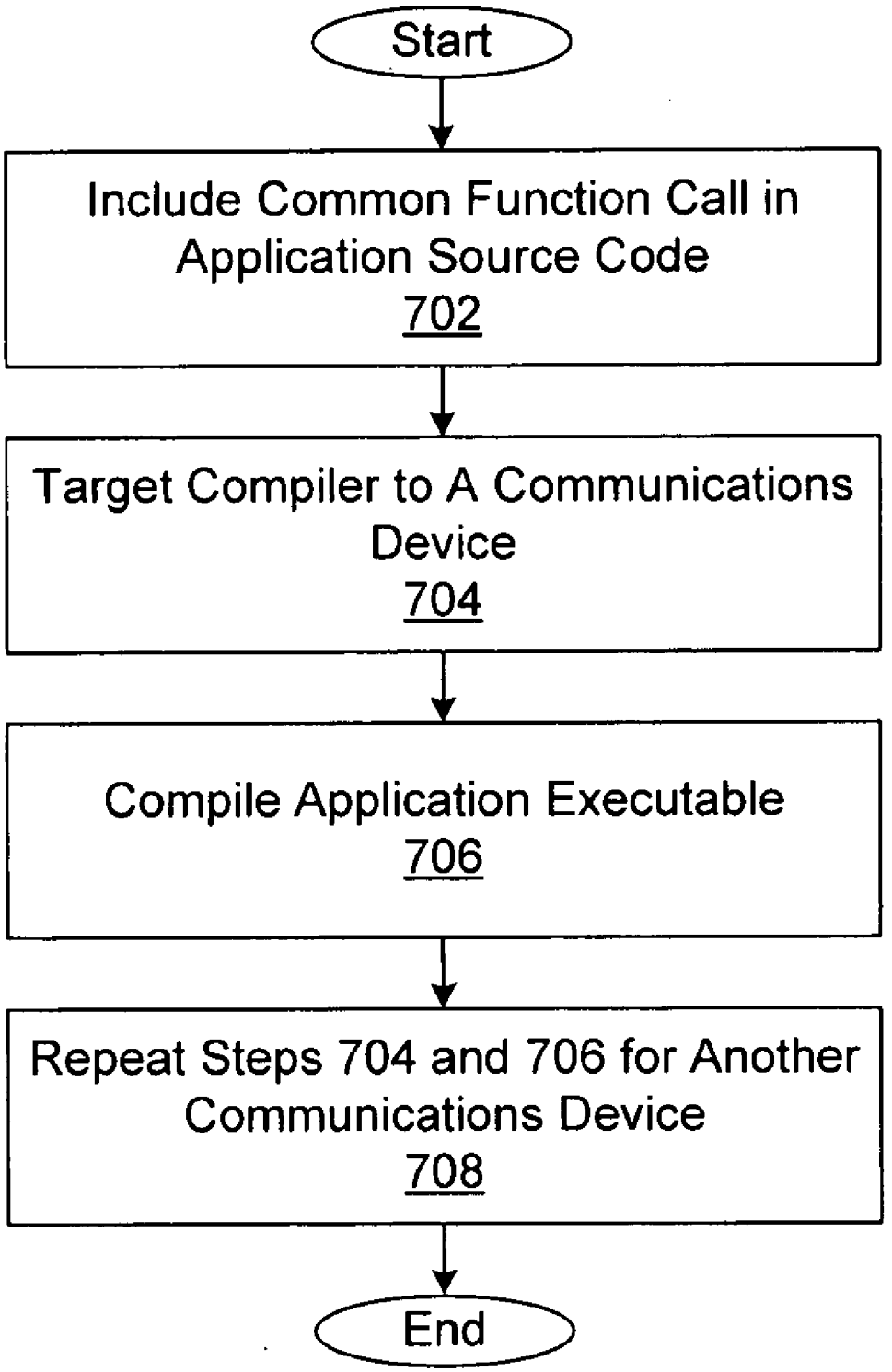

Start
Include Common Function Call in Application Source Code
702
Target Compiler to A Communications Device
704
Compile Application Executable
706
Repeat Steps 704 and 706 for Another Communications Device
708
End

FIG. 7

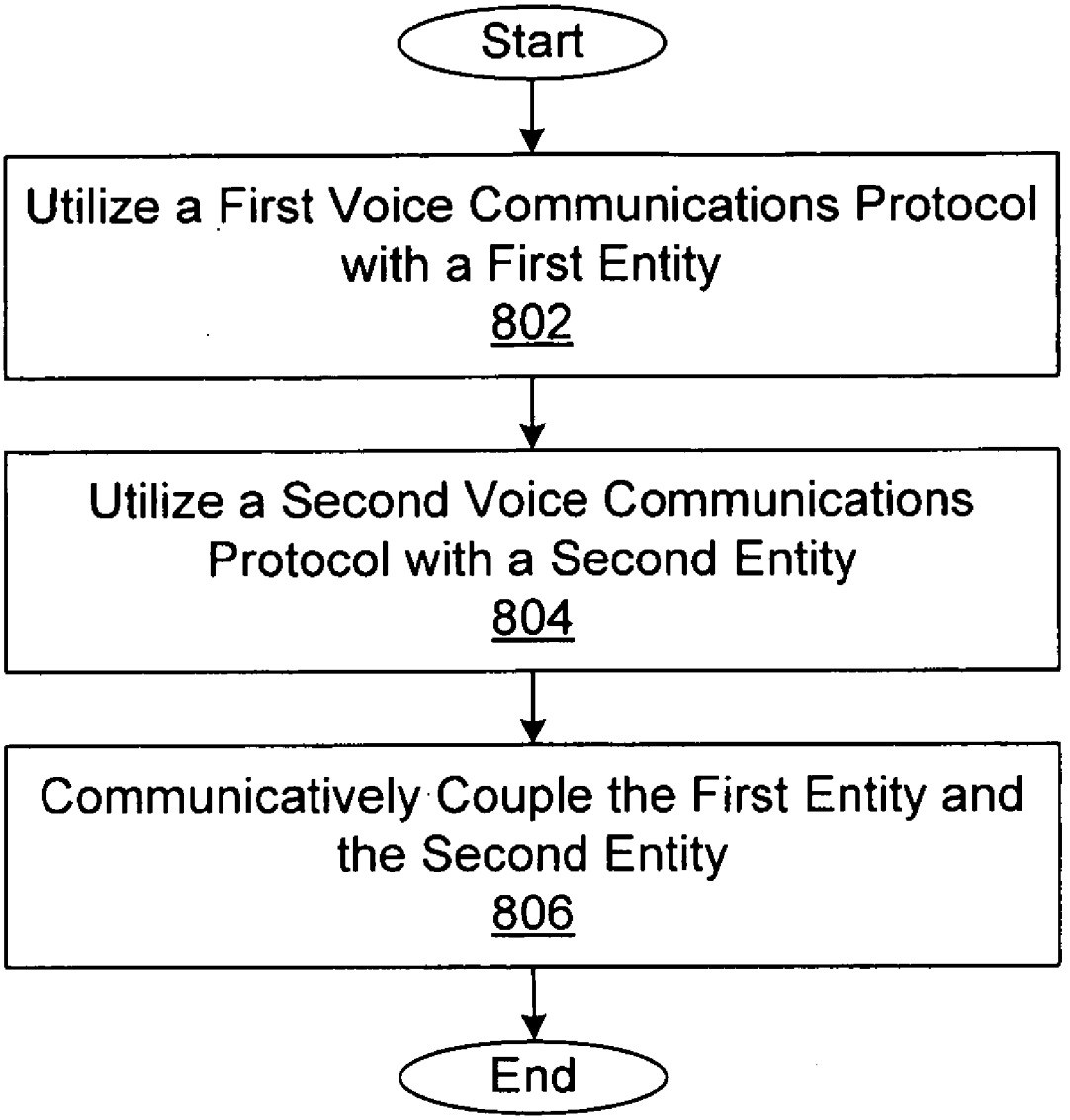

Start
Utilize a First Voice Communications Protocol with a First Entity
802
Utilize a Second Voice Communications Protocol with a Second Entity
804
Communicatively Couple the First Entity and the Second Entity
806
End

FIG. 8

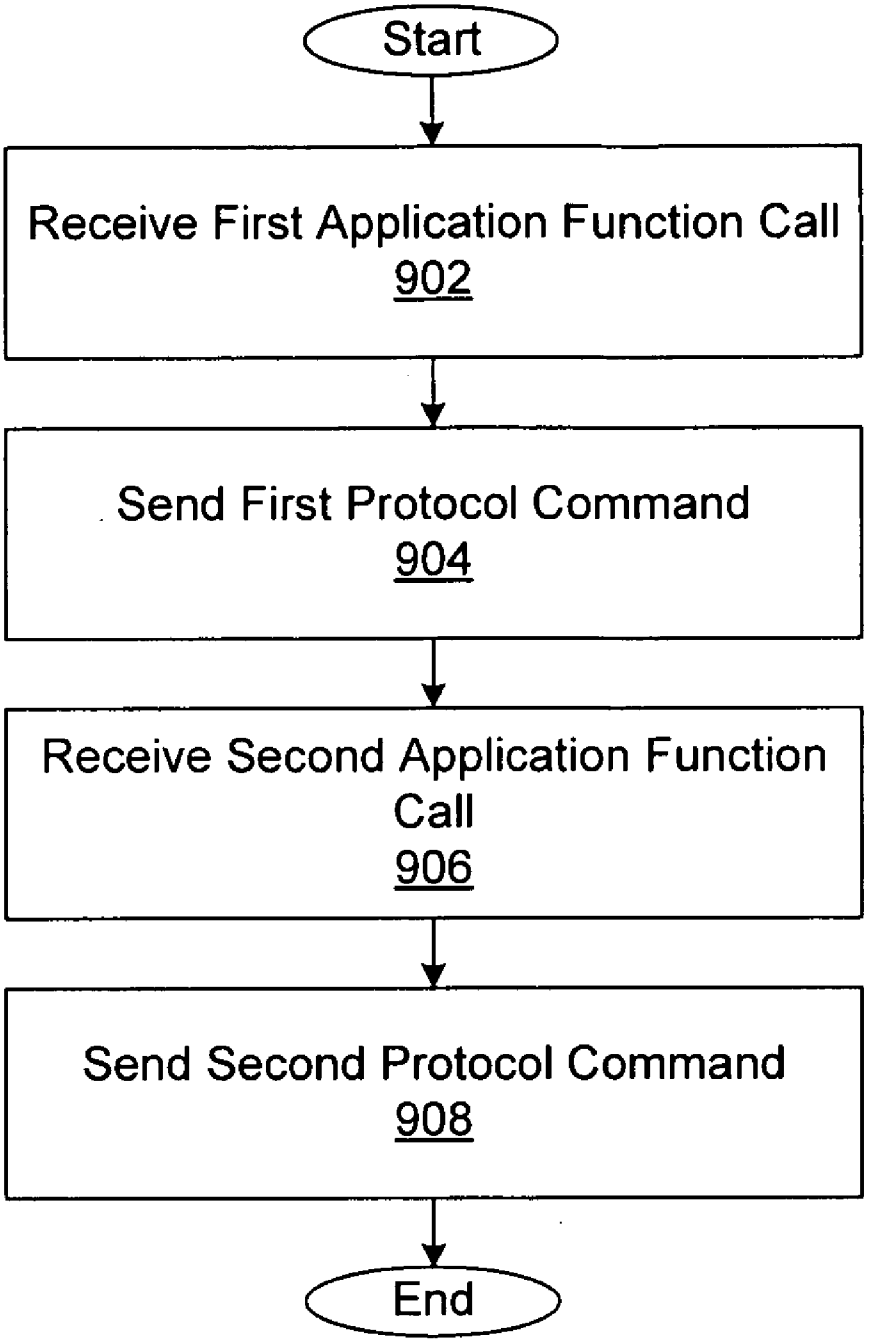

Start
Receive First Application Function Call
902
Send First Protocol Command
904
Receive Second Application Function Call
906
Send Second Protocol Command
908
End

FIG. 9

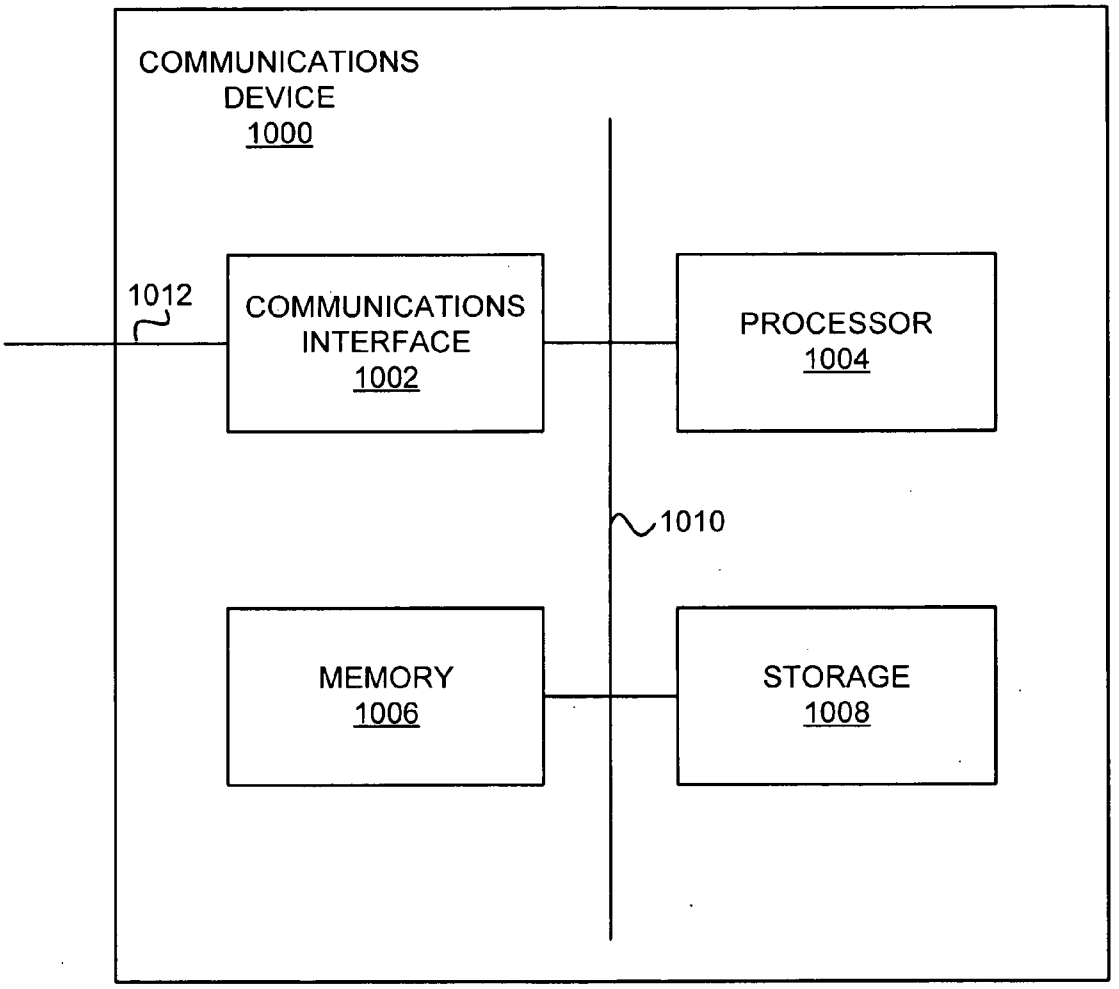

COMMUNICATIONS DEVICE 1000
1012
COMMUNICATIONS INTERFACE 1002
PROCESSOR 1004
1010
MEMORY 1006
STORAGE 1008

FIG. 10

SYSTEMS AND METHODS FOR PROVIDING A GENERIC INTERFACE IN A COMMUNICATIONS ENVIRONMENT

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit and priority of U.S. Provisional Application No. 60/982,684 entitled "Systems and Methods for Providing Unified Mobile Communications," and filed on Oct. 25, 2007, which is incorporated herein by reference.

BACKGROUND

[0002] 1. Field of the Invention

[0003] The present invention relates generally to the field of digital communications interfaces and more specifically to systems and methods for providing a generic interface in a communications environment.

[0004] 2. Background Art

[0005] Digital communications may be performed over a variety of communications media, including voice, email, text messaging, multimedia messaging, etc. These digital communications may utilize any of a variety of protocols. The communications media may not be compatible with one another. Therefore, a communications device may not be able to seamlessly communicate over two different communications media, such as voice and text. In addition, the variety of protocols may also be incompatible with one another. These protocol incompatibilities may prevent a communications device that utilizes one protocol from communicating with another communications device that utilizes a different protocol.

[0006] Because of these incompatibilities, a software application that is intended to communicate using more than one communication media and/or protocol may need to include separate code with separate function calls for each communications media and/or protocol. This can become unwieldy and cumbersome, making multiple communications media and/or protocols interoperating seamlessly in the application difficult or impractical.

SUMMARY

[0007] A method for providing a communications services interface is disclosed. The method includes receiving a first application function call. The first application function call specifies a first communications channel utilizing a first communications protocol to communicate over a network. The method further includes sending a first protocol command to control communications over the first communications channel. The first protocol command is responsive to the first application function call. The method additionally includes receiving a second application function call. The second application function call specifies a second communications channel utilizing a second communications protocol to communicate over the network. The second application function call has a same syntax as the first application function call. The second communications protocol is different than the first communications protocol. The method also includes sending a second protocol command to control communications over the second communications channel. The second protocol command is responsive to the second application function call.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** illustrates an exemplary communications system.

[0009] FIG. **2** illustrates an exemplary communications system including a communications device configured to communicate over a network.

[0010] FIG. **3** illustrates an exemplary method of allocating and activating communications services.

[0011] FIG. **4** illustrates an exemplary method of initiating a call.

[0012] FIG. **5** illustrates an exemplary method of terminating a call.

[0013] FIG. **6** illustrates an exemplary method of accepting an incoming call.

[0014] FIG. **7** illustrates an exemplary method of providing an interface between a communications application and a plurality of communications protocols.

[0015] FIG. **8** illustrates an exemplary method of providing communications between multiple entities.

[0016] FIG. **9** illustrates an exemplary method of providing a communications services interface.

[0017] FIG. **10** illustrates an exemplary communications device.

DETAILED DESCRIPTION

[0018] Systems and methods for providing a generic interface in a communications environment are described. These systems and methods enable applications to seamlessly communicate over multiple communications media and/or use multiple communications protocols by using a shared application programming interface. The application programming interface may provide a common command function call configured to interface with multiple protocol stacks. The shared application programming interface may abstract the uniqueness of and differences between various communications media and protocols into a common set of function calls and data structures.

[0019] Using the application programming interface, an application may interface to multiple incompatible communications media and communications protocols using a common set of software code. Because the details of the communications protocols are abstracted by the application programming interface, the application software code may not need to address the details of each individual communications protocol. Because the application software code may be independent of the details of the individual communications protocols, the application software code may easily be expanded to support new communications protocols also supported by the application programming interface.

[0020] FIG. **1** illustrates an exemplary communications system **100**. The communications system **100** includes a communications device **102** and a network **104**. The communications device **102** may be configured to communicate using a variety of communications protocols **106** over various communications media **108**. One or more communications services providers **110** may provide various communications services over the network **104**.

[0021] The communications device **102** may include a mobile communications device such as a cellular telephone,

cordless telephone handset, portable computer equipped with wireless internet access, personal digital assistant, etc. The communications device **102** may be configured to operate in multiple modes, such as both Wi-Fi and cellular, and thereby provide communications via multiple communications media **108** and/or networks **104** using one or more communications protocols **106**. The communications device **102** may also include a fixed-location communications device such as a desktop personal computer with internet access, desktop telephone, conference speakerphone, etc. Software configured to implement the communications protocols **106** may be associated with the communications device **102**. The communications device **102** may include a transceiver configured to communicate over the network **104**.

[0022] The various communications media **108** may include media connections provided by various communications protocols including circuit-switched (CS) protocols, internet protocol (IP), and proprietary protocols. The communications media **108** may include voice communications such as plain old telephone service (POTS), cellular telephone service, voice over internet protocol (VoIP), voice mail, and/or text communications such as email, Short Message Service (SMS), instant messaging (IM), and text chat services. Multimedia communications including text, still images, video, and audio may also be provided as part of the communications media **108**. The various communications media **108** may also include internet access, web browsing, file transfer protocol (FTP), and the like.

[0023] The media connections provided by the communications media **108** may include communications services associated with the one or more communications services providers **110**. The one or more communications services providers **110** may associate a communications services provider account with the communications device **102**. The communications services provider account may be associated with one or more communications protocols **106**, usernames, passwords, internet addresses, and other communications attributes.

[0024] A communications channel may be provided by the communications device **102** utilizing the one or more communications services providers **110** over the network **104**. The communications channel may be established by the communications device **102** connecting and authenticating with the one or more communications services providers **110** using the communications protocols **106**. The communications device **102** may establish one or more communications channels simultaneously. Each of the communications channels may use a different protocol or be carried by a different communications services provider **110**. In some embodiments, more than one communications channel may use a single protocol or be provided by a single communications services provider **110**. Each communications channel may be associated with a unique service identification tag (ID), and be independent from other communications channels that may be established by the communications device **102**.

[0025] The communications protocols **106** may adhere to standards defined for communicating over the various communications media **108**. For example, communications protocols **106** adhering to internet standards may include HTTP, AJAX, File Transfer Protocol (FTP), User Datagram Protocol (UDP), and Transmission Control Protocol/Internet Protocol (TCP/IP). In addition, communications protocols adhering to voice communications standards may include Global System for Mobile communications (GSM), Extensible Messaging and Presence Protocol (XMPP), and Session Initiation Protocol (SIP). GSM may be used to support cellular telephone communications over cellular networks provided by one or more communications services providers **110**. XMPP may be used to support instant messaging services provided by one or more communications services providers **110**. XMPP and SIP may be used to support voice over internet protocol (VoIP) communications provided by one or more communications services provider **110**. Furthermore, communications protocols adhering to presence and instant messaging standards may include Common Profile for Presence (CPP), Common Profile for Instant Messaging (CPIM), Common Presence and Instant Messaging (CPIM) Message Format, and XMPP.

[0026] In one embodiment, the communications protocols **106** may be implemented on a computing device (not shown) disposed external to the communications device **102** and communicatively coupled with the communications device **102** via the network **104**. In this embodiment, commands configured to exercise the communications protocols **106** may be issued from the communications device **102** to the computing device.

[0027] The network **104** may include a wired communications network such as an Ethernet local area network (LAN) or a landline POTS network. The network **104** may also include a wireless communications network such as a Wi-Fi network, a WiMax network, or a cellular telephone network. The network **104** may include an internet or World Wide Web (WWW) network. The network **104** may be configured to carry communications associated with the communications media **108** and the communications protocols **106**.

[0028] FIG. **2** illustrates an exemplary communications system **200** including the communications device **102** configured to communicate over the network **104**. The communications device **102** includes a communications system software **202** as well as an operating system **204**. The communications system software **202** includes an application **206** configured to communicate with another entity over the network **104**. The other entity may include another communications device (not shown) configured to communicate over the network **104**. A communications services interface module **208** includes software for providing communications services to the application **206** to enable the application **206** to communicate over the network **104**. The communications system software **202** also includes protocol stacks **210** and a DSP engine **212**. The protocol stacks **210** may comprise modules including software and/or electronic circuitry configured to implement communications protocols for communicating over the network **104** via a network interface **214**. The protocol stacks **210** include a XMPP protocol stack **210**A, an SIP protocol stack **210**B, a proprietary protocols protocol stack **210**C, an IM services protocol stack **210**D, and a cellular services protocol stack **210**E, each of which may be hereinafter referred to as a member of the protocol stacks **210**. The DSP engine **212** may comprise a module including software and/or electronic circuitry configured to perform digital signal processing functions in conjunction with the communications services interface module **208**.

[0029] Each member of the protocol stacks **210** may be configured to establish one or more communications channels over the network **104** by interfacing with the network **104** via the network interface **214**. The network interface **214** may also interface with, communicate with, and/or interoperate with the operating system **204** to implement the one or more

communications channels. The operating system **204** may include Palm OS, Symbian, Windows CE, Windows Mobile, Windows XP, Windows Vista, MacOS, UNIX, Linux, Solaris, Nucleus OS, Vx Works, etc.

[0030] The application **206** may comprise a software module including a user interface. The user interface may be configured to receive commands and instructions from a user associated with the communications device **102** and report a status relating to the one or more communications channels to the user. The application **206** may also be configured to receive communications input from the user and provide communications output to the user.

[0031] The communications services interface module **208** provides generalized control of the protocol stacks **210** for establishing and manipulating the communications media **108**. Other protocol stacks (not shown) implementing other communications protocols, such as Simple Traversal of User Datagram Protocol Through Network Address Translators (STUN), may also be controlled by the communications services interface module **208**. The communications services interface module **208** may include data and algorithms taking into account the communications services which each member of the protocol stacks **210** is capable of supporting. The communications services interface module **208** may also include data and algorithms configured to couple communications services and functionality between one member of the protocol stacks **210** or the DSP engine **212** with another member of the protocol stacks **210** or the DSP engine **212**. The communications services interface module **208** may enable one or more communications services over one or more communications media **108**, using one or more communications protocols **106**, and carried by the one or more communications services providers **110** to seamlessly interface with one another.

[0032] The communications services interface module **208** may utilize the DSP engine **212** to provide digital processing of voice, audio, and/or video in conjunction with the protocol stacks **210**. The communications services interface module **208** may create common audio tones used in communications services supported by the protocol stacks **210**, such as dial tones, call progress tones, DTMF tones, and telephone ringing tones.

[0033] The communications services interface module **208** may control multimedia streaming over the network **104**. For example, the communications services interface module **208** may control the streaming of voice over the network **104**. The communications services interface module **208** may also control the streaming of audio and/or video over the network **104**.

[0034] The communications services interface module **208** includes an application programming interface **216** and a communications services protocol interface **218**. The application programming interface **216** is configured to provide a variety of function calls related to communications for use by the application **206**. The function calls may be configured to abstract the details of underlying protocols implemented in the protocol stacks **210** and the DSP engine **212**. By abstracting these details, the function calls enable a generalized common interface to the plurality of underlying protocols which may be independent of the details of each of the underlying protocols, according to exemplary embodiments. The function calls may abstract protocol-specific communications between the communications services interface module **208** and each member of the protocol stacks **210** into common function calls between the application **206** and the communications services interface module **208**. The application **206** may use the function calls to send one or more API calls **220** to the communications services interface module **208**. The application **206** may also use the function calls to configure the application **206** to process one or more API events **222** which may be received from the communications services interface module **208**.

[0035] The application programming interface **216** may provide support for two types of the one or more API calls **220**. A first type of the one or more API calls **220** may be configured to enable the application **206** to control an action performed by at least one member of the protocol stacks **210** or the DSP engine **212**. A second type of the one or more API calls **220** may be configured to establish a feedback mechanism by which at least one member of the protocol stacks **210** or the DSP engine **212** may notify the application **206** of an event or status.

[0036] The feedback mechanism may include the one or more API events **222**. Each API event of the one or more API events **222** may be associated with a particular function call, or instance of the one or more API calls **220**, which may have established the feedback path associated with the API event. The one or more API events **222** may be asynchronous. Examples illustrating the feedback mechanism are described herein with reference to FIGS. **3-6**.

[0037] A single function call may be used by the application **206** to interface with a plurality of the members of the protocol stacks **210** by changing a parameter (or argument) of the single function call. For example, source code associated with the application **206** may include a single function call that includes a parameter specifying that the XMPP protocol stack **210**A be utilized for performing a communications function. The single function call may then be used again by the application source code to perform the communications function using the SIP protocol stack **210**B in addition, simply by replacing the parameter specifying that the XMPP protocol stack **210**A be utilized with a parameter specifying that the SIP protocol stack **210**B be utilized.

[0038] In response to the one or more API calls **220** received from the application **206**, the communications services interface module **208** may control and communicate with the protocol stacks **210** as well as the DSP engine **212** to perform functions related to the one or more communications channels carried over the network **104**. The communications services interface module **208** may issue protocol commands **224** to the protocol stacks **210**. The communications services interface module **208** may also issue DSP commands **226** to the DSP engine **212**. The protocol commands **224** issued to one member of the protocol stacks **210**, such as the XMPP protocol stack **210**A, may differ in form and/or syntax from the protocol commands **224** issued to another member of the protocol stacks **210**, such as the SIP protocol stack **210**B.

[0039] A first protocol command, such as one of the protocol commands **224**, issued in response to a first API call, such as the one or more API calls **220**, having a given protocol-dependent parameter may be syntactically different from a second protocol command issued in response to a second API call having a same function name as the first API call but a different protocol-dependent parameter than the first API call. The syntactical difference may be embodied by a different function name, a different set of parameters, or both. The syntactical difference may be dependent upon, or responsive to, a syntax required by each protocol implemented within the set of the protocol stacks **210** and the DSP engine **212**. Each

protocol command of the protocol commands **224** may conform to a syntax standard corresponding to the member of the protocol stacks **210** to which the protocol command is directed. Each member of the protocol stacks **210** may have a different syntax standard for protocol commands **224** than other members of the protocol stacks **210**.

[0040] The communications services interface module **208** may receive protocol events **228** from the protocol stacks **210**. The communications services interface module **208** may also receive DSP events **230** from the DSP engine **212**. An instance of the protocol events **228** received from one member of the protocol stacks **210** may differ in syntax and/or form from another instance of the protocol events **228** received from a different member of the protocol stacks **210**. A specific protocol event among the instances of protocol events **228** may be in response to one or more communications **232** received through the network **104** by the communications device **102**. For example, the specific protocol event may notify the communications services interface module **208** that a communications channel has been established in response to a network acknowledgement, which may include an instance of the one or more communications **232** received through the network **104**.

[0041] The communications services interface module **208** may send the one or more API events **222** to the application **206** when triggered by the protocol events **228** to notify the application **206** of a particular occurrence or status. The one or more API events **222** may also be sent from the communications services interface module **208** when triggered by an instance of the DSP events **230** issued by the DSP engine **212** to notify the application **206** of a particular occurrence or status. The protocol events **228** and the DSP events **230** may be asynchronous.

[0042] Each instance of the protocol events **228** issued in response to a first communication, which may include an instance of the one or more communications **232**, may be syntactically different from the other instances of the protocol events **228** issued in response to a second communication, which may include another instance of the one or more communications **232**. The syntactical difference between each instance of the protocol events **228** may be dependent upon a syntax standard required by each protocol supported by members of the protocol stacks **210**. The communications services interface module **208** may convert the syntactically different instances of the protocol events **228** and the DSP events **230** into the one or more API events **222** having a common syntax. For example, a first API event, such as an instance of the one or more API events **222**, sent from the communications services interface module **208** to the application **206** in response to the first communication may have a same function name as a second API event sent from the communications services interface module **208** to the application **206** in response to the second communication, although a first protocol event, such as an instance of the protocol events **228**, associated with the first communication and a second protocol event associated with the second communication may be syntactically different. The first API event may differ from the second API event in only a parameter value.

[0043] The communications services protocol interface **218** may provide a conversion between the common function calls provided by the application programming interface **216** and the protocol-specific communications between the communications services interface module **208** and the protocol stacks **210** and the DSP engine **212**. The communications services protocol interface **218** may provide the conversion between a common API call, which may include an instance of the one or more API calls **220**, and each of the protocol commands **224** and the DSP commands **226**. The communications services protocol interface **218** may also provide the conversion between each instance of the protocol events **228** and the DSP events **230** and a common API event, which may include an instance of the one or more API events **222**.

[0044] The protocol stacks **210** may communicate with the communications services interface module **208** via a command-event model. For example, the communications services interface module **208** may send a protocol command, such as an instance of the protocol commands **224**, to a protocol stack which is a member of the protocol stacks **210**. The protocol command may contain a block of digital data representative of the command. The communications services interface module **208** may then receive a protocol event, such as an instance of the protocol events **228**, sent by the protocol stack. The protocol event may contain a block of digital data representative of the event. The event may include a status report in response to the protocol command, an IP event received from a communications channel over the network **104**, etc. The communications services interface module **208** may use one or more Inter-Process Communication (IPC) techniques to send the protocol command and to receive the protocol event. A different IPC technique may be used to send the protocol command than to receive the protocol event. Examples of IPC techniques include pipes, sockets, remote procedure calls (RPC), shared memory, and message passing.

[0045] The communications services interface module **208** may support hot swapping or plug-and-play operation of the members of the protocol stacks **210**. For example, a selected member of the protocol stacks **210** may be deactivated while the communications services interface module **208** continues operating and supporting other members of the protocol stacks **210**. The selected member of the protocol stacks **210** may be deactivated without interrupting or ceasing operation of any communications services or communications channels supported by the other members of the protocol stacks **210**. The selected member of the protocol stacks **210** may be deactivated because the communications services interface module **208** detects an error condition in the selected member of the protocol stacks **210**, because hardware or system resources of the communications device **102** are not sufficient to support continued operation of the selected member of the protocol stacks **210**, because the selected member of the protocol stacks **210** is being upgraded to a new version of the selected member of the protocol stacks **210**, because the user associated with the communications device **102** wishes to deactivate communications services supported by the selected member of the protocol stacks **210**, because resources associated with the network **104** and/or the communications services providers **110** are insufficient to support operation of communications services supported by the selected member of the protocol stacks **210**, or other various reasons.

[0046] As another example, a new protocol stack may be added as a new member of the protocol stacks **210** and be registered with and supported by the communications services interface module **208** while the communications services interface module **208** continues to operate and support other members of the protocol stacks **210** as well as any one or more communications services or communications chan-

nels supported by the other members of the protocol stacks **210**. The new protocol stack may be dynamically added when one or more resources become available to support operation of the new protocol stack. The one or more resources that become available may include hardware or system resources of the communications device **102** such as a network interface, a required quantity of free memory, or processing capacity. The one or more resources that become available may also include resources associated with the network **104** and/or the communications services providers **110** such as communications services, communications bandwidth, or network servers. The new protocol stack may also be dynamically added when one or more communications services and/or protocols supported by the new protocol stack are desired.

[0047] As a further example, the selected member of the protocol stacks **210** may be deactivated because of an error condition. Examples of error conditions include bugs, crashes, unresponsiveness, incorrect behavior, etc. Then, the selected member of the protocol stacks **210** may be restarted to restore the selected member of the protocol stacks **210** to full operation. While any communications services and/or communications channels supported by the selected member of the protocol stacks **210** may be interrupted when the selected member of the protocol stacks **210** is deactivated, the interrupted communications services and/or communications channels may be restored or reactivated after the selected member of the protocol stacks **210** is restarted.

[0048] In an embodiment, the communications services interface module **208** may monitor usage of the members of the protocol stacks **210** as well as available hardware and system resources of the communications device **102**. The communications services interface module **208** may dynamically activate and/or deactivate various members of the protocol stacks **210** as the various members of the protocol stacks **210** are needed and/or as available resources allow. In this way, a set of active members of the protocol stacks **210** may dynamically change depending on dynamically changing system resources of the communications device **102**, resources associated with the network **104**, and/or resources associated with the communications services providers **110**. By dynamically changing the set of active members of the protocol stacks **210**, memory and/or processing resources of the communications device **102** may be conserved.

[0049] The application **206** may be written as source code in a computer language such as C, C++, or Java. The application source code may include function calls provided by the application programming interface **216** to include communications functionality associated with each of the protocols in the protocol stacks **210** as well as the DSP engine **212**. A software compiler executing on a computing processor (not shown) may compile the source code into object code. The object code may be targeted to a particular computing processor associated with the communications device **102**. The application programming interface **216** may include one or more libraries configured to provide object code for various target computing processors. A compiler switch may be set to control the compiler to generate executable object code for the target computing processor associated with the compiler switch setting. Therefore, the application programming interface **216** may enable a single source code to be targeted to more than one target computing processor and/or communications device **102** based upon a compiler switch setting.

[0050] FIG. **3** illustrates an exemplary method of allocating and activating one or more communications services. The method illustrates how an application programming interface, such as the application programming interface **216** discussed herein, may be used by an application, such as the application **206**, to allocate and activate communications channels using different protocol stacks, such as the members of the protocol stacks **210**. The method also illustrates how a communications services interface module, such as the communications services interface module **208**, may support plug-and-play protocol stacks whereby new members of the protocol stacks **210** may be dynamically added and supported by the communications services interface module **208** without re-coding, recompiling, or interrupting operation of the communications services interface module **208** and/or application **206**. The new members of the protocol stacks **210** may be dynamically added and supported without interrupting operation of the one or more communications services already activated. After the one or more communications services are allocated and activated, the communications channels may be used by the application **206**. The application **206** may include a state machine configured to implement the method.

[0051] In step **302**, a protocol stack, such as a member of the protocol stacks **210**, sends a registration event, such as an instance of the protocol events **228**, to the communications services interface module **208**. By sending the registration event, the protocol stack may register with the communications services interface module **208**. The registration event may include data regarding the protocol stack such that the communications services interface module **208** may use the protocol stack to allocate and activate one or more communications services associated with the protocol stack. The communications services interface module **208** may be configured to utilize the protocol stack after receiving the registration event even though the communications services interface module **208** may have no data regarding the protocol stack prior to receiving the registration event. In this way, the communications services interface module **208** may support plug-and-play operation of a dynamically added protocol stack. The communications services interface module **208** may therefore support a communications interface protocol via the dynamically added protocol stack which the communications services interface module **208** did not previously support.

[0052] In step **304**, the application **206** is notified of the availability of one or more protocols supported by the protocol stack registered in step **302**. The communications services interface module **208** may send a protocol availability event, which may include an instance of the one or more API events **222**, to the application **206**. The protocol availability event may include data regarding the one or more protocols supported by the protocol stack registered in step **302**. In conjunction with the data regarding the one or more protocols, the application **206** may use the one or more protocols after receiving the protocol availability event even though the application **206** may have had no data regarding using the one or more protocols via the communications services interface module **208** prior to receiving the protocol availability event. In this way, the application **206** may utilize the one or more protocols supported by the protocol stack which is dynamically added and registered in step **302**.

[0053] In step **306**, a new communications service is allocated. The application **206** may use an API function call to send an allocation command, which may include an instance of the one or more API calls **220**, to the communications

services interface module **208**. The allocation command may specify which protocol, and consequently which member of the protocol stacks **210**, is to be associated with the new communications service.

[0054] In step **308**, the new communications service is created via the protocol stack associated with the new communications service, which may include a member of the protocol stacks **210**. The communications services interface module **208** may send a communications service creation command, which may include an instance of the protocol commands **224**, to the protocol stack associated with the new communications service. The communications service creation command may be sent in response to receiving the allocation command sent by the application **206** in step **306**. The communications service creation command sent to the protocol stack associated with the new communications service may be syntactically different from another communications service creation command that may be sent to a different member of the protocol stacks **210**. The communications service creation command sent, and the protocol stack associated with the new communications service, may be responsive to a parameter included in the allocation command sent by the application **206** to the communications services interface module **208** in step **306**.

[0055] The protocol stack associated with the new communications service may perform functions related to creating the new communications service in response to receiving the communications service creation command. The functions performed by the protocol stack associated with the new communications service to create the new communications service may be specific to the protocol associated with the new communications service. For example, the SIP protocol stack **210**B may initialize a user agent, while the XMPP protocol stack **210**A may initialize an endpoint.

[0056] In step **310**, a creation status of the new communications service is reported to the communications services interface module **208**. After the protocol stack associated with the new communications service creates the new communications service, the protocol stack associated with the new communications service may send a protocol service creation event, which may include an instance of the protocol events **228**, back to the communications services interface module **208** to notify the communications services interface module **208** that the protocol stack associated with the new communications service has successfully created the new communications service. In some embodiments, the protocol service creation event may be sent to the communications services interface module **208** to report a communications service creation error.

[0057] In step **312**, a communications service allocation status is reported to the application **206**. After the communications services interface module **208** receives the protocol service creation event in step **310**, the communications services interface module **208** may send a corresponding interface service creation event, which may include an instance of the one or more API events **222**, to the application **206**. The corresponding interface service creation event may report the communications service allocation success or failure status in response to the creation status reported by the protocol stack associated with the new communications service in step **310**.

[0058] In step **314**, communications service parameters are set. The application **206** may send one or more communications service parameter setting commands, each of which may correspond to an instance of the protocol commands **224**, to the communications services interface module **208** using an API function call which may include an instance of the one or more API calls **220**. The communications service parameters may include a uniform resource identifier (URI), server name and/or internet address, login userid and/or password, and so forth.

[0059] In step **316**, the protocol stack associated with the new communications service is configured according to the communications service parameters set in step **314**. The communications services interface module **208** may send one or more protocol parameter setting commands, each of which may include an instance of the protocol commands **224**, to the protocol stack associated with the new communications service. The one or more protocol parameter setting commands may be sent in response to receiving the one or more communications service parameter setting commands sent by the application **206** in step **314**. The one or more protocol parameter setting commands sent to the protocol stack associated with the new communications service may be syntactically different from one or more protocol parameter setting commands that may be sent to a different member of the protocol stacks **210**.

[0060] In step **318**, the new communications service is activated. The application **206** may send an activation command to the communications services interface module **208** using an API function call which may include an instance of the one or more API calls **220**. The activation command may specify the new communications service to be activated by identifying the previously allocated new communications service.

[0061] In step **320**, the protocol stack associated with the new communications service is activated. The communications services interface module **208** may send a communications service activation command, which may include an instance of the protocol commands **224**, to the protocol stack associated with the new communications service. The communications service activation command may be sent in response to receiving the activation command sent by the application **206** in step **318**. The communications service activation command sent to the protocol stack associated with the new communications service may be syntactically different from a communications service activation command that may be sent to a different member of the protocol stacks **210**.

[0062] The protocol stack associated with the new communications service may perform functions related to activating the new communications service in response to receiving the communications service activation command. The functions performed by the protocol stack associated with the new communications service to activate the new communications service may be specific to the protocol associated with the new communications service. For example, the SIP protocol stack **210**B may register a user agent, while the XMPP protocol stack **210**A may connect and authenticate against an XMPP server.

[0063] In step **322**, an activation status of the protocol stack associated with the new communications service is reported to the communications services interface module **208**. After the protocol stack associated with the new communications service activates the new communications service, the protocol stack associated with the new communications service may send a protocol activation event, which may include an instance of the protocol events **228**, back to the communications services interface module **208** to notify the communications services interface module **208** that the protocol stack associated with the new communications service has success-

fully activated the new communications service. In some embodiments, the protocol activation event may be sent to the communications services interface module **208** to report a communications service activation error.

[0064] In step **324**, a communications service activation status is reported to the application **206**. After the communications services interface module **208** receives the protocol activation event in step **322**, the communications services interface module **208** may send a corresponding interface service activation event, such as an instance of the one or more API events **222**, to the application **206**. The corresponding interface service activation event may report the communications services activation success or failure status in response to the activation status reported by the protocol stack associated with the new communications service in step **322**.

[0065] In optional step **326**, another communications service may be allocated and activated by repeating steps **302**-**324**. The other communications service may utilize a different protocol or member of the protocol stacks **210** than the prior new communications service. In other embodiments, the other communications service may utilize the same protocol or member of the protocol stacks **210** as the prior new communication service, but may allocate and activate a separate communications channel than the prior new communications service.

[0066] FIG. **4** illustrates an exemplary method of initiating a call. The call may be initiated over a communications service previously allocated and activated as described with reference to FIG. **3**. The call may be initiated by a calling party and directed to a called party. The calling party may include a first communications service endpoint at a first communications device, which may include an example of the communications device **102**. The first communications service endpoint may include a first application, which may include an example of the application **206**. The called party may include a second communications service endpoint at a second communications device, which may include another example of the communications device **102**. The second communications service endpoint may include a second application, which may include another example of the application **206**. Protocol signaling and data traffic may be communicated over a network, such as the network **104**, between the first communications service endpoint and the second communications service endpoint according to the communications protocol associated with the communications service.

[0067] Protocol signaling between the calling party and the called party may include data packets sent and received over the network **104** in accordance with the protocol to perform communications functions such as initiating a call, acknowledging a call, accepting a call, rejecting a call, putting a call on hold, resuming a call previously put on hold, initiating a conference call, terminating a call, requesting contact information, sending contact information, requesting presence information or status, sending presence information or status, sending text messages, sending multimedia messages, and so forth.

[0068] In step **402**, a call initiation is signaled. The first application may send a call initiation command to the communications services interface module **208** specifying a called party to call and a communications service to use to call the called party. The call initiation command may be sent using an API function call, which may include an instance of the one or more API calls **220**. The API function call may have a consistent syntax regardless of which communications service, communications channel, or communications protocol may be associated with the call. API function call parameters may be specified to correspond with the communications service, communications channel, or communications protocol associated with the call.

[0069] In step **404**, a protocol stack associated with the call is commanded to initiate the call. The protocol stack associated with the call may be chosen among the members of the protocol stacks **210** based on the communications service and/or the communications channel specified by the first application or associated with the called party. The communications services interface module **208** may then send a protocol call initiation command to the protocol stack associated with the call. The protocol call initiation command may include-an instance of the protocol commands **224**. Syntax of the protocol call initiation command may depend upon, or be responsive to, the protocol stack associated with the call. For example, the protocol call initiation command may differ in syntax than if a different member of the protocol stacks **210** was associated with the call, the communications service, and/or the communications channel.

[0070] In step **406**, the protocol stack associated with the call performs protocol signaling to call the called party. The protocol signaling may include sending a call initiation data packet corresponding to the protocol associated with the call over the network **104** to the called party. The protocol signaling may also include monitoring the network **104** for an acknowledgement data packet that may be sent from the called party to the calling party to acknowledge receipt of the call initiation data packet.

[0071] In step **408**, the protocol signaling of the called party is reported. After the protocol stack associated with the call has sent the data packet to the called party in step **406**, the protocol stack associated with the call may send a protocol signaling event, which may include an instance of the protocol events **228**, to the communications services interface module **208**. The protocol signaling event may report that the protocol stack associated with the call has begun signaling the called party to initiate the call.

[0072] In step **410**, calling the called party is reported. The communications services interface module **208** may send a calling event, which may include an instance of the one or more API events **222**, to the first application to report that the protocol stack associated with the call has signaled the called party to initiate the call. The calling event may be sent to the first application in response to receiving the protocol signaling event from the protocol stack associated with the call indicating that the protocol stack associated with the call has begun protocol signaling to initiate the call.

[0073] In step **412**, the protocol stack associated with the call's receipt of an acknowledgement from the called party is reported. The received acknowledgement may indicate that the called party is in receipt of the request to initiate the call and is performing protocol signaling in response to the request. The protocol signaling being performed by the called party may include sending an acknowledgement data packet to the calling party. The calling party's protocol stack associated with the call may process the acknowledgement data packet received from the called party and send a protocol acknowledgement event, which may include an instance of the protocol events **228**, to the communications services interface module **208**. The protocol acknowledgement event may report that the called party has acknowledged the initiation of the call.

[0074] In step **414**, the called party's acknowledgement of the call is reported. The communications services interface module **208** may send an interface acknowledgement event, which may include an instance of the one or more API events **222**, to the first application to report that the called party has acknowledged receipt of the call initiation. The interface acknowledgement event may be sent to the first application in response to receiving the protocol acknowledgement event sent from the protocol stack associated with the call in step **412**. As an illustration, the reported acknowledgement may correspond to a called telephone ringing in the earpiece of a calling telephone after dialing a telephone number.

[0075] In step **416**, the protocol stack associated with the call's receipt of an acceptance of the call from the called party is reported. The called party may send a call acceptance data packet to the calling party over the network **104** to tell the calling party that the call is being accepted. The calling party's protocol stack associated with the call may process the call acceptance data packet received from the called party and send a protocol call acceptance event, which may include an instance of the protocol events **228**, to the communications services interface module **208**. The protocol call acceptance event may report that the called party accepts the call from the calling party.

[0076] In step **418**, the communications services interface module **208** reports that the called party accepts the call. The communications services interface module **208** may send an interface call acceptance event, which may include an instance of the one or more API events **222**, to the first application to report that the called party accepts the call from the calling party. The event may be sent to the first application in response to receiving the protocol call acceptance event sent from the protocol stack associated with the call in step **416**.

[0077] FIG. **5** illustrates an exemplary method of terminating the call. The method illustrated in FIG. **5** assumes that the call between the calling party and the called party has already been initiated as described with reference to FIG. **4**. A method similar to that illustrated in FIG. **5** may also be used for another desired communications function, such as placing the call on hold and resuming the call previously placed on hold, by customizing the commands, events, and data-packets to correspond to the other desired communications function. In this exemplary method, the calling party terminates the call in progress. The method may also be applicable to the called party terminating the call in progress.

[0078] In step **502**, termination of the call in progress is signaled. The first application may send a call termination command to the communications services interface module **208** specifying that the call with the called party be terminated. The call termination command may be sent using an API function call, such as an instance of the one or more API calls **220**. The API function call may have a consistent syntax regardless of which member of the protocol stacks **210** is associated with the call in progress.

[0079] In step **504**, the protocol stack associated with the call in progress is commanded to terminate the call in progress. The communications services interface module **208** may determine which member of the protocol stacks **210** is associated with the call in progress. The communications services interface module **208** may then send a call termination command to the protocol stack associated with the call in progress. The call termination command may include an instance of the protocol commands **224**. Syntax of the call termination command may depend upon, or be responsive to, the protocol stack associated with the call in progress. For example, the termination command to be sent to the protocol stack associated with the call in progress may differ in syntax than if a different member of the protocol stacks **210** was associated with the call in progress.

[0080] In step **506**, protocol signaling with the called party is performed. The protocol stack associated with the call in progress may perform protocol signaling including sending a call termination data packet corresponding to the protocol associated with the call in progress over the network **104** to the called party. The call termination data packet may notify the called party that the call in progress is being terminated. The protocol signaling may also include monitoring the network **104** for an acknowledgement data packet that may be sent from the called party to the calling party to acknowledge receipt of the call termination data packet terminating the call.

[0081] In step **508**, termination of the call in progress by the protocol stack associated with the call in progress is reported. After the protocol stack associated with the call in progress has sent the call termination data packet to the called party in step **506**, the protocol stack associated with the call in progress may send a protocol call termination event, which may include an instance of the protocol events **228**, to the communications services interface module **208**. The protocol call termination event may report that the protocol stack associated with the call in progress has begun or completed signaling the called party to terminate the call. In some embodiments, the protocol call termination event may be sent to the communications services interface module **208** to report a termination error.

[0082] In step **510**, termination of the call in progress is reported. The communications services interface module **208** may send an interface call termination event, which may include an instance of the one or more API events **222**, to the first application to report that the protocol stack associated with the call in progress has terminated the call with the called party. The interface call termination event may be sent to the first application in response to receiving the protocol call termination event from the protocol stack associated with the call in progress in step **508**.

[0083] FIG. **6** illustrates an exemplary method of accepting an incoming call. The incoming call may be accepted by the called party in response to the call initiation from the calling party, as described with reference to FIG. **4**. In this exemplary method, the called party may include the second communications service endpoint and the second application at the second communications device.

[0084] In step **602**, protocol signaling for the incoming call is received. A protocol stack associated with the incoming call, which may include a member of the protocol stacks **210**, may monitor the network **104** for the call initiation data packet to arrive. The call initiation data packet may correspond to a call initiation protocol signal. When the protocol stack associated with the incoming call recognizes the call initiation protocol signal received over the network **104** as the incoming call initiation data packet, the protocol stack associated with the incoming call may receive the call initiation data packet for processing.

[0085] In step **604**, a protocol incoming call event, which may include an instance of the protocol events **228**, corresponding to the incoming call is generated. The protocol stack associated with the incoming call that receives the incoming call initiation data packet in step **602** may process the incoming call initiation data packet. If the protocol stack associated

with the incoming call determines that the incoming call initiation data packet represents the incoming call corresponding to the communications service or communications channel supported by the protocol stack associated with the incoming call, the protocol stack associated with the incoming call may send the protocol incoming call event to the communications services interface module **208**. Syntax of the protocol incoming call event may depend upon, or be responsive to, the protocol stack associated with the incoming call. For example, the protocol incoming call event may differ in syntax than if a different member of the protocol stacks **210** was associated with the incoming call, the communications service, and/or the communications channel.

[0086] In step **606**, the second application is notified of the incoming call. The communications services interface module **208** may receive the protocol incoming call event sent in step **604**. The communications services interface module **208** may process the protocol incoming call event, effectively converting the protocol incoming call event whose syntax may be unique to the originating protocol stack associated with the incoming call into a protocol-independent incoming call event to be sent to the second application. The communications services interface module **208** may then send the protocol-independent incoming call event, which may include an instance of the one or more API events **222**, to the second application to notify the second application of the incoming call. The protocol-independent incoming call event sent to the second application may be in a consistent syntax regardless of which member of the protocol stacks **210** is associated with the incoming call.

[0087] In step **608**, the incoming call is acknowledged. The second application may send an acknowledgement command to the communications services interface module **208** specifying that an acknowledgement be sent to the calling party. The acknowledgement command may be sent using an API function call, such as an instance of the one or more API calls **220**. The acknowledgement command may have a consistent syntax regardless of which member of the protocol stacks **210** is associated with the incoming call.

[0088] In step **610**, a protocol acknowledgement command to acknowledge the incoming call is generated. The communications services interface module **208** may send the protocol acknowledgement command to the protocol stack associated with the incoming call. The protocol acknowledgement command may include an instance of the protocol commands **224**. Syntax of the protocol acknowledgement command may depend upon, or be responsive to, the protocol stack associated with the incoming call. For example, the protocol acknowledgement command may differ in syntax than if a different member of the protocol stacks **210** was associated with the incoming call. The protocol stack associated with the incoming call may then signal the calling party to acknowledge the incoming call over the network **104**.

[0089] In step **612**, the incoming call is accepted. The second application may send an accept call command to the communications services interface module **208** specifying that the incoming call be accepted. The accept call command may be sent using an API function call, which may include an instance of the one or more API calls **220**. The API function call may have a consistent syntax regardless of which member of the protocol stacks **210** is associated with the incoming call.

[0090] In step **614**, a protocol accept call command to accept the incoming call is generated. The communications services interface module **208** may send the protocol accept call command to the protocol stack associated with the incoming call. The protocol accept call command may include an instance of the protocol commands **224**. Syntax of the protocol accept call command may depend upon, or be responsive to, the protocol stack associated with the incoming call. For example, the protocol accept call command may differ in syntax than if a different member of the protocol stacks **210** was associated with the incoming call. The protocol stack associated with the incoming call may then signal the calling party to accept the incoming call over the network **104**.

[0091] FIG. **7** illustrates an exemplary method of providing an interface between a communications application and a plurality of communications protocols. The method includes providing a common function call as part of an API in source code for the communications application, which may include an example of the application **206**, configuring a compiler for a target communications device or processor, and compiling the communications application source code into communications application executable code including the interface.

[0092] In step **702**, the common function call is included in the communications application source code. The common function call may be part of the application programming interface **216**, described with reference to FIG. **2**. The communications application source code may use a same common function call, which may correspond to an instance of the one or more API calls **220**, for a first protocol stack as a second protocol stack. The first protocol stack and the second protocol stack may each include a member of the protocol stacks **210**, and may each be different from one another. The first protocol stack or the second protocol stack may require that a protocol command, which may correspond to one of the protocol commands **224**, be in syntax specific to the first protocol stack or the second protocol stack, respectively. The protocol command syntax for the first protocol stack may be different and incompatible with the protocol command syntax for the second protocol stack.

[0093] In step **704**, a first target communications device, which may include an instance of the communications device **102**, is targeted by a software compiler. The software compiler and one or more associated function libraries may be configured to compile the communications application source code into executable object code targeted to the first target communications device. The associated function libraries may include libraries associated with the application programming interface **216**. The software compiler and/or the associated function libraries may include an option to target the executable object code to one or more different communications devices **102**. The option may include a specification of a computing processor and/or an operating system associated with the one or more different communications devices **102**.

[0094] In step **706**, the communications application executable code is compiled. The software compiler may compile the communications application source code into the communications application executable code using the associated function libraries on a computing processor. The communications application executable code may include executable API calls, which may include instances of the one or more API calls **220**, to interface to the communications services interface module **208**. The communications services interface module **208** may be configured to issue an instance of the protocol commands **224** to a member of the protocol stacks

210, in response to the executable API call to be received from the communications application executable code.

[0095] A syntax of the instance of the protocol commands **224** may depend upon, or be responsive to, the member of the protocol stacks **210** to which the instance of the protocol commands **224** is issued. For example, the instance of the protocol commands **224** to be issued to one member of the protocol stacks **210** may differ in syntax from another instance of the protocol commands **224** to be issued to a different member of the protocol stacks **210**. Therefore, the communications services interface module **208** converts a single common function call syntax as received from the application **206** into a plurality of protocol command syntaxes responsive to the member of the protocol stacks **210** to which the instance of the protocol commands **224** is to be issued. This conversion enables the communications application source code to be independent of the details of each individual protocol supported by the communications services interface module **208**.

[0096] In optional step **708**, steps **704** and **706** may be repeated for one or more additional target communications devices. Step **708** facilitates the creation of a plurality of different communications application executable codes from a single communications application source code. A first of the plurality of communications application executable codes may execute on the first target communications device while a second and/or subsequent communications application executable code created for a different target communications device than the first communications application executable code may execute on a different target communications device.

[0097] FIG. **8** illustrates an exemplary method of providing communications between multiple entities. The multiple entities may include a central entity, a first entity, and a second entity, where the central entity may be communicatively coupled with both the first entity and the second entity. The communications may include voice communications protocols such as XMPP, SIP, GSM, etc. The communications may also include other protocols such as text communications protocols and multimedia communications protocols. The entities may include communications devices such as the communications device **102**. The communications between the multiple entities may be carried over a network such as the network **104**.

[0098] In step **802**, a first voice communications protocol is utilized with the first entity. The central entity and the first entity may establish a first communications channel therebetween utilizing the first voice communications protocol. The first voice communications protocol may be implemented using a protocol stack, such as a member of the protocol stacks **210**, on an example of the communications device **102**.

[0099] In step **804**, a second voice communications protocol is utilized with the second entity. The central entity and the second entity may establish a second communications channel therebetween utilizing the second voice communications protocol. The second voice communications protocol may be different from the first communications protocol. In other embodiments, the second voice communications protocol may be the same as the first communications protocol. The first voice communications channel and the second voice communications channel may be carried over different communications services providers, such as communications services providers **110**. For example, the first voice communications channel may be carried over a cellular telephone service provider, while the second voice communications channel may be carried over a voice over internet protocol service provider or an internet service provider.

[0100] In step **806**, the first entity and the second entity are communicatively coupled. In one embodiment, a voice conference service may be provided between the central entity, the first entity, and the second entity, such that all three entities may communicate with each other via the voice conference service by communicatively coupling the first communications channel and the second communications channel. In some embodiments, one or more additional entities may join the voice conference. A new communications channel between the central entity and the one or more additional entities may use a different communications protocol or communications services provider **110** than either the first communications channel or the second communications channel.

[0101] In another embodiment, a voice call may be transferred. The central entity may receive and accept a call from the first entity, and transfer the call to the second entity. The call from the first entity may be received over the first communications channel using the first communications protocol, while the call may be transferred to the second entity over the second communications channel using the second communications protocol. In some embodiments, the first communications protocol and the second communications protocol are different. In other embodiments, the first communications protocol and the second communications protocol may be the same. The first voice communications channel and the second voice communications channel may be carried over different communications services providers **110**.

[0102] In a further embodiment, a voice call may be forwarded. The central entity may receive the call initiation protocol signal from the first entity, and forward the call to the second entity without answering the call. The call initiation protocol signal from the first entity may be received over the first communications channel using the first communications protocol, while the call may be forwarded to the second entity over the second communications channel using the second communications protocol. In some embodiments, the first communications protocol and the second communications protocol may be different. In other embodiments, the first communications protocol and the second communications protocol may be the same. The first voice communications channel and the second voice communications channel may be carried over different communications services providers **110**.

[0103] FIG. **9** illustrates an exemplary method of providing a communications services interface. The method illustrates how the communications services interface, which may include an example of the communications services interface module **208** discussed herein, may be used by a communications application, which may include an example of the application **206**, to communicate over multiple communications channels. The multiple communications channels may communicate over a network, such as the network **104**.

[0104] In step **902**, the communications services interface module **208** receives a first application function call, which may include an instance of the one or more API calls **220**, from the application **206**. The first application function call may specify a first communications channel to which the first application function call pertains. The first communications channel may be controlled by a first module, which may include a member of the protocol stacks **210**. The first module

may utilize a first module communications protocol to communicate. The first module communications protocol may include any communications protocol supported by the first module.

[0105] In step **904**, the communications services interface module **208** sends a first protocol command, which may include an instance of the protocol commands **224**, to the first module. The first protocol command may be configured to control communications over the first communications channel. The first protocol command may be responsive to, or configured according to, the first application function call received in step **902**. The communications services interface module **208** may monitor a status of the first communications channel. The communications services interface module **208** may send a first status event, which may include an instance of the one or more API events **222**, to the application **206** reporting the status of the first communications channel.

[0106] In step **906**, the communications services interface module **208** receives a second application function call, which may include an instance of the one or more API calls **220**, from the application **206**. The second application function call may specify a second communications channel to which the second application function call pertains. The second communications channel may be controlled by a second module, which may include a member of the protocol stacks **210**. The second module may utilize a second module communications protocol to communicate. The second module communications protocol may be any communications protocol supported by the second module.

[0107] In some embodiments, the first application function call may have a different syntax from the second application function call. In other embodiments, the first application function call and the second application function call may have a same syntax. In some embodiments, the first module may be a different module from the second module. In other embodiments, the first module and the second module may be a same module. In some embodiments, the first module communications protocol may include a different communications protocol from the second module communications protocol. In other embodiments, the first module communications protocol and the second module communications protocol may include a same communications protocol.

[0108] In step **908**, the communications services interface module **208** sends a second protocol command, which may include an instance of the protocol commands **224**, to the second module. The second protocol command may be configured to control communications over the second communications channel. The second protocol command may be responsive to, or configured according to, the second application function call received in step **906**. The communications services interface module **208** may monitor a status of the second communications channel. The communications services interface module **208** may send a second status event, which may include an instance of the one or more API events **222**, to the application **206** reporting the status of the second communications channel.

[0109] In some embodiments, the second protocol command may have a different syntax from the first protocol command. In other embodiments, the second protocol command and the first protocol command may have a same syntax. In some embodiments, the second communications channel may be carried by a different communications services provider, such as an instance of the one or more communications services providers **110**, than the first communications channel. In other embodiments, the second communications channel may be carried by a same communications services provider **110** as the first communications channel.

[0110] FIG. **10** illustrates an exemplary communications device **1000**. The communications device **1000** may comprise the communications device **102** according to some embodiments. The communications device **1000** comprises at least a communications interface **1002**, a processor **1004**, a memory **1006**, and storage **1008**, which are all coupled to a bus **1010**. The bus **1010** provides communications between the communications interface **1002**, the processor **1004**, the memory **1006**, and the storage **1008**.

[0111] The communications interface **1002** may communicate with other communications devices (not shown) via a communications medium **1012**. The processor **1004** executes instructions. The memory **1006** permanently or temporarily stores data. Some examples of the memory **1006** are RAM and ROM. The storage **1008** also permanently or temporarily stores data. Some examples of the storage **1008** are hard disks and disk drives.

[0112] The embodiments discussed herein are illustrative. As these embodiments are described with reference to illustrations, various modifications or adaptations of the methods and/or specific structures described may become apparent to those skilled in the art.

[0113] The above-described components and functions can be comprised of instructions that are stored on a computer-readable storage medium. The instructions can be retrieved and executed by a processor (e.g., processor **1004**). Some examples of instructions are software, program code, and firmware. Some examples of storage medium are memory devices, tape, disks, integrated circuits, and servers. The instructions are operational when executed by the processor to direct the processor to operate in accord with the invention. Those skilled in the art are familiar with instructions, processor(s), and storage medium.

[0114] While various embodiments have been described above, it should be understood that they have been presented by way of example only, and not limitation. For example, any of the elements associated with the application programming interface may employ any of the desired functionality set forth hereinabove. Thus, the breadth and scope of a preferred embodiment should not be limited by any of the above-described exemplary embodiments.

What is claimed is:

1. A method for providing a communications services interface, the method comprising:

receiving a first application function call specifying a first communications channel utilizing a first communications protocol to communicate over a network;

sending a first protocol command to control communications over the first communications channel, the first protocol command being responsive to the first application function call;

receiving a second application function call specifying a second communications channel utilizing a second communications protocol to communicate over the network, the second application function call having a same syntax as the first application function call, the second communications protocol being different than the first communications protocol; and

sending a second protocol command to control communications over the second communications channel, the

second protocol command being responsive to the second application function call.

2. The method of claim **1**, further comprising monitoring a status of the first and second communications channels and reporting an event corresponding to the first or second communications channel.

3. The method of claim **2**, wherein the status of the first and the second communications channels includes a presence status.

4. The method of claim **1**, wherein the first communications protocol includes a cellular telephone voice communications protocol and the second communications protocol includes a voice over internet communications protocol.

5. The method of claim **1**, wherein the first communications channel utilizes a different communications service provider than the second communications channel.

6. The method of claim **1**, wherein the first communications protocol includes a text communications protocol.

7. The method of claim **6**, wherein the second communications protocol includes a voice communications protocol.

8. The method of claim **1**, further comprising controlling streaming video over the network.

9. The method of claim **1**, further comprising controlling streaming audio over the network.

10. The method of claim **1**, further comprising providing a text chat room service providing text communications over the first communications channel and over the second communications channel, wherein the text communications sent over the first communications channel are also sent over the second communications channel.

11. The method of claim **10**, wherein the first communications protocol is different than the second communications protocol.

12. The method of claim **1**, wherein the first communications protocol includes an SIP protocol and the second communications protocol includes an XMPP protocol.

13. A method comprising:

utilizing a first voice communications protocol to provide voice communications between a central entity and a first entity;

utilizing a second voice communications protocol to provide voice communications between the central entity and a second entity, the second voice communications protocol being different from the first voice communications protocol; and

communicatively coupling the first entity and the second entity.

14. The method of claim **13**, wherein the first communications channel and the second communications channel are carried over different communications service providers.

15. The method of claim **13**, wherein the first voice communications protocol includes a cellular service protocol and the second voice communications protocol includes a voice over internet protocol.

16. The method of claim **13**, wherein the first voice communications protocol includes an SIP protocol and the second voice communications protocol includes an XMPP protocol.

17. The method of claim **13**, wherein communicatively coupling the first entity and the second entity includes providing a voice conference service between the central entity, the first entity, and the second entity.

18. The method of claim **13**, wherein communicatively coupling the first entity and the second entity includes transferring a voice call from the first entity to the second entity.

19. The method of claim **13**, wherein communicatively coupling the first entity and the second entity includes forwarding a voice call from the first entity to the second entity.

20. A method comprising:

including an application programming interface function call in an application source code, the application programming interface function call configured to selectively utilize either a first communications protocol or a second communications protocol, the selection of communications protocol to utilize being responsive to a parameter setting of the application programming interface function call, the first protocol and the second protocol being different;

targeting a compiler to compile the application source code into an executable application configured to execute on a first processor;

compiling the application source code into an executable application targeted to execute on the first processor, the compilation being performed using the compiler;

targeting the compiler to compile the application source code into an executable application configured to execute on a second processor; and

compiling the application source code into an executable application targeted to execute on the second processor, the compilation being performed using the compiler.

21. A system for providing communications services comprising:

a communications device including

a transceiver configured to transmit and receive communication signals,

a memory configured to store computer-readable instructions,

a processor configured to

read the computer-readable instructions from the memory,

execute the computer-readable instructions, and

communicate with other communications devices using the transceiver; and

a program including computer-readable instructions stored on the memory, the program being executable by the processor for performing a method for providing a communications services interface, the method comprising:

receiving a first application function call specifying a first communications channel utilizing a first communications protocol to communicate over a network;

sending a first protocol command to control communications over the first communications channel, the first protocol command being responsive to the first application function call;

receiving a second application function call specifying a second communications channel utilizing a second communications protocol to communicate over the network, the second application function call having a same syntax as the first application function call, the second communications protocol being different than the first communications protocol; and

sending a second protocol command to control communications over the second communications channel, the second protocol command being responsive to the second application function call.

22. A computer readable storage medium having stored thereon a program, the program being executable by a processor for performing a method for providing a communications services interface, the method comprising:

receiving a first application function call specifying a first communications channel utilizing a first communications protocol to communicate over a network;

sending a first protocol command to control communications over the first communications channel, the first protocol command being responsive to the first application function call;

receiving a second application function call specifying a second communications channel utilizing a second communications protocol to communicate over the network, the second application function call having a same syntax as the first application function call, the second communications protocol being different than the first communications protocol; and

sending a second protocol command to control communications over the second communications channel, the second protocol command being responsive to the second application function call.

23. The computer readable storage medium of claim **22**, the method further comprising monitoring a status of the first and second communications channels and reporting an event corresponding to the first or second communications channel.

24. The computer readable storage medium of claim **23**, wherein the status of the first and second communications channels includes a presence status.

25. The computer readable storage medium of claim **22**, wherein the first communications protocol includes a cellular telephone voice communications protocol and the second communications protocol includes a voice over internet communications protocol.

26. The computer readable storage medium of claim **22**, wherein the first communications channel utilizes a different communications service provider than the second communications channel.

27. The computer readable storage medium of claim **22**, wherein the first communications protocol includes a text communications protocol.

28. The computer readable storage medium of claim **27**, wherein the second communications protocol includes a voice communications protocol.

29. The computer readable storage medium of claim **22**, the method further comprising controlling streaming video over the network.

30. The computer readable storage medium of claim **22**, the method further comprising controlling streaming audio over the network.

31. The computer readable storage medium of claim **22**, the method further comprising providing a text chat room service providing text communications over the first communications channel and over the second communications channel, wherein the text communications sent over the first communications channel are also sent over the second communications channel.

32. The computer readable storage medium of claim **31**, wherein the first communications protocol is different than the second communications protocol.

33. The computer readable storage medium of claim **22**, wherein the first communications protocol includes an SIP protocol and the second communications protocol includes an XMPP protocol.

34. A method for providing a communications services interface, the method comprising:

receiving a first application function call specifying a first communications channel to communicate over a network;

sending a first protocol command to control communications over the first communications channel, the first protocol command being responsive to the first application function call;

receiving a second application function call specifying a second communications channel to communicate over the network, the second application function call having a same syntax as the first application function call, the second communications channel being carried by a different communications services provider than the first communications channel; and

sending a second protocol command to control communications over the second communications channel, the second protocol command being responsive to the second application function call.

35. A method for providing a communications services interface, the method comprising:

registering a first protocol stack with a communications services interface module;

activating a first communications service using the first protocol stack; and

registering a second protocol stack with the communications services interface module without interrupting operation of the first communications service.

36. The method of claim **35**, wherein the second protocol stack is configured to support a second communications protocol which the communications services interface module did not previously support.

37. The method of claim **35**, further comprising activating a second communications service using the second protocol stack without interrupting operation of the first communications service.

38. The method of claim **35**, further comprising deactivating the second protocol stack without interrupting operation of the first communications service.

39. The method of claim **38**, wherein deactivating the second protocol stack is responsive to availability of communications resources.

40. The method of claim **35**, wherein registering the second protocol stack is responsive to availability of communications resources.

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