US006782413B1

(12) **United States Patent**
Loveland

(10) **Patent No.: US 6,782,413 B1**
(45) **Date of Patent: Aug. 24, 2004**

(54) **DISTRIBUTED CONFERENCE BRIDGE**

(75) Inventor: **Shawn D. Loveland**, Redmond, WA (US)

(73) Assignee: **Microsoft Corporation**, Redmond, WA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/502,849**

(22) Filed: **Feb. 11, 2000**

(51) **Int. Cl.**[7] **G06F 15/16**
(52) **U.S. Cl.** **709/204**; 379/120
(58) **Field of Search** 709/204, 205, 709/206, 207, 232; 379/202, 203, 204, 93.21, 120; 370/265, 266

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,953,159 A * 8/1990 Hayden et al. 370/62
5,590,186 A * 12/1996 Liao et al. 379/210
5,825,858 A * 10/1998 Shaffer et al. 379/120
5,982,870 A * 11/1999 Pershan et al. 379/221
6,005,870 A * 12/1999 Leung et al. 370/466
6,100,882 A * 8/2000 Sharman et al. 345/320
6,236,644 B1 * 5/2001 Shuman et al. 370/261
6,272,214 B1 * 8/2001 Jonsson 379/202
6,339,784 B1 * 1/2002 Morris et al. 709/204
6,424,994 B1 * 7/2002 Pirich et al. 709/205
6,448,978 B1 * 9/2002 Salvador et al. 345/741
6,457,043 B1 * 9/2002 Kwak et al. 709/204
6,501,740 B1 * 12/2002 Sun et al. 370/261

OTHER PUBLICATIONS

General Magic Corporate Site. *PORTICO: Portico Features and Overview.* [web page] 1999; http://www.generalmagic.com/portico/portico_overview.shtml. [Accessed Oct. 5, 1999].
General Magic. *PORTICO: Frequently Asked Questions.* [web page] 1999; http://www.generalmagic.com/portico/portico_faq.shtml. [Access Oct. 5, 1999].

* cited by examiner

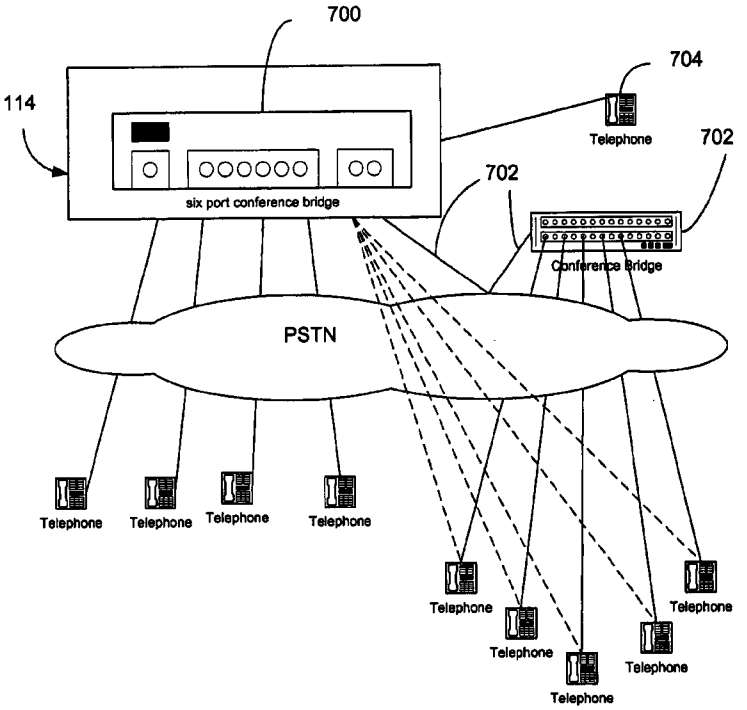
Primary Examiner—Glenton B. Burgess
Assistant Examiner—Kimberly Flynn
(74) *Attorney, Agent, or Firm*—Leydig, Voit & Mayer, Ltd.

(57) **ABSTRACT**

A system is disclosed for enabling communication between server resources and a wide spectrum of end-terminals to enable users access to the resources of both converged and non-converged networks via voice and/or electronically generated commands.

A configurable distributed conference bridge is incorporated within the converged network architecture model of the present invention. The distributed conference bridge enables local conference resources to be utilized and incorporates external service bureau conference bridge resources when needed to supplement the internal conference bridge resources of a system.

17 Claims, 9 Drawing Sheets



Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1019 – 001

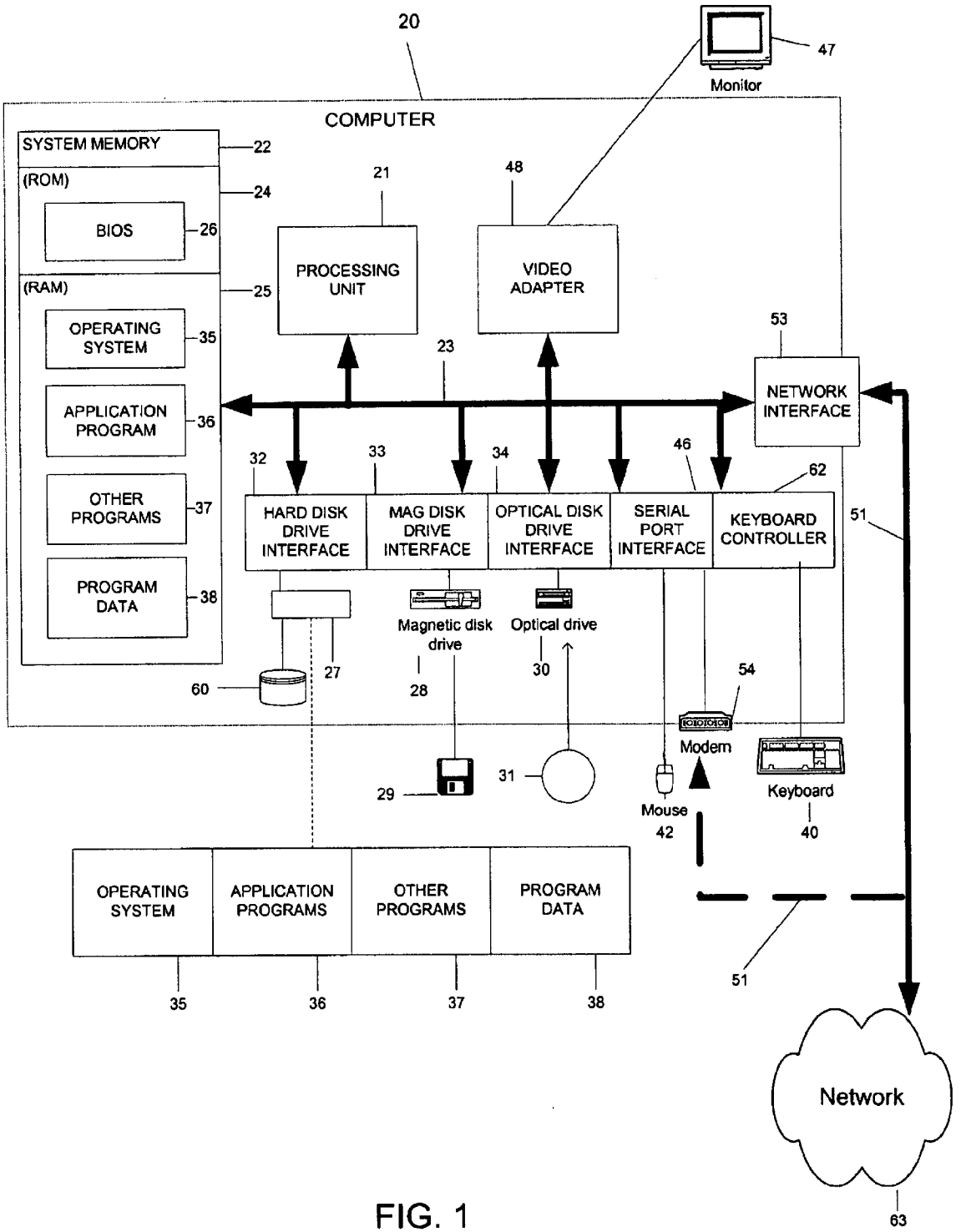

20
Monitor
47
COMPUTER
SYSTEM MEMORY
22
(ROM)
24
BIOS
26
(RAM)
25
OPERATING SYSTEM
35
APPLICATION PROGRAM
36
OTHER PROGRAMS
37
PROGRAM DATA
38
21
PROCESSING UNIT
48
VIDEO ADAPTER
23
53
NETWORK INTERFACE
32
33
34
46
62
HARD DISK DRIVE INTERFACE
MAG DISK DRIVE INTERFACE
OPTICAL DISK DRIVE INTERFACE
SERIAL PORT INTERFACE
KEYBOARD CONTROLLER
51
Magnetic disk drive
Optical drive
60
27
28
30
54
Modem
29
31
Mouse
42
Keyboard
40
OPERATING SYSTEM
APPLICATION PROGRAMS
OTHER PROGRAMS
PROGRAM DATA
35
36
37
38
51
Network
63

FIG. 1

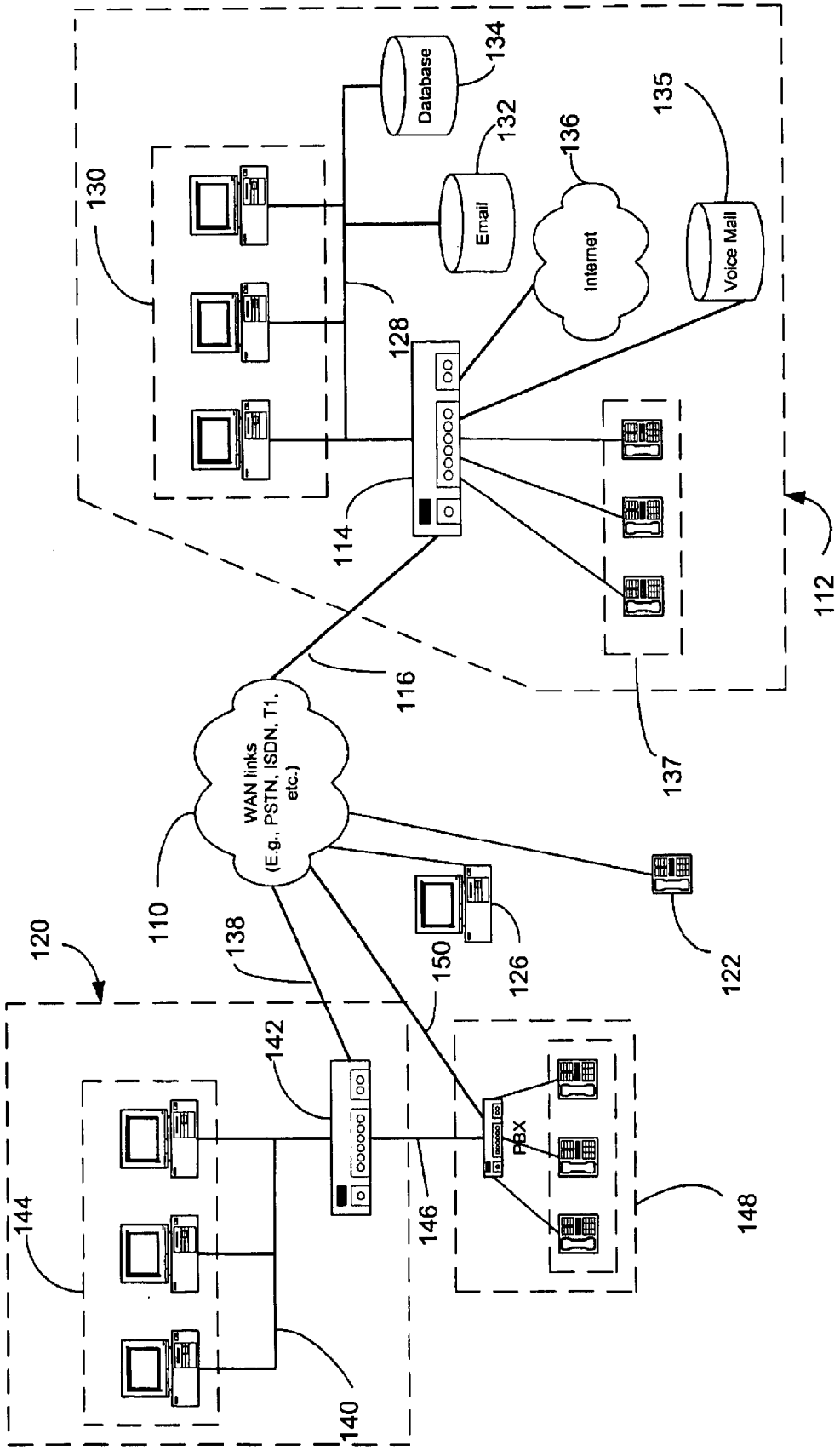

Database
Email
Internet
Voice Mail
WAN links
(E.g., PSTN, ISDN, T1, etc.)
PBX
110
112
114
116
120
122
126
128
130
132
134
135
136
137
138
140
142
144
146
148
150

FIG. 2

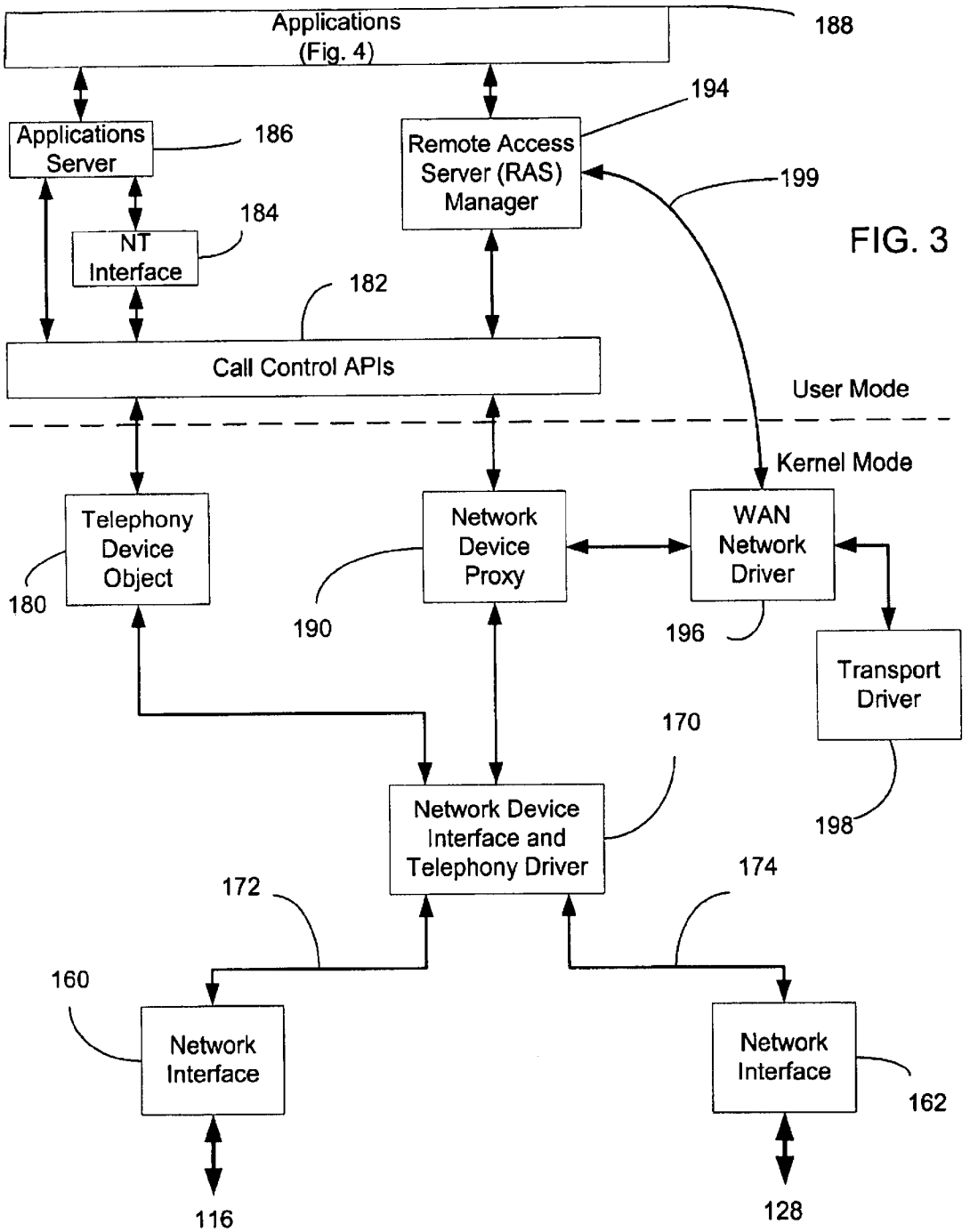

Applications
(Fig. 4)
188
Applications Server
186
Remote Access Server (RAS) Manager
194
199
NT Interface
184
182
Call Control APIs
User Mode
Kernel Mode
Telephony Device Object
180
Network Device Proxy
190
WAN Network Driver
196
Transport Driver
198
170
Network Device Interface and Telephony Driver
172
174
160
Network Interface
Network Interface
162
116
128

FIG. 3

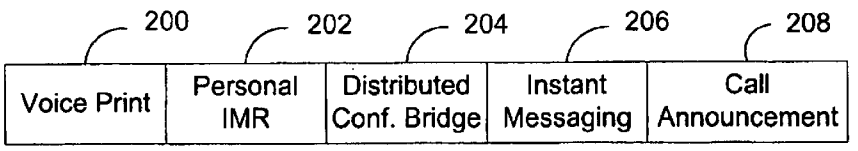

200
202
204
206
208
Voice Print
Personal IMR
Distributed Conf. Bridge
Instant Messaging
Call Announcement

FIG. 4

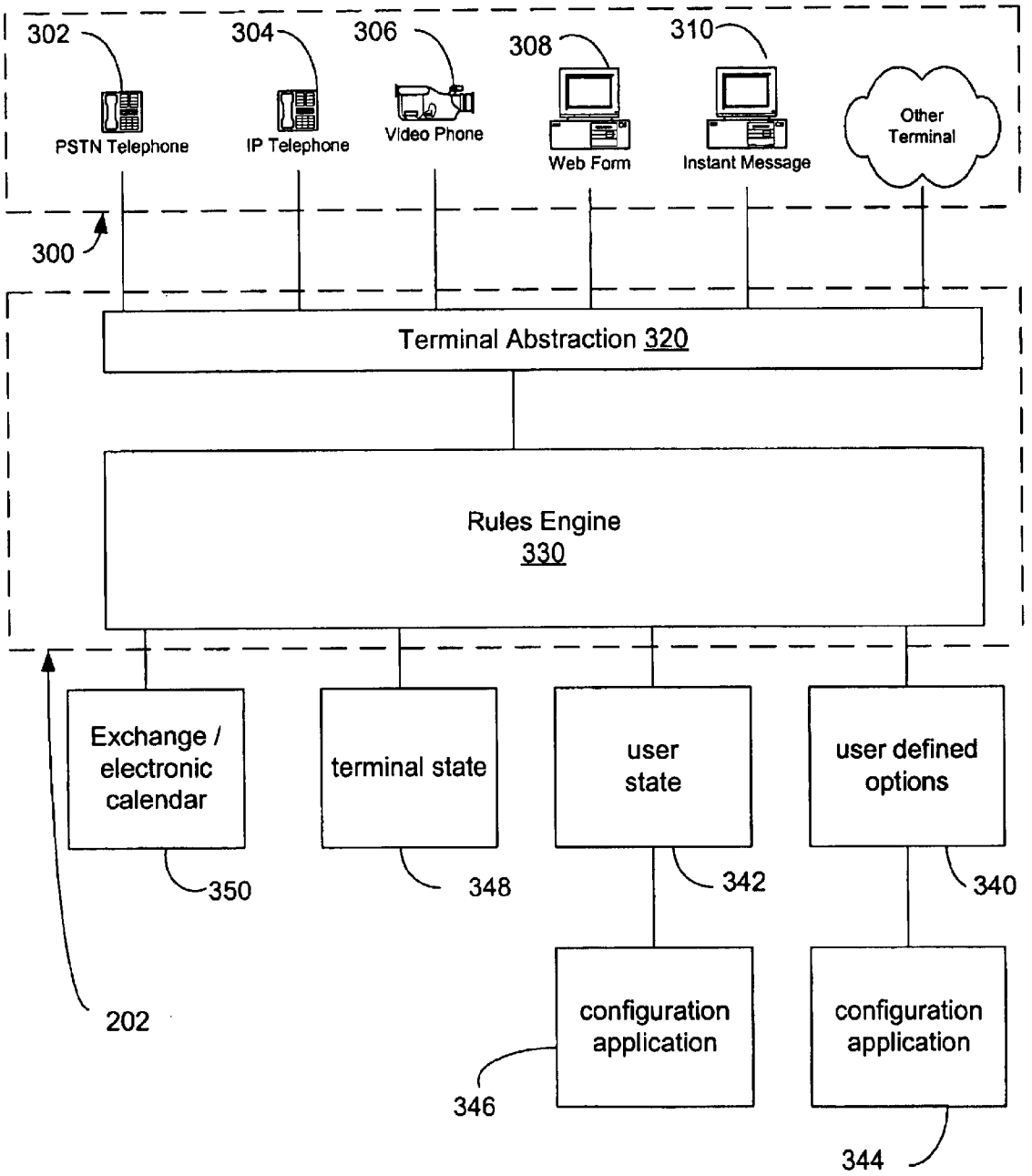

302
304
306
308
310
PSTN Telephone
IP Telephone
Video Phone
Web Form
Instant Message
Other Terminal
300
Terminal Abstraction 320
Rules Engine 330
Exchange / electronic calendar
terminal state
user state
user defined options
350
348
342
340
202
configuration application
configuration application
346
344

FIG. 5

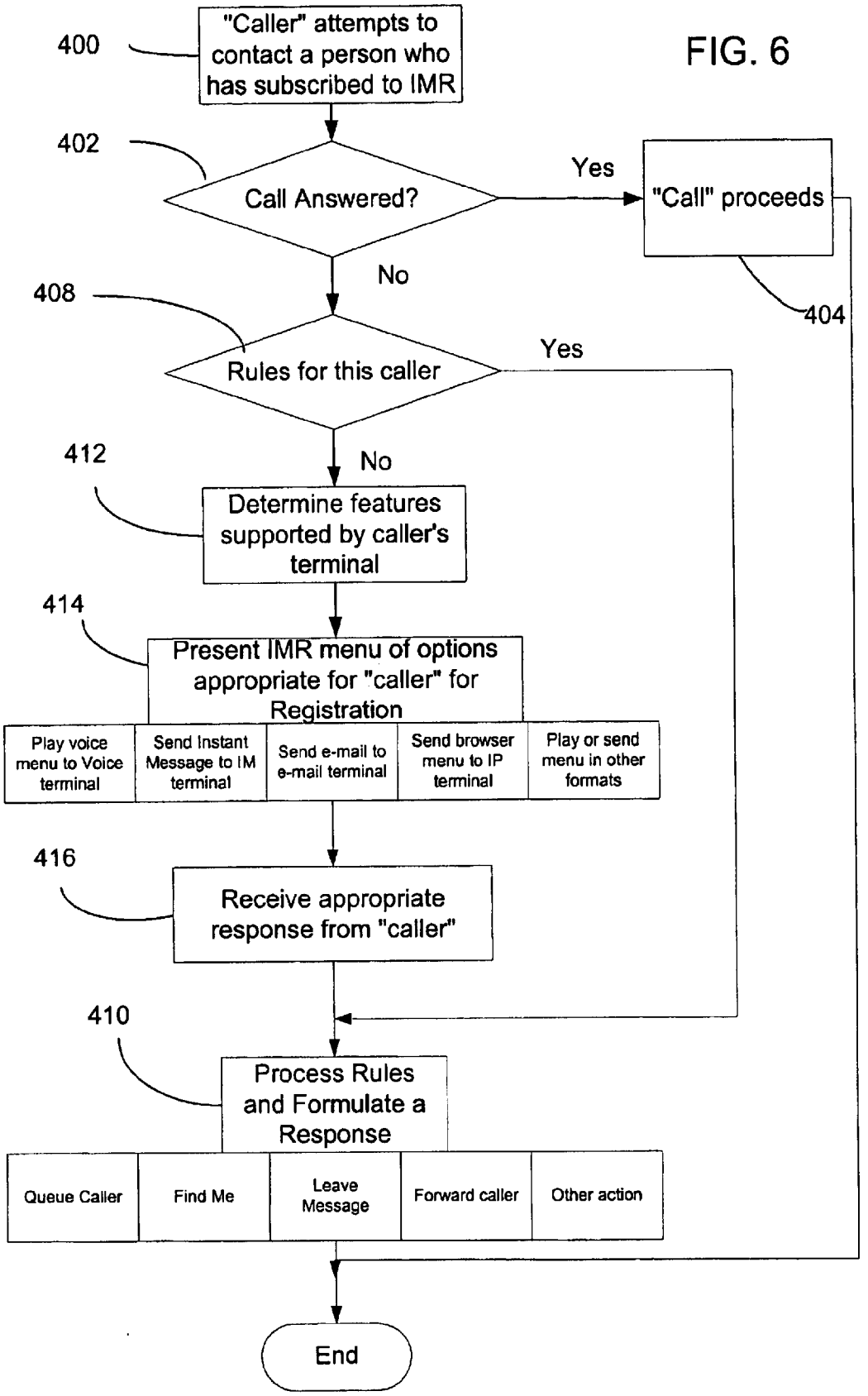


FIG. 6
400
"Caller" attempts to contact a person who has subscribed to IMR
402
Call Answered?
Yes
"Call" proceeds
404
No
408
Rules for this caller
Yes
No
412
Determine features supported by caller's terminal
414
Present IMR menu of options appropriate for "caller" for Registration
Play voice menu to Voice terminal
Send Instant Message to IM terminal
Send e-mail to e-mail terminal
Send browser menu to IP terminal
Play or send menu in other formats
416
Receive appropriate response from "caller"
410
Process Rules and Formulate a Response
Queue Caller
Find Me
Leave Message
Forward caller
Other action
End

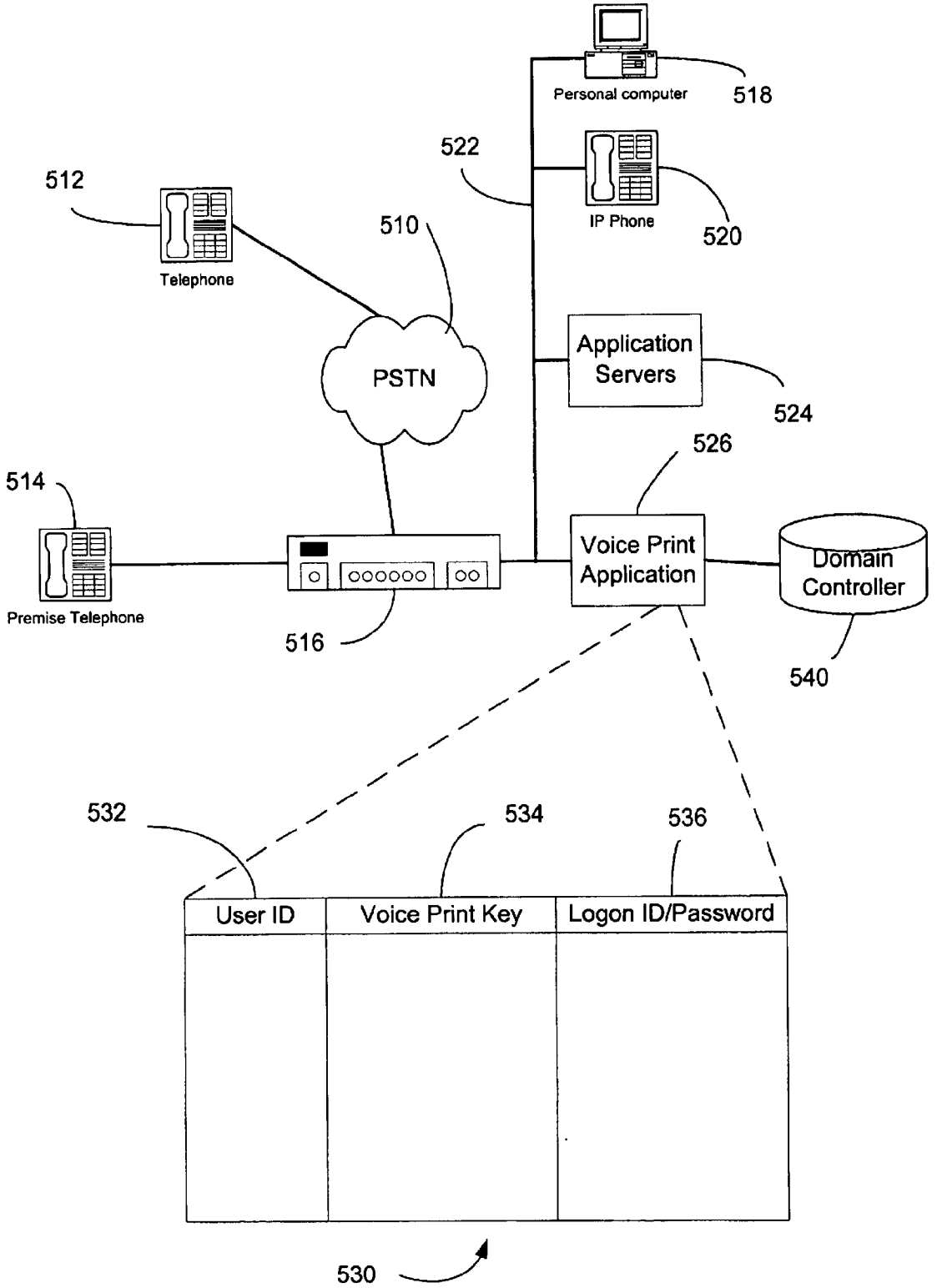

Personal computer
518
522
IP Phone
520
512
Telephone
510
PSTN
Application Servers
524
526
514
Premise Telephone
Voice Print Application
Domain Controller
516
540
532
534
536
User ID
Voice Print Key
Logon ID/Password
530

FIG. 7

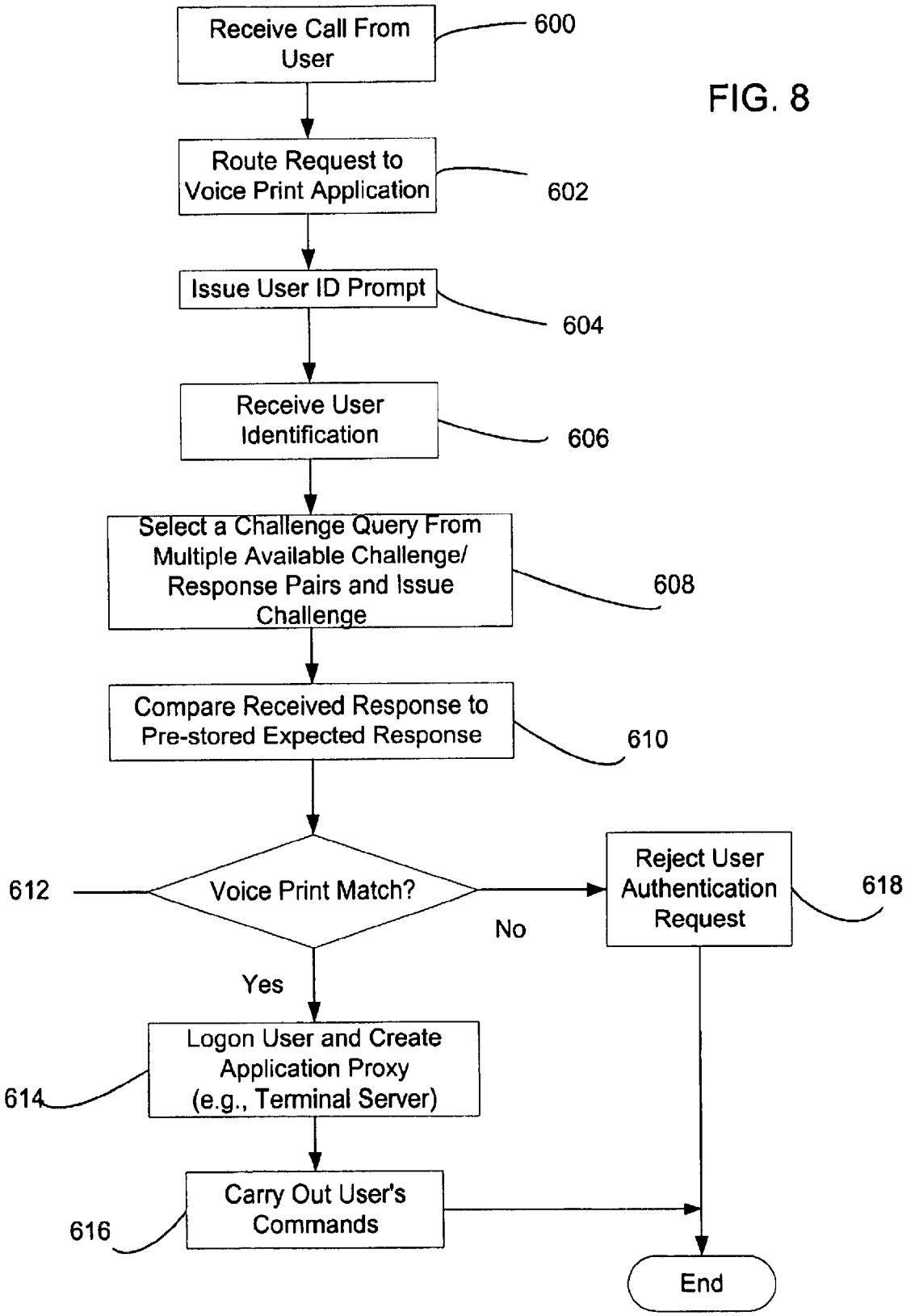

Receive Call From User
600
Route Request to Voice Print Application
602
Issue User ID Prompt
604
Receive User Identification
606
Select a Challenge Query From Multiple Available Challenge/ Response Pairs and Issue Challenge
608
Compare Received Response to Pre-stored Expected Response
610
612
Voice Print Match?
No
Reject User Authentication Request
618
Yes
Logon User and Create Application Proxy (e.g., Terminal Server)
614
Carry Out User's Commands
616
End

FIG. 8

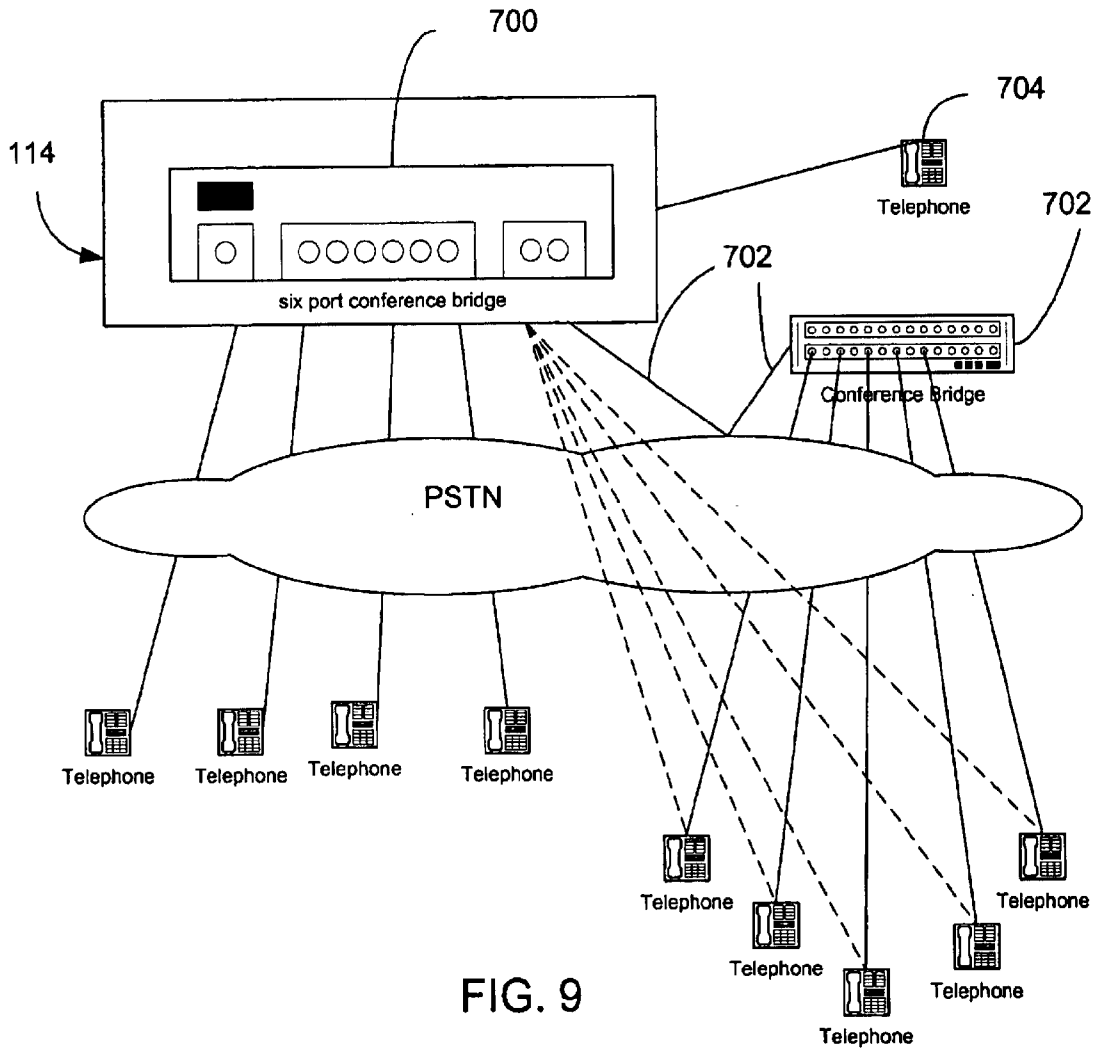

700
704
114
Telephone
702
702
six port conference bridge
Conference Bridge
PSTN
Telephone
Telephone
Telephone
Telephone
Telephone
Telephone
Telephone
Telephone
Telephone

FIG. 9

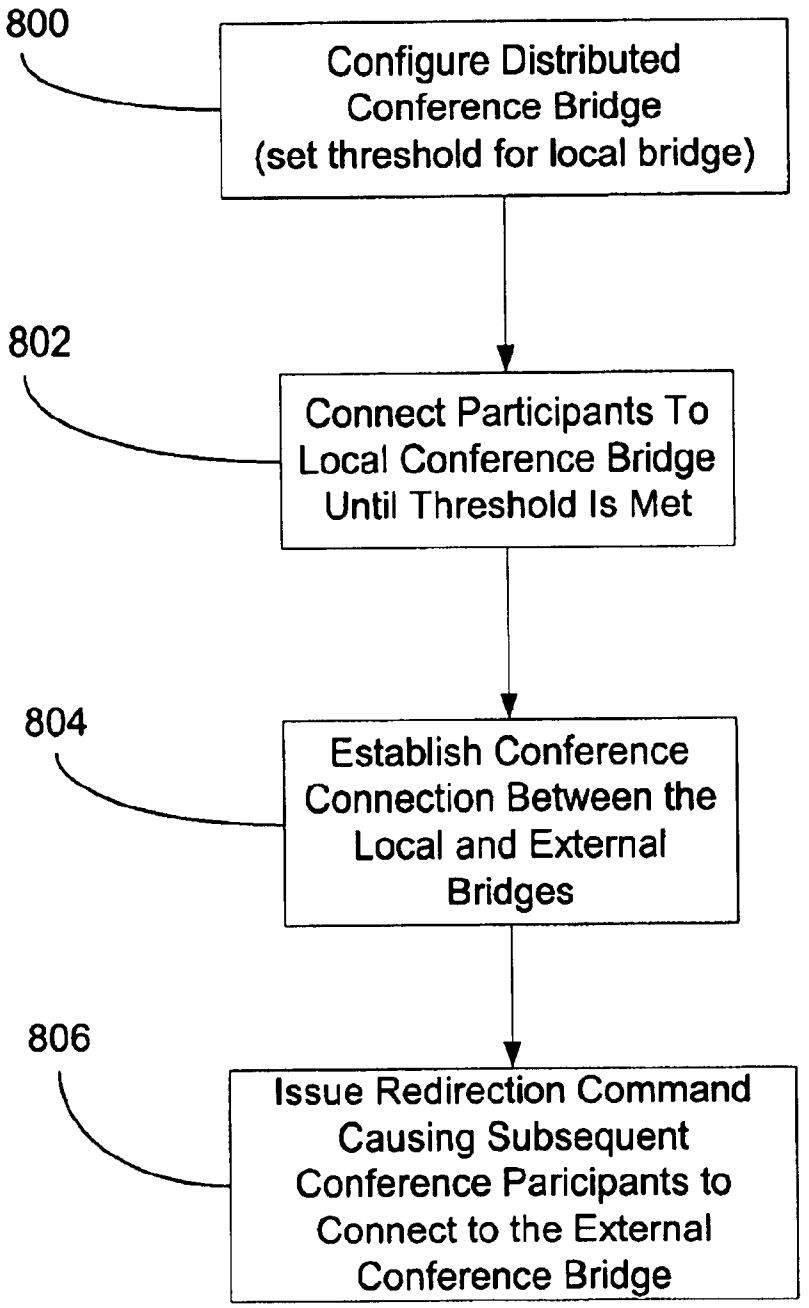

800
Configure Distributed Conference Bridge (set threshold for local bridge)
802
Connect Participants To Local Conference Bridge Until Threshold Is Met
804
Establish Conference Connection Between the Local and External Bridges
806
Issue Redirection Command Causing Subsequent Conference Paricipants to Connect to the External Conference Bridge

FIG. 10

DISTRIBUTED CONFERENCE BRIDGE

AREA OF THE INVENTION

The present invention generally relates to the area of networks for providing telephony and data resources and more particularly to methods and mechanisms for providing access to networked resources via either voice or electronic data communications.

BACKGROUND OF THE INVENTION

The overwhelming majority of access to computer resources today from remote locations has been via remote electronic data communications. There are many forms of such access including for example modems or digital subscriber lines. Remote users communicate with, and access the resources of, a local system via a personal computer or computer appliance, such as for example a palm-sized scaled-down version of a personal computer.

Applications typically support connected computers having graphical user interfaces. However, similar interface functionality is not supported for end-devices having voice user interfaces. As a result, a user's access to the functionality of a particular application or resource is dictated by the manner in which the user accesses the computer system upon which the application or resource resides.

Businesses typically have two systems accessed remotely on a regular basis by their users. A local area network handles data communications, and a private branch exchange (PBX) system handles voice communications. The local area network provides access by users to file and computer applications/servers thereby enabling a user to carry out computer applications on a computer from a remote location. The PBX system enables users to retrieve and respond to voice messages left for the users on the PBX voice mail system. The PBX also enables a remote user to call multiple persons served by the PBX with a single call.

The businesses also include two separate and distinct sets of physical communications lines to their places of business. A first set of lines provide communication links between a public switched telephone network (PSTN) and a private branch exchange (PBX) system including phones and other telephony. A set of PSTN lines terminate at a business site at a PBX connected to a business' internal phone lines. A second set of lines provide links between external data networks and internal local area networks (LANs) for the businesses. Examples of such lines are T1, E1, ISDN, PRI, and BRI.

In recognition of the potential efficiencies arising from converging two physically and operationally distinct networks into a single network, the network technology industry has sought to define and implement a single, converged, network meeting the demands for all types of communications including voice, facsimile, data, etc. As a result, a new telephony/data transmission paradigm is emerging. The new paradigm is based upon a packet-based, switched, multimedia network. Data and voice, while treated differently at the endpoints by distinct applications, share a common transport mechanism.

Convergence presents the opportunity for the creation of applications including communication interfaces that not only support computer-generated commands, but also voice commands from a remote user. It also presents the opportunity to enhance the variety and flexibility of uses for PBX systems.

One aspect of computer systems accessed remotely via voice commands is the implementation of security measures. Voice interfaces present the opportunity for users to connect to a network from virtually any location. Presently, security mechanisms for restricted access systems accessed via telephone typically rely upon users to enter a number on a touch-tone phone to limit access. However, this method is highly susceptible to eavesdropping. Also, the users are often required to enter a long sequence of numbers that can easily be forgotten. A voice-controlled computer system will require speech recognition functionality. Speech recognition programs and associated "training" databases (used to train the software to recognize voice commands from a user) do not guarantee that another user's speech will not invoke protected operations on the computer system. Thus, if the computer system is to be secure, then additional speaker recognition/authentication procedures must be included in the system.

The use of speaker recognition/authentication processes to protect resources in a computer system is known. Such systems have weaknesses that enable imposters to gain access to the computer system. The simplest voice authentication scheme requires a user to speak a password, and the authentication system verifies the user by comparing the spoken password to an existing copy of the password. An obvious weakness to this authentication procedure is that the security system cannot distinguish between whether the user is the source of the vocalized password or it is merely an electronically recorded copy of the user's voice.

One solution to the well known "electronically-recorded" password scheme is to request the user to utter the password multiple times. The multiple utterances, in addition to being compared to the digitally stored vocal password at the computer system site, are compared to one another to ensure that the utterances are sufficiently different from one another to ensure that a recording of the password is not being replayed multiple times by an imposter seeking to gain remote access to protected computer resources. Of course, the imposter can circumvent this safeguard by making multiple recordings of the password spoken multiple times by an authorized user. Furthermore, copies of a single original spoken password can be altered and then stored to create variations from the original.

What is needed is a speaker authentication scheme wherein imposters cannot use a recording of the user's voice to render a valid passwords to gain access to protected computer resources. There exist a number of systems that attempt to overcome the shortcomings of voice-based authentication schemes. Such authentication mechanisms include smart cards, secure ID's, and retina scanners. However, these mechanisms require special hardware at the site from which a user calls.

In accordance with another aspect of a converged wide-area network interface to a computer system, there is an interest to exploit a system wherein telephony and digital data systems share programs and data. Voice-based computer access, described above, is one such effort to exploit converged technology. Once authenticated, a user may access computer resources via voice commands rather than issuing commands by means of a remote computer (e.g., a laptop computer). The user may access a number of applications integrated into the converged local network including databases, file servers, Interactive Voice Response (IVR) servers, call centers, voice mail, PBX hubs/endnodes, and conference bridges.

With regard to the last of the listed potential applications, it is noted that conference bridges are generally imple-

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1019 – 011

mented today in two ways. One way is to purchase a Conference Bridge with certain capacity. It is then used as a fixed resource like a physical conference room. If a conference bridge has 24 ports it can support one 24-user conference call. It could also support three eight-port conference calls.

Extending the size of a conference via external conference bridging is a challenge to coordinators of a conference. A second conference phone number has to be forwarded to each of the participants who is to be bridged into the conference via the external bridge. Then the external conference bridge calls in to the internal conference bridge. Alternatively, callers could call a number that is received by the PBX handling the conference which in turn forwards the call to an external conference bridge. However, each forwarded call uses two trunks in the PBX system.

Another option is to subscribe to a conference bureau. A bureau is a service that supplies an external conference bridge (and number to call into the bridge). The bureau typically charges a customer based upon the number of users and the duration of the use of the bridge (e.g., per user-minute). External bridges allow for more dynamic meetings however the cost for utilizing external bridges on a regular basis is substantial.

SUMMARY OF THE INVENTION

The present invention seeks to exploit the convergence paradigm and/or the ability to communicate with a wide spectrum of end-terminals to enable users access to the resources of both converged and non-converged networks via voice and/or electronically generated commands. For example, an electronic personal assistant (ePA) incorporates generalizing/abstracting communications channels, data and resources provided through a converged computer/telephony system interface such that the data and resources are readily accessed by a variety of interface formats including a voice interface or data interface. A set of applications provide dual interfaces for rendering services and data based upon the manner in which a user accesses the data. An electronic personal assistant in accordance with an embodiment of the invention provides voice/data access to web pages, email, file shares, etc.

The electronic personal assistant enables a user to transmit voice commands to a voice-based resource server to provide information accessible to the resource server. In accordance with an aspect of an embodiment of the invention, a user is authenticated by receiving vocal responses by a user to one or more requests variably selected and issued by a speaker recognition-based authentication facility—thereby ensuring that every time a user logs into the network there is a unique challenge response to gain access to the network resources. A spoken response is compared to one or more stored voice samples previously provided by the user during an enrollment procedure. If the spoken response is sufficiently close to the one or more stored voice samples, then the user is authenticated as a domain user or logged onto the local system. The voice-based authentication facility enables a user to log in to a computer without the aid of a keyboard, smart card or such. This would work in a kiosk environment. Thereafter, an application proxy is created. The application proxy acts on behalf of the authenticated authorized user.

In accordance with particular aspects of the specific embodiments of the invention, a set of remotely accessed voice applications are provided. One such application comprises a personal interactive multimedia response (IMR). Each user configures a personal IMR system. In a converged network environment, the user is provided access to the IMR through a personal computer interface, web interface, instant message, e-mail, as well as a voice user interface over a telephone connection.

A configurable distributed conference bridge is another potential application incorporated within the converged network architecture model of the present invention. The distributed conference bridge enables local conference resources to be utilized and incorporates external service bureau conference bridge resources when needed to supplement the internal conference bridge resources of a system. This may or may not require any user intervention to create the bridged conference bridge. The dynamically configurable extensible conference bridge application supports standard voice conference calls, multimedia conference calls, and blended conference calls. As a consequence a customer need not provision in-house conference bridge resources, switch resources, or trunks for a worst case scenario and the conference bridge may be used on a more ad hock basis since it can dynamically grow to meet the demands of the conference.

In accordance with an aspect of a preferred embodiment of the conference bridge application, in addition to manual call set-up with regard to the overflow connections to the external bridge, the conference bridge application supports automatic redirecting head end conference phone numbers utilizing remote call forward, QSIG, PINT, and/or in-band signaling.

BRIEF DESCRIPTION OF THE DRAWINGS

While the appended claims set forth the features of the present invention with aa particularity, the invention, together with its objects and advantages, may be best understood from the following detailed description taken in conjunction with the accompanying drawings of which:

FIG. **1** is a block diagram schematically depicting an exemplary computer system for incorporating the terminal abstraction architecture and carrying out the electronic personal assistant and voice print operations in accordance with a preferred embodiment of the present invention;

FIG. **2** is a schematic drawing depicting an exemplary network environment, including a converged network supporting both voice and data communications over a same network interface, into which the present invention may be incorporated;

FIG. **3** is a schematic drawing of an exemplary interface between a public and a private network for implementing an embodiment of the present invention;

FIG. **4** is a diagram identifying a set of voice-based applications supported on a private network in accordance with an embodiment of the present invention;

FIG. **5** is a block diagram depicting the components of a personal interactive multimedia application;

FIG. **6** is a flowchart summarizing the steps of a personal IMR application;

FIG. **7** is a schematic diagram depicting components within a converged computer system for facilitating voice-based authentication of a user;

FIG. **8** summarizes the steps performed by an interface server/controller in accordance with a voice print application to determine whether to grant access to network resources to which access is selectively provided to authenticated authorized users;

FIG. **9** is a schematic depiction of a distributed conference bridge; and

FIG. **10** is a flowchart summarizing the steps performed to create a distributed conference bridge.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Turning to the drawings, wherein like reference numerals refer to like elements, the invention is illustrated as being implemented in a suitable computing environment. Although not required, the invention will be described in the general context of computer-executable instructions, such as programs, being executed by a computer or similar device. Generally, programs include routines, other programs, objects, components, data structures, dynamic-linked libraries (DLLs), executable code, etc. that perform particular tasks or implement particular abstract data types. Moreover, those skilled in the art will appreciate that the term "computer" is not meant to limit the invention to personal computers, as the invention may be practiced on multiprocessor systems, network devices, minicomputers, mainframe computers, computer appliances, and the like. The invention may also be practiced in distributed computing environments where tasks are performed by physically distinct processing devices that are communicatively linked. In a distributed computing environment, parts of a program may be located in both local and remote memory storage devices.

With reference to FIG. **1**, an exemplary system for implementing the invention is shown. As best shown in FIG. **1**, the system includes a general purpose computer in the form of a conventional computer **20**, including a processing unit **21**, a system memory **22**, and a system bus **23** that couples various system components including the system memory to the processing unit **21**. The system bus **23** may be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. The system memory may include read only memory (ROM) **24** and random access memory (RAM) **25**. A basic input/output system (BIOS) **26**, containing the basic routines that help to transfer information between elements within the computer **20**, such as during start-up, may be stored in the ROM **24**. The computer **20** may further include a hard disk drive **27** for reading from and writing to a hard disk **60**, a magnetic disk drive **28** for reading from or writing to a removable magnetic disk **29**, and an optical disk drive **30** for reading from or writing to a removable optical disk **31** such as a CD ROM or other optical media.

If included in the computer **20**, the hard disk drive **27**, magnetic disk drive **28**, and optical disk drive **30** may be connected to the system bus **23** by a hard disk drive interface **32**, a magnetic disk drive interface **33**, and an optical disk drive interface **34**, respectively. The drives and their associated computer-readable media provide nonvolatile storage of computer readable instructions, data structures, programs and other data for the computer **20**. Although the exemplary environment described herein employs a hard disk **60**, a removable magnetic disk **29**, and a removable optical disk **31**, it will be appreciated by those skilled in the art that other types of computer readable media which can store data that is accessible by a computer, such as magnetic cassettes, flash memory cards, digital video disks, Bernoulli cartridges, random access memories, read only memories, and the like may also be used in the exemplary operating environment.

A number of programs may be stored on the hard disk **60**, magnetic disk **29**, optical disk **31**, ROM **24** or RAM **25**, including an operating system **35**, one or more applications programs **36**, other programs **37**, and program data **38**. A user may enter commands and information into the computer **20** through input devices such as a keyboard **40**, which is typically connected to the computer **20** via a keyboard controller **62**, and a pointing device, such as a mouse **42**. Other input devices (not shown) may include a microphone, joystick, game pad, satellite dish, scanner, or the like. Input devices as well as peripheral devices may be connected to the processing unit **21** through a serial port interface **46** that is coupled to the system bus, a parallel port, game port, universal serial bus (USB), 1394 bus, or other interfaces. A monitor **47** or other type of display device is also connected to the system bus **23** via an interface, such as a video adapter **48**. In addition to the monitor, computers typically include other devices not shown, such as speakers and printers.

The computer **20** operates in a networked environment using logical connections to one or more devices within a network **63**, including by way of example personal computers, servers, routers, network PCs, a peer device or other common network node. These devices typically include many or all of the elements described above relative to the computer **20**.

The logical connections depicted in FIGS. **1** and **2** include one or more network links **51**, for which there are many possible implementations, including local area network (LAN) links and wide area network (WAN) links. Such networking links are commonplace in offices, enterprise-wide computer networks, intranets and the Internet. It will be appreciated that the network connections shown are exemplary and other means of establishing a data path between the computers may be used. When used in a LAN, the computer **20** may be connected to the network **63** through a network interface or adapter **53**. When used in a WAN, the computer **20** typically includes a modem **54** or other means for establishing communications over the network link **51**, as shown by the dashed line in FIG. **1**. The network link **51** may also be created over public networks, using technologies such as dial-up networking, the Internet, Digital Subscriber Line (DSL), Asynchronous Transfer Mode (ATM), Virtual Private Network (VPN) or any other conventional communication method. The modem **54** may be connected to the system bus **23** via the serial port interface **46**, and may be external or internal. In a networked environment, programs depicted relative to the computer **20**, or portions thereof, may be stored on other devices within the network **63**.

In the description that follows, the invention will be described with reference to acts and symbolic representations of operations that are performed by one or more computers, unless indicated otherwise. As such, it will be understood that such acts and operations, which are at times referred to as being executed, include the manipulation by the processing unit of the computer of electrical signals representing data in a structured form. This manipulation transforms the data or maintains it at locations in the memory system of the computer, which reconfigures or otherwise alters the operation of the computer in a manner well understood by those skilled in the art. The data structures where data is maintained are physical locations of the memory that have particular properties defined by the format of the data. However, while the invention is being described in the foregoing context, it is not meant to be limiting as those of skill in the art will appreciate that various of the acts and operation described hereinafter may also be implemented in hardware.

Turning now to FIG. **2**, a schematic diagram depicts components of an exemplary communications network envi-

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1019 – 013

ronment for incorporating an architecture wherein multiple types of user interfaces, including voice and graphical, are supported for individual applications and other computer resources residing on a networked system. Support for multiple types of user interfaces is provided by a terminal abstraction interposed between remote terminals having various user interfaces and individual applications and other computer resources on the networked system. The terminal abstraction, comprising a set of modules corresponding to user interface types, enables similar functionality to be provided by applications and resources to an extensible set of end-devices having differing user interfaces connected via a wide area network (WAN) **110** including by way of example any one or more of a set of linking networks such as a public switched telephone network (PSTN), integrated services data network (ISDN), T1, etc.

The converged computing/communications environment depicted in FIG. **2** includes a local network **112**. In the local network **112**, PSTN voice, IP voice, e-mail, instant messaging, video, fax, IP Fax, and data calls are blended together and passed through one routing/rules engine within a network interface/server **114**. A converged communications link **116** connects the network interface/server **114** to the WAN **110**. The converged communications link **116** supports both voice and data communications between the local network **112** and the WAN **110**. While only a single link **116** is shown in FIG. **2** for the network interface/server **114**, the network interface/server **114** also includes standard telephony interfaces which the network interface/server **114** utilizes to communicate over the PSTN via ordinary phone trunk lines.

The WAN **110** in turn provides wide area links to a variety of connected end-devices including, by way of example, a local area network **120**, a public telephone **122**, a facsimile machine, an Internet telephone, and a personal computer **126**. The network interface/server **114** passes packets of information for voice phone conversations, voice mail, email, internet phone, video phone, fax, remote data access, remote service access, etc. In accordance with the connection processing architecture of the present invention, for a particular application, data and voice calls are directed to a terminal abstraction that communicates with the application according to an end-device independent format. Communications between the terminal abstraction and the application are not distinguished by the mode of access by an end-device to the application.

With regard to the local network **112**, a link **128** connects the network interface/server **114** to an Ethernet link **128** of a local computer network including a set of computing devices **130**. The computing devices **130** comprise, for example, personal computers, servers, client terminals and workstations. FIG. **2** explicitly shows two such servers, i.e., an email server **132** and a database server **134**. The network interface/server **114** is also coupled to a voice mail system **135** and includes a link to the Internet **136**. While not shown in FIG. **1**, those skilled in the art will appreciate that the network interface/server **114** is physically coupled to links **116** and **128** via network interfaces including hardware and software adapted to transmit and receive data in accordance with the communications protocol for the associated links **116** and **128**.

In accordance with the spectrum of communications supported by the network interface/server **114**, the network interface/server **114** acts as a PBX hub and supports connections to a set of telephony equipment including telephones **137**, facsimile machines, etc. via a variety of link types including, ordinary telephone lines, Ethernet, ATM, or even a wireless communication link. The network architecture of the local network **112** is merely exemplary. While the PBX functionality is built into the network server/interface **114** in the present example, a separate PBX hub may be located external to the network server/interface **114**. The actual hardware configuration of a network or system embodying the present invention will be based upon choices of system hardware providers and the customers that utilize systems embodying the present invention. However, in accordance with an embodiment of the present invention, a terminal abstraction, a software entity, is interposed between an application and an end-terminal device that is communicating with the application.

The local area network **120**, connected to the WAN **110** via link **138** includes network components similar to those of the first private network **112**. Link **138** is connected to a computer network data interface/server **142**. However, in contrast to the network interface/server **114**, the link **138** between the WAN **110** and the computer network data interface/server **142** supports only data calls (i.e., voice telephone calls are not supported). However, while only a single link **138** is shown in FIG. **2** for the network interface/server **142**, the network interface/server **142** may comprise multiple physical lines including multiple phone trunk lines to communicate over the PSTN.

An Ethernet link **140** connects the computer network data interface/server **142** to computing equipment **144**. Computer network data interface/server **142** is connected via link **146** to telephony equipment **148** (including a PBX hub and telephones). Since the link **138** does not support voice calls, a trunk line **150** connects the PBX of the telephony equipment **148** to the public switched transmission network of the WAN **110**. The PBX hub of the telephony equipment **148** includes functionality enabling applications within the local area network **120** to interface with voice-based end devices via link **146**.

The links **116** and **138**, in accordance with an embodiment of the present invention, are circuit switched. In other words, any particular connection supported by the links **116** and **138** is assigned a channel or channels (or a range of bandwidth) from a set of available channels (or bandwidth ranges). However, in alternative embodiments of the present invention, connections via links **118** and **138** are identified within transmitted packets rather than assigning a particular channel. Thus the local networks **112** and **120** may incorporate either circuit or packet switching.

FIG. **2** depicts an exemplary network configuration; however, those skilled in the art will readily appreciate from the disclosure herein that a multitude of network configurations incorporating the present invention are possible. In fact, convergence of data and voice communications expands the possibilities for potential networks that are not confined by the type of end devices (e.g., phone, computer, fax machine, instant messaging) connected to the network or even a same link on a network—such as both voice and data nodes on a single Ethernet link.

Text to speech (TTS) and speech to text (STT) converters play an important role in systems incorporating both voice and electronic (e.g., networked computer) modes of user access to applications incorporating the terminal abstraction architecture. User interaction, via audible commands and responses, with a variety of applications (e.g., databases) is rendered by TTS and STT converters within or coupled to the network interface/server **114**. The TTS converter enables applications executing within the local area network **112** to transmit human understandable speech signals to a phone

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1019 – 014

receiver used by a remote user thereby enabling the applications to communicate information to the remote users via audible sounds. The STT converter, employing speech recognition technology, enables a user to issue vocal commands and provide information by speaking commands into the receiver of a phone or through a voice command interface of a multimedia personal computer or a host-based server supporting various numbers of users simultaneously. The TTS and STT converters enable a user to communicate with the resources of the local area network **112** even if the user does not have a computer to receive and interpret a digitally encoded message. Alternatively, the user may submit commands via touch tone signals.

A network interface need not be converged to support both vocal and electronic data commands from a remote user. In an alternative embodiment, a network interface is non-converged and a user accesses resources within a data network via voice and/or touch-tone commands by means of the TTS converter and the STT converter. Finally, it is noted that a number of individually identified network entities depicted in FIG. **2** can be incorporated into a single hardware component. For example, a private branch exchange, database, and special purpose servers (e.g., email, voicemail, etc.) may be incorporated into the network interface/server **114** assuming that the processor could handle the aggregate processing load without degrading the expected level of performance of the network interface/server **114**.

Furthermore, the system hardware and software can be owned and managed in a variety of manners. For example the entire system can be customer owned and managed, customer owned and managed by third parties, owned and managed by a third party offering IP Centrex services, or an ISP offering the service(s) in conjunction with an IP Centrex company.

Having described a general network environment within which the present invention may be deployed, attention is directed to FIG. **3** which schematically depicts functional components of an exemplary computer network data interface/server (i.e., communications server), such as network interface/server **114** embodying the present invention. The network interface/server **114** is physically coupled to links **116** and **128** via network interfaces **160** and **162**. The hardware and software in network interfaces **160** and **162** conform to the protocols of corresponding links **116** and **128**. The network interfaces **160** and **162** comprise multiple replicas of individual network cards to support multiple lines, such as telephone system trunk lines connecting the network interface/server **114** to the PSTN. Other interfaces, that have not been depicted in FIG. **2**, support the connection of phone lines for the local phones **137** to the PBX system within the network interface/server **114**.

Each of the network interfaces **160** and **162** is communicatively coupled, via software and/or hardware links **172** and **174** respectively, to a multipurpose driver **170** supporting both data and telephony connections. Data calls are calls that do not communicate via audible speech commands. Voice calls involve spoken commands and information. Data calls include, by way of example, Internet multimedia, video, Fax, IP telephony, e-mail, web forms, and web events. The multipurpose driver **170** utilizes unique identification information to distinguish between voice calls and data calls and route the calls accordingly to higher level programs and processes.

Voice call connection requests are routed by the multipurpose driver **170** to a telephony device object **180**. The telephony device object **180** passes the requests to call control application program interfaces (APIs) **182**. The call control APIs **182** pass the requests to higher level processes in the user level of the network interface/server **114** to perform application-specific operations. More particularly, the requests submitted via a voice call connection are passed by the call control APIs **182** to a voice call applications server **186**. The voice call applications server **186** determines the nature of the request and invokes a particular application from a set of applications **188** registered with the voice applications server **186**.

In accordance with a preferred embodiment of the present invention, one or more of the set of applications **188** support multiple modes of access via various terminal types. The support of multiple terminal types is facilitated by a terminal abstraction comprising interface models defining a variety of user interfaces for a variety of distinct modes of accessing corresponding applications. As a result, the applications are able to present their functionality (e.g., a schedule planner, email, a database, etc.) to connected users via a number of distinct modes of access. The different modes of access result from the use of unconventional end-terminal types (i.e., other than personal computers) to communicate with the applications and request the resources provided by the applications. Such unconventional end-terminal types include, by way of example, a cellular phone (including potentially a graphical or text interface), a palm-sized computer, computer appliance, and an ordinary telephone. In each instance a typical user interface cannot be supported by the end-terminal due to computational power limitations as well as, in some instances the absence of any visual display. Terminal abstraction modules are discussed in greater detail herein below with reference to FIG. **5**, a schematic depiction of a particular example of an application (an interactive multimedia response system) that incorporates the terminal abstraction architecture for supporting multiple modes of access.

The terminal abstraction, conceptually an interface layer between functional components of an application and user terminals, can be either tightly integrated with a particular application or be provided as a generic/universal entity with a defined interface to which applications make calls during the course of execution of the applications. Thus, in certain embodiment of the present invention, the terminal abstractions are a part of specific applications. In other embodiments of the present invention, the terminal abstraction is at least partially carried out by system-level functions having standard interface definitions thereby significantly reducing the size and complexity of the applications that utilize them and thus reducing the programming effort involved in developing applications supporting multiple modes of access.

During the course of operation, the applications **188** pass requests to the voice applications server **186**. The voice applications server **186** reformulates the request if necessary and passes the reformed request in the form of a system request to an NT Interface **184**. The NT Interface **184** passes commands to the call control APIs **182** which pass the requests, in the form of system commands, to the WINDOWS NT operating system (or a suitable alternative operating system). Examples of system commands used to support the voice applications include lineAddProvider, lineClose, lineDrop, lineGetID, and lineMakeCall. Those skilled in the art will readily appreciate that a number of other general system commands can used to support execution of the voice applications **188** in view of the disclosure herein.

Both data calls and voice calls are initially routed to a network device proxy **190**. At the commencement of a call,

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1019 – 015

the network device proxy **190** routes the call to the call control APIs **182** including for example TAPI. Processes and tables within the call control APIs **182** in cooperation with a remote access service (RAS) manager **194** register the call, and in the case of data calls potentially create additional connections based upon the throughput requested for the data call and the availability of additional channels on the link **116**.

After registering the call and allocating the proper number of channels to the call, control of the remainder of the call session is directed to application-specific processes. In the case of a voice call, the call is directed to the telephony device driver **180** that, in turn, directs the call to a particular application in the manner described previously above. In the case of a data call, the call is directed from the network device proxy **190** to a wide area network/network device interface **196**. While in the data connection mode, the WAN/network device interface **196** calls a transport layer driver **198** and thereafter executes the call by direct calls to the RAS manager **194** via path **199**. The RAS manager **194** in turn accesses the applications **188**.

Turning now to FIG. **4**, a set of voice applications are identified from the applications **188** generally identified in FIG. **3**. The applications identified in FIG. **4**, and others identified herein below, are provided collectively in the form of an electronic personal assistant that combines access to computer and telephony resources into a single extensible data and resource access system. In accordance with an embodiment of the present invention, one or more of the applications provide at least a graphical user interface facilitating user access via personal computers and a voice user interface for access to the resources of the electronic personal assistant via ordinary telephones. It is noted that the list of applications identified in FIG. **4** and recited herein is not exhaustive, and thus those skilled in the art will readily appreciate that additional applications may be added to, and even ones of the recited applications removed from, the electronic personal assistant without departing from the present invention.

A voice print application **200**, a security mechanism, enables an authorized user to call into the network interface/server **114** (or in general a communications server) from any phone or other terminal device having a suitable voice signal transducer, including for example a personal computer having a microphone input, and be authenticated by properly responding to a set of authentication queries by the voice print application **200**. The voice print application **200** utilizes a variable challenge/response scheme to confound imposters seeking to gain access using a recorded version of an authentic user's vocal response to a static query. The challenge/response scheme embodied within the voice print application **200**, described herein below in conjunction with FIGS. **7** and **8**, comprises variably issuing one or more queries, from a set containing multiple potential challenges, to an authorized user to obtain a voice sample for authentication of the user during logon.

Use of the voice print application **200** is not limited to remote calls. The voice print application **200** is intended for use at any terminal including a suitable voice transducer. Therefore, the voice print application **200** may also be used, by way of example to logon to a standalone computer or a local area network to gain access to restricted resources contained therein.

Users are preferably able to access the electronic personal assistant from a variety of end-terminal devices having different voice transducers, including ordinary telephones, cellular phones, wireless transmitters, and personal computer microphones. The potential to access the electronic personal assistant from a variety of terminals and connections of varying quality presents the need to ensure that a user's vocal logon attempt is not rejected merely because a different voice transducer or bad connection created differences between a training sequence and a query response. Preferably, sufficiently robust voice match procedures, known to those skilled in the art of voice-based user identity verification, are carried out during the comparison operation to reliably generate a positive match result when a proper user accesses the electronic personal assistant. Fail-safe authentication procedures for authentication provide fall-back mechanisms for instances where a user's voice is improperly rejected due to changes in the user's voice because of a cold or a poor phone connection.

A personal IMR application **202** enables an authorized user to configure a customized interactive multimedia response system that is unique to the user's phone (or any other end-terminal suitable for receiving calls) It is noted that in the context of the disclosed and claimed invention, a "call" generally encompasses an event involving one entity (e.g., person) initiating contact with another entity (e.g., person) without regard to a particular mode of communication. Examples of various call types include: voice calls, e-mail, or instant messages executed using a variety of computers/appliances. In known phone systems, a single voice response system definition (a set of response rules) is applied to an ACD (automated call distributor) or to the company's head number to route voice telephone calls to specific numbers or a queue. In contrast, in accordance with an embodiment of the present invention, a database within the network interface/server **114** supports a distinct IMR configuration for each phone or other callable end-terminal in a PBX system (including converged networks). Other callable end-terminals include by way of example IP phones and applications within networked computers.

In addition to individual custom configuration, another feature of the personal IMR application **202** is the flexible/extensible multimedia nature of the personal IMR application **202**. The personal IMR application **202** receives communications, including phone calls and electronic messages (e.g., email), in a variety of formats and routes the communications to a variety of destinations according to a set of rules defined for the particular recipient of the communications. A rules engine attempts to establish communication between the two users via the best method available. For example Person A calls Person B. Person B has set the find me status to out of the office. Person B's out-of-the-office device is a two-way pager capable of receiving pages, e-mail, and instant messages. The IMR system attempts to determine the capabilities of Person A's terminal either through querying the device directly or asking the user interactively through an interactive voice response menu. For example if Person A's terminal (a phone) is a phone capable of sending instant messages, the IMR will establish an instant messaging (IM) session between the two users. If Person A's terminal is not capable of sending e-mail or an instant message, the IMR will allow Person A to send a numeric page to Person B.

Furthermore, the personal IMR application **202** incorporates access to databases tied to other applications. One configurable feature is a "find me" function that determines a likely present location(s) of the call recipient by accessing information stored in a personal database file such as a personal planner or appointment calendar. Rather than route the call to ordinary voice mail (thus initiating a phone tag

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1019 – 016

sequence), the call is redirected, if designated to do so by the recipient, to the likely present location or locations, simultaneously or serially, at which the call recipient can be reached (e.g., a cell phone number). The form of the forwarded call is not confined to a voice phone call. As will be demonstrated by an example below, the personal IMR application **202** also forwards calls to the recipient in the form of text messages.

In an exemplary configured response scenario the personal IMR application **202** is programmed to route a received instant message to a cell phone or a beeper that accepts text messages, two way pages, or instant messages. In response to the instant message sent to the personal IMR application, the personal IMP, determines, by referring to a user status variable and/or a set of configured rules for the recipient, that the intended recipient is likely on a particular cell phone that accepts text messages. The IMR application issues a response to the sender of the instant message informing the sender that the recipient is out of the office. The response further invites the sender to transmit a message to the recipient's cell phone with the following format: "cell phone: message". The personal IMR system also notifies the sender of any particular restrictions on messages to the cell phone, For example, the IMR application **202** may inform the sender that messages to the recipient's cell phone are limited to 125 characters, and that the recipient's receiving device cannot send replies. The personal IMR stores a subsequently received text message in a personal message storage space for the recipient. After retrieving the message, the recipient may issue a response in the format of "Message: message". In other words, a Message type designation followed by the message text. The personal IMR application **202** provides a number of advantages over known interactive voice response systems. The potential modes of access to the IMR application **202** are expanded because the personal IMR application **202** supports both voice and electronic data access. Furthermore, the breadth of potential responses is expanded to include electronic data message responses such as instant messaging and email in addition to the traditional voice mail and call forwarding capabilities of known PBXs. Moreover, the personal IMR application **202** accesses databases to determine the status of the recipient and select a proper response based upon applying the status information to a configured set of rules. Finally, the personal IMR application **202** is defined for individual recipients, thereby enabling customized response schemes to be defined for each recipient. By way of example, in one configuration of the personal IMR application **202**, a user browsing on a web page could cause a "call" to be placed in the sales queue by a personal IMR of the call recipient. When a sales agent becomes available they will place a "call" to the user. The call may be in the form of email, instant message, a phone call, an Internet Protocol phone call, etc. The structure of the personal IMR application **202** is discussed further herein below in conjunction with FIGS. **5** and **6**.

A distributed conference bridge application **204** performs automatic set-up of a phone conference that may include either of both internal and external conference bridge hardware. The participants in the phone conference are connected according to a conference call connection arrangement defined by a user. Through a configuration editor interface, the user specifies a threshold value, including zero, for the number of conference participants to be connected into the phone conference via an internal conference bridge (typically integrated into a PBX system). A configuration editor component of the distributed conference bridge application **204** may incorporate the terminal abstraction architecture described herein above. Such a configuration editor supports user specification of distributed conference bridge parameter values via graphical and voice user interfaces.

After the connection scheme has been defined, the distributed conference bridge application **204** controls the set-up of the conference call connections. Under the direction of the distributed conference bridge application **204**, conference participants are connected to the internal conference bridge until the number of connections corresponds to the threshold value for internal conference bridge connections. Thereafter, the distributed conference bridge application **204** signals the central office controlling a first head end telephone number for the customer's conference bridge to redirect callers to a second head end telephone number corresponding to the external conference bridge. The signal to redirect calls to the external conference bridge is provided in the form of PINT,QSIG, or in-band remote call forwarding, all of which are well known signals to those skilled in the art.

An advantage of the above described re-direction capability is the simplicity with which the distributed conference bridge, including both an internal (PBX integrated) conference bridge and an external conference bridge, is assembled. Only a single conference call need be identified to the participants. In the case where participants call in, all participants use a same call-in number. With regard to the participants that are connected to the external conference bridge after the internal bridge reaches its designated capacity, the participants are unaware that their call was redirected. There is no change in participants' procedure or a reduction of features from users that are connected to internal conference bridge.

One embodiment of a distributed conference bridge includes a conference call involving calls over ordinary phone lines such as for example PBX and PSTN lines. However, the conference bridge connection operations and mechanisms described above are not limited to such networks. Rather they are also applicable to conference calls over virtually any public or private network. Finally, incorporating the terminal abstraction architecture to the call connections enables the creation of a hybrid conference call arrangement including, for example callers connected through private phone networks, a PSTN and/or the Internet.

An instant messaging application **206** treats an instant message the same as a phone call. The external interface and operation of instant messaging remains the same as known instant messaging services. A user via the network interface/server **114** registers with an instant message server (e.g., MICROSOFT NETWORK). In accordance with an aspect of the particular implementation of the convergence paradigm in the present electronic personal assistant, all messages are transformed into message abstractions that are treated equally, to the extent possible, regardless of the end-terminal that issued the message. Thus, email, voicemail, instant messages, etc. can be accessed by a recipient by phone or computer interface.

However, this does not mean that the type of end-terminal is irrelevant to the instant messaging application **206**. The terminal abstraction renders a generic message, and the rules engine applies a criterion for handling the generic message. The call type is taken into account when routing. For example an instant message would never be routed to a telephone headset unless the text message has been converted to audible speech or the telephone was equipped with a text data display. With regard to the instant messaging application, the instant message can be forwarded to voice

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1019 – 017

mail, an instant message enabled destination phone, etc. Instant messaging forwarding could use the IMR to forward the message or have it's own forwarding mechanism.

A Call Announcement application **208** provides both audible (PC chime or utilizing TTS speaks the callers name) and/or visual call announcements through a call recipient's personal computer. The Call Announcement application **208** also enables the call recipient to issue commands to control acceptance or rerouting of a received call via graphical and/or voice user interface commands. The Call Announcement application **208** receives caller identification information associated with an incoming call. Thereafter, the call announcement application **208** references a rules database to determine any particular customized announcement features to apply to the call. An example of a customized announcement feature is immediate forwarding of calls to voice mail. Another example, in an environment adopting the terminal abstraction architecture, is converting a voice mail message to text and storing the message in email. The call announcement application **208** thereafter carries out the call announcement.

The set of applications **188** is extensible both horizontally (new independent applications) and vertically (leveraging existing voice/phone accessed applications). Thus, any number of additional voice applications may be added to the set of voice applications **188**.

Other applications are also included within the extensible set of applications **188**, but not specifically identified in FIG. **4**. The applications described below provide multiple modes of access by incorporating the terminal abstraction architecture. Also, the multi-access mode capability facilitates integrating the described applications with other base applications such as email, databases, and Web browsers to enhance utility of those applications.

A workgroup monitoring application enables authorized users to monitor the status of a workgroup member's phone line to determine the line status and other call information, including a caller identity and degree of importance of the call. Access to monitor a particular line is controlled through security. For example a secretary could monitor the phone of another employee for whom the secretary provides assistance. The secretary's workgroup monitoring application would likely not be allowed to monitor the phone of another employee for whom she provides no assistance. The workgroup monitoring application includes voice access mode access to enable a workgroup member to monitor a line from out of the office at a public phone and issue a message (e.g., via urgent email dictated and sent via vocal commands from a phone) to a particular recipient to get off the phone to free the line for another important call.

Another voice application is voice activated dialing (Intelligent Dial Tone) that not only initiates dialing a phone number but also carries out particular types of phone calls such as conference calls based upon verbal commands. An Internet/intranet integration application responds to verbal commands while performing a voice-based task such as replaying email, accessing information from a central database, files on a network share, sending a document to a fax recipient, by launching a browser and retrieving and reading back (email or fax) information accessed via the voice commands.

Enhanced Contact Controls are yet another application that may exploit the terminal abstraction architecture presented herein. Enhanced Contact Control enables scheduled tasks to be automatically activated, and a user is prompted to initiate a call via voice commands rendered directly to a phone integrated within the computer. The call can alternatively be initiated by a sequence of clicks and drag/drop acts by a user at the computer. The Enhanced Contact Control application may also incorporate priority rules etc. when executing scheduled tasks.

VUI Personal Information Manager applications enable a user to access contact information from a remote location by vocal commands to databases maintained within the control of the network interface/server **114** and to take appropriate actions including dialing a client's telephone number that was retrieved by the PIM. This application integrates a number of previously discussed features and applications supported by the electronic personal assistant including the voice print application **200**, TTS, STT, and the voice activated dialing application.

Turning now to FIG. **5**, an exemplary application program architecture is provided to illustrate the general functional parts of the terminal abstraction architecture facilitating multiple modes of access by users to applications and their associated resources through a communications server such as the network interface/server **114**. The personal IMR application **202** provides user configured responses to callers that utilize a variety of access modes to contact a particular recipient. A set of access modes **300** includes a public switched telephone network (PSTN) telephone **302**, an Internet Protocol (IP) telephone **304**, a videoconference phone **306**, a web form **308** via a personal computer and an instant message **310** via a personal computer. The set of different access modes depicted in FIG. **5** is exemplary and thus there is no intention to limit the scope of the terminal abstraction to handling sessions involving the specifically identified access modes. Rather the set of modes is preferably extensible. Additional modes of access are incorporated into the terminal abstraction software of the application (or operating system) software.

In an embodiment of the terminal abstraction architecture, the IMR application **202** comprises two functional components, a terminal abstraction component **320** and a rules engine component **330**. The terminal abstraction component communicates, on behalf of the IMR application **202**, with the end terminals. Differences between modes of access are handled primarily by the terminal abstraction component **320**. The terminal abstraction tailors functionality provided by the IMR application **202** (including the interface specification) to a specific mode of access. For example, the terminal abstraction component **320** tailors interaction with the PSTN telephone **302** and IP telephone **304** to voice user interface. In contrast, the terminal abstraction component **320** tailors interaction with the Web form **308** and Instant Message **310** modes of access to a text or graphical user interface.

The method of communication between the terminal abstraction component **320** and functional components of the IMR application **202**, such as a rules engine component **330**, is the same without regard to the mode of access. Thus, the functional components of the IMR application **202** are not directly exposed to, and need not consider, the particular one of the set of modes of access **300** to a call recipient. The terminal abstraction component **320** tailors a generalized call response, formulated by a rules engine **330**, to a particular mode of access used to call the recipient.

The rules engine component **330** comprises a framework for applying a set of response rules applicable to all types of calls regardless of the mode of access to a particular recipient. The rules engine component of the IMR application **202** applies a defined criterion to a set of status and data values

pertaining to a particular call recipient. The rules engine formulates a response. The generalized response is then provided to the terminal abstraction. Because the terminal abstraction component **320** of the personal IMR application **202** handles communication and interface differences between various modes of access, the rules engine component **330** need not consider the mode of access utilized by a caller when formulating a response. This does not preclude, a user from specifying a particular type of response based upon the mode of access by a caller and the rules engine applying that rule to formulate a response.

A portion of the parameters potentially accessed by the rules engine component **330** are designated via user configuration interfaces. A set of user defined options **340** specify a user customizable set of response options that are applied by the rules engine component **330** to formulate a call response. A user state **342** specifies the status of a call recipient. For example the recipient may be in/out of the office, on the phone, in a meeting, etc. Both the user defined options **340** and user state **342** are set via configuration applications **344** and **346**. The configuration applications **344** and **346** need not be applets that are integrated into the personal IMR application. Rather, the configuration applications **344** and **346** may be a web browser, a text editor, a voice-based user configuration interface, etc. Multiple modes of access are supported enabling configuration from a number of different end-terminal types.

The rules engine component **330** consults automatically set values to formulate a response. For example a terminal state **348** may be accessed. The terminal state **348** may include whether a computer terminal is on, being used, is on standby/screen saver mode. The terminal state **348** may include whether the phone is off-hook or the do not disturb feature has been activated in order to formulate a response.

The rules engine component **330** also consults parameter values that are independently set by other applications, but are accessible to the rules engine component **330**. For example, the rules engine component may consult a calendar **350** maintained by the call recipient to determine a probable location of the call recipient. Other potential databases may also be accessed to render information used by the rules engine component **330** to formulate a response.

Having described the components of the personal IMR application **202**, attention is directed to FIG. **6** showing the steps performed in response to a received call to a recipient with an activated personal IMR application **202**. During step **400** a call is received by the personal IMR for a particular caller. In response, during step **402** if the call (which may be a regular call, an email message, a web form, a fax, an instant message, etc.) is answered, then control passes to step **404** and the call proceeds as normal. That is, response mechanisms of the personal IMR are not invoked. Control then passes to the End **406** which corresponds to the end of a call.

If the call is not answered by the call recipient during step **402**, then control passes to step **408**. At step **408** the IMR application **202** determines the identity of the caller and whether response rules exist for the caller and the current mode of access used by the caller to reach the recipient. If a set of rules have been established for the identified caller and the identified mode of access, then control passes to step **410** wherein the rules engine component **330** processes the call in accordance with a configured response options (specified for both the caller and the recipient) and the present status and data values for the call recipient. The media or manner in which the response is provided is not limited to voice response. Rather the response may take the form of a call queue wherein the caller placed behind other callers who are on hold. The response may be activation of a find me application which seeks to track down the intended call recipient by referencing a calendar or day planner database, or by forwarding the call to a number specified by the recipient. The response may request the caller to leave a message—which could be placed in a voice mailbox, email box or an instant message for the recipient. The responses are not limited to the above identified response types, rather the responses are intended to be an extensible set that are added in accordance with new modes of access and channels by which a recipient can request further actions by the caller when the recipient is unavailable or unable to take a call. Control then passes from step **410** to the End **406**.

If during step **408** a set of rules cannot be identified for the particular caller, then control passes to step **412**. At step **412** the capabilities of the caller's terminal are determined. Step **412** involves gaining sufficient information about the caller's mode of access to select a proper interface and options to be implemented by the terminal abstraction component **320** of the personal IMR application **202**.

After determining the traits of the caller's mode of access, control passes to step **414** wherein the caller is presented a menu comprising a set of IMR actions. The user interface of the menu is tailored by the personal IMR application **202** to the caller's mode of access and carried out by the terminal abstraction component **320** according to the caller's mode of access.

The caller may select from the menu an option to play a voice menu for a voice access terminal. Another selection is to allow the caller to send an instant message to the terminal of the call recipient—based for example on the determination by the personal IMR application **202** that the recipient's terminal is on. The caller is presented the opportunity to send an email message to the email box associated with the call recipient. Yet another exemplary response is sending a browser menu in the event that the caller terminal is an Internet Protocol terminal. The set of multimedia options presented to a caller by the personal IMR application **202** is by no means limited to the above examples. The potential selections in the menu of options selectable by the caller include playing or sending menus to presenting options to callers according to the mode of access used by the caller to contact the call recipient.

At step **416**, the personal IMR application **202** receives a response from the caller based upon the set of options provided to the caller during step **414**. Control then passes to step **410**, described previously above, wherein the caller selection is processed by the rules engine component **330** based upon the configured response and the status and data parameters for the call recipient. Control then passes to the End **406**. It should be understood that the above described sequence of steps performed by a personal IMR application are illustrative, and that those skilled in the art will recognize that the personal IMR application can be performed in a multitude of ways.

Having described a set of voice applications accessed via the network interface/server **114** (or any other suitable communications server) and having further described an example of the terminal abstraction architecture in the form of a personal IMR application **202**, attention is now directed to FIGS. **7** and **8** depicting and summarizing the voice print application **200**. A public switched telephone network **510** (or other suitable network) connects users having access to any phone such as phone **512** to a network communications

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1019 – 019

server **516**. A user may alternatively call into the network communications server **516** via a premise telephone **514** that is directly connected to the network communications server **516** as shown in FIG. **7** (in the event that a PBX hub is built into the network communications server **516**). In other embodiments, a PBX hub is interposed between the premise telephone **514** and the network communications server **516**. The type of end terminal need not be limited to the above described phones. Rather, the "phone" may comprise, by way of example, a microphone equipped personal computer **518** or an Internet Protocol phone **520** connected to the network communications server **516** via a LAN link **522**. The communications server **516** includes a number of applications such as the aforementioned applications **188**. LAN link **522** also supports connections to other applications servers **524**.

The network communications server **516** executes a voice print application **526** including a voice print authentication database **530**. The voice print authentication database **530** includes multiple entries corresponding to each of the authorized users of the system. An identification field **532** within each user entry comprises a unique user identification. The unique user identification is used to reference a proper voice print challenge and pre-stored expected response from the user.

A voice print key field **534** stores multiple challenge/response pairs for each user. During a user voice logon, one or more of the challenge/response pairs are variably selected (e.g., randomly/pseudo-randomly from a set) to facilitate authenticating the user. A user identification/password field **536** includes the alphanumeric sequences for logging a user onto the system (e.g., a network domain, a specific application, etc.). The information within the user identification/password field **536** is sensitive in nature and must be secure both within the database **530** and when transmitted to a domain controller **540** during logon.

it is noted that while not specifically identified in the drawings, the voice print authentication database **530** includes a file of queries enabling the computer network data interface/server **516** to transmit challenge queries to an identified user in order to prompt a response. In cases where a large quantity of potential questions are stored, the questions themselves can be stored as text. The text of a query is retrieved and converted to speech by a TTS converter. The query is not to be confused with the expected response(s) that are stored as a digital file representing a vocal recording of the speaker during a learning phase.

As previously mentioned, the queries are such that a variable response is required. The query itself need not be variable. For example, the question may request the user to repeat a present date and time furnished by the voice print application. In another example of a variable response, the questions themselves are indeed variable between logon attempts. The contents of the identification field **532** and the identification/password field **536** are used to log an authenticated user onto the system via a standard Windows challenge response mechanism utilizing the domain controller **540**.

Turning now to FIG. **8**, an exemplary set of steps are depicted for invoking and executing a user logon procedure that compares a user's vocal query response to one or more stored voice samples corresponding to an expected response to authenticate an authorized user. In a secure system, the comparison and successful match of a response to a pre-stored sample is a precondition to granting access to the data and other resources available to the user via the communications server **516**. Thus, in response to receiving a call during step **600** from a user requesting authentication, control passes to step **602** wherein the communications server **516** routes the request to the voice applications **188**, and more particularly the voice print application **200**.

At step **604**, the voice print application **200** invokes operations within the communications server **516** to issue a prompt (preferably audible, but may be text in the case of text interfaces available on personal computers and some phones today) to the user to submit a user identification. Next, during step **606** the communications server **516** receives the user's identification. The user identification may be in the form of a sequence of touch tones or alternatively spoken words. The response is converted to an alphanumeric sequence that is then used to access an entry corresponding to the user within the voice print authentication database **530**. Assuming a corresponding entry is located within the database **530**, control passes to step **608**.

At step **608**, the voice print application **200** variably selects a challenge query from the corresponding voice print key field **534**. The form of the query may be a request to repeat a word, phrase, or sequence of numbers. For example, the voice print application **200** selects a request out of a pool of potential requests and couples the query with a request for the speaker to speak today's date (e.g. "Please say Seattle and today's date"). In this particular example, it is reasonably assured that the combination of words and phrases in the response will be unique every time an authorized user logs onto the system. An important factor in the variable logon request scheme is that there is a low likelihood that a particular request will be repeated by the voice print application **200**. Thus the voice print application provides assurance that expected user responses will be unique and reduces the system's vulnerability to imposter attacks. Alternatively the query may comprise one or more questions from a set of personal questions answered by the user during a secure registration process. The query is transmitted to the user by the communications server **516**.

Next, during step **610**, the communications server **516** receives the identified user's audible response, and the response is forwarded to the voice print application **200**. The voice print application **200** compares the user's response to a pre-stored reference response (or set of responses). At step **612**, if the user's response comes within an acceptable range of similarity to the pre-stored reference response, then the identified user is considered authentic by the voice print application **200** and control passes to step **614**.

At step **614** the voice print application **200** creates a virtual user desktop for the authenticated user and logs into the domain with the cached user credentials that are stored in the voice print application **200**. A MICROSOFT TERMINAL SERVER could be used for the virtual desktop and operate on behalf of the user. The voice print application **200** retrieves the contents of the network identification/password field **536** from the voice print authentication database **530** and a logon proxy submits a logon request via a password notification message to the connected domain controller **540**. Thereafter, the voice print application **200** creates an application proxy that holds the credentials for the authenticated user. In a network environment, the application proxy would have all the credentials of the user as if the user had logged in locally via a personal computer or remotely over a remote access server (RAS).

During step **616**, the application proxy created during step **614** carries out requests received from the authenticated user. The user requests may be either vocal or electronically

generated (e.g., touch tone). Examples of network resources that may be directly accessed by the application proxy include: email requests that are accessed and read back to the authenticated user; a personal IMR editor (e.g., change a forwarding number); Internet sites that are accessed, for example, via an Web telephony engine; and a database that is selectively accessed according to the authenticated user's credentials assigned during the logon step **614**. The application proxy created by the voice print application **200** may interact with other applications that in turn access computer resources. The application proxy could also utilize Microsoft's accessibility features and allow a user to fully interact with the terminal server virtual desktop and applications similar to how a sight-impaired user interacts with a PC monitor. When a user hangs up the phone, the session is terminated and control passes to the End.

If at step **612**, the voice print application **200** determines that the user's audible response is not sufficiently similar to the pre-stored reference response (or responses), then control passes to step **618** wherein the voice print application rejects the user logon request and control passes to the End. However, in an alternative embodiment of the present invention, the user may be allowed multiple tries to logon, in such a case an event log will tally an unsuccessful logon attempt by a user during step **618** and return to step **308** (or a variation thereof where the user is merely asked to repeat a previous response). The voice print application will repeat the query/response cycle until the number of successive failures reaches a limit and then control passes to the End.

Those skilled in the art will appreciate that there are numerous ways to gauge whether a match of a response and a pre-stored sample has occurred, and various the challenge/response/match cycle may be repeated multiple times to ensure that a user is authentic—even in instances where a match has occurred. Therefore, there is no intention to limit the present invention to the illustrative challenge/response/match sequence depicted in FIG. **8**.

Having described the voice print application **200**, attention is now directed to the previously mentioned distributed conference bridge application **204** with reference to FIGS. **9** and **10**. FIG. **9** provides an exemplary conference call arrangement wherein part of a distributed conference bridge arrangement comprising 10 trunk lines is handled by an internal conference bridge **700** within the network interface/server **114**. The PBX system within the network interface/server **114** handles more than the ten trunk lines needed for the conference. However, the internal conference bridge **700** can only connect six callers for a conference involving ten different lines. Therefore, the remaining participants are connected to an external conference bridge **702**. A conference connection **710** between the internal conference bridge **700** and the external conference bridge **702** merges the two conference bridges into a single, distributed conference bridge. The conference call includes callers attached via the PSTN as well as locally connected phones within the PBX such as phone **704**.

The dotted connection lines in FIG. **9** illustratively depict that even though the actual connection of a portion of the participants to the conference occurs through the external bridge **702**, this connection is transparent to the participants. All conference participants follow procedures for connecting to the internal conference bridge **700**. The system handles re-direction of calls to the connected external bridge **702**. The example in FIG. **9** includes only telephone end points. However, it is noted that the method and apparatus for building and controlling a distributed conference bridge, described below with reference to FIG. **10** is applicable to Internet Protocol terminals (e.g., in a Net Meeting application), video conferences, and wireless end-terminals—even hybrid conference call arrangements.

Turning to FIG. **10**, the steps are summarized for setting up a distributed conference bridge including both an internal conference bridge and external conference bridge as depicted in FIG. **9**. Prior to commencing set up of a conference call, during step **800** the network interface/server **114** is configured. Assignment of lines to the internal conference bridge during configuration is accomplished via a graphical or voice user interface presented to the arranger of the conference call via a logged on computer or other end-terminal or rules logic assigned to the conference bridge application. The set up interface is tailored by a terminal abstraction module of the distributed conference bridge application based upon the type of terminal used to perform the configuration. During the configuration a threshold is specified. The threshold corresponds to the maximum number of lines (including a value of zero) that can be connected into the internal conference bridge **700** when the conference call is set up. Configuration also includes designating the total number of callers expected to participate in the call. An external conference bridge service is notified of the need for external conference bridge resources.

After configuring the distributed conference bridge, decision-making and call routing processes executed by the distributed conference bridge application **204** carry out automated assembly/set-up of a phone conference. The phone conference includes both an internal conference bridge associated with the PBX system of the user and an external conference bridge provided by an outside phone services vendor. In particular, during step **802** the network interface/server **114** connects callers into the internal conference bridge **700** until the threshold has been reached. In particular, during step **802** the network interface/server **114** determines whether the threshold has been reached. If the threshold has not been reached, then a next caller is connected to the internal conference bridge **700**. If the threshold has been reached, then control passes to step **804** wherein one of the bridge connections of the internal conference bridge **700** is used to automatically establish a conference linkage to the external conference bridge utilizing automatic dialing functions supported by the network interface/server **114**. The connection between the internal bridge **700** and the external bridge **702** is established through QSIG, PINT, in band signaling, or data exchange across the Internet between two conference bridge servers. Control then passes to step **806**.

At step **806**, the network interface/server **114**, under the control of the distributed conference bridge application **204**, automatically signals the central office controlling the head end telephone number for the customer's conference bridge using the PINT, QSIG, or in-band Remote Call Forwarding to redirect callers to a head end telephone number corresponding to the bridged conference bridge. The remaining callers are connected to the external conference bridge **702** without their calls ever reaching the PBX supporting the internal conference bridge **700**. By intercepting the calls at the central office and forwarding them to the external conference bridge, the distributed conference bridge application prevents calls by the externally connected participants from tying up trunk lines to a PBX system supporting the internal portion of the phone conference. Participants in the conference are unaware that their call was redirected. There is no change in end user's procedure to connect to the external conference bridge **702** or reduction of features from users that connected to the customer's conference bridge. The conference call continues to completion.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1019 – 021

Illustrative embodiments of the present invention and certain variations thereof have been provided in the Figures and accompanying written description. Those skilled in the art will readily appreciate from the above disclosure that many variations to the disclosed embodiment are possible including for example using alternative program and data structures. For example, while a particular arrangement of processes is presented in FIG. **3** for implementing a computer network data interface/server (or more generally, a communications server), other arrangements may be used without deviating from the invention. Also, the order of performing the disclosed steps is subject to modification without departing from the scope of the present invention. The manner in which the general steps themselves are carried out may be modified in alternative embodiments of the invention. The present invention is not intended to be limited to the specifically disclosed exemplary embodiments. Rather the present invention is intended to cover the disclosed embodiments as well as others falling within the scope and spirit of the invention to the fullest extent permitted in view of this disclosure and the inventions defined by the claims herein below.

What is claimed is:

1. A method for creating a set of connections for a distributed conference bridge, including a first conference bridge and a physically distinct second conference bridge, joining a set of participants in a single conference, the method comprising the steps of:

configuring a communications controller for an internal communications system, the configuring step comprising identifying the second conference bridge;

connecting participants to the first conference bridge until a threshold of connected participants is reached;

establishing a conference connection between the first conference bridge and the second conference bridge;

issuing a redirection command causing conference participants to be directed to the second conference bridge; and

providing a terminal abstraction, interposed between functional resources of a conference bridge application and end-devices, to provide the functional resources in a manner tailored to individual ones of a variety of user interfaces, including graphical and voice user interfaces, the terminal abstraction comprising:

a graphical user interface terminal abstraction component interposed between the functional resources and a first end-device supporting a graphical user interface, the graphical user interface terminal abstraction component transforming messages from the first end-device to a generic format expected by the functional resources, the graphical user interface terminal abstraction component further transforming messages from the functional resources to a first end-device format expected by the first end-device; and

a voice user interface terminal abstraction component interposed between the functional resources and a second end-device supporting a voice user interface, the voice user interface terminal abstraction component transforming messages from the second end-device to a generic format expected by the functional resources, the voice user interface terminal abstraction component further transforming messages from the functional resources to a second end-device format expected by the second end-device.

2. The method of claim **1** wherein the redirection command is transmitted by a telephone system communications controller to a phone company central office.

3. The method of claim **2** wherein the redirection command is provided through QSIG signaling.

4. The method of claim **2** wherein the redirection command is provided through PINT signaling.

5. The method of claim **2** wherein the redirection command is provided through in-band signaling.

6. The method of claim **1** wherein the configuring step further comprises designating a threshold value corresponding to a number of conference participants connected to the first conference bridge.

7. The method of claim **1** wherein the issuing a redirection command occurs after the threshold of connected participants is reached.

8. A computer-readable medium including computer-executable instructions facilitating performing a set of steps for creating a set of connections for a distributed conference bridge, including a first conference bridge and a physically distinct second conference bridge, joining a set of participants in a single conference, the steps including:

configuring a communications controller for an internal communications system, the configuring step comprising identifying the second conference bridge;

connecting participants to the first conference bridge until a threshold of connected participants is reached;

establishing a conference connection between the first conference bridge and the second conference bridge;

issuing a redirection command causing conference participants to be directed to the second conference bridge; and

providing a terminal abstraction, interposed between functional resources of a conference bridle application and end-devices, to provide the functional resources in a manner tailored to individual ones of a variety of user interfaces, including graphical and voice user interfaces, the terminal abstraction comprising:

a graphical user interface terminal abstraction component interposed between the functional resources and a first end-device supporting a graphical user interface, the graphical user interface terminal abstraction component transforming messages from the first end-device to a generic format expected by the functional resources, the graphical user interface terminal abstraction component further transforming messages from the functional resources to a first end-device format expected by the first end-device; and

a voice user interface terminal abstraction component interposed between the functional resources and a second end-device supporting a voice user interface, the voice user interface terminal abstraction component transforming messages from the second end-device to a generic format expected by the functional resources, the voice user interface terminal abstraction component further transforming messages from the functional resources to a second end-device format expected by the second end-device.

9. The computer-readable medium of claim **8** wherein the configuring step further comprises designating a threshold value corresponding to a number of conference participants connected to the first conference bridge.

10. The computer-readable medium of claim **8** wherein the redirection command is transmitted by a telephone system communications controller to a phone company central office.

11. The computer-readable medium of claim **10** wherein the redirection command is provided through QSIG signaling.

12. The computer-readable medium of claim **10** wherein the redirection command is provided through PINT signaling.

13. The computer-readable medium of claim **10** wherein the redirection command is provided through in-band signaling.

14. The computer-readable medium of claim **8** wherein the issuing a redirection command occurs after the threshold of connected participants is reached.

15. An extensible conference bridge system for creating a distributed conference bridge, to handle a number of callers in a single conference that exceeds a threshold number of trunk lines for a first conference bridge, by merging trunk lines supported by a second conference bridge, the conference bridge system including:

a configuration interface for identifying the second conference bridge;

a network interface component for:

connecting participants to the first conference bridge until a threshold of connected participants is reached,

establishing a conference connection between the first conference bridge and the second conference bridge, and

issuing a redirection command causing conference participants to be directed to the second conference bridge; and

a terminal abstraction, interposed between functional resources of a conference bridge application and end-devices, to provide the functional resources in a manner tailored to individual ones of a variety of user interfaces, including graphical and voice user interfaces, the terminal abstraction comprising:

a graphical user interface terminal abstraction component interposed between the functional resources and a first end-device supporting a graphical user interface, the graphical user interface terminal abstraction component transforming messages from the first end-device to a generic format expected by the functional resources, the graphical user interface terminal abstraction component further transforming messages from the functional resources to a first end-device format expected by the first end-device; and

a voice user interface terminal abstraction component interposed between the functional resources and a second end-device supporting a voice user interface, the voice user interface terminal abstraction component transforming messages from the second end-device to a generic format expected by the functional resources, the voice user interface terminal abstraction component further transforming messages from the functional resources to a second end-device format expected by the second end-device.

16. The extensible conference bridge system of claim **15** wherein the network interface component issues the redirection command to a central office switch to redirect incoming calls identifying the configurable extensible conference bridge to the second conference bridge.

17. The extensible conference bridge system of claim **15** wherein the configuration interface includes an interface component for designating a threshold value corresponding to the threshold number of trunk lines for the first conference bridge.

* * * * *