US 20050232248A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2005/0232248 A1

Norris et al. (43) Pub. Date: Oct. 20, 2005

(54) CALL WAITING FEATURE FOR A TELEPHONE LINE CONNECTED TO THE INTERNET

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(21) Appl. No.: **11/153,827**

(22) Filed: **Jun. 15, 2005**

Related U.S. Application Data

(63) Continuation of application No. 09/994,200, filed on Nov. 26, 2001, now abandoned, which is a continuation of application No. 08/997,018, filed on Dec. 23, 1997, now Pat. No. 6,353,611, which is a continuation-in-part of application No. 08/562,678, filed on Nov. 27, 1995, now Pat. No. 5,805,587.

Publication Classification

(51) **Int. Cl.**[7] **H04L 12/28**; H04L 12/66

(52) **U.S. Cl.** **370/352**; 370/401

(57) **ABSTRACT**

Conventional Internet access service and new computer programs are added to a conventional telephone central office. This system is able to alert a subscriber whose telephone line is connected to the Internet of a waiting call via the Internet access connection. Specifically, in response to a call that is waiting for a subscriber, the system establishes a new communication with the subscriber using the Internet access connection and new programs in the subscriber's data terminal. The system then notifies the subscriber of the waiting call via the Internet access connection. The system may then forward the telephone call to the subscriber via the Internet access connection responsive to a subscriber's request to do so without terminating the subscriber's Internet connection, or the subscriber may choose to answer the call in a conventional manner, or may select another option in response to the call notification.

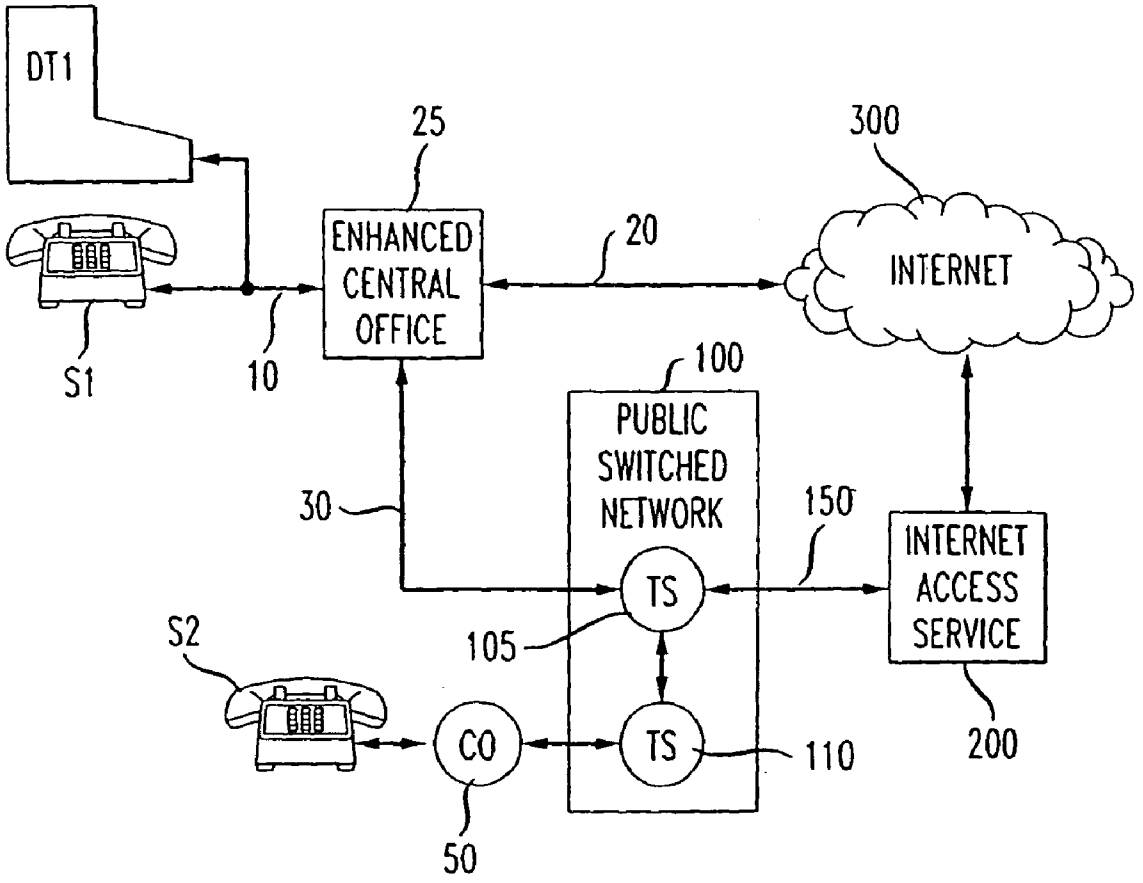


FIG. 1

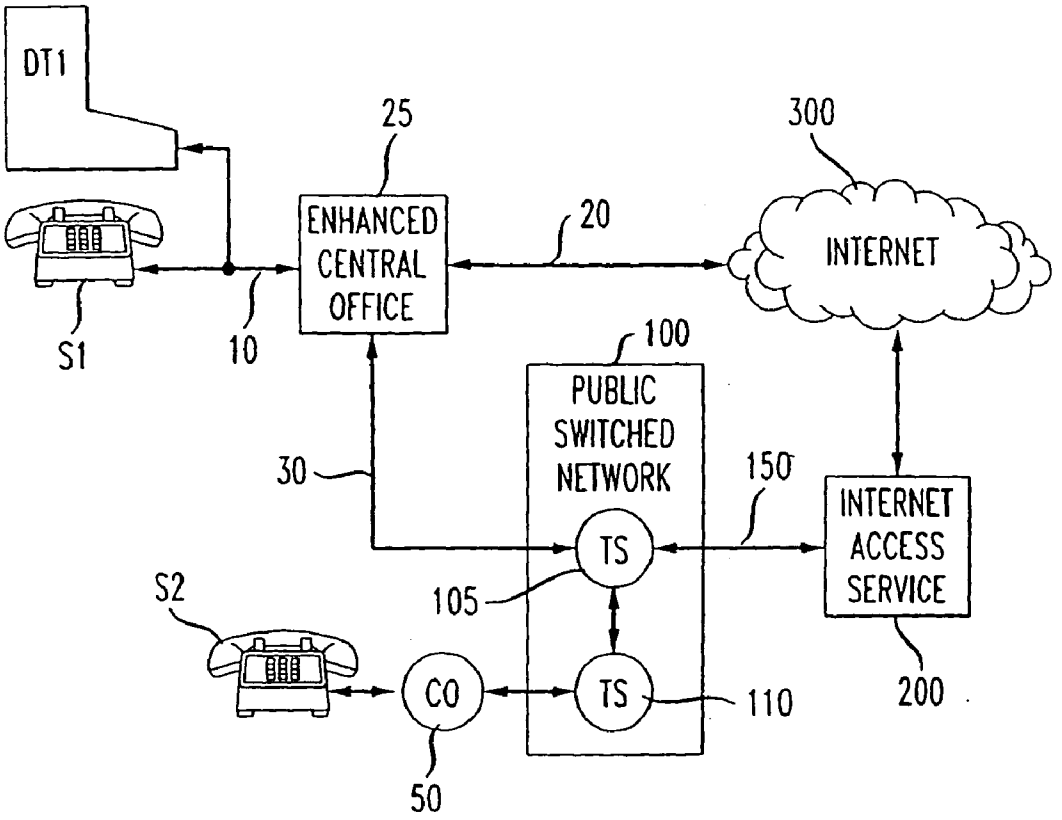
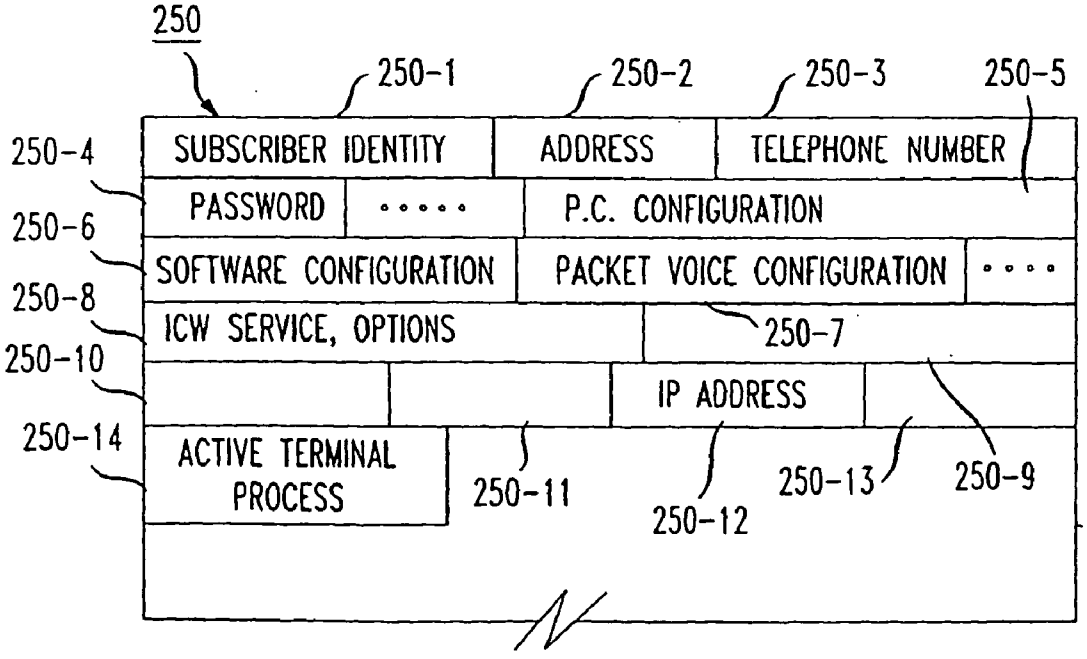

DT1
25
300
ENHANCED CENTRAL OFFICE
20
INTERNET
S1
10
100
PUBLIC SWITCHED NETWORK
30
150
INTERNET ACCESS SERVICE
TS
105
S2
CO
TS
110
200
50

FIG. 2


250
250-1
250-2
250-3
250-5
250-4
SUBSCRIBER IDENTITY
ADDRESS
TELEPHONE NUMBER
PASSWORD
• • • • •
P.C. CONFIGURATION
250-6
SOFTWARE CONFIGURATION
PACKET VOICE CONFIGURATION
• • • •
250-8
ICW SERVICE, OPTIONS
250-7
250-10
IP ADDRESS
250-14
ACTIVE TERMINAL PROCESS
250-11
250-12
250-13
250-9

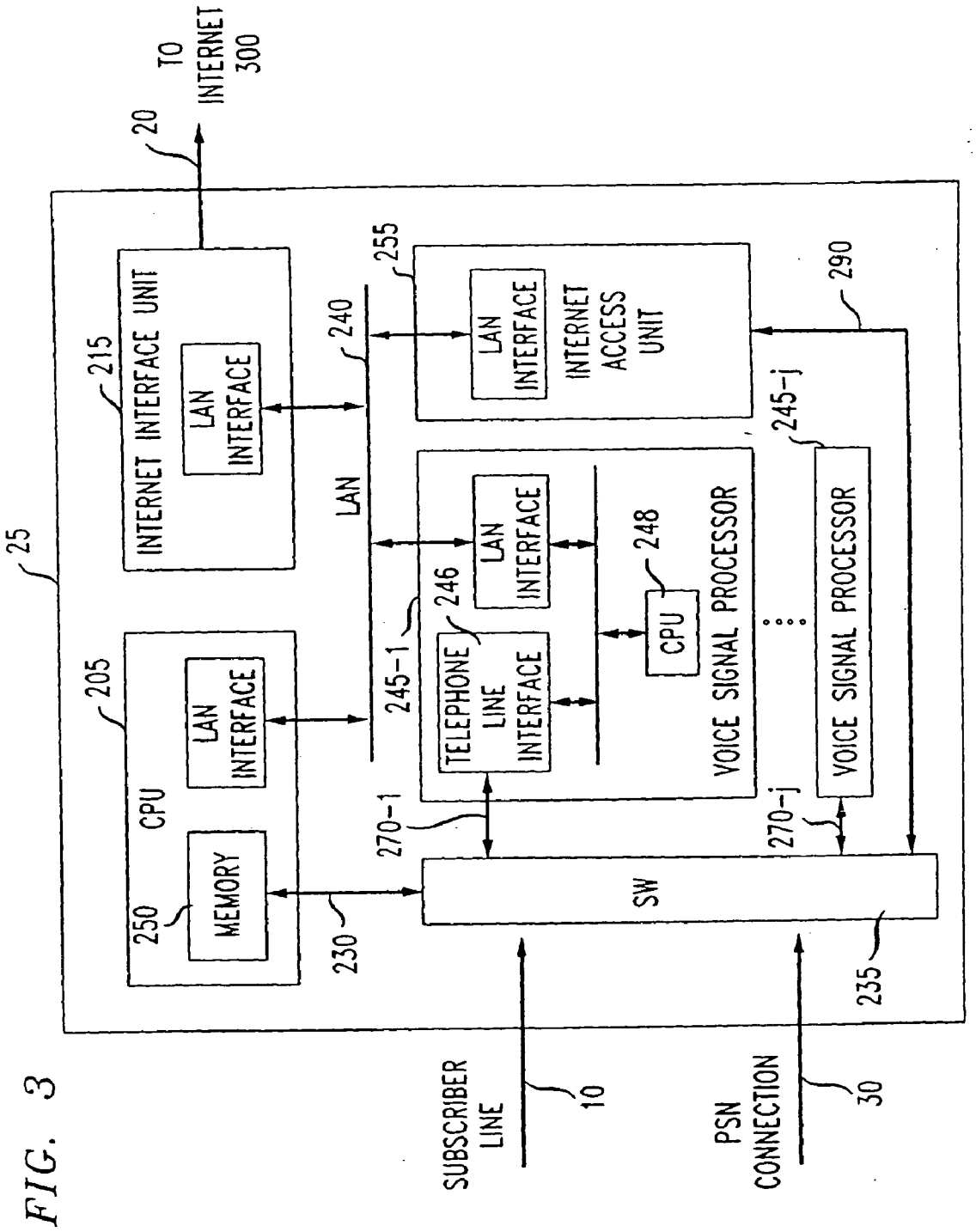

TO INTERNET 300
20
25
INTERNET INTERFACE UNIT
215
LAN INTERFACE
240
LAN
255
LAN INTERFACE
INTERNET ACCESS UNIT
290
205
CPU
LAN INTERFACE
250
MEMORY
230
245-1
246
TELEPHONE LINE INTERFACE
LAN INTERFACE
248
CPU
VOICE SIGNAL PROCESSOR
245-j
VOICE SIGNAL PROCESSOR
270-1
270-j
SW
235
SUBSCRIBER LINE
10
PSN CONNECTION
30

FIG. 3

FIG. 4

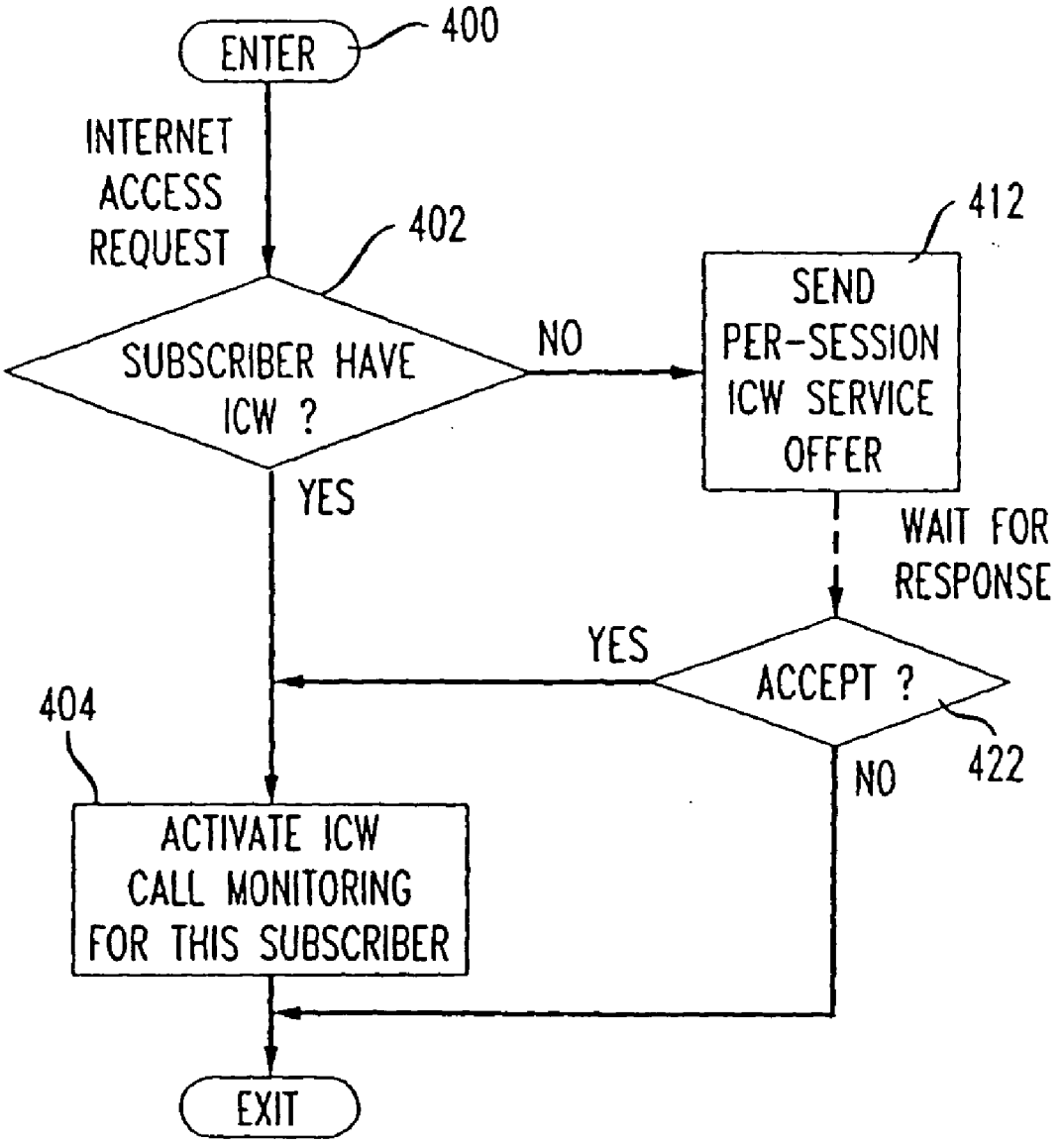

ENTER
400
INTERNET ACCESS REQUEST
402
SUBSCRIBER HAVE ICW ?
NO
412
SEND PER-SESSION ICW SERVICE OFFER
YES
WAIT FOR RESPONSE
YES
ACCEPT ?
422
NO
404
ACTIVATE ICW CALL MONITORING FOR THIS SUBSCRIBER
EXIT

FIG. 5

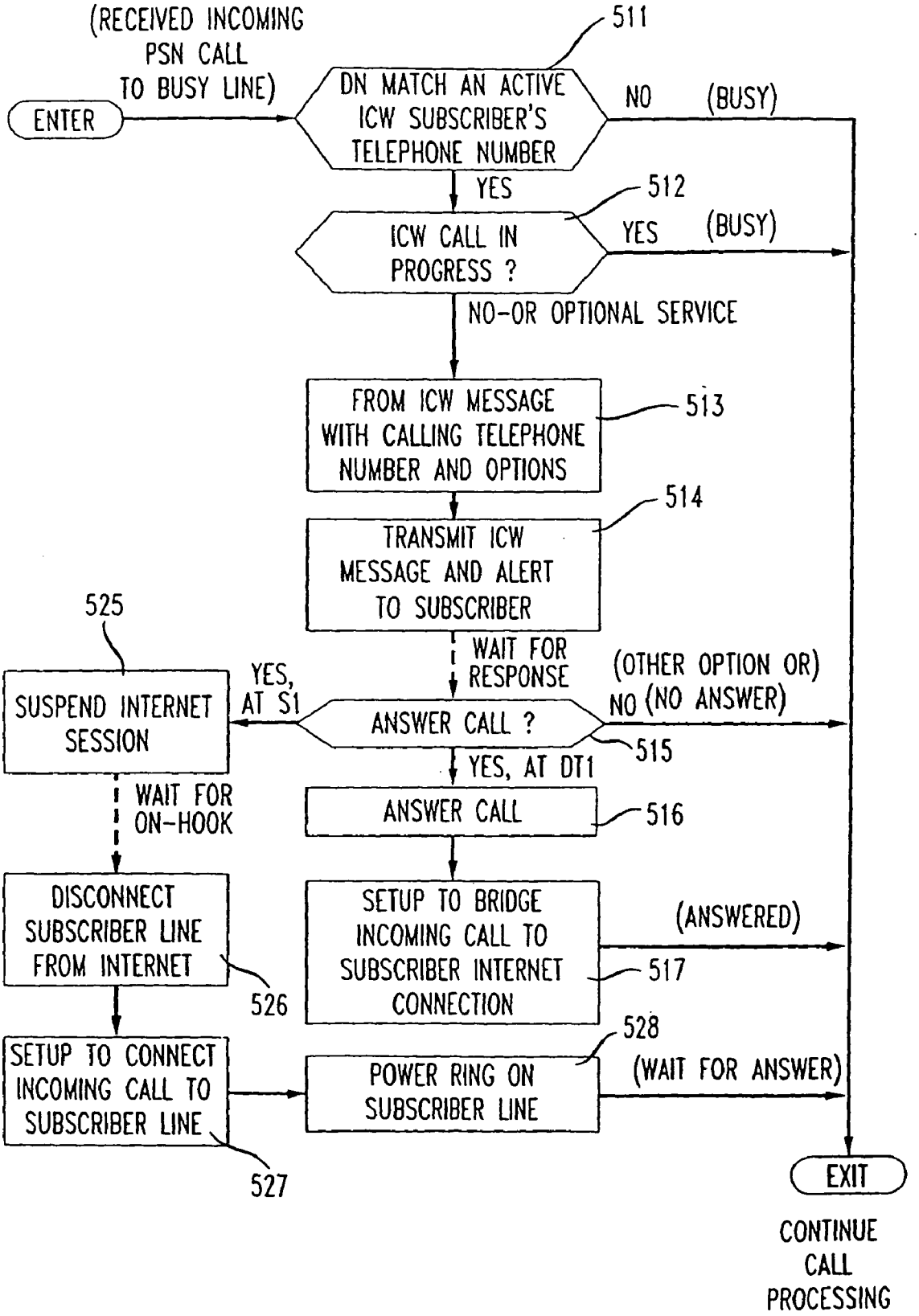

(RECEIVED INCOMING PSN CALL TO BUSY LINE)
ENTER
511
DN MATCH AN ACTIVE ICW SUBSCRIBER'S TELEPHONE NUMBER
NO
(BUSY)
YES
512
ICW CALL IN PROGRESS ?
YES
(BUSY)
NO-OR OPTIONAL SERVICE
FROM ICW MESSAGE WITH CALLING TELEPHONE NUMBER AND OPTIONS
513
514
TRANSMIT ICW MESSAGE AND ALERT TO SUBSCRIBER
525
WAIT FOR RESPONSE
(OTHER OPTION OR) NO (NO ANSWER)
YES, AT S1
SUSPEND INTERNET SESSION
ANSWER CALL ?
515
YES, AT DT1
WAIT FOR ON-HOOK
ANSWER CALL
516
DISCONNECT SUBSCRIBER LINE FROM INTERNET
526
SETUP TO BRIDGE INCOMING CALL TO SUBSCRIBER INTERNET CONNECTION
(ANSWERED)
517
528
SETUP TO CONNECT INCOMING CALL TO SUBSCRIBER LINE
POWER RING ON SUBSCRIBER LINE
(WAIT FOR ANSWER)
527
EXIT
CONTINUE CALL PROCESSING

FIG. 6

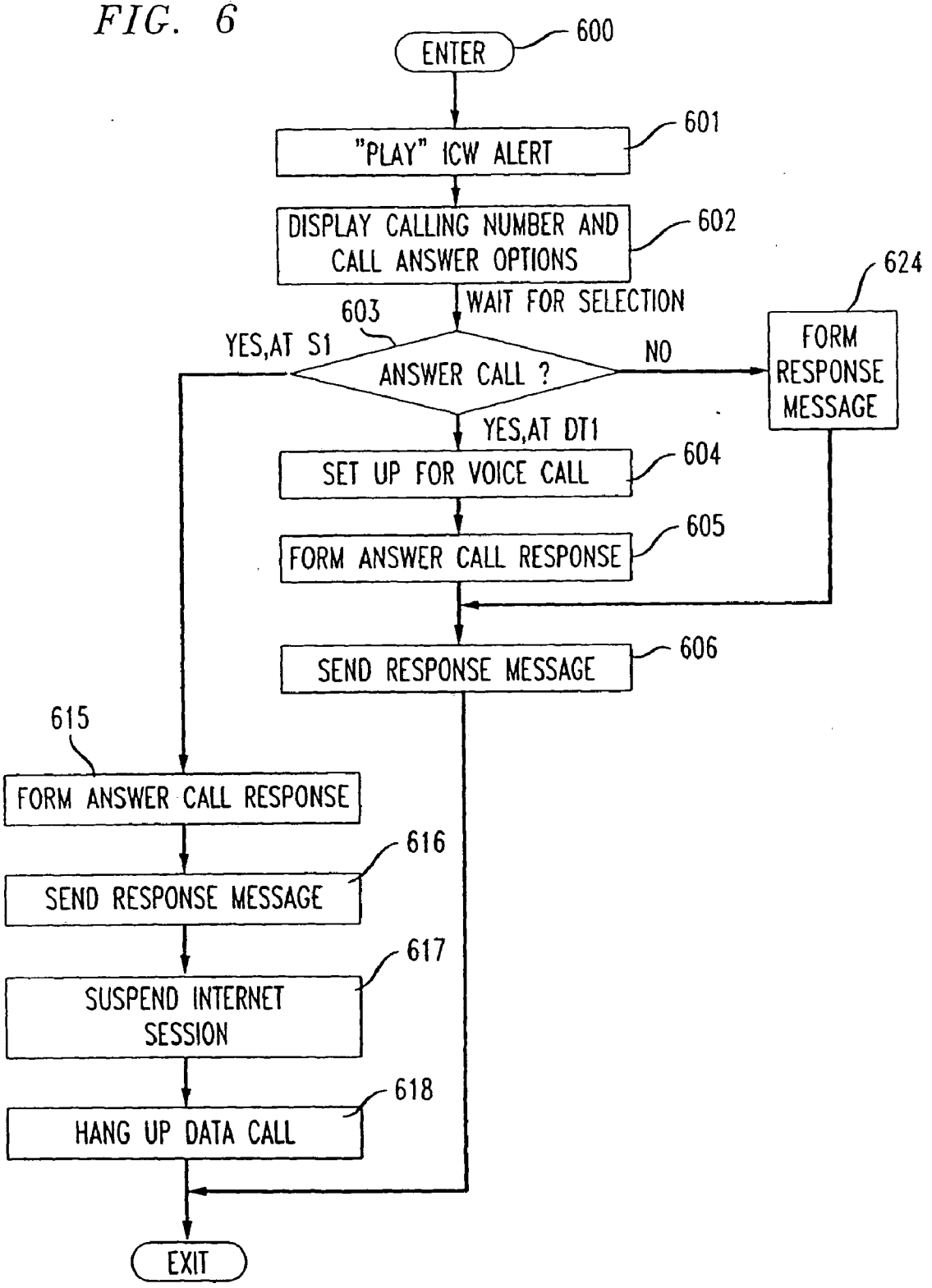

ENTER
600
"PLAY" ICW ALERT
601
DISPLAY CALLING NUMBER AND CALL ANSWER OPTIONS
602
WAIT FOR SELECTION
603
ANSWER CALL ?
YES,AT S1
NO
YES,AT DT1
624
FORM RESPONSE MESSAGE
SET UP FOR VOICE CALL
604
FORM ANSWER CALL RESPONSE
605
SEND RESPONSE MESSAGE
606
615
FORM ANSWER CALL RESPONSE
SEND RESPONSE MESSAGE
616
SUSPEND INTERNET SESSION
617
HANG UP DATA CALL
618
EXIT

FIG. 7

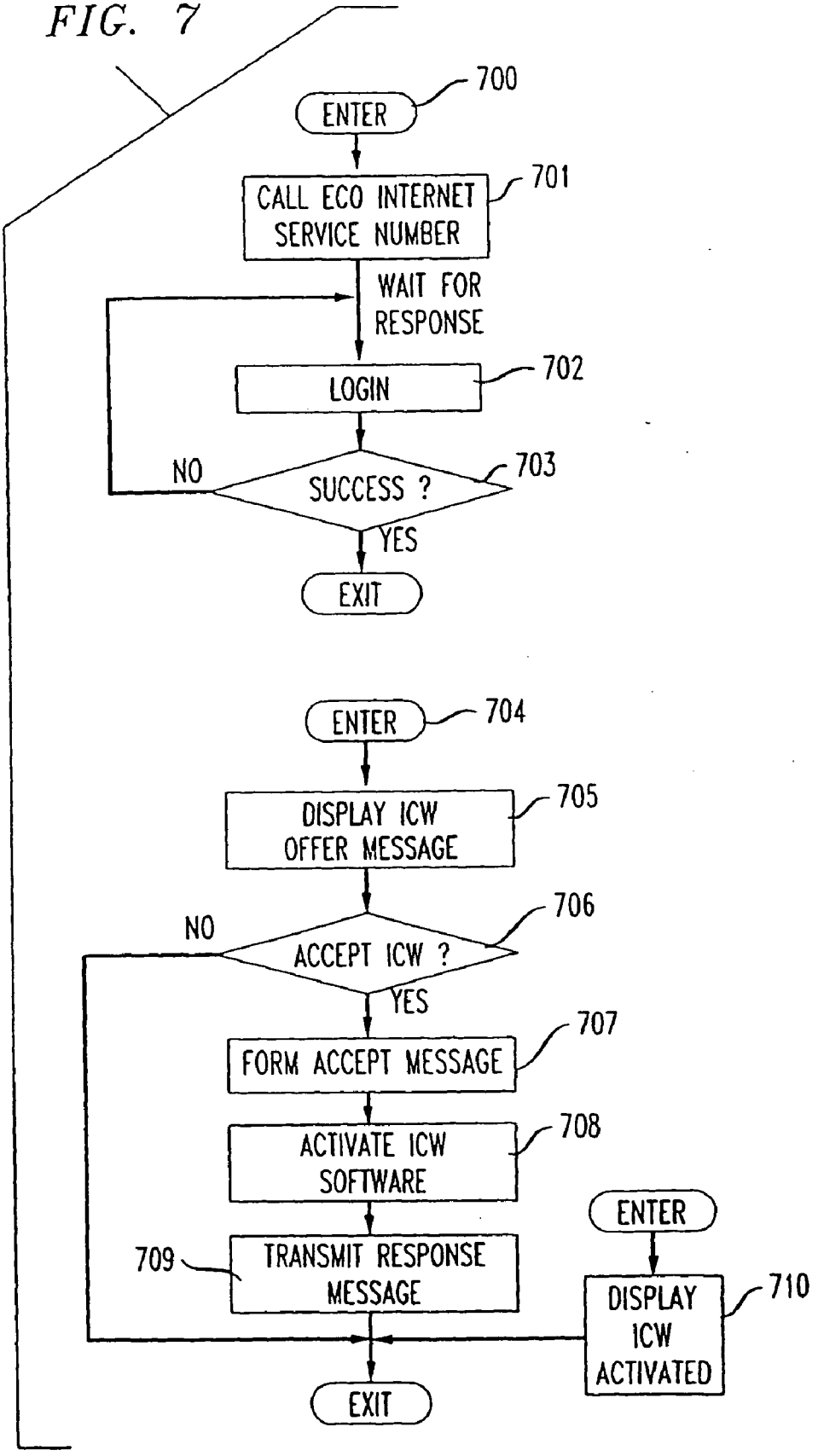
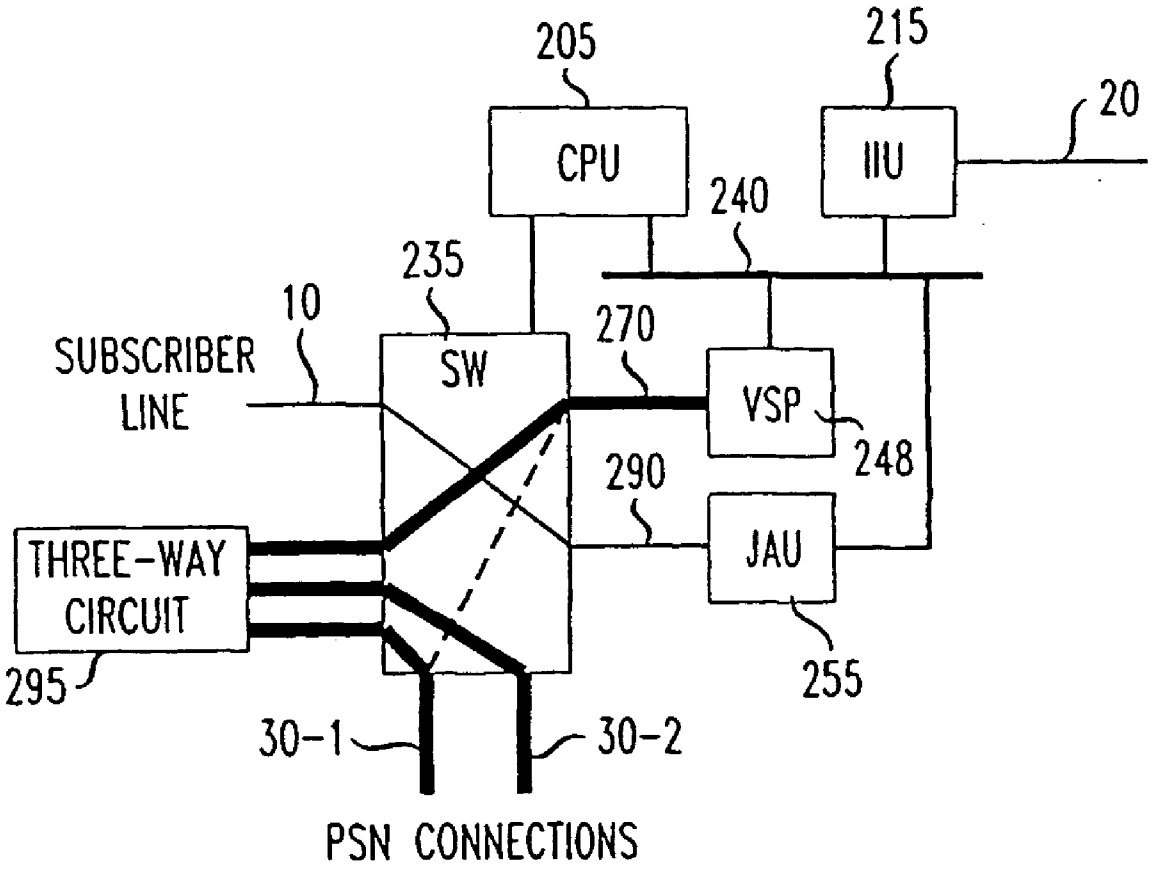

ENTER
700
CALL ECO INTERNET SERVICE NUMBER
701
WAIT FOR RESPONSE
LOGIN
702
NO
SUCCESS ?
703
YES
EXIT
ENTER
704
DISPLAY ICW OFFER MESSAGE
705
NO
ACCEPT ICW ?
706
YES
FORM ACCEPT MESSAGE
707
ACTIVATE ICW SOFTWARE
708
ENTER
709
TRANSMIT RESPONSE MESSAGE
DISPLAY ICW ACTIVATED
710
EXIT

FIG. 8


205
215
20
CPU
IIU
240
235
10
270
SUBSCRIBER LINE
SW
VSP
248
290
JAU
THREE-WAY CIRCUIT
295
255
30-1
30-2
PSN CONNECTIONS

CALL WAITING FEATURE FOR A TELEPHONE LINE CONNECTED TO THE INTERNET

FIELD OF THE INVENTION

[0001] The invention relates to a call waiting feature for telephone calls and more particularly relates to a call waiting feature for a called telephone station set that is busy as a result of being connected to the Internet via an enhanced telephone central office system.

BACKGROUND OF THE INVENTION

[0002] Call waiting is a telephone feature that is provided by a telephone switching office, e.g., a Central Office (CO), to alert a called party to an incoming call when that party's telephone station set is busy with another call. We have recognized that a telephone switching office cannot apply the call waiting feature to the telephone line that is connected to the well-known Internet. This limitation stems from the fact that the application of call waiting signals to the telephone line would interfere with the data connection. Also, when a data call is established between a subscriber's telephone line and the Internet via an Internet Access Service (IAS), the subscriber would not be able to hear the call waiting tone even if the data connection/communications were able to recover from the interference. Disadvantageously, then, a telephone subscriber who subscribes to call waiting cannot be notified that a call is waiting when the subscriber's line is connected to the Internet.

[0003] In co-pending U.S. application Ser. No. 08/562,678, filed Nov. 27, 1995, entitled "Call Notification Feature for a Telephone Line Connected to the Internet," which is incorporated herein by reference, we disclosed a method to overcome this disadvantage: by placing new functionality at the IAS and the called party's data terminal; by activating conventional call forwarding to route the subscriber's incoming calls to the IAS rather than giving busy signals; and by utilizing the new LAS and data terminal functionality-first to notify the called party of the incoming call, and then, if requested by the called party, to connect that call to the called party. The connection between the incoming call and the called party was via the IAS and data terminal on the existing connection by converting conventional telephone voice signals to packetized voice signals suitable for transmission over an Internet connection.

SUMMARY OF THE INVENTION

[0004] In accordance with the present invention, we have found that an alternative to the call forwarding feature disclosed in U.S. Ser. No. 08/562,678 may be used to achieve the same benefit, i.e., to notify a subscriber of a waiting call even though the subscriber's telephone line is connected to the Internet. This alternative also provides the additional benefit of providing the subscriber with additional options for responding to incoming calls. Specifically, in accordance with the present invention, the telephone central office serving the subscriber may be equipped with the Internet Access Service provisions disclosed in U.S. Ser. No. 08/562,678. A call directed to the subscriber will be processed at such an enhanced central office (ECO) in a conventional manner if the subscriber is not connected to the Internet via its IAS equipment, and will now be processed according to a method similar to that disclosed in U.S. Ser. No. 08/562,678 if the subscriber is connected to the Internet via the ECO's IAS equipment. That is, the ECO's IAS establishes a new communication with the subscriber via the Internet access connection, and then notifies the subscriber of the waiting call via the Internet access connection. The ECO may then connect the incoming telephone call to the subscriber via that Internet access connection responsive to a subscriber request to do so.

[0005] Additionally, the subscriber may be offered service options not available with conventional telephone central office services nor disclosed in U.S. Ser. No. 08/562,678, e.g., the option of terminating or suspending the Internet call so as to be able to answer an incoming call in a conventional manner, and the option to set up a three-way conference among the subscriber (talking via the existing Internet connection) and two incoming calls from other parties.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] In the drawings:

[0007] **FIG. 1** illustrates a telecommunications system in which the principles of the invention may be practiced;

[0008] **FIG. 2** is an illustrative example of a data record that may be used to implement the inventive service in the system of **FIG. 1**;

[0009] **FIG. 3** is a broad block diagram of the Enhanced Central Office (ECO) of **FIG. 1**;

[0010] **FIGS. 4 and 5** illustrate in flow chart form the programs which implement the principles of the invention in the ECO of **FIG. 1**;

[0011] **FIGS. 6 and 7** illustrate in flow chart form the programs which implement the principles of the invention in the subscriber terminal of **FIG. 1**; and

[0012] **FIG. 8** is a second block diagram of the ECO of **FIG. 1** illustrating an additional aspect of the invention.

DETAILED DESCRIPTION

[0013] An illustrative embodiment of the invention will be discussed in the context of a public switched network including a local exchange carrier (central office). It is understood of course that such a discussion is not to be taken as a limitation, since the claimed invention may be practiced in conjunction with different types of telecommunications systems, for example, a private telecommunications network.

[0014] Accordingly, then, in a conventional manner, a telephone subscriber, e.g., the subscriber associated with telephone station S1, **FIG. 1**, may access the well-known Internet by first loading appropriate Internet communications software, e.g., the Windows 95 Dialup Networking Software with accompanying TCP/IP stack from Microsoft Corp. of Redmond, Wash. (hereinafter, Windows 95 Dialup Networking Software), into associated data terminal DT1, which may be, for example, a personal computer having multimedia and telephony capability, as will be discussed below. The subscriber may then cause terminal DT1 to place a telephone call to an Internet access service that the subscriber is associated with, such as Internet Access Service (IAS) **200**, to access the Internet, represented by block **300**. In doing so, terminal DT1 places telephone line **10** in

an off-hook state and then dials the telephone number assigned to IAS **200**. Assuming that IAS **200** is not located in the same local dialing region as terminal DT**1**, then the telephone call will be routed via public switched network (PSN) **100**, e.g., the AT&T network. Specifically, upon receipt of the dialed number, then enhanced central office ECO **25**, in a conventional manner, establishes a telephone connection to toll switch (TS) **105** via path **30**. TS **105**, in turn and in a conventional manner, establishes a connection to IAS **200** via path **150**. IAS **200** then sends conventional data communications signals to the terminal DT**1** software (e.g., the aforementioned Windows 95 Dialup Networking Software) that allows the subscriber to communicate/interface with Internet **300**.

[**0015**] In the current invention, the subscriber may alternatively access the Internet directly from the subscriber's enhanced central office ECO **25**, as will be described in detail below. The subscriber causes the data terminal DT**1** to place a telephone call to a telephone number which ECO **25** recognizes as a request to connect to the Internet via ECO **25**'s own Internet access equipment subunits.

[**0016**] Responsive to receipt of the subscriber's Internet access request, ECO **25** takes a telephone number it associates with the subscriber's line ("ANI") and then translates the ANI into a memory address that it uses to access its internal memory to unload a data record that is associated with the subscriber. An illustrative example of such a record is shown in **FIG. 2**. Specifically, record **250** is formed from a number of fields respectively containing the subscriber's identity (name) **250-1**, address **250-2**, telephone number (ANI) **250-3**, password **250-4**, and other data. ECO **25** permits the caller to access Internet **300** if a password that the caller/subscriber enters via DT**1** matches the contents of field **250-4**. If such a match does not occur after the caller has made a number of attempts to enter the correct password via terminal DT**1**, then ECO **25** terminates the call, as is done conventionally whenever a login fails. Assuming a match occurs, then ECO **25** communicates with the caller in accordance with the contents of fields **250-5** and **250-6** (**FIG. 2**), which respectively specify the configuration of terminal DT**1** and configuration of the Internet interface software, e.g., the aforementioned Windows 95 Dialup Networking Software, loaded in terminal DT**1**. In addition, ECO **25** assigns an Internet IP address to the call and stores the address in field **250-12**. (Alternatively, ECO **25** may assign such an address to the subscriber just once, when the subscriber initially enters a subscription for the service as is done conventionally.) ECO **25** thereafter uses the IP address to route the subscriber's data messages (packets) to and from Internet **300** via a conventional data router, as will be discussed below. The subscriber may then begin to access Internet **300** in a conventional manner. That is, terminal DT**1** formulates and transmits data packets addressed to Internet destinations indicative of entries/inquires specified by the subscriber as a result of interacting with Internet **300** using the software loaded in terminal DT**1**. Similarly, ECO **25** routes to terminal DT**1** all packets that it receives from the Internet addressed to terminal DT**1**.

[**0017**] More specifically and also referring now to **FIG. 3**, it is seen that an ECO **25** includes Central Processor Unit (CPU) **205**, which may be, for example, the central processor of a 5ESS® switch available from Lucent Technologies, Inc. CPU **205** communicates with the various elements forming the associated ECO **25** via control path **230** and local area network (LAN) **240**. Such elements include switch SW **235** and Internet Access Unit (IAU) **255**, in which SW **235**, may be, for example, the switching and peripheral modules of the 5ESS from Lucent and in which IAU **255** may be, for example, the Ascend MAX 4000 apparatus available from Ascend Communications, Inc. of Mountain View, Calif. The ECO **25** also includes an Internet Interface Unit (IIU) **215** for providing a physical as well as a logical interconnection between LAN **240** and Internet **300**. IIU **215** includes a conventional data router, for example, the Model 7000 router available from Cisco Systems Inc., and a high-speed data service unit, for example, the DataSMART T3/E3 IDSU available from Kentrox of Portland, Oreg. In any event, it is to be understood that an ECO, as discussed herein, could be a switch added to an ISP, rather than an ISP added to a switch.

[**0018**] When the subscriber's Internet access request call (placed via terminal DT**1**) is received, ECO **25** causes the call to be connected by SW **235** to IAU **255** via path **290**. IAU **255** responds to the call by presenting the caller with a conventional login procedure. If the caller responds by entering the correct password (i.e., the password contained in field **250-4** of the associated record (**FIG. 2**), which IAU **255** also obtains as a result of communicating with processor **205** via LAN **240**), then IAU **255** assigns a conventional IP address to the call as a way of interfacing the call with Internet **300** via IIU **215** and access connection **20**. (It is noted that for a conventional Internet access service arrangement, the subscriber may be assigned a permanent IP address which would be stored in field **250-12** (**FIG. 2**) at the time that the subscriber obtains the service.) In addition, IAU **255** notifies processor **205** that it has completed the connection between terminal DT**1** and Internet **300**.

[**0019**] If the login is successful, then processor **205** invokes the program of **FIG. 4**. Processor **205**, in accord with the program, checks the contents of field **250-8** of the associated record **250** (**FIG. 2**) to determine if the Internet user subscribes to the inventive "Internet Call Waiting" (ICW) service (block **402**). If so, processor **205** then sets up to monitor for calls that might otherwise be given a busy signal as a result of the terminal DT**1** subscriber's telephone line **10** being busy on the Internet (block **404**). The processor **205** program then exits. If processor **205** finds at block **402** that the Internet user does not subscribe to ICW, then CPU **205** may offer ICW service to the user on a one-time basis for this Internet session. CPU **205** sends a message for display on terminal DT**1** which indicates the ICW offer to the user (block **412**). If the user accepts (block **422**), processor **205** then sets up to monitor for calls to the user which might otherwise be given a busy signal (block **404**), so as to be "activated" for this instant Internet session, and sets an indicator in field **250-8** (**FIG. 2**) indicating ICW is active for this user.

[**0020**] Returning now to **FIG. 3**, it is seen that ECO **25** includes a plurality of voice signal processors (VSP) **245-1** through **245**-j, one of which is illustrated in broad block diagram form, namely, VSP **245-1** (hereinafter just (VSP) **245**). VSP **245** includes central processor unit (CPU) **248**, telephone line interface (TLI) **246** and a connection to LAN **240**. VSP **245** communicates with switch **235** via a selected one of the paths **270**, and communicates with processor **205**, IIU **215** and IAU **255** via LAN **240**.

[0021] In an illustrative embodiment of the invention, VSP **245**, may be, for example, a personal computer having an Intel Pentium processor running under the Microsoft Windows NT 4.0 operating system, an Etherlink 10BASE-T LAN interface card available from 3Com Corporation of Santa Clara, Calif., and a V.34 Office FIX (version 2.0) sound card having a telephone interface available from Spectrum Signal Processing, Inc. of Mountain View, Calif. VSP **245** interconnects conventional telephone voice signals received from subscriber line **10** via SW **235** and path **270***i* with conventional TCP/IP packet network communications that is transported over Ethernet LAN **240** and Internet **300**. The processing of calls from DT1 and routed to Internet **300** via LAN **240** will be explained below in detail. It is noted at this point, however, that particular software, such as the VocalTec version 4.0 software product available from VocalTec, Inc. of Northvale, N.J., may be used in VSP **245** to process, compress and then packetize voice signals that are received via switch **235** and TLI **246** for transmission to Internet **300** via LAN **240**. Similarly, such software may be used to convert the contents of packets representing voice into a stream of voice signals that is transmitted to station S1 via TLI **246**, path **270***i*, SW **235** and subscriber line **10**.

[0022] If, while the subscriber is busy "surfing" the Internet, a caller at station S2 (**FIG. 1**) places a call to station S1, then a telephone connection is established in a conventional manner from the station S2 telephone line to ECO **25** via CO **50**, TS **110** and TS **105**. The signaling information that is transported over path **30** includes, inter alia, the S1 telephone number dialed by S2. Such information may also include the calling party telephone number (station S2) as in conventional Caller ID. SW **235** (**FIG. 3**), responsive to receipt of such information, sends a message identifying the newly-arrived call and containing information relating thereto to processor **205** via control connection **230**. Processor **205**, in turn, instructs SW **235** to assign an idle VSP **245***i* to the call.

[0023] Since the station S2 call is routed to ECO **25** via path **30**, then the call is received via SW **235** as is done conventionally. Also referring now to **FIG. 5**, upon receipt of the call, SW **235** alerts processor **205** to the incoming call and passes the station S2 telephone number (if available) as well as the station S1 telephone number (the dialed number DN) thereto. Processor **205** in response to receipt of S1's number (DN) uses the number to access its internal memory and unload a copy of the subscriber's record **250** (block **511**). If the subscriber is not connected to the Internet or if the subscriber does not subscribe to Internet Call Waiting (ICW), then processor **205** exits, thereby continuing to process the call in a conventional manner, e.g., give a busy signal or provide "call forward on busy" as per S1's conventional service subscriptions. If, on the other hand, the contents of fields **250-14** and **250-8**, **FIG. 2**, indicate that the called subscriber is busy on the Internet, and has ICW service, then processor **205** checks whether the user already has an ICW call active between the user's DT1 terminal and a calling party S2 (block **512**). If so, then (as in conventional call waiting when a subscriber already has two active calls), CPU **205** exits to continue conventional busy-line call processing. If not (or if so, and the user also subscribes to an ICW service option as explained below), then CPU **205** instructs SW **235** to connect path **30** to "audible ring" (i.e., providing audible ringing to the caller's telephone) and (block **513**) forms an alerting message indicating, inter alia, (a) that a call is waiting, (b) telephone number of the waiting call (the "caller ID", if available), and (c) call answering options: connect call via the Internet connection to terminal DT1 as mentioned above; forward call to another telephone number (which may be the user's voice mail service "voice mailbox" or other destination); suspend or interrupt the user's Internet connection to enable the user to receive the incoming call at conventional voice terminal S1; ignore call; or other ICW option such as to set up a three-way conference call. The selection of options available to each ICW subscriber is set at the time of subscription and is indicated by the contents of field **250-8** (**FIG. 2**). Processor **205** then assembles the message into one or more data packets each containing DT1's assigned Internet IP address as the destination and supplies each such packet to IIU **215** via LAN **240** (block **514**). IIU **215**, in turn, routes the packets to module IAU **255**, which then transmits the payload data as it is received over path **290** in a conventional manner. The data is then transported over the path **290** connection to SW **235** for transmission over telephone line **10**. Upon receipt of the data, terminal DT1 displays the information characterized by the data on the terminal DT1 display, thereby alerting the subscriber to the waiting call even though the subscriber's telephone line is connected to the Internet, in accordance with an aspect of the invention.

[0024] Following the foregoing, processor **205** waits for receipt of a response from the alerted subscriber, as represented by the dashed line between blocks **514** and **515** in **FIG. 5**. When processor **205** receives the expected response, processor **205** checks to see if the subscriber elected to answer the station S2 call (block **515**). If so, and the call is to be answered at DT1, processor **205** directs VSP **245** (i.e., TLI **246** and CPU **248**) to answer the call (block **516**). TLI **246** transmits an answer supervision signal over path **270**-i. In response to receipt of the latter signal, SW **235** sends an answer supervision signal for the incoming call to TS **105** (**FIG. 1**) via path **30**. Processor **205** then sets up to bridge the calling party to the subscriber via VSP **245**, LAN **240** and IAU **255** (block **517**). Such "bridging" is established between VSP **245** and IAU **255** via LAN **240** and IIU **215** as in conventional packet data communications. Processor **205** unloads from memory **250** (i.e., field **250-7**, **FIG. 2**) information identifying the type of packet voice software that is loaded in the subscriber's terminal DT1. Processor **205** then instructs processor **248** (VSP **245**) to invoke the aforementioned VocalTec software (or other software that performs a similar function) that is designed to process a telephone call that is to be transported over the Internet **300**. The CPU **248** software, in turn, returns a response to processor **205** acknowledging its instruction to receive and transmit packets from and to the IP address previously assigned to the subscriber's Internet connection via access unit **255**.

[0025] Thereafter, the assigned VSP **245**/TLI **246** supplies voice signals that it receives from the calling party to CPU **248** as a conventional data stream. CPU **248**, in turn, collects the signals and forms them into packets in accordance with the aforementioned VocalTec software, which attaches to each such packet the IP address assigned to the subscriber's connection. CPU **248** then presents the packet to LAN **240** and IIU **215**, which in turn routes the packet in a conventional manner to the LAN **240** port connected to access unit **255**. Unit **255**, in turn, transmits the data packet as well as any other packets received from Internet **300** and addressed

to DT1 over the subscriber's connection. Briefly referring again to **FIG. 1**, in an illustrative embodiment of the invention, data terminal DT1 may be, for example, a personal computer running under the Microsoft Windows 95 operating system and driven by, for example, the Intel Pentium processor. Terminal DT1 also includes a conventional sound card, such as the UltraSound MAX sound card available from Gravis Computer Technology of Bellingham, Wash. as well as attached speakers and microphone. Also, conventional software packages such as the aforementioned Windows 95 Dialup Networking software and Internet Phone software, version 4.0, also available from VocalTec are loaded in terminal DT1. As configured, a conventional modem interfaces terminal DT1 with telephone line **10**.

[**0026**] When terminal DT1 receives packets via line **10**, the Internet software running on the subscriber's terminal DT1 examines each such packet to determine if it contains voice signals or information originating from the Internet. If the former, then the "Internet Phone" software reassembles the voice signal from a series of received packets, as is done conventionally, and then presents the result to the terminal DT1 sound card which causes the signals to be routed to the terminal DT1 loudspeaker for presentation to the subscriber. Internet information, on the other hand, is identified and processed in a background mode for display on the terminal DT1 display.

[**0027**] When the subscriber talks into the terminal DT1 microphone, the resulting voice signals are converted into a series of packets by the sound card and accompanying software. Terminal DT1 then outputs the packets via the terminal DT1 modem to line **10** for transmission to VSP **245**. In doing so, terminal DT1 software inserts an address in each such packet so that the packet may be routed to the originator of the call, as is done conventionally in the transmission of a voice packet in telephony. Each packet that VSP **245** receives from terminal DT1 is transported via path **290**, IAU **255** and LAN **240** to IIU **215** which then routes the packet to either Internet **300** or VSP **245** based on the destination address contained in the packet. The VSP **245** port that receives the packet unloads the payload and passes it to the packet voice software that CPU **248** is executing. That is, CPU **248** converts a series of voice packets into a digital voice signal, which TLI **246** then supplies to SW **235** via path **270**. SW **235**, in turn, transmits the voice signal over path **30** to TS **105**, which retransmits the signal to station S2 by way of CO **50**. The call waiting party and Internet connected subscriber may continue to communicate with one another in this manner, until the call is terminated.

[**0028**] In response to receipt of the call-waiting notification, the subscriber may elect to answer the station S2 call using conventional telephone receiver S1. If so, then processor **205** (block **525**, **FIG. 5**) interrupts the user's Internet session, changes the indicators of field **250-14** (**FIG. 2**) to "inactive," then waits for subscriber line **10** to become idle (on-hook condition). Upon receiving the on-hook status from SW **235** (block **526**), processor **205** instructs SW **235** to disconnect line **10** from path **290** (**FIG. 3**). Processor **205** then sets up to complete the incoming call in a conventional manner (block **527**), applies power ring to line **10** (block **528**) so as to cause receiver S1 to ring, then exits (conventional wait-for-answer call processing).

[**0029**] When terminal DT1 receives a data message encoded in analog form via its modem and telephone line **10**, the modem converts the encoded analog signal to a digital signal, which is then accumulated to form a message. If the message represents the aforementioned call waiting message, then terminal DT1 invokes the program of **FIG. 6** to process the message. Specifically, the DT1 program causes the terminal DT1 hardware to generate and output via the terminal loudspeaker(s) a tone that simulates an alerting signal, e.g., a ringing signal (block **601**). The program then displays the option message along with the calling telephone number ("Caller ID"), if available (block **602**). If the subscriber selects one of the displayed options, then the program checks to see if the entered option is to answer the call (block **603**). If so, and the call is to be answered at DT1, then the program prepares to execute the aforementioned VocalTec Internet Phone software (block **604**) that allows the subscriber to place and/or receive a voice call via the Internet by storing in associated memory the IP address of VSP **245** contained in the message sent by ECO **25** (processor **205**). The terminal DT1 program then forms a response to answer the call at DT1 (block **605**) and transmits the response to ECO **25** (block **606**). If the subscriber elects to answer the call at S1, the DT1 program forms a response to answer the call at S1 (block **615**), transmits the response to ECO **25** (block **616**), suspends the subscriber's Internet activity (block **617**), and puts the subscriber line **10** back in an idle (on hook) condition to allow the incoming call to be received in a conventional manner by the subscriber (block **618**). (If the subscriber's terminal DT1 has the capability to answer incoming calls in a conventional manner, it will deactivate this capability prior to exiting the program). Referring again to block **603**, **FIG. 6**, if the subscriber has elected a choice other than answering the call at DT1 or S1, then the DT1 program forms the corresponding response (block **624**), proceeds to block **606** and then exits.

[**0030**] **FIG. 7** illustrates, in flow chart form, the program that a terminal, e.g., terminal DT1, may invoke to place a telephone call to an Internet access service, e.g., ECO **25**, for the purpose of establishing a connection to the Internet. As mentioned above, such software may be any one of a number of different commercial software products that are designed to allow a user to interact with the Internet, for example, the aforementioned Windows 95 Dialup Networking software. Specifically, when the terminal program is invoked it unloads from internal memory a data record containing the telephone number that the call uses to access the Internet (block **701**). The program then places a call to that telephone number and then waits for receipt of a response from the called Internet access service, e.g., ECO **25**. Upon receipt of the expected response, the program sets up a "login" into the called IAS (block **702**) as is done conventionally by transmitting a requested password. If the login is successful (block **703**), the terminal application program that is loaded when the subscriber establishes the Internet session, sends a message to processor **205** indicating that it can receive a call alert message. If processor **205** receives that message, then it updates the contents of field **250-14** (**FIG. 2**) to indicate that the user may receive call alert messages. The program then exits. If the login is not successful, then the caller/subscriber may re-enter his/her password (block **702**). It is noted that ECO **25** may terminate the call if the caller fails to enter a valid password after making several attempts to do so.

[**0031**] If the DT1 program receives a message offering per-session ICW service, then the program is re-entered

(block **704**) and displays the message (block **705**). If the caller/subscriber responds via, e.g., the terminal DT1 keyboard, the program checks the entry to see if the subscriber accepts (block **706**). If not, then the program exits. Otherwise, the program forms a message accepting the offer (block **707**), activates ICW-associated software (block **708**), transmits the message (block **709**) and then exits. Thereafter, when the program receives a message from ECO **25** indicating that ICW has been activated, then the program (block **710**) displays that event and then exits.

[**0032**] Referring now to **FIG. 8**, ECO **25** of **FIG. 1** and **FIG. 3** is now illustrated in broad block diagram form including a conventional telephone central office three-way circuit **295** attached in a conventional manner to switch **235**, and also now with two PSN call connections shown as **30-1** and **30-2**. The three heavy lines in **FIG. 8** (**295** to **270**; **295** to **30-1**; **295** to **30-2**) illustrate the three legs of a three-way call set up by processor **205** in response to a request from an Internet user at terminal DT1 and line **10** to have a three-way conference with caller S2 (**FIG. 1**) and another party (such request formed at block **624**, **FIG. 6** and received by CPU **205** at block **515**, **FIG. 5**). The dashed line (**270** to **30-1** within SW **235**, **FIG. 8**) illustrates the DT1-to-S2 call connection which was removed by SW **235** when processor **205** instructed it to set up the three-way connection.

[**0033**] The foregoing is merely illustrative of the principles of the invention. Those skilled in the art will be able to devise numerous arrangements, which, although not explicitly shown or described herein, nevertheless embody those principles that are within the spirit and scope of the invention. For example, the Internet is used in the present application as an illustrative example of a data network used in practicing the invention. The Internet is a specific type of data network in that it utilizes a set of unique network standards to support communications across computers. This set of network standards is typically referred to as TCP/IP ("Transmission Control Protocol/Internet Protocol"). The "Internet" (when capitalized) typically refers to the collective set of computers and networks that make up the global public data network that is based on the TCP/IP standards. However, in addition to the Internet, other networks based on the TCP/IP standards such as an "internet" (uncapitalized refers to a public data network in a generic sense) or an "intranet" (refers to a private data network in a generic sense) could be used to practice the invention. Moreover, additional data networks not based on the TCP/IP standards can be used in practicing the invention because the invention does not rely on a specific data network protocol implementation such as TCP/IP. All that would be required is that the data network include the ability to multiplex streams of data packets across a network interface, and uniquely address computers and sessions running on the network. As such, the data network used to practice the present invention could be a private corporate intranet, rather than the Internet, that utilizes an enhanced private branch exchange (PBX), rather than a local central office switch, as the ECO.

We claim:

1. A method of processing a telephone call from a calling station to a called station that is busy as a result of having established a connection to a data network via an enhanced telephone switching system, said method comprising the steps of

receiving said call at said enhanced telephone switching system and, responsive to said called station being busy, sending a message to said called station via said connection to said data network to alert a subscriber at said called station to the receipt of said call, and

connecting said calling station to said called station via said connection to said data network so that a caller at said calling station may communicate with a subscriber at said called station.

2. The method of claim 1 wherein said enhanced telephone switching system includes an access server for establishing connections to said data network.

3. The method of claim 1 wherein said step of connecting said calling station includes the step of,

responsive to receiving from said called station via said connection a message containing a request to answer said call, then performing said step of connecting.

4. The method of claim 1 wherein said step of connecting said calling station includes the step of multiplexing signals received from said calling station and signals received from said data network and addressed to said called station over said connection to said called station.

5. The method of claim 1 wherein said step of connecting said calling station includes the step of routing data signals received from said called station via said connection to said data network and routing voice signals received from said called station via said connection to said calling station.

6. The method of claim 3 wherein said step of connecting said calling station includes the step of, responsive to said message from said called station containing a request to connect said call from said calling station to an alternate telephone number, then routing said call to said alternate telephone number.

7. The method of claim 3 wherein said step of connecting said calling station includes the step of, responsive to said message from said called station containing a request to set up a three-way call connection between the called station, the calling station and a station currently connected to the called station, then setting up said three-way call connection.

8. The method of claim 1 wherein said step of connecting said calling station includes the step of, responsive to a message from said called station containing a request to not answer said call from a calling station, then not answering said call.

9. The method set forth in claim 1 wherein said data network is an Internet network further comprising the steps of

responsive to receiving an initial call from said called station at said enhanced telephone switching system, connecting said initial call to said Internet,

determining if said subscriber also subscribes to a call waiting service, if so, then activating said call waiting service.

10. The method of claim 9 wherein said step of activating includes the step of sending a message to said called station via said connection to notify said called station that said activation has been executed.

11. The method of claim 9 wherein if said subscriber does not subscribe to said call waiting service, then offering said call waiting service for the duration of said Internet connection, and

performing said activating step if said subscriber elects to accept said service offer.

12. The method of claim 11 wherein said step of activating includes the step of sending a message to said called station via said connection to notify said called station that said activation has been executed.

13. The method of claim 1 wherein said data network is a public network such as the Internet.

14. The method of claim 1 wherein said data network is a private network such as an intranet.

15. A method of processing a call waiting feature for a first telephone station set whose telephone line is connected to the Internet comprising the steps of

responsive to receiving at an enhanced telephone switching system, an initial call from said first telephone station, extending a connection from said first telephone station to said Internet,

receiving a voice call from a second telephone station directed to said first telephone station, and, responsive to said first telephone station being connected to said Internet, sending a data message via said connection to said first telephone station to alert a subscriber to receipt of the voice call from said second telephone station, and

bridging a connection to said second telephone station with the connection between said Internet and said first telephone station so that a caller at said second telephone station may communicate with said subscriber at said first telephone station.

16. The method of claim 15 wherein said enhanced telephone switching system includes an access server for extending connections to said Internet.

17. The method of claim 15 further comprising the steps of

responsive to receiving from said first telephone station a message containing a request to answer said voice call, performing said step of bridging.

18. The method of claim 15 wherein said step of bridging said second telephone station includes the step of multiplexing voice signals received from said second telephone station and data signals received from said Internet and addressed to said first telephone station over said connection to said first telephone station.

19. The method of claim 15 wherein said step of bridging said second telephone station includes the step of routing data signals received from said first telephone station via said connection to said Internet and routing voice signals received from said called station via said connection of said calling station.

20. The method of claim 17 wherein said step of bridging said second telephone station includes the step of, responsive to receipt of said message from said first telephone station containing a request to forward said voice call from said second telephone station to an alternate telephone number, then routing said call from said second telephone station to said alternate telephone number.

21. The method of claim 17 wherein said step of bridging said second telephone station includes the step of, responsive to receipt of said message from said first telephone station containing a request to set up a three-way call connection between said first telephone station, said second telephone station and a third telephone station currently connected to said first telephone station, then creating said three-way call connection.

22. The method of claim 15 wherein said step of connecting said calling station includes the step of, responsive to a message from said first telephone station containing a request to not answer said voice call from said first telephone station, then not answering the voice call.

23. The method set forth in claim 15 further comprising the steps of

responsive to connecting the initial call to said Internet, determining if a subscriber associated with said first telephone station also subscribes to a call waiting service, if so, then activating said call waiting service.

24. The method of claim 23 wherein if a subscriber associated with said first telephone station does not subscribe to said call waiting service, then offering to activate said call waiting service for the duration of said Internet connection, and

performing said activating step if said subscriber elects to accept said service offer.

25. The method of claim 24 wherein said step of activating includes the step of sending a message to said first telephone station via said Internet connection to notify said subscriber that said activation has been executed.

26. A method of processing a three-way calling feature for a first telephone station set whose telephone line is connected to the Internet, comprising the steps of

responsive to receiving at an enhanced telephone switching system an initial call from said first telephone station, extending a connection from said first telephone station to said Internet,

receiving a voice call from a second telephone station directed to said first telephone station and, responsive to said first telephone station being connected to said Internet, sending a data message via said connection to said first telephone station to alert a subscriber to the receipt of the voice call from said second telephone station, and

bridging a connection to said second telephone station to the connection between said Internet and said first telephone station so that a caller at said second telephone station may communicate with said subscriber at said first telephone station, then

responsive to receiving a voice call from a third telephone station directed to said first telephone station while said first telephone station is connected to said second telephone station, bridging connections to said second telephone station and said third telephone station to a three-way conference circuit, and bridging said three-way conference circuit to the connection between said Internet and said first telephone station.

27. The method of claim 26 wherein said step of bridging connections comprises the steps of,

responsive to receiving said voice call from said third telephone station at said enhanced telephone switching system, sending a data message via said Internet connection to said first telephone station to alert a subscriber thereat to the receipt of the voice call from said third telephone station, and

responsive to receiving from said first telephone station via said Internet connection a message containing a request to three-way answer said voice call, performing said step of bridging connections.

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