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**Ho et al.**

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- (54) **VOICE VIRTUAL PRIVATE NETWORK**
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**Related U.S. Application Data**

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*H04M 3/42* (2006.01)  
*H04W 4/16* (2009.01)

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CPC ..... *H04M 3/56* (2013.01); *H04M 3/42221* (2013.01); *H04W 4/16* (2013.01)

- (58) **Field of Classification Search**  
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See application file for complete search history.

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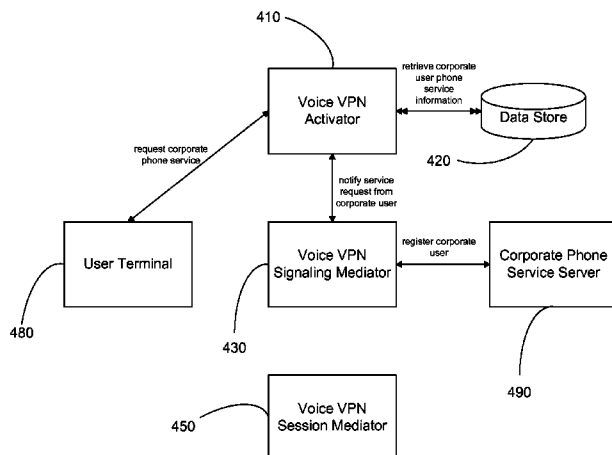
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(57) **ABSTRACT**

Embodiments of the present invention include a Voice Virtual Private Network (Voice VPN) and methods for providing access to remote peer users across same. In one embodiment, voice and communication services of one or more corporate network are provided to remote user terminals across a Voice VPN Gateway. The level and type of access to voice and communication services provided can be determined statically, dynamically, or adaptively based on user data or user habits or history.

**19 Claims, 10 Drawing Sheets**



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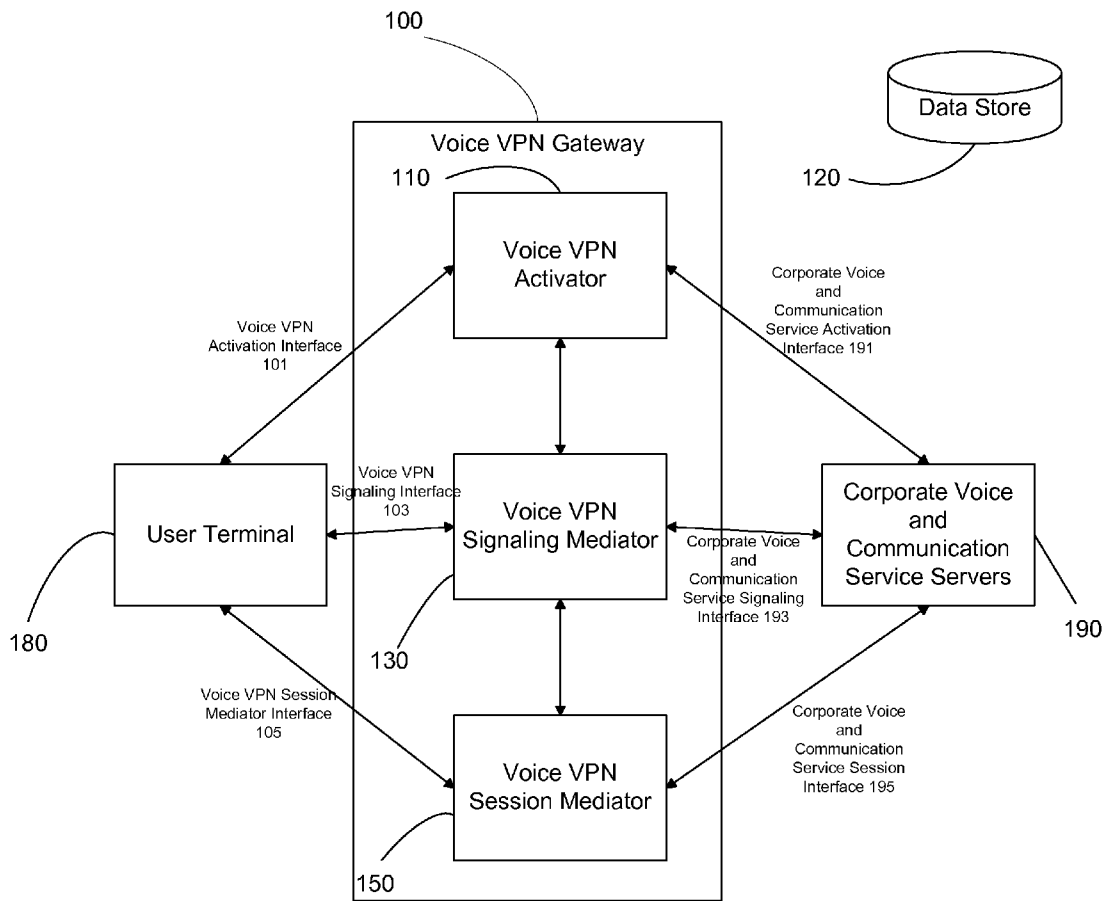


Figure 1

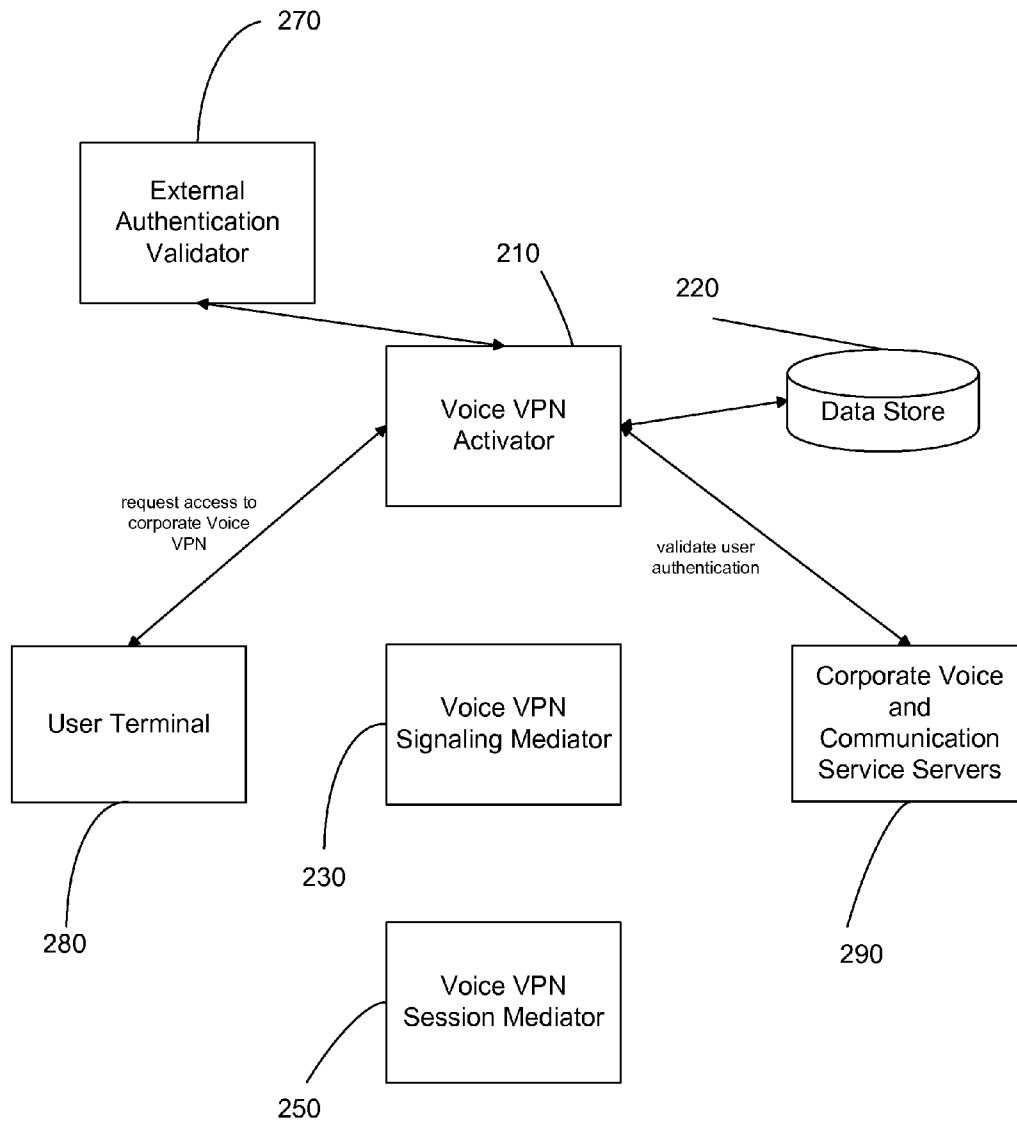


Figure 2

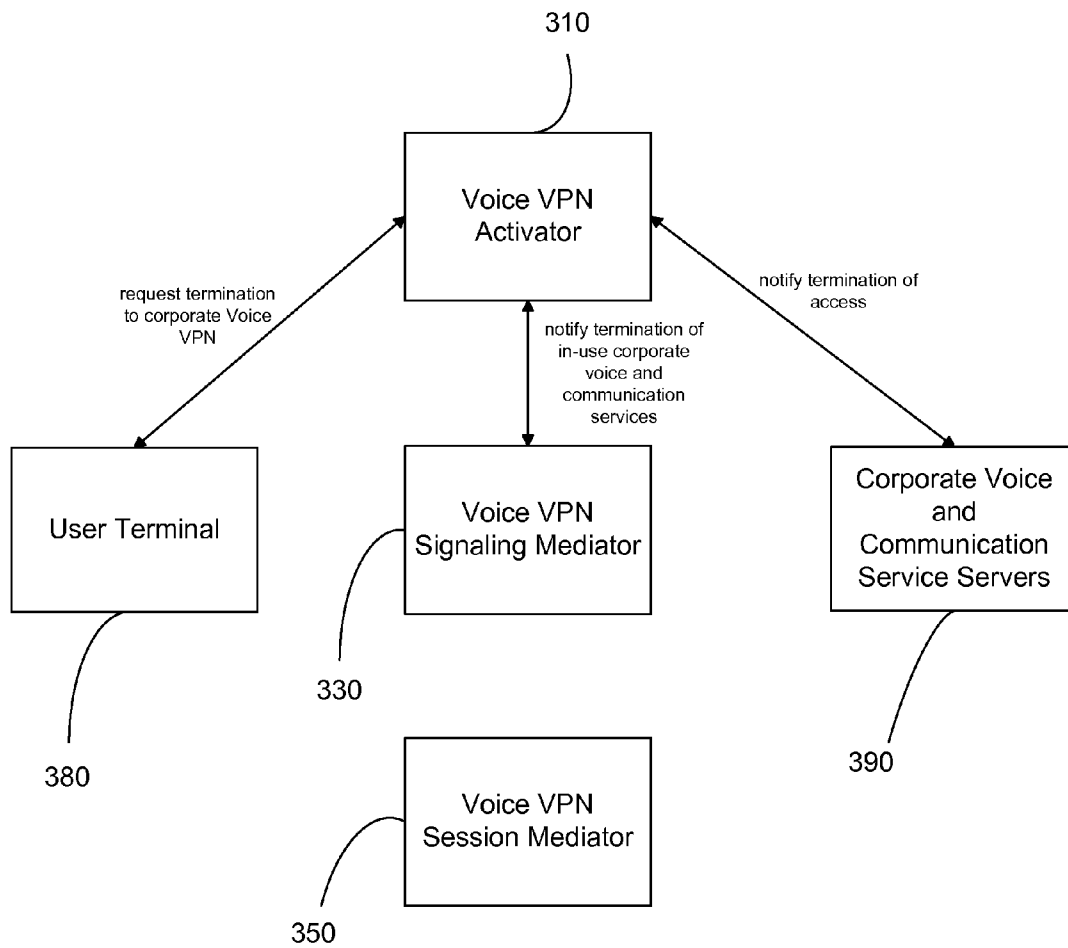


Figure 3

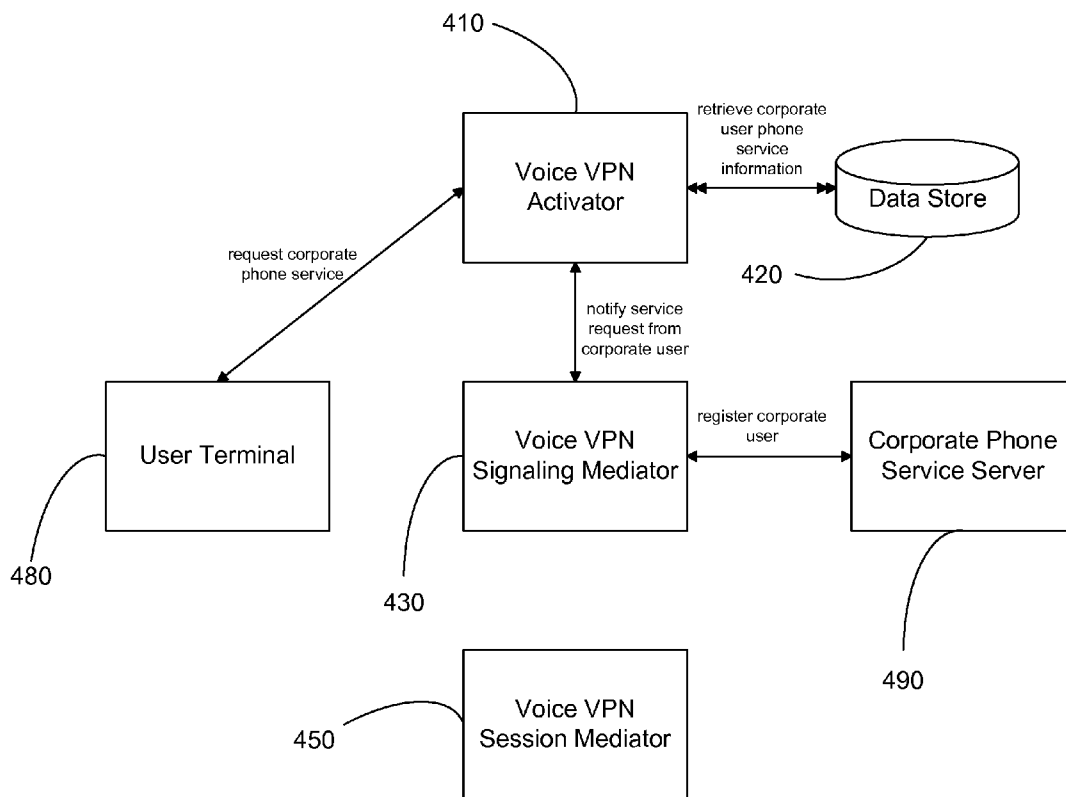


Figure 4

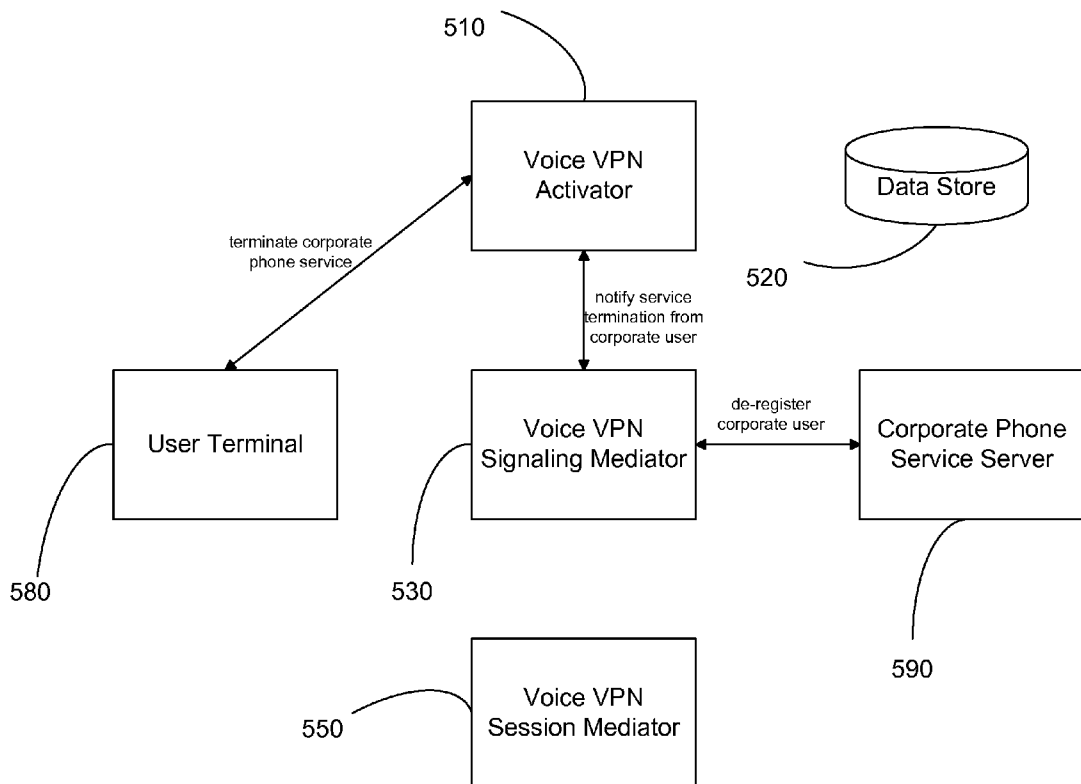


Figure 5

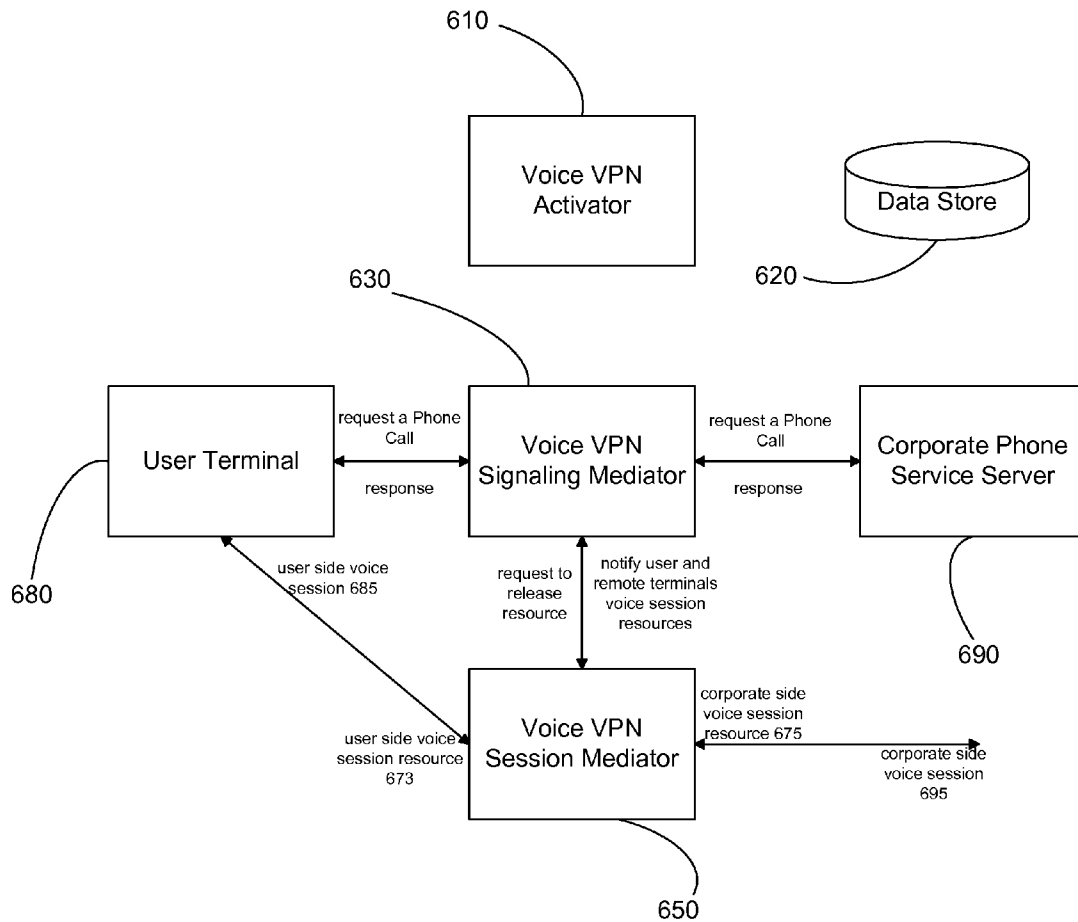


Figure 6



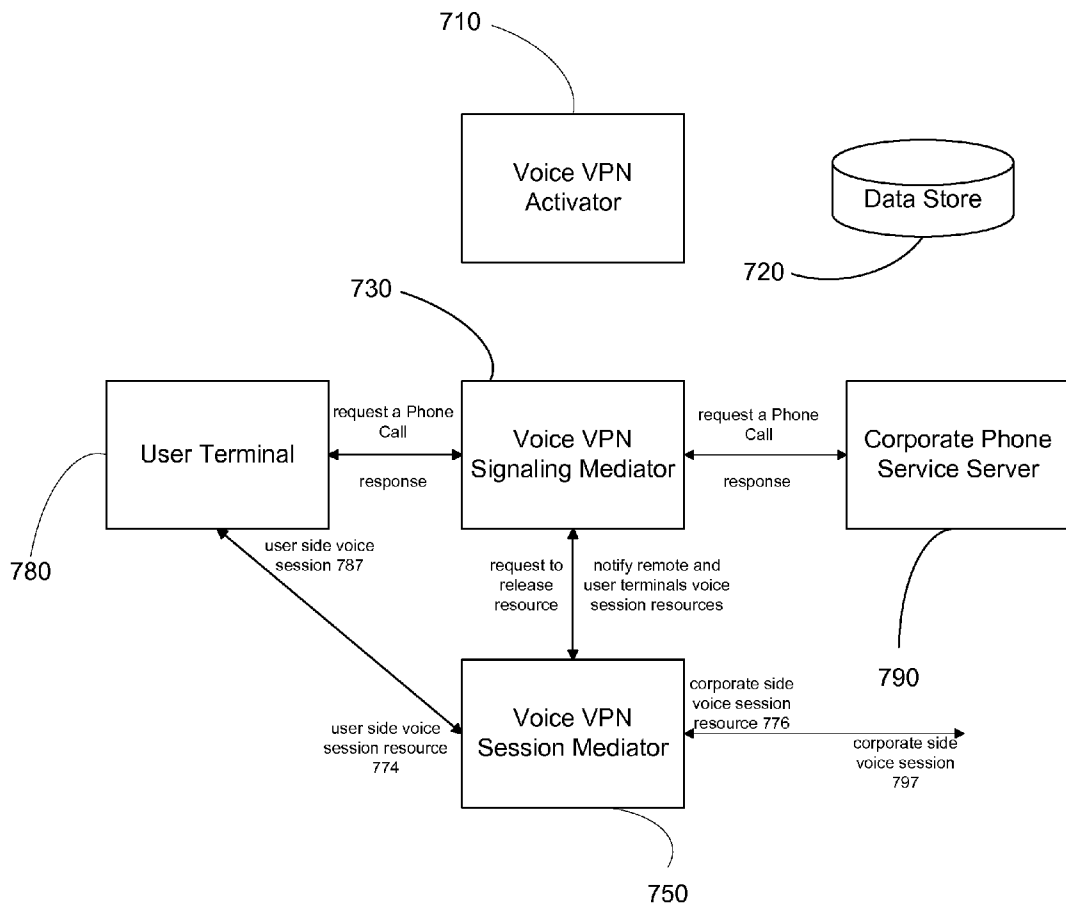


Figure 7

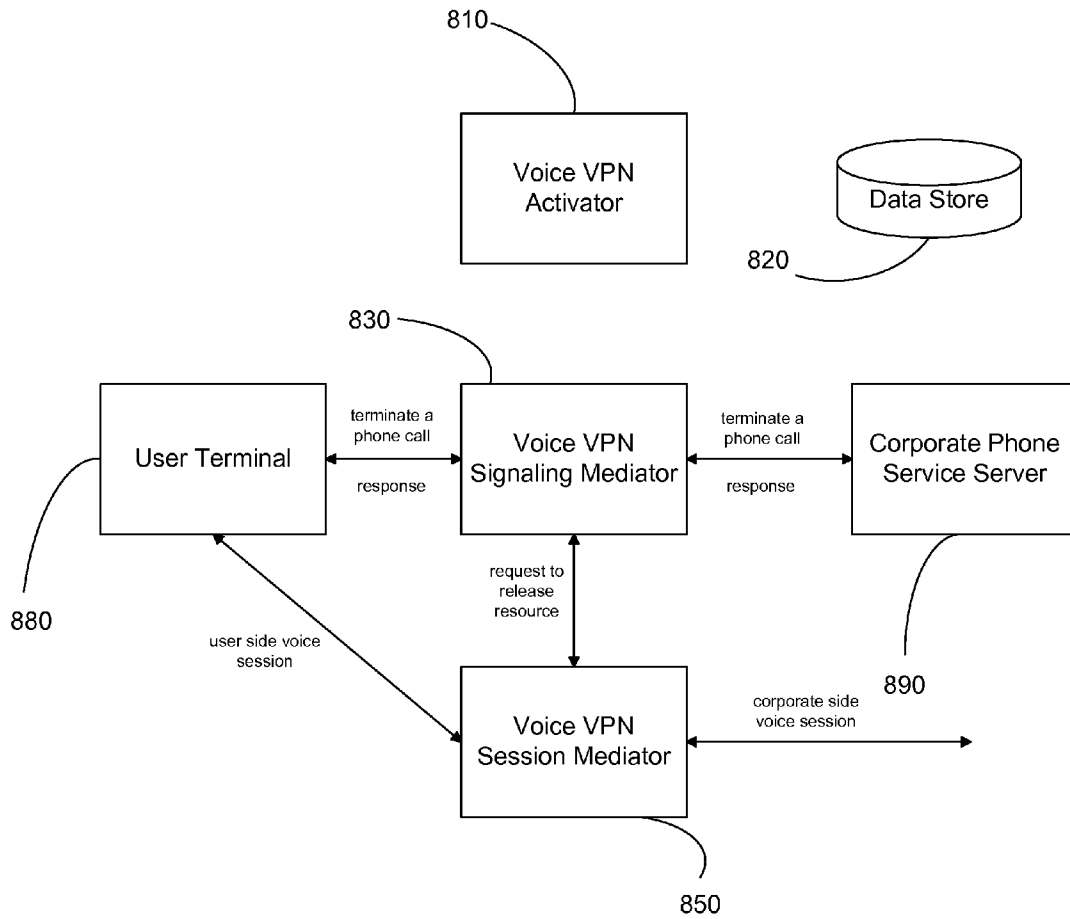


Figure 8

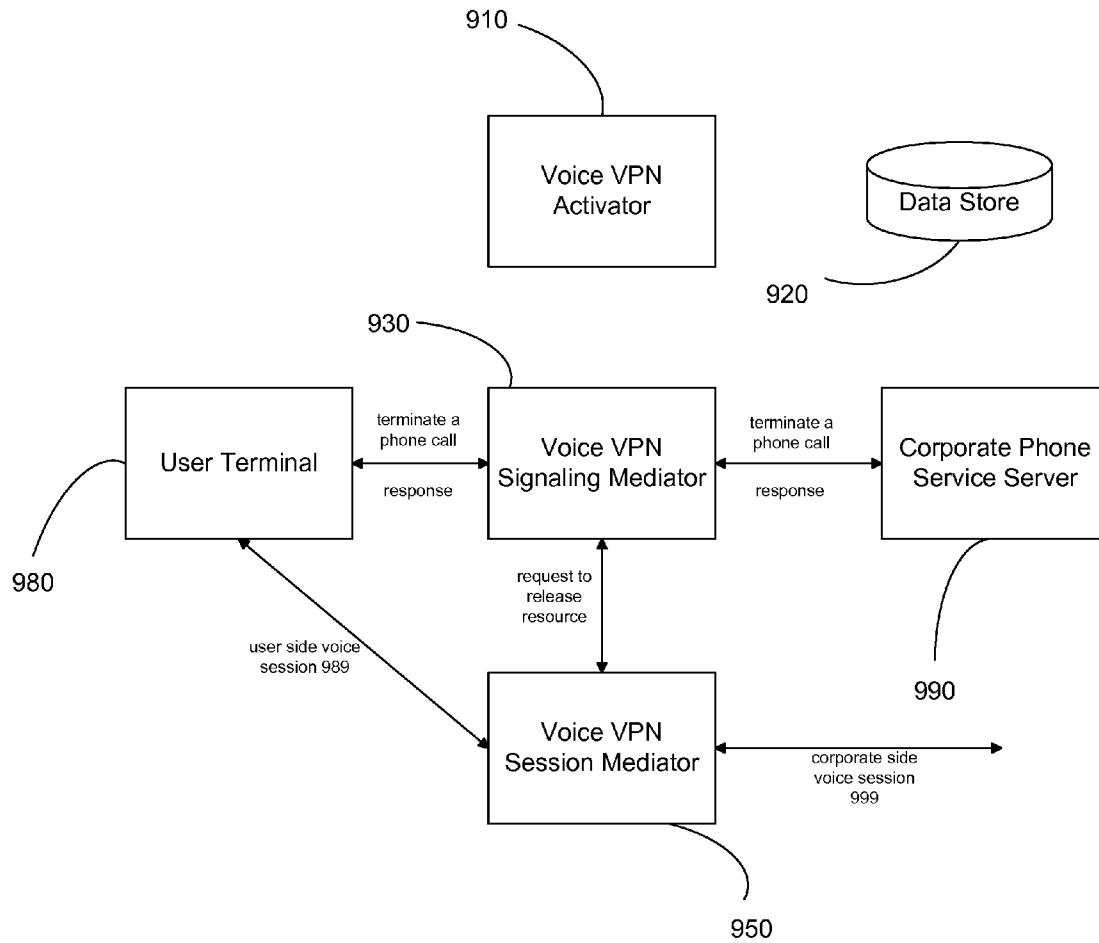


Figure 9

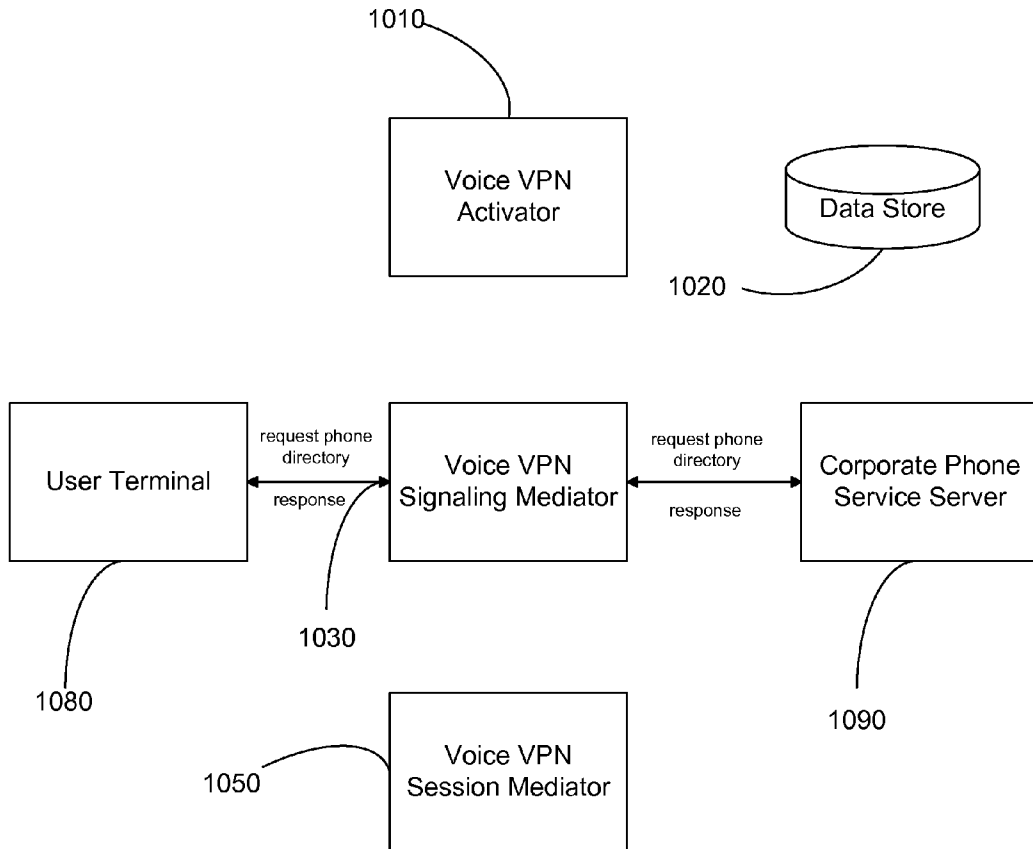


Figure 10

**VOICE VIRTUAL PRIVATE NETWORK****CROSS-REFERENCE TO RELATED APPLICATIONS**

This patent application is a continuation of co-pending U.S. patent application Ser. No. 12/505,569, filed on Jul. 20, 2009, which in turn is a continuation of U.S. patent application Ser. No. 11/105,043, filed on Apr. 12, 2005 and issued as U.S. Pat. No. 7,583,662 on Sep. 1, 2009.

**BACKGROUND OF THE INVENTION****Field**

This invention relates generally to telecommunications, more specifically, to a Voice Virtual Private Network (Voice VPN) to provide secure access to corporate voice and communications functionalities for corporate users.

**Related Art**

The era of Private Branch Exchange (PBX) arrived in 1976 when AT&T introduced its System 75 all digital switch for business. In a few years, PBXs quickly replaced WATS and Centrex as the voice communications of choice for corporations, improving business efficiency and productivity. In the ensuing years, PBX remains the flagship, and perhaps the only infrastructure with which corporate voice communications are provided. During this time, emerging technologies, particularly the 800-number service and Call Center have enhanced the capabilities of PBX, extending its reach, and creating new business opportunities.

After three decades of dominance in the corporate world however, a significant transformation of the corporate voice communications is now taking place. The emergence of various access methods, for example, cellular wireless, WiFi, and cordless phones, have given users the mobility they never had before. This newfound convenience has irreversibly changed the work style of corporate users.

The proliferation of the Internet and the deployment of Customer Relationship Management (CRM) solutions have greatly reduced the role of traditional Call Center as corporate users and customers can readily retrieve information, secure or otherwise, through the Web interface. On the other hand, such technologies have also improved productivity and shaped corporate user expectations. Similarly, the maturing Voice over IP (VoIP) and other IP information technologies open up a unique opportunity for rich, real-time and multi-media communications, legitimately challenging the status quo of PBXs in their current form.

Despite this inevitable transition, however, the principal use of voice communications in the corporate businesses sector remains unchanged. Traditional PBXs are undergoing progressive evolution to integrate with VoIP, WiFi, Corporate Directory, among other functions. At the same time, emerging IP-based communications services such as email and Instant Messaging are extending to include audio and voice capabilities. These enhancements however, are limited to corporate users who are within the realm of the corporate networks. Secure and ubiquitous extension of these services to remote corporate users is either impossible or infeasible because the supporting infrastructures or apparatus simply do not exist.

Some of the issues solved by the present invention are best illustrated by examples. In one scenario, a salesperson, while working with a customer, needs to reach a technical

department for information. Without access to the corporate directory, he decides to call a colleague in the sales department, and asks her to transfer the call. After a successful call transfer however, the engineer who receives the call has no reliable way to authenticate the caller and therefore may not feel comfortable disclosing the sensitive or proprietary information needed by the salesperson to make the sale.

In another scenario, an executive, traveling to Asia, will need to join a scheduled teleconference at 9 pm Pacific time being hosted on a U.S. corporate PBX telephone system. Prior to departure from the U.S., the executive would need to collect all the needed information, such as conference time, PIN code, phone number, etc. The executive will also need to look-up the International Direct Dial number, the United States Country code, and/or other country specific access numbers unique to the local dialing plan. In addition to complexity of making the telephone call to join the teleconference, the billing and possible reimbursement can also be complicated. When the executive returns from the business trip, the telephony usage during the trip will have to be reported, recorded and processed separately.

In another scenario, a telecommuter working from home needs the full set of corporate voice and communication services to do his work. Current solutions typically include proprietary phone and software at home and complementary gateway equipment and software at the corporate site. Such solutions often require extensive development and support and are probably not feasible for massive deployment.

In yet one other scenario, a traveling salesman is working in a coffee shop that provides WiFi Internet service. His cell phone is out of the coverage area of a compatible cellular service. While he can establish a data connection from his PC to the corporate VPN over the Internet to retrieve company information, he is unable to reach the corporate voice service.

The above examples illustrate a need for a fundamentally new corporate infrastructure or apparatus to support a secure and ubiquitous access to corporate voice and communication services for corporate users, and hence a need for a method for a Voice VPN.

**BRIEF SUMMARY OF THE INVENTION**

Embodiments of the present invention include methods for setting up, accessing and terminating services of a Voice VPN. In one embodiment, the present invention includes a Voice VPN Gateway that acts as the interface between a Corporate User Terminal and Corporate Voice and Communication Service Servers for providing voice and communication services to a corporate user.

In one embodiment, the Voice VPN provides remote corporate users with full or partial access to corporate voice and communication services such as making and accepting telephone calls, and accessing corporate telephones directories.

In another embodiment, the Voice VPN can facilitate calls and other services between remote peer parties who can be corporate voice service users inside the realm of the corporate voice network, other Voice VPN users, users connected to the corporate network via other networks such as PSTN or any combination thereof.

**BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE FIGURES**

FIG. 1 is a diagram illustrating a Voice Virtual Private Network Gateway system according to one embodiment of the present invention.

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FIG. 2 is a diagram illustrating a method for accessing a corporate Voice Virtual Private Network according to one embodiment of the present invention.

FIG. 3 is a diagram illustrating a method for terminating access to a corporate Voice Virtual Private Network according to one embodiment of the present invention.

FIG. 4 is a diagram illustrating a method for activating corporate phone services according to one embodiment of the present invention.

FIG. 5 is a diagram illustrating a method for terminating corporate phone services according to one embodiment of the present invention.

FIG. 6 is a diagram illustrating a method for placing a phone call according to one embodiment of the present invention.

FIG. 7 is a diagram illustrating a method for receiving a phone call according to one embodiment of the present invention.

FIG. 8 is a diagram illustrating a method for a corporate user to drop a phone call according to one embodiment of the present invention.

FIG. 9 is a diagram illustrating a method for a remote peer user to drop a phone call according to one embodiment of the present invention.

FIG. 10 is a diagram illustrating a method for retrieving a corporate phone directory according to one embodiment of the present invention

#### DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 is Voice Virtual Private Network (Voice VPN) Gateway. A Voice VPN Gateway facilitates access to a corporate Voice VPN. A Voice VPN provides corporate users ubiquitous and secure access to corporate voice and communication services. With a Voice VPN corporate users can access corporate voice and communication services through a variety access networks. A Voice VPN Gateway is the interface between user terminals such as phones and Corporate Voice and Communication Service Servers, such as a corporate telephone system. The present invention is a system and method for a Voice VPN.

FIG. 1 illustrates a Voice VPN Gateway. Voice VPN Gateway 100 has three modules—a Voice VPN Activator 110, a Voice VPN Signaling Mediator 130 and a Voice VPN Session Mediator 150. User Terminal 180 interacts with the Voice VPN Activator 110 over Voice VPN Activation Interface 101.

Corporate users access the corporate Voice VPN using a User Terminal 180. User Terminal 180 uses the Voice VPN Activation Interface 101 to request access to corporate Voice VPN, and to request one or more corporate voice and communication services.

In one embodiment, Voice VPN Activation Interface 101 is based on Internet Protocol.

In one embodiment, Voice VPN Activation Interface 101 is based on Web technologies including, but not limited to, HTTP, Web Services, Java.

In one embodiment, Voice VPN Activation Interface 101 is based on a client-server protocol. User Terminal 180 is a client sending requests to the server that is Voice VPN Activator 110.

In one embodiment, the access network is a public telephony network such as Public Switched Telephone Network (PSTN) or Voice over IP Telephone network (VoIP).

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In one embodiment, Voice VPN Signaling Interface 103 for the corporate phone service is based on Web technologies.

In one embodiment, Voice VPN Signaling Interface 103 is based on SIP technology. In such an embodiment, User Terminal 180 includes a SIP user agent, whereas Voice VPN Signaling Mediator 130 includes a SIP proxy or a SIP server.

In one embodiment, Voice VPN Signaling Interface 103 is based on H.323 technology.

In one embodiment, the access network is the Internet.

In one embodiment, the access network is a private network such as a corporate virtual private network, or an extranet between the corporate network and other partner corporate networks.

In one embodiment, the access network is inside the corporate network where the corporate user is in a remote office.

In one embodiment, the corporate policy requires security control over the use of corporate voice and communication services with a desktop phone.

To use a corporate voice and communication service, User Terminal 180 interacts with Voice VPN Signaling Mediator 130 over the Voice VPN Signaling Interface 103 and Voice VPN Session Mediator 150 over Voice VPN Session Mediator Interface 105.

In one embodiment, User Terminal 180 uses Voice VPN Signaling Interface 103 to set up a corporate voice and communication service session.

In one embodiment, a corporate voice and communication service is the corporate phone service.

In one embodiment, Voice VPN Signaling Interface 103 is based on Internet Protocol.

In one embodiment, Voice VPN Signaling Mediator 130 is software residing in the User Terminal 180, and Voice VPN Signaling Interface 103 is an internal programming interface such as a function call or an inter-method call (IPC).

After a corporate voice and communication service session is established, User Terminal 180 conducts the service session over the Voice VPN Session Mediator Interface 105.

In one embodiment, the format of the service session content depends on the corporate voice and communication service.

In one embodiment, the service session is secure.

In one embodiment, a corporate voice and communication service is the corporate phone service.

In FIG. 1, Voice VPN Gateway 100 communicates with Corporate Voice and Communication Service Servers 190 on behalf of the corporate user throughout a Voice VPN session of the corporate user. Thus, Corporate Voice and Communication Service Servers 190 consider the corporate user as if the corporate user is accessing the corporate voice and communication services from within the corporate network. In order to act on behalf of the corporate user, the Voice VPN Gateway 100 mediates the communication between the User Terminal 180 and the Corporate Voice and Communication Service Servers 190. Voice VPN Activator 110 interacts with Corporate Voice and Communication Service Servers 190 over Corporate Voice and Communication Service Activation Interface 191 to perform user authentication for accessing corporate voice and communication services.

In one embodiment, Corporate Voice and Communication Service Servers 190 do not require additional authentication.

In one embodiment, Voice VPN Signaling Mediator 130 interacts with Corporate Voice and Communication Service Servers 190 over Corporate Voice and Communication Ser-

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vice Signaling Interface **193** for service specific signaling procedures. Voice VPN Session Mediator **150** establishes a corporate voice and communication service session with the peer over the Corporate Voice and Communication Service Session Interface **195**.

In one embodiment, the corporate voice and communication service session is specific to the corporate voice and communication service.

In one embodiment, the corporate voice and communication service session is between Voice VPN Session Mediator **150** and Corporate Voice and Communication Service Servers **190**.

In another embodiment, the corporate voice and communication service session is between Voice VPN Session Mediator **150** and the user terminal of the peer.

In one embodiment, Voice VPN Session Mediator Interface **105** for the corporate phone service is based on voice over packet technology. Voice signals are sampled, digitized and put into IP packets.

In one embodiment, the voice over packet technology is similar to Voice over IP technology.

In one embodiment, the voice packets are transferred using Real Time Transport Protocol (RTP).

In one embodiment, a streaming protocol such as Real Time Streaming Protocol (RTSP) is used.

In one embodiment, the voice packets are transferred using any streaming or real time transport protocols.

In one embodiment Voice VPN Session Mediator Interface **105** includes a plurality of network attributes such as security, quality of services, jitter and network delay attributes.

In one embodiment, the voice packets are encrypted.

In one embodiment, the voice packets are transmitted with the highest priority.

In one embodiment, the voice packets are transmitted within a maximum end-to-end 35 millisecond delay.

When corporate phone services are needed, a corporate user can instruct User Terminal **180** to request the corporate phone service from Voice VPN Activator **110**.

In one embodiment Voice VPN Activation Interface **101** is based on Web technology. User Terminal **180** includes a Web browser and Voice VPN Activator **110** provides a Web page for User Terminal **180** to submit the request for the corporate phone service.

In one embodiment, User Terminal **180** sends the request based on a client-server protocol model. Voice VPN Activator **110** determines the corporate user phone service information.

In one embodiment, the corporate user phone service information includes corporate user identity data for the corporate phone service.

In one embodiment, the corporate user phone service information includes the capabilities of User Terminal **180**.

In one embodiment, the capabilities of User Terminal **180** include the codec capability, the security attributes, and the network transport capability such as quality of services.

In one embodiment, User Terminal **180** transmits the corporate user phone service information to Voice VPN Activator **110**.

In one embodiment, Voice VPN Activator **110** retrieves the corporate user phone service information from Data Store **120**. Voice VPN Activator **110** sends the corporate user phone service information to Voice VPN Signaling Mediator **130**. Voice VPN Signaling Mediator **130** registers with Corporate Phone Service Server **190**. Voice VPN Signaling Mediator **130** transmits a part or all of the corporate user phone service information to Corporate Phone Service

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Server **190** to activate the corporate phone service for the corporate user. Voice VPN Signaling Mediator **130** indicates to Voice VPN Activator **110** of the successful registration of the corporate phone service. Voice VPN Activator **110** subsequently responds to User Terminal **180** of a successful activation of the corporate phone service. The corporate user can start using the corporate phone service.

A corporate user can request a complete set or a partial set of phone service features. In one embodiment, a corporate user can request a set of phone service features such as making a phone call, receiving a phone call, and other corporate phone service features.

In one embodiment, a corporate user can request phone calling service only, in which case incoming calls are not routed to the corporate user.

In one embodiment, the corporate user can request phone call receiving service only that delivers calls to User Terminal **180**. In such an embodiment, the corporate user cannot make a call with the corporate phone service.

FIG. 2 illustrates a method for requesting access to the corporate Voice VPN. User Terminal **280** sends a request to Voice VPN Activator **210**. Voice VPN activator queries Data Store **220** for user authentication data and validates user authentication with Corporate Voice and Communication Service Servers **290**.

In one embodiment User Terminal **280** provides the corporate user identity and a password. Voice VPN Activator **210** compares the corporate user identity and the password with the information in the Data Store **220**.

In one embodiment, Voice VPN Activator **210** checks with External Authentication Validator **270** to validate the corporate user identity and the password.

In one embodiment, after validating a corporate user, Voice VPN Activator **210** requests user authentication with Corporate Voice and Communication Service Servers **290**.

In one embodiment, Corporate Voice and Communication Service Servers **290** may require additional corporate user information. Voice VPN Activator **210** sends prompts to User Terminal **280** for necessary information.

In one embodiment, Corporate Voice and Communication Service Servers **290** do not require additional information.

In one embodiment, it is not necessary to perform user authentication for the Corporate Voice and Communication Service Servers **290**. In such a case, the Voice VPN Activator **210** does not interact with the Corporate Voice and Communication Service Servers **290**. After validating all necessary user authentications, Voice VPN Activator **210** responds positively to User Terminal **280**. The corporate user is thus allowed access the corporate Voice VPN.

In one embodiment, Voice VPN Activator **210** notifies Corporate Voice and Communication Service Servers **290** that the corporate user terminates the access to any corporate voice and communication services.

In the embodiment where Voice VPN Activator **210** receives a termination request from User Terminal **280**, Voice VPN Activator **210** responds to User Terminal **280** of a successful termination of the access to the corporate Voice VPN.

In FIG. 2, during the process of validating the corporate user's authentication, Voice VPN Activator **210** determines a plurality of corporate voice and communication services that are allowed for the corporate user.

In one embodiment, the allowed corporate voice and communication services are determined based on the corporate position or corporate role of the corporate user.

In one embodiment, the allowed corporate voice and communication services are determined based on the time of the day.

In one embodiment, the allowed corporate voice and communication services are determined based on the user's subscription of corporate voice and communication services.

In one embodiment, corporate voice and communication services are activated automatically according to a schedule. The allowed corporate voice and communication services will include the scheduled services when the corporate user accesses the Voice VPN at the appropriate time.

In one embodiment, the allowed corporate voice and communication services are determined based on a combination of criteria including the previous embodiments.

In one embodiment, the allowed corporate voice and communication services are determined based on a particular corporate user's past use habits. Using artificial intelligence principles, it is possible to make the set of allowed and available voice and communications services dependent on adaptive logic including, but not limited to, various forms of fuzzy logic or Bayesian analysis. In this way a corporate user can adaptively be assigned a set of voice and communications services or be prompted to request services from a set of recently or most likely needed voice and communication services.

Upon determining the plurality of corporate voice and communication services, and confirming the corporate user's authentication, Voice VPN Activator 210 informs User Terminal 280 of the accessible corporate voice and communication services.

FIG. 3 illustrates a method for terminating access to corporate Voice VPN. User Terminal 380 requests Voice VPN Activator 310 to terminate access to the corporate Voice VPN.

In one embodiment, Voice VPN Activator 310 determines User Terminal 380 is no longer using the corporate Voice VPN.

In one embodiment, User Terminal 380 is powered off. Voice VPN Activator 310 cannot continue communicating with User Terminal 380.

In one embodiment, Voice VPN Activator 310 terminates access to Voice VPN after not receiving a signal from User Terminal 380 for some time out period.

In one embodiment, the time out period is over 45 seconds.

In another embodiment, the time period is over 3 minutes. After the time out period expires Voice VPN Activator 310 terminates access to the corporate Voice VPN.

After Voice VPN Activator 310 receives a termination request or determines the termination of User Terminal 380, Voice VPN Activator 310 checks for any corporate voice and communication services in use. If there are any corporate voice and communication service in use, Voice VPN Activator 310 sends a request to Voice VPN Signaling Mediator 330 to terminate the corporate voice and communication service for the corporate user.

FIG. 4 illustrates a method of requesting use of corporate phone service. In this illustration, the Voice and Communication Service Server is a Corporate Phone Service Server 490.

In one embodiment, the corporate phone service is based on Voice over Internet Protocol.

In one embodiment, Corporate Phone Service Server 490 includes a Session Initiation Protocol (SIP) server and a media gateway.

In a one embodiment, Corporate Phone Service Server 490 is an IP PBX.

In one embodiment Corporate Phone Service Server 490 is a Soft Switch. In the same embodiment, Voice VPN Signaling Mediator 430 includes a Session Initiation Protocol (SIP) user agent that communicates with the SIP server in Corporate Phone Service Server 490. Voice VPN Session Mediator 450 includes a codec module equipped with an IP interface to handle the Voice over Internet Protocol (VoIP) packets between itself and Corporate Phone Service Server 490.

FIG. 5 illustrates a method for terminating corporate phone service. User Terminal 580 requests Voice VPN Activator 510 to terminate the usage of the corporate phone service.

In one embodiment, User Terminal 580 terminates the Voice VPN access, indicating its intention to terminate all in-use voice and communication services including the corporate phone service.

In one embodiment, Voice VPN Activator 510 determines User Terminal 580 is no longer using the corporate phone service, for example, after determining User Terminal 580 is no longer active in Voice VPN communication. Voice VPN Activator 510 notifies Voice VPN Signaling Mediator 530 of the termination of the corporate phone service by the corporate user. Voice VPN Signaling Mediator 530 de-registers the corporate user from Corporate Phone Service Server 590.

In one embodiment, the corporate phone service is always available and does not require a notification of service termination.

FIG. 6 illustrates a method for making a phone call according to one embodiment of the present invention. A corporate user dials a phone number of a callee. User Terminal 680 informs Voice VPN Signaling Mediator 630 of the callee information which includes the callee phone number and the user terminal voice session resource that is used to establish a voice session with Voice VPN Session Mediator 650. Voice VPN Signaling Mediator 630 requests Voice VPN Session Mediator 650 to reserve a resource that is to be used to establish a corporate side voice session, a resource that is to be used to establish a user side voice session with User Terminal 680, and a resource to mediate between the two sessions. Voice VPN Signaling Mediator 630 also informs Voice VPN Session Mediator 650 of the user terminal voice session resource. Voice VPN Session Mediator 650 responds to Voice VPN Signaling Mediator 630 with reservations for corporate side voice session resource 675 and user side voice session resource 673. Voice VPN Signaling Mediator 630 responds to user terminal 680 with user side voice session resource 673.

In one embodiment, Voice VPN Session Mediator 650 establishes a user side voice session 685 with User Terminal 680 immediately.

In one embodiment, Voice VPN Session Mediator 650 establishes the user side voice session 685 at a later time. Voice VPN Signaling Mediator 630 requests Corporate Phone Service Server 690 to make a phone call to the callee. The request includes the callee phone number and the corporate side voice session resource 675.

In one embodiment, Voice VPN Signaling Mediator 630 includes a SIP user agent and Corporate Phone Service Server 690 includes a SIP server. The request is a SIP INVITE message. This message carries the SDP information which includes the corporate side voice session resource 675, and the callee information which includes the callee phone number. Corporate Phone Service Server 690 subsequently responds positively to the request.



In one embodiment, Corporate Phone Service Server **690** responds with a SIP OK message. The response message includes the corporate side peer voice session resource information so that a corporate side voice session can be established.

In one embodiment, corporate side voice session **695** is between Voice VPN Session Mediator **650** and Corporate Phone Service Server **690**.

In one embodiment, the corporate side voice session **695** is between Voice VPN Session Mediator **650** and a tele-  
phone system.

In one embodiment, corporate side voice session **695** is between Voice VPN Session Mediator **650** and a Voice VPN Session Mediator, when the callee is another corporate user accessing the corporate Voice VPN. Voice VPN Signaling Mediator **630** notifies Voice VPN Session Mediator **650** of the corporate side peer voice session resource information. Voice VPN Session Mediator **650** establishes corporate side voice session **695**.

In one embodiment, Voice VPN Session Mediator **650** establishes the user side voice session **685** with User Terminal **680** at the same time. Voice VPN Signaling Mediator **630** responds positively to User Terminal **680** of successful establishment of a phone call. The corporate user can then conduct the phone conversation with the callee with the reserved resource in Voice VPN Session Mediator **650** that mediates user side voice session **685** and corporate side voice session **695**.

Methods for using other common corporate phone features such as voice mail, consultation hold, call transfer, call trace are illustrated in conjunction with FIG. **6**.

#### Corporate Voice Mail Feature

FIG. **6** also illustrates a method by which a corporate user accesses the corporate voice mail feature provided by Corporate Phone Service Server **690**. The corporate user activates this feature at User Terminal **680**. User Terminal **680** sends this request to Voice VPN Signaling Mediator **630** with the voice mail feature information. Voice VPN Signaling Mediator **630** uses this information to establish the corporate side voice session towards Corporate Phone Service Server **690**. Signaling Mediator **630** also instructs the Voice VPN Session Mediator **650** to mediate the user side voice session and the corporate side voice session. The signaling and session mediation procedures are the same as making a phone call to a remote peer user as illustrated in FIG. **6**. Upon successful session establishment of the user side voice session and the corporate side voice session, the corporate user is communicating with the voice mail system.

In one embodiment, the voice mail system does not require further user authentication.

In another embodiment, the voice mail system prompts the corporate user for user identity information that may include, but is not limited to, a password or access code. Interaction between the corporate user and the voice mail system may use mechanisms such as tone detection or voice recognition. These mechanisms are known to those skilled in the art. The voice mail service session may be terminated by the corporate user as in FIG. **8**, or by the voice mail system, which is the remote peer user as illustrated in FIG. **7**.

#### Call Waiting Feature

In one embodiment, while the corporate user is in a phone session with the remote peer user, another remote caller makes a phone call through Corporate Phone Service Server **690** to the corporate user. Corporate Phone Service Server **690** determines the corporate user is reachable through Voice VPN Signaling Mediator **630**. Corporate Phone Service Server **690** requests a phone call to the corporate user with

Voice VPN Signaling Mediator **630**. In such an embodiment, Voice VPN Signaling Mediator **630** supports the Call Waiting feature. Voice VPN Signaling Mediator **630** determines that the corporate user is active on a phone session. It sends a call waiting indication to User Terminal **680** that includes information of the remote caller. Corporate user at User Terminal **680** receives a call waiting alert and decides to accept the new call. User Terminal **680** responds to Voice VPN Signaling Mediator **630** to accept the waiting call. Voice VPN Signaling Mediator **630** communicates with Corporate Phone Service Server **690** to put the original corporate side voice session on hold. Voice VPN Session Mediator **650** establishes a new corporate side voice session with the remote caller as illustrated in the receiving a phone call method in FIG. **7**.

Additionally, Voice VPN Signaling Mediator **630** instructs Voice VPN Session Mediator **650** to mediate the user side voice session and the new corporate side voice session. While the corporate user is conversing with the remote caller, the remote peer user is put on hold. The corporate user can alternatively converse between the remote peer user and the remote caller by indicating her choices to Voice VPN Signaling Mediator **630** via User Terminal **680**. Voice VPN Signaling Mediator **630** instructs Voice VPN Session Mediator **650** to mediate between the user side voice session and the chosen corporate side voice session.

#### Call Transfer Feature

In one embodiment, while the corporate user is in a phone session with the remote peer user, the corporate user wants to transfer the remote peer user to a new remote peer user. The corporate user selects the call transfer feature and supplies the phone number of the new remote peer user. User Terminal **680** sends the call transfer feature selection and the new remote peer user information to Voice VPN Signaling Mediator **630**. Voice VPN Signaling Mediator **630** sends the call transfer feature selection and the new remote peer user information to Corporate Phone Service Server **690**. When the call transfer method is successfully completed, the Corporate Phone Service Server **690** sends a response to the Voice VPN Signaling Mediator **630** indicating the success of the operation.

In one embodiment, Voice VPN Signaling Mediator **630** sends the success indication to User Terminal **680**. User Terminal **680** drops the phone call as illustrated in the dropping a call by the corporate user method in FIG. **8**.

In another embodiment, Corporate Phone Service Server **690** determines to drop the phone call to User Terminal **680** upon successfully transferring the phone call to the new remote user. Corporate Phone Service Server **690** proceeds to drop the phone call, as illustrated by the dropping a call by the remote peer user method in FIG. **9**.

#### Call Recording Feature

In one embodiment, while the corporate user is in a phone session with the remote peer user, the corporate user wants to record the conversation. The corporate user selects the call recording feature. User Terminal **680** sends the call recording request information to Voice VPN Signaling Mediator **630**.

In one embodiment, Voice VPN Signaling Mediator **630** sends the call recording request information to Corporate Phone Service Server **690**. Corporate Phone Service Server **690** records the phone session.

In one embodiment, Corporate Phone Service Server **690** sends a recording start indication to Voice VPN Signaling Mediator **630**, which sends the recording start indication to User Terminal **680**.

In one embodiment, Voice VPN Signaling Mediator **630** does not send the call recording request information to Corporate Phone Service Server **690**. Voice VPN Signaling Mediator **630** instructs Voice VPN Session Mediator **650** to record the phone session.

In one embodiment, Voice VPN Signaling Mediator **630** sends a recording start indication to User Terminal **680**.

In one embodiment, Voice VPN Signaling Mediator **630** does not send a recording start indication to User Terminal **680**. In one embodiment, during the recording of the phone session, Voice VPN Session Mediator **650** records the phone session to Data Store **620**.

There are other embodiments of this Call Recording feature, for example, to stop the recording by the corporate user. Skilled in the art should be able to apply the same principle to implement this feature.

The foregoing descriptions illustrate methods for handling a number of commonly used corporate phone service features. It should be obvious to those skilled in the art to apply similar methods to handle other corporate phone service features.

FIG. 7 illustrates a method for receiving a phone call. When a remote caller makes a phone call through the Corporate Phone Service Server **790** to the callee, the corporate user, Corporate Phone Service Server **790** determines the corporate user is reachable through Voice VPN Signaling Mediator **730**. Corporate Phone Service Server **790** requests a phone call to the corporate user with Voice VPN Signaling Mediator **730**. The request includes the callee information, which includes the callee phone number, and the corporate side peer voice session resource information.

In one embodiment Corporate Phone Service Server **790** includes a SIP server. The request message is a SIP INVITE message. Voice VPN Signaling Mediator **730** matches the callee phone number with all corporate Voice VPN users who had activated the corporate phone service and determines the corporate user as the callee. Voice VPN Signaling Mediator **730** requests Voice VPN Session Mediator **750** to reserve a resource that is to be used to establish a corporate side voice session, a resource that is to be used to establish a user side voice session with User Terminal **780**, and a resource to mediate between the two sessions. Voice VPN Signaling Mediator **730**, in addition, informs Voice VPN Session Mediator **750** the corporate side peer voice session resource information. Voice VPN Session Mediator **750** reserves the resources and responds to Voice VPN Signaling Mediator **730** with the reserved resource information which includes corporate side voice session resource **776** and user side voice session resource **774**.

In one embodiment Voice VPN Signaling Mediator **730** includes a SIP user agent. It responds to the SIP INVITE message with SDP information of corporate side voice session resource **776**. In such an embodiment, Voice VPN Session Mediator **750** establishes corporate side voice session **797** with the corporate side peer voice session resource information.

In another embodiment, Voice VPN Session Mediator **750** establishes corporate side voice session **797** at a later time. Voice VPN Signaling Mediator **730** notifies User Terminal **780** of a phone call request. The notification message includes the caller information and user side voice resource information **774**. User Terminal **780** alerts the corporate user of a phone call request. The corporate user decides to accept the call. User Terminal **780** responds to Voice VPN Signaling Mediator **730** to accept the phone call. The response message includes the user terminal voice session resource

information. Voice VPN Signaling Mediator **730** notifies Voice VPN Session Mediator **750** of the user terminal voice session resource information. Voice VPN Session Mediator **750** establishes user side voice session **787** with User Terminal **780**.

In one embodiment, Voice VPN Session Mediator **750** also establishes the corporate side voice session **797** with the corporate side peer voice session resource information. Voice VPN Signaling Mediator **730** responds positively to Corporate Phone Service Server **790**. The corporate user can now conduct a phone conversation with the caller with the reserved resource in Voice VPN Session Mediator **750** that mediates user side voice session **787** and corporate side voice session **797**.

FIG. 8 illustrates a method for dropping a phone call by a corporate user. User Terminal **880** requests Voice VPN Signaling Mediator **830** to terminate a phone call. This request includes the user side voice session information. Voice VPN Signaling Mediator **830** maps the user side voice session information to the corresponding corporate side voice session. Voice VPN Signaling Mediator **830** sends a request to Corporate Phone Service Server **890** to terminate the phone call. This request message includes the corporate side voice session information. Corporate Phone Service Server **890** responds positively to the request.

In one embodiment Corporate Phone Service Server **890** includes a SIP server. The request message is a SIP BYE message. Corporate Phone Service Server **890** responds with a SIP OK message. Voice VPN Signaling Mediator **830** requests Voice VPN Session Mediator **850** to release the voice session resources.

In one embodiment Voice VPN Signaling Mediator **830** sends such a request to Voice VPN Session Mediator **850**.

FIG. 9 illustrates a method for dropping a phone call by the remote peer user. Upon notification of a termination of a phone call by the remote peer user, Corporate Phone Service Server **990** requests Voice VPN Signaling Mediator **930** to terminate a phone call. The request message includes the corporate side voice session information.

In one embodiment, Corporate Phone Service Server **990** includes a SIP server. The request message is a SIP BYE message. Voice VPN Signaling Mediator **930** matches the corporate side voice session information with all active corporate side voice sessions to determine which phone call to terminate. Voice VPN Signaling Mediator **930** notifies User Terminal **908** to terminate the phone call.

In one embodiment, Voice VPN Signaling Mediator **930** does not inform User Terminal **980** of the phone call termination. User Terminal **980** detects inactivity of user side voice session **989** to determine the phone call is terminated.

In one embodiment, User Terminal **980** detects that the user side voice session **989** is disconnected, and determines the phone call is terminated.

In one embodiment, the corporate user detects inactivity of the remote peer user and determines the phone call is terminated. Voice VPN Signaling Mediator **930** requests Voice VPN Session Mediator **950** to release the voice session resources. Voice VPN Session Mediator **950** terminates corporate side voice session **999** and user side voice session **989**. Voice VPN Signaling Mediator **930** responds positively to Corporate Phone Service Server **990**.

In one embodiment Corporate Phone Service Server **990** includes a SIP server. The response message is a SIP OK message.

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In an embodiment, Voice VPN Signaling Mediator **930** responds to Corporate Phone Service Server **990** before requesting Voice VPN Session Mediator **950** to release the voice session resources.

FIG. **10** illustrates a method for retrieving a corporate phone directory. User Terminal **1080** requests the corporate phone directory from Voice VPN Signaling Mediator **1030**. Voice VPN Signaling Mediator **1030** requests the corporate phone directory from Corporate Phone Service Server **1090**. Corporate Phone Service Server **1090** responds with the corporate phone directory. Voice VPN Signaling Mediator **1030** formats the information, and responds to User Terminal **1080** with the corporate phone directory.

In the forgoing descriptions of various possible embodiments of the present invention, the remote peer party is a corporate voice service user inside the realm of the corporate voice network, another Voice VPN user, or a user connected to the corporate network via other networks such as PSTN. The illustrations of the inventions are not limiting to the illustrated corporate phone service. Those skilled in the art should be able to apply the principles of the present invention to other corporate phone service features, as well as other voice and communication services.

Foregoing described embodiments of the invention are provided as illustrations and descriptions. They are not intended to limit the invention to precise form described. In particular, it is contemplated that functional implementation of invention described herein may be implemented equivalently in hardware, software, firmware, and/or other available functional components or building blocks, and that networks may be wired, wireless, or a combination of wired and wireless. Other variations and embodiments are possible in light of above teachings, and it is thus intended that the scope of invention not be limited by this Detailed Description, but rather by Claims following.

What is claimed is:

1. A system for providing teleconferencing services, comprising:

a server within a private data network for providing teleconferencing services within the private data network;

a user terminal external to the private data network and directly coupled to a public network, the user terminal comprising a session initiation protocol (SIP) user agent; and

a SIP-based teleconferencing gateway coupled to the server via the private data network and coupled to the user terminal via the public network, wherein the SIP-based teleconferencing gateway:

receives a SIP registration request from the SIP user agent of the user terminal to receive teleconferencing services within the private data network,

in response to the SIP registration request, retrieves user terminal information for receiving the teleconferencing services from a data store of the SIP-based teleconferencing gateway, and

sends the retrieved user terminal information to the server to activate the user terminal for receiving the teleconferencing services;

wherein the server:

receives the user terminal information from the SIP-based teleconferencing gateway,

activates the user terminal for teleconferencing services using the user terminal information, and

after activating the user terminal, sends to the SIP-based teleconferencing gateway a request for a teleconference call to the user terminal as a callee of the

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teleconference call, wherein the request comprises a callee telephone number, wherein the teleconference call comprises an Internet protocol (IP)-based voice call; and

wherein the SIP-based teleconferencing gateway further: receives the request for the teleconference call from the server,

compares the callee telephone number in the request with a plurality of user terminals activated for the teleconferencing services within the private data network;

determines that the callee telephone number in the request matches the user terminal;

sends a SIP notification to the user terminal of the request for the teleconference call to the user terminal,

receives an acceptance of the teleconference call from the user terminal,

after receiving the acceptance of the teleconference call from the user terminal:

reserves resources for the IP-based voice call of the teleconference call,

establishes with the server a server side IP-based voice session associated with the IP-based voice call using the resources reserved for the IP-based voice call,

establishes with the user terminal a user side SIP-based voice session associated with the IP-based voice call using the resources reserved for the IP-based voice call, and

mediates audio signals of the IP-based voice call between the user side SIP-based voice session and the server side IP-based voice session using the resources reserved for the IP-based voice call, wherein the SIP-based teleconferencing gateway comprises an interface,

wherein in mediating the audio signals of the IP-based voice call, the interface transmits the audio signals between the user side SIP-based voice session and the server side IP-based voice session.

2. The system of claim 1, wherein the user terminal detects inactivity of the user side voice session.

3. The system of claim 2, wherein the user terminal terminates the user side voice session upon detecting inactivity of the user side voice session.

4. The system of claim 1, wherein the SIP-based teleconferencing gateway receives the SIP registration request using a web-based technology.

5. The system of claim 4, wherein the web-based technology comprises one or more of the following: a web service; hypertext transfer protocol (HTTP); and Java.

6. The system of claim 1, wherein the public network comprises one or more of the following: a cellular data network; a wireless network; and Internet.

7. The system of claim 1, wherein the SIP-based teleconferencing gateway encrypts signals for the user side voice session.

8. The system of claim 1, wherein the SIP-based teleconferencing gateway establishes a signaling session with the user terminal.

9. The system of claim 8, wherein the SIP-based teleconferencing gateway receives a recording request from the user terminal over the signaling session, wherein the recording request is to record the teleconferencing call.

10. The system of claim 1, wherein in mediating the audio signals of the IP-based voice call, the interface:

samples and digitizes the audio signals of the IP-based voice call;  
places the sampled and digitized audio signals of the IP-based voice call into one or more voice packets; and transmits the one or more the voice packets between the user side SIP-based voice session and the server side IP-based voice session.

11. The system of claim 1, wherein the server comprises a SIP server agent, the user terminal comprises the SIP user agent, and the SIP-based teleconferencing gateway comprises a SIP proxy, wherein the server and the SIP-based teleconferencing gateway communicate through the SIP server agent and the SIP proxy, wherein the user terminal and the SIP-based teleconferencing gateway communicate through the SIP user agent and the SIP proxy.

12. A method for providing teleconferencing service, comprising:

- (a) receiving, by a session initiation protocol (SIP)-based teleconferencing gateway coupled to a server within the private data network, a SIP registration request from a SIP user agent of a user terminal to receive teleconferencing services within the private data network, the user terminal being external to the private data network and directly coupled to a public network, the SIP-based teleconferencing gateway being coupled to the user terminal via the public network;
- (b) in response to the SIP registration request, retrieving user terminal information for receiving the teleconferencing services from a data store of the SIP-based teleconferencing gateway;
- (c) sending, by the SIP-based teleconferencing gateway, the retrieved user terminal information to the server to activate the user terminal for receiving teleconferencing services;
- (d) receiving, by the server, the user terminal information from the SIP-based teleconferencing gateway;
- (e) activating, by the server, the user terminal for teleconferencing services using the user terminal information;
- (f) after activating the user terminal, sending, by the server to the SIP-based teleconferencing gateway, a request for a teleconference call to the user terminal as a callee of the teleconference call, wherein the request comprises a callee telephone number, wherein the teleconference call comprises an Internet protocol (IP)-based voice call;
- (g) receiving, by the SIP-based teleconferencing gateway, the request for the teleconference call from the server;
- (h) comparing, by the SIP-based teleconferencing gateway, the callee telephone number in the request with a plurality of user terminals activated for the teleconferencing services within the private data network;
- (i) determining, by the SIP-based teleconferencing gateway, that the callee telephone number in the request matches the user terminal;
- (j) sending, by the SIP-based teleconferencing gateway, a SIP notification to the user terminal of the request for the teleconference call to the user terminal;
- (k) receiving, by the SIP-based teleconferencing gateway, an acceptance of the teleconference call from the user terminal;
- (l) after receiving the acceptance of the teleconference call from the user terminal:
  - (1) reserving, by the SIP-based teleconferencing gateway, resources for the IP-based voice call of the teleconference call;

(2) establishing, by the SIP-based teleconferencing gateway with the server, a server side IP-based voice session associated with the IP-based voice call using the resources reserved for the IP-based voice call;

(3) establishing, by the SIP-based teleconferencing gateway with the user terminal, a user side SIP-based voice session associated with the IP-based voice call using the resources reserved for the IP-based voice call; and

(4) mediating, by the SIP-based teleconferencing gateway, audio signals of the IP-based voice call between the user side SIP-based voice session and the server side IP-based voice session using the resources reserved for the IP-based voice call, wherein the SIP-based teleconferencing gateway comprises an interface, wherein the mediating comprises:

transmitting, by the interface, the audio signals between the user side SIP-based voice session and the server side IP-based voice session.

13. The method of claim 12, further comprising:

(m) detecting, by the user terminal, inactivity of the user side voice session.

14. The method of claim 13, further comprising:

(n) terminating, by the user terminal, the user side SIP-based voice session upon detecting inactivity of the user side SIP-based voice session.

15. The method of claim 12, wherein the receiving (a) comprises:

(a1) receiving, by the SIP-based teleconferencing gateway, the SIP registration request using a web-based technology, wherein the web-based technology comprises one or more of the following: a web service; hypertext transfer protocol (HTTP); and Java.

16. The method of claim 12, wherein the public network comprises one or more of the following: a cellular data network; a wireless network; and Internet.

17. The method of claim 12, wherein the establishing (13) comprises:

(13i) establishing, by the SIP-based teleconferencing gateway, a signaling session with the user terminal, wherein the method further comprises:

(m) receiving, by the SIP-based teleconferencing gateway, a recording request from the user terminal over the signaling session, wherein the recording request is to record the teleconference call.

18. The method of claim 12, wherein the mediating comprises:

sampling and digitizing the audio signals of the IP-based voice call by the interface;

placing the sampled and digitized audio signals of the IP-based voice call into one or more voice packets by the interface; and

transmitting, by the interface, the one or more the voice packets between the user side SIP-based voice session and the server side IP-based voice session.

19. The method of claim 12, wherein the server comprises a SIP server agent, the user terminal comprises the SIP user agent, and the SIP-based teleconferencing gateway comprises a SIP proxy, wherein the server and the SIP-based teleconferencing gateway communicate through the SIP server agent and the SIP proxy, wherein the user terminal and the SIP-based teleconferencing gateway communicate through the SIP user agent and the SIP proxy.