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(54) Title: MOBILE BRANCH EXCHANGE
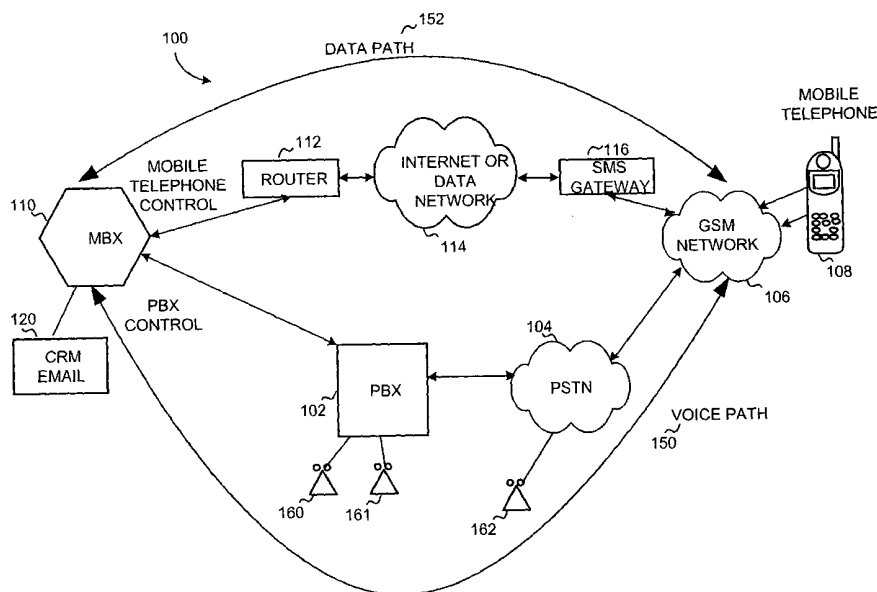
(57) Abstract: A mobile branch exchange (MBX) allows a user of a mobile telephone to exploit the functionality of a private branch exchange (PBX) as if the user were using a PBX-connected wire line telephone in an office setting. A server is placed on corporate premises and the server is configured to communicate with corresponding client software programmed into a programmable mobile telephone. The server directly interfaces with the PBX to control call placement and connectivity and operates as an intermediary proxy for the mobile telephone. In a preferred embodiment, the server establishes a data pathway to the mobile telephone that is, from a network point of view, independent of a parallel voice pathway established between the PBX and mobile telephone.

MOBILE BRANCH EXCHANGE

[0001]   This application claims the benefit of U.S. Provisional Application No. 60/251,042

filed December 5, 2000, U.S. Provisional Application No. 60/255,897 filed December

18, 2000, and U.S. Provisional Application No. 60/266,341 filed February 5, 2001,

which are herein incorporated by reference in their entireties.

BACKGROUND

Field of the Invention

[0002]   The present invention is directed to mobile telephony and related features thereof.

More specifically, the present invention is directed to extending the functionality of a

private branch exchange (PBX) to a mobile telephone or other mobile communication

device. The present invention is further directed to providing other advanced services

with respect to a mobile telephone that would otherwise be available only via a hard-

wired networked computer and/or telecommunications system.

Background of the Invention

[0003]   Voice communication is a touchstone of modern society and, in particular, business.

Salespeople, technical people and employees at home, on the move, or on vacation,

all need to stay in touch with colleagues and clients. However, when a businessperson

leaves the office environment, he typically leaves behind a significant

telecommunications infrastructure that resides in the business' telephone private

branch exchange (PBX). A PBX offers tremendous functionality for the employee,

such as calling line identity (including caller ID), conferencing, transferring, internal

number plans and group calling and, more significantly, the PBX also allows IS/IT

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administrators to manage and provide high-quality, competitive, and cost efficient

corporate telephony communications by means of features such as call screening and

monitoring, Least Cost Routing (LCR), Virtual Private Networks (VPN), automated

recording, automatic routing to switchboards, Interactive Voice Response systems

(IVR), voice messaging systems, and call centers. However, this functionality is

abandoned the instant the businessperson leaves the businesses premises and uses

public mobile telephony services rather than the *private* fixed telephony system.

Thus, when a businessperson is on the road, it is, at the very least, inconvenient, if not

impossible, to avail himself of the functionality offered by a PBX. For instance, the

PBX contains a set of conferencing features that allow employees to set up both blind

and two-step conferences on the fly that are normally inaccessible from a mobile

telephone.

[0004]   Similarly, although some businesses allow their employees to divert office telephone

calls to their mobile telephone, the mobile user employee is not able to see the true

calling line identity of a diverted call, as the identity of the PBX trunk line is

presented by the mobile network instead, and it is very cumbersome for employees to

transfer the call to another PBX user, and impossible to allow the PBX to

automatically route the call to another PBX user or group if the diverted call is not

answered.

[0005]   Thus, as can be readily appreciated, basic PBX functionality is not available to a

mobile telephone user.

[0006]   In addition, while the use of mobile telephones has exploded in recent years, mobile

telephones have also introduced inconveniences of their own. For example, now, not

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ATTENTION : PAGES 3-25 WERE MISSING UPON FILING.

[0058]   Figures 5A-5C illustrate a scenario in which both the caller and callee are parties to

an MBX in accordance with the present invention. As shown, beginning first with

Figure 5A, an IndirectCallRequest is sent to MBX 110. Then a call B is placed from

mobile telephone 108 to a phantom number at PBX 102, preferably at the same time

that the IndirectCallRequest is transmitted via the data pathway, which causes a

phantom call C to be placed from a virtual terminal to a remote telephone 108a

equipped in accordance with the present invention. At the same time, PBX 102 is

commanded to establish or create a call, A, between the conventional office

telephones 160, 161 of the caller and callee. Finally, calling line identity information

(not shown) with respect to the caller is sent via a second data pathway, in accordance

with TIEP, that is established between the MBX and the callee's telephone 108a. In

this scenario it is noted that both the remote telephone 108a and office telephone 161

preferably ring simultaneously.

[0059]   Eventually, the callee answers call C at the remote telephone 108a, as depicted in

Figure 5B, and the procedure of answering an incoming call (Figures 3A-3D) is

executed such that call A for an instant connects the caller's office telephone with the

callee's mobile telephone. The procedure of answering an outgoing call (figures 4B-

4D) is then executed, thereby completing the connection between the two mobile

telephones 108, 108a via PBX 102, as shown in Figure 5C.

        (4) Outgoing Conference

[0060]   This next sequence, illustrated by Figures 6A-6B, depicts how a third party can be

conferenced in to an on-going conversation between a mobile telephone 108 and a

remote number 162. In this case, as shown in Figure 6A, a call A is established

between mobile telephone 108 and a remote number 162. As with a typical call, a
virtual terminal is also conferenced in to keep track of call A and to be available to
reestablish the voice channel with mobile telephone 108 should mobile telephone 108
drop the call. In this case, in order to conference in a second remote telephone 162a,
a "conference blind add" TIEP request is sent via the data channel to MBX 110. This
causes MBX 110 to instruct PBX 102 to place the virtual terminal on hold and to
place a new call B to a second remote telephone number, namely 162a. Call B, is
then immediately conferenced with call A, as shown in Figure 6B. As a result,
mobile telephone 108 is in communication with both remote telephones 162 and
162a.

(5) Incoming Conference

[0061]   Figures 7A-7B illustrate how an incoming call can be conferenced in with a pre-
established call between a mobile telephone 108 and one or more remote telephones.
As shown in Figure 7A, call A is an existing call between mobile telephone 108 and a
first remote telephone 162. A call B is placed from a second remote telephone 162a
to office telephone number 160. As a result, a call C is established between the
virtual terminal and mobile telephone 108 in parallel with a TIEP package for calling
line identity. From the perspective of the user of mobile telephone 108, the new
incoming call is presented as a call-waiting or queued call.

[0062]   Assuming the user of mobile telephone 108 desires to include the caller from remote
telephone 162a in the ongoing conversation, the user inputs (as will be described in
more detail later herein) into mobile telephone 108 an indication that the second
caller should be included. As a result, the client side application loaded on mobile

telephone 108 sends a "conference blind include" request via TIEP back to MBX 110

via the data channel. As a result, call C is dropped and call B is redirected to the

phantom number, answered at a virtual terminal, placed on hold, and conferenced

with call A at the virtual terminal. This sequence is depicted in Figure 7B. The result

within PBX 102 is shown in Figure 7C.

[0063]   Figures 7D and 7E illustrate the case where the new incoming call from remote

number 162a is rejected by the user of mobile telephone 108. Specifically, as shown

in Figure 7D, call A is an existing call and calls B and C represent the sequence that

occurs for a new incoming call. Call C, again, is preferably presented as a call

waiting call to the user of mobile telephone 108. Referring now to Figure 7E, if the

user of mobile telephone 108 fails to answer call C, call C will be dropped. This will

result in call B ringing at office telephone 160 until it is diverted to voice-mail, as

might be the case in a typical office environment.

(6) Conference - Lost Participant

[0064]   Figure 8 shows a sequence in which one of the conference participants, namely

remote telephone number 162a, drops out of the conference call. In this case, MBX

110 is alerted to this fact and in response, sends a "conference party lost" signal via

TIEP to mobile telephone 108 via the data channel. As will become apparent in the

description of the Graphical User Interface for the mobile telephone of the present

invention described later herein, the loss of a participant from a conference call

preferably results in a visual cue to the user of mobile telephone 108.

(7) Conference - Drop Participant

[0065]   Figure 9 illustrates the case of a conference call in which the user of mobile telephone

108 desires to expressly drop a participant from the conference call rather than the

participant himself initiating the drop from the conference call. In this case, a "drop

conference party" signal is sent in accordance with TIEP from mobile telephone 108

to MBX 110 via the data channel. MBX 110, in turn, causes PBX 102 to drop the

participant indicated by the user of mobile telephone 108. In this case, remote

telephone number 162a is dropped.

(8) Forward Call

[0066]   Figures 10A and 10B illustrate how an incoming call can be forwarded by mobile

telephone 108. As shown, a call A is placed by remote telephone number 162 to

office telephone number 160. As is the case for any incoming call, a phantom call B

is placed between a virtual terminal within PBX 102 and mobile telephone 108. In

parallel with this, calling line identity information is sent from MBX 110 to mobile

telephone 108 via TIEP over the data channel. Then, as shown in Figure 10B,

assuming the user of mobile telephone 108 wants to forward the call to another

number, the user enters or indicates such a desire via, e.g., a graphical user interface

(described below), and the client side application loaded on mobile telephone 108

generates a "forward (x_no)" TIEP command that is sent via the data channel back to

MBX 110. Then, as a result of receiving such a command, MBX 110 causes PBX

102 to drop call B between the virtual terminal and mobile telephone 108 and to

forward call A to the destination x_no that was passed from mobile telephone 108 to

MBX 110.

(9) Transfer Call

[0067]   Figures 11A and 11B illustrate how a call is transferred in accordance with the

present invention. In this sequence, referring first to Figure 11A, a call A is pre-

established between mobile telephone 108, remote number 162 and, in accordance

with the preferred embodiment of the present invention, the virtual terminal within

PBX 102. To transfer this call, a "conference blind add (o_no)" command is sent

from mobile telephone 108 to MBX 110. This command causes MBX 110 to

conference-in office telephone 161 corresponding to the o_no number that was passed

to MBX 110 via the data channel. Once the conferencing is complete, MBX 110

causes PBX 102 to drop the mobile portion of call A, as shown in Figure 11B,

thereby leaving only the remote telephone number 162 and the office telephone

number 161 (along with the virtual terminal) in communication with each other,

thereby effecting the call transfer function.

(10) Listen In - Forward

[0068]   Figures 12A-12E illustrate how an incoming call can be listened to and then

forwarded as desired, all from mobile telephone 108. Referring first to Figure 12A, a

remote telephone number places a call A to office telephone number 160. As is the

case with all incoming calls, a call B is established between a virtual terminal within

PBX 102 and mobile telephone 108 and, in parallel, calling line identity information

in accordance with TIEP is sent to mobile telephone 108 via the data channel.

Assuming the user of mobile telephone 108 desires only to listen-in to the incoming

call, rather than answering it, the client side application on mobile telephone 108

sends a ListenIn(x_no) command to MBX 110 via the data channel. This causes a

call C to be placed between virtual terminal and office telephone 160 and further

causes calls B and C to be conferenced together, as shown in Figure 12B.

[0069]   Then, as shown in Figure 12C, calls C and A are conferenced together and the mobile

portion of call C is muted. The result, as shown in Figure 12D, is that call A is the

"live" call and is established among remote telephone number 162, office telephone

160 and the virtual terminal within PBX 102.

[0070]   Finally, having received a listen in command, as shown in Figure 12B, call A is then

redirected to the number that was included in that command, as shown in Figure 12E.

(11) Listen In - Intrude

[0071]   Figure 13 shows a sequence, which is an extension of the sequence illustrated in

Figures 12A-12E. In this case, if the user of mobile telephone 108 desires to intrude,

or become a participant in the call that has been placed by remote telephone number

162, then the user of mobile telephone 108 simply un-mutes the mobile portion of the

conferenced call locally at the mobile telephone, or via an appropriate TIEP

command, thereby becoming an active participant.

[0072]   Control of PBX 102 by MBX 110 can be accomplished using the following

exemplary commands that are standard commands used by the vast majority of

commercially available PBXs:

-    Make Call

-    Answer Call

-    Clear (End) Call

-    Clear (Drop) Connection

-    Deflect (Redirect) Call

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- Transfer Call

- Conference Call

- Hold Call

- Retrieve (Unhold) Call

[0073]   In addition the relatively simple commands above, the present invention preferably

configures a set of virtual terminals in the PBX, configured in hunt groups to which a

PBX phantom number can be assigned. Thus, as can be readily appreciated by those

skilled in the art, there are only very minor configuration changes needed to have a

conventional PBX operate in accordance with the principles of the present invention.

[0074]   The present invention not only extends conventional PBX functionality to a mobile

telephone, but because mobile telephone 108 can be programmed via application

layer 208, a significant number of other features associated with PBX and general

usability functionality can also be provided to the user of mobile telephone 108

and/or the company/organization with which the user is associated, as will become

apparent from the additional description below.

[0075]   Figure 14 illustrates an exemplary screen shot that might be displayed on

display 202 of mobile telephone 108. Display 202 preferably implements touch

screen functionality whereby the user can select particular items by touching or

tapping a stylus or other pointing device (e.g., a finger) to display screen 202. In a

preferred embodiment, several screens are easily accessible by arranging the screens

in a tabbed configuration. In the case of the screen illustrated in Figure 14, there are

tabs assigned for contacts, dial, call, note, and register.

[0076]   Figure 14 illustrates an exemplary contacts screen in accordance with the present

invention. In a preferred embodiment, each person or company, etc. that is entered in

the contacts list includes full contact information and, in particular, telephone

numbers via which those contacts can be contacted, and the contact list is fully

consistent and synchronised with the already existing contact list on the mobile

telephone. In accordance with the preferred embodiment of the present invention, the

user of mobile telephone 108 can simply double tap a selected contact on display

screen 202, which will when then preferably present one or more telephone numbers

for the selected contact. In a preferred embodiment, the displayed telephone number

is then tapped and mobile telephone 108 is automatically dialed and the call

connected in accordance with the MBX control described above.

[0077]   Figure 15 illustrates the display under the dial tab. In this screen a dial pad 1501 is

displayed along with several preprogrammed speed dialing keys 1503. If dial pad

1501 is employed then mobile telephone 108 will initiate a call once call button 1505

is tapped. If a speed-dialing key 1503 is tapped, then mobile telephone 108

preferably immediately initiates the call without having to tap call button 1505. If the

internal dialing check-button 1502 is selected, the user can dial using the internal

dialing plan of the PBX, as if dialing from the office phone. If the internal dialing

1502 check-button is not selected, the user can dial using the regular public dialing

plan.

[0078]   A user of mobile telephone 108 can also access one of several registers that are

updated in the normal course of usage of the system and service provided by the

present invention. One example of a register in accordance with the present invention

is a missed call register, as shown in Figure 16. Such a register captures and stores

the telephone numbers and preferably also a name of a party whose telephone call

was missed, because, e.g., mobile telephone 108 was powered off, or mobile

telephone 108 was out of range of a wireless network. Different registers, including,

but not limited to, outgoing calls and incoming calls, are preferably chosen from a

pull down menu 1601. Preferably, there is also an option 1603 for selecting whether

to show the times of the calls stored in the register being viewed. Other details of

parameters of calls may also be stored and/or displayed as may be desired for a

particular implementation of the present invention.

[0079]   In an alternative quick dialing method, call button 1505 is preferably programmed to

cause the last dialed number to be displayed in field 1701, and if call button 1505 is

tapped again, the last dialed number is automatically called. If the displayed number

is not the number that the user wishes to call, then the user may choose from a last

dialed list 1703. Once the desired telephone number or party is selected, call button

1505 is tapped to initiate the call.

[0080]   As also shown in Figure 16, a user of mobile telephone 108 can also access a voice

message indication button 1504 which is highlighted and displays an open envelope

when the voice message indicator lamp on the office telephone is lit. When the voice

message indicator lamp on the office telephone is not lit, the button displays a closed

envelope, as pictured. The user of mobile telephone 108 can click on the voice

message indication button 1504 to dial directly to the PBX voice message system, and

the client also provides a mechanism for sending pre-configured DTMF tones to

automatically log on the user to the PBX voice messaging system.

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[0081]   Figure 18 shows an exemplary screen shot displayed by mobile telephone 108 at the

time an incoming call is received. As previously explained, the present invention

provides full calling line identity (CLI) information at the mobile telephone. At least

a portion of this information is preferably passed via data path 152 before a voice

connection is fully established between the mobile telephone user and a caller. In a

preferred embodiment, MBX 110 or mobile telephone 108 initiates a public directory

or customer relations management (CRM) database look-up and/or native contact list

look-up whereby full contact details of the calling party including a company name

and title can be displayed to the local telephone user. Accordingly, the present

invention provides a particularly useful call-screening feature whereby, especially in

a mobile communications environment, a user can limit the calls that he wishes to

engage in. Figure 18 also shows an exemplary information display of the CLI

information. To answer an incoming call, the user simply taps call button 1505.

[0082]   To reject a call, the user taps a hang up button 1801 in the incoming call screen. In a

preferred embodiment, when hang up button 1801 is tapped, the incoming call ceases

at mobile telephone, but the call continues at the associated office telephone, and

voice mail, if available. Of course, the call is also preferably placed in the

appropriate register for later retrieval, as might be desired.

[0083]   A significant feature of the present invention is the ability for a mobile telephone user

to forward a call and establish conference calls as though the user were using their

conventional PBX-connected office telephone. Referring still to Figure 18 two

buttons, 1803 and 1805, are provided for these two features.

[0084]   Figure 19 shows an exemplary screen that is presented to a user when forward button

1803 is tapped. Specifically, the dial tab is presented to the user to give the user the

opportunity to choose a party to whom the caller should be forwarded. Once the

telephone number is selected in field 1901, forward button 1903 is tapped to forward

the call. As shown, the telephone number can be selected via dial pad 1501, speed

dial buttons 1503 or a last call list.

[0085]   A conference call is preferably initiated by tapping conference button 1805 (Figure

18) and Figure 20 illustrates an exemplary screen under the call tab when a

conference is desired. In this case, participants in a conference call are listed along

with the time that each of the participants has been connected. To add a participant,

the user taps add participant button 2001 and a screen like that illustrated in Figure 19

is presented to the user, whereby the user can select a telephone number associated

with the desired new conference participant via dial pad 1501, speed dial buttons

1503 or last call list 1901.

[0086]   An incoming call also can be conferenced in with an on-going call. When the

incoming call is received at mobile telephone 108, the user is notified and given the

opportunity to tap add participant button 2001 to connect the new call to the

conference call. Preferably, all participants, including the newly added party, are

listed in the call tab screen like that shown in Figure 20. At any time, the user of

mobile telephone 108 can drop a participant in a conference call by tapping drop

participant button 2003.

[0087]   Figure 21 shows an exemplary screen shot presented under the note tab. In

accordance with the present invention, a user of mobile telephone 108 can take a note

during a call by tapping the note tab and then tapping into note text area 2101. Text

can be entered using a keyboard presented to the user or a character recognition

program. The completed note is preferably auto-saved at the end of the call.

However, a note can also preferably be edited or added to after the call has been

completed. A save icon in tool bar 2103 is then tapped to save the note.

[0088]   As with most personal digital assistants, mobile telephone 108 preferably includes a

calendar application. In accordance with the present invention, such a calendar

application can be populated with telephone calls that are made or received via

mobile telephone 108, as well as notes that have been generated in connection with

such telephone calls. An exemplary calendar is shown in Figure 22 and Figure 23

shows one of the calendar entries after being expanded. In this case, a note associated

with the telephone call is also shown. It is subsequently possible for the user to

search for previous calls by means of the native calendar search function provided

with most personal digital assistants.

[0089]   Having described the basic functionality and implementation techniques of the

present invention, the following will describe still more features and advantages of

the present invention.

[0090]   The first and perhaps foremost advantage of the present invention is that an

office worker need only have a single telephone number via which people can contact

that person. That is, since mobile telephone 108 is controlled, ultimately, by MBX

110, calls passing through PBX 102 can be routed to the office worker's conventional

wire line telephone or to his/her mobile telephone 108. Indeed, the present invention

preferably provides synchronized simultaneous ringing wherein mobile telephone 108

and the mobile telephone user's wire line office telephone ring at the same time when an incoming call is received, thereby permitting the user to answer the call where most convenient without having to manually configure a redirection of the call. Similarly, one's existing office telephone number automatically becomes a user's single unified business number both for receiving incoming calls and external presentation of outgoing calls. Also, there is no need for the user to continuously modify forward settings at the PBX office telephone, as the simultaneous ringing mechanism can be statically configured.

[0091]   Another feature of the present invention, as already described herein, is the receipt of full calling line identify information, which can be gleaned from any number of directories or databases that can be accessed either directly from within mobile telephone 108 or via MBX 110, or even directly from data network 114 (e.g., LDAP) without even accessing MBX 110. In a preferred embodiment, a user's address book, stored for example, in Microsoft Outlook, can be synchronized with the address book of mobile telephone 108.

[0092]   Also, because MBX 110 is in constant communication with PBX 102, even if mobile telephone 108 is not powered on, MBX 110, SMS Gateway 116 or GSM data-network 106 can store calls that have been missed and when mobile telephone 108 is subsequently powered on the missed call information can be updated in the call register of the mobile telephone. Of course, this feature is also effective when mobile telephone 108 is out of range of mobile telephone network 106.

[0093]   Also, because of the functionality provided by MBX 110, it is possible for a user of mobile telephone 108 to listen in on voicemail that is being left by a caller.

This gives the user of mobile telephone 108 the opportunity to interrupt and answer the call as desired, thereby simulating home-answering machine behavior. Again, this functionality is made possible by the close association of MBX 110 with PBX 102 along with the fact that mobile telephone 108 is in communication with MBX 110 both via a voice path 150 and data path 152, i.e., the VDSP.

[0094]   Since incoming calls received at mobile telephone 108 are passed through PBX 102, even if mobile telephone 108 loses wireless connectivity with mobile telephone network 106, the call may still be connected with PBX 102. In such an instance, MBX 110 will preferably attempt to re-establish or reconnect mobile telephone 108 with the call that is still connected with PBX 102 or, if that is not possible, redirect the call to the user's voice mailbox, or alternatively, a switchboard. As previously explained, the virtual terminal within PBX 102 is kept in conference with the on-going mobile telephone call in the event it is necessary to re-establish the call.

[0095]   Because data path 152 provides calling line identity information to mobile telephone 108 without there having to be a connected voice path, the present invention also supports forwarding a call without ever answering it. This is particularly useful when a user is busy at a meeting or on another call.

[0096]   Another benefit of having mobile telephone 108 being closely related to PBX 102 through MBX 110 is that the mobile telephone can now be used as though it were a conventional wire line office telephone in the sense that the mobile telephone user can choose to use the internal short number dialing plan that is supported by virtually all PBXs. For example, instead of having to dial a full number of an office colleague,

the mobile telephone user can simply dial a four/five digit extension that has been assigned to the office colleague. Similarly, mobile telephone 108 can be configured such that the user must dial a "9" in order to access an outside line.

[0097]   Although users are preferably able to configure the ordering or organization of basic calling data such as contact name, times of calls, etc., software incorporated in mobile telephone 108 is preferably able to conduct searches of the several data records and notes as well. This searching functionality is preferably applicable to both incoming and outgoing calls. Also, call records can be integrated with existing customer relations management (CRM) systems. In the overall system topology 100 of the present invention, element 120 (Figure 1) could be such a CRM system.

[0098]   In a preferred embodiment of the present invention, MBX 110 and/or mobile telephone 108 can also be programmed to filter incoming calls based on user-identified criteria such as time of day, calendar status or VIP list. For example, the system can be configured to permit only a predetermined set of callers to be able to get through to mobile telephone 108 whereas others are automatically redirected to voicemail. In this way, a user can have a significant amount of control over his accessibility to others. The filtering mechanisms can be loaded on either (or both) mobile telephone 108 or MBX 110.

[0099]   Another significant advantage to having mobile telephone 108 closely associated with PBX 102 is the ability to control telecommunications services and, particularly, mobile telecommunications costs. For example, corporate users who are given access to a mobile telephone in accordance with the present invention can have their access to both domestic or international call destinations limited/controlled,

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since the present invention can enforce routing of all calls through the PBX, and

thereby reuse the existing call screening functionality in the PBX. Thus, not only can

employees be controlled with respect to outbound calling while in a wire line office

environment, but those employees can now also be controlled with respect to

outgoing calling even if they are using a mobile telephone.

[00100]   Similarly, present mobile telephone users do not have access to true pre-

negotiated rates for telephone connectivity. Long distance calling, in particular, is

very expensive when initiated from a mobile telephone versus a land line telephone,

especially when "roaming." However, the present invention provides a way to bypass

these more expensive telephone connections by channeling all mobile telephone

communications through a PBX. Accordingly, assuming the mobile telephone user is

not roaming, then all long distance calls initiated by the mobile telephone can enjoy

the lower telecommunications prices available to PBX-connected wire-line

telephones. Also, a mobile-to-mobile call between different mobile operators is

frequently significantly more expensive than the sum of the costs of a mobile-to-fixed

and a fixed-to-mobile call, further reducing mobile telephone call charges.

[00101]   In the case that it is more costly to route calls via the PBX than directly, it is possible

with the present invention to configure the client to route specific calls directly (not

via PBX) by means of the standard GSM call routing mechanism. This least cost

routing mapping is based on automatic client side number recognition and the identity

of the mobile operator and the country at which the phone is currently registered.

[00102]   In addition, if a corporation has locations in different parts of a country or the

world, then mobile telephone 108 can be programmed to operate with selected local

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MBXs so that every call initiated by mobile telephone 108 is, effectively, a local
initiated call.

[00103]   Still another useful feature of the present invention is that users of mobile
telephone 108 can now use project codes when initiating telephone calls. Those
project codes are then fed back to MBX 110, preferably via data path 152, and
registered there for cost allocation to the appropriate clients, thereby avoiding a
charge to a corporation.

[00104]   The present invention, as will be appreciated by those skilled in the art, can
also, in view of the rich data being passed between mobile telephone 108 and MBX
110/PBX 102, provide significant insight into call data records whereby information
technology personnel or others can monitor the call volume and distribution patterns
of one or more mobile telephone users. This can lead to more leverage in negotiating
telecommunications services and monitoring the usage patterns of individuals.

[00105]   Finally, the description of the present invention has been directed, primarily, to
extending telephone calls placed to and from a mobile telephone that has
programmable capabilities. However, the programmable mobile telephone/PDA
device contemplated to be employed in the context of the present invention could also
be used for many other purposes. For example, email could be forwarded and sent
to/from such a device, as described in U.S. Patent 6,219,694 B1 to Lazaridis et al.
Similarly, the mobile telephone/PDA could be used as an extension of a user's office
computer, whereby files or applications that are manipulated on the user's computer
can be synchronized or mirrored on the mobile telephone/PDA used in connection
with the present invention. Examples of such functionality include accessing the

world wide web via data path 152 or accessing a CRM database in a home office via data path 152, or via some other connectivity outside of the MBX paradigm of the present invention. The foregoing functionality is preferably all available on a single device with a single mobile operator subscription for voice and data service.

[00106]   The foregoing disclosure of the preferred embodiments of the present invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many variations and modifications of the embodiments described herein will be obvious to one of ordinary skill in the art in light of the above disclosure. The scope of the invention is to be defined only by the claims appended hereto, and by their equivalents.

[00107]   Further, in describing representative embodiments of the present invention, the specification may have presented the method and/or process of the present invention as a particular sequence of steps. However, to the extent that the method or process does not rely on the particular order of steps set forth herein, the method or process should not be limited to the particular sequence of steps described. As one of ordinary skill in the art would appreciate, other sequences of steps may be possible. Therefore, the particular order of the steps set forth in the specification should not be construed as limitations on the claims. In addition, the claims directed to the method and/or process of the present invention should not be limited to the performance of their steps in the order written, and one skilled in the art can readily appreciate that the sequences may be varied and still remain within the spirit and scope of the present invention.

WHAT IS CLAIMED IS:

1. A system for providing private branch exchange (PBX) functionality to a mobile communications device, comprising:

a mobile communications device operable to communicate via a voice pathway and a data pathway;

a private branch exchange (PBX) operable to be in communication with the mobile communications device via the voice pathway; and

a mobile branch exchange (MBX) in communication with the PBX and in communication with the mobile communications device via the data pathway, the MBX being operable to (i) monitor the PBX for activity related to a user of the mobile communications device, and (ii) control the PBX in accordance with commands received via the data pathway from the mobile communications device.

2. The system of claim 1, wherein the MBX is a server.

3. The system of claim 2, wherein the mobile communications device comprises client-side software that is operable with the MBX.

4. The system of claim 1, wherein the MBX and the mobile communications device communicate with each other using a voice data synchronization protocol.

5. The system of claim 1, wherein the MBX monitors the PBX for a call to a callee made by the mobile communications device and wherein the MBX causes the call made by the

communications device to pass through the PBX such that the call made by the communications device appears to the callee as being placed from a PBX-connected telephone.

6. The system of claim 1, wherein the mobile communications device is at least one of a personal digital assistant, a mobile telephone and a mobile computer.

7. The system of claim 1, wherein the voice pathway and data pathway a common communications network.

8. The method of claim 1, wherein the voice pathway comprises at least one of a packet switched network and a circuit switched network.

9. The method of claim 1, wherein the data pathway comprises at least one of a packet switched network and a circuit switched network.

10. The method of claim 1, wherein the data pathway comprises at least one of a short messaging service (SMS) device, an Unstructured Supplementary Services Data (USSD) device, a General Packet Radio System (GPRS) device, and a Unified Mobile Telecommunications System (UMTS) device.

11. The system of claim 1, wherein the PBX is monitorable and controllable by the MBX via an application programming interface (API).

12. The system of claim 11, wherein the API comprises at least one of CSTA, TAPI and JTAPI, and TSAPI.

13. The system of claim 1, wherein the MBX is electronically connected to the PBX.

14. The system of claim 1, wherein the MBX and PBX comprise an integral device.

15. The system of claim 1, wherein the mobile communications device comprises a graphical user interface for controlling at least one of incoming and outgoing calls.

16. The system of claim 1, wherein the mobile communications device provides conference call functionality.

17. The system of claim 16, wherein the conference call functionality comprises a graphical user interface that indicates the participants in a conference call.

18. The system of claim 16, wherein the conference call functionality comprises adding a new conference call participant by placing a call to the new conference call participant from the mobile communications device.

19. The system of claim 16, wherein the conference call functionality comprises adding a new conference call participant by accepting an incoming call from the new conference call participant at the mobile communications device.

20. The system of claim 16, wherein the conference call functionality comprises causing, from the mobile communications device, a conference call participant to be dropped from an ongoing conference call.

21. The system of claim 16, wherein the conference call functionality comprises indicating to a user of the mobile communications device (i) how long each participant has been participating in a conference call and (ii) whether a participant has been dropped.

22. A system for extending telephone calls to and from a mobile communications device, comprising:

a server in communication with (i) a PBX and (ii) a data pathway; and

a wireless communications device programmed with client-side software that operates together with the server via the data pathway,

wherein the server notifies the wireless communications device of an incoming call received at the PBX for the user of the wireless communications device, wherein the server causes the PBX to place an outgoing call from the PBX to the wireless communications device, and wherein the server causes said incoming call and said outgoing call to be switched into a common circuit.

23. The system of claim 22, wherein the incoming call is destined for a PBX-connected telephone that is assigned for use by a person using the wireless communications device.

24. The system of claim 22, wherein a call initiated at the wireless communications device to a callee, is routed through the PBX in accordance with information received from the server.

25. The system of claim 24, wherein the callee is given the impression that the call initiated at the wireless communications device is being placed from a PBX-connected telephone.

26. The system of claim 24, wherein at least a portion of the information received from the server is provided by the wireless communication device.

27. The system of claim 22, wherein the wireless communications device is at least one of a personal digital assistant, a mobile telephone and a computer.

28. The system of claim 22, wherein the server and wireless communications device communicate with one another using the data pathway.

29. A method of extending a telephone call, received at a private branch exchange, to a mobile communications device, comprising the steps of:

monitoring the private branch exchange (PBX) for an incoming first call for a selected telephone number;

sending to the mobile communications device via a data connection an indication of the existence of the incoming first call;

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receiving at the computer server a request to answer the incoming first call;

causing the PBX to establish a new second connection between the PBX and the mobile

communications device; and

connecting the incoming first call with the new connection, thereby connecting the

incoming first call to the mobile communications device.

30. The method of claim 29, wherein each of the recited steps occurs automatically.

31. The method of claim 29, further comprising sending calling line identity information

to the mobile communications device via the data connection.

32. The method of claim 29, further comprising simultaneously ringing a PBX-

connected telephone associated with the selected telephone number and the mobile

communications device.

33. The method of claim 29, further comprising storing calling data with respect to the

incoming first call on the mobile communications device.

34. The method of claim 29, further comprising causing the PBX to conference in a third

call.

35. The method of claim 34, further comprising displaying participants in a conference

call.

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36. The method of claim 34, further comprising adding the third call at by placing the third call from the mobile communications device.

37. The method of claim 34, further comprising adding the third call by accepting the third call at the mobile communications device.

38. The method of claim 34, further comprising causing, from the mobile communications device, the third call to be dropped.

39. The method of claim 34, further comprising indicating on the mobile communications device at least one of (i) how long each participant in a conference call has been participating and (ii) whether a participant has been dropped.

40. The method of claim 29, further comprising transferring the incoming first call to a third party by controlling the PBX.

41. The method of claim 29, further comprising determining the origin of the incoming first call and filtering the same based on predetermined criteria.

42. The method of claim 29, further comprising accumulating and aggregating call data records.

43. The method of claim 29, further comprising automatically reconnecting the incoming first call with the mobile communications device in the event a connection therebetween is lost.

44. The method of claim 29, further providing lost call indications in the event that the mobile communications device was powered off when the call occurred.

45. The method of claim 29, further providing a PBX voice message indication in the event that a voice message has been left on or removed from the PBX voice messaging system.

46. A method of employing a private branch exchange (PBX) to route calls from a mobile communications device to a callee, comprising the steps of:

establishing a data connection between the mobile communications device and a server;

sending to the server from the mobile communications device via the data connection calling information for contacting the callee;

establishing a first call between the mobile communications device and the PBX;

causing the PBX to establish a second connection between the PBX and the callee based on the calling information; and

connecting the first call with the second connection within the PBX, thereby connecting the callee to the mobile communications device.

47. The method of claim 46, wherein each of the recited steps occurs automatically.

48. The method of claim 46, further comprising storing calling data with respect to the first call and the second connection.

49. The method of claim 46, further comprising causing the PBX to conference in a third call.

50. The method of claim 46, further comprising transferring the connected first call and second connection.

51. The method of claim 46, further comprising accumulating and aggregating call data records.

52. The method of claim 46, further comprising automatically reestablishing the first call in the event a connection is lost.
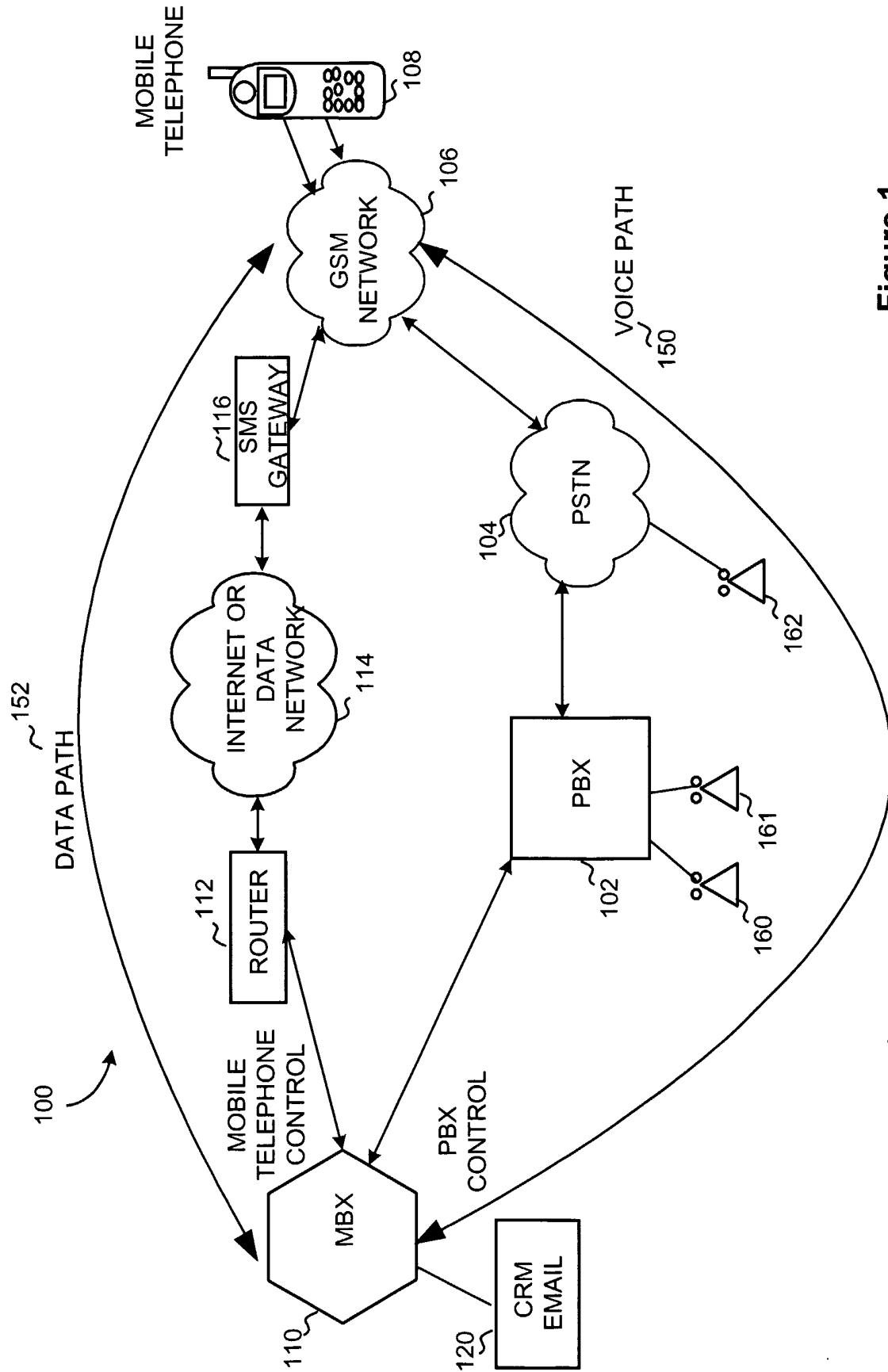
Figure 1
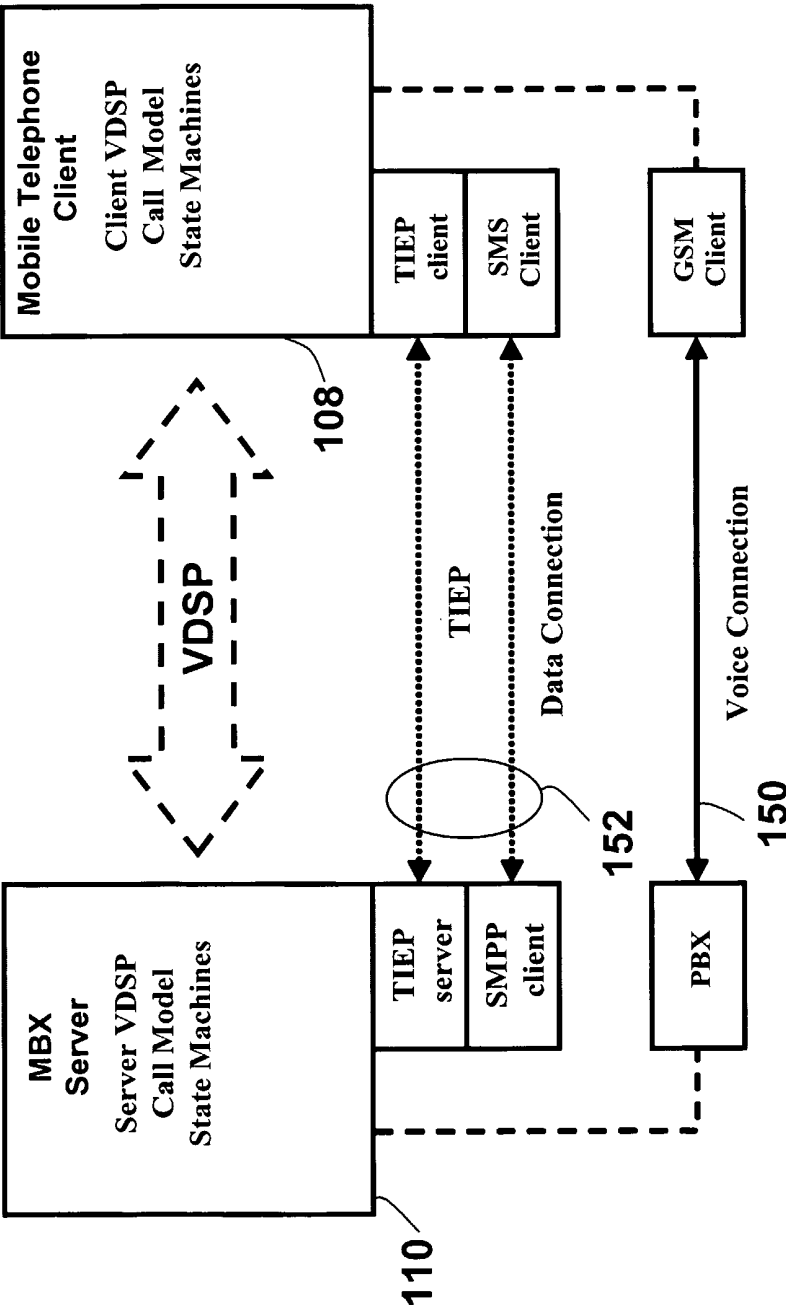
Figure 1A
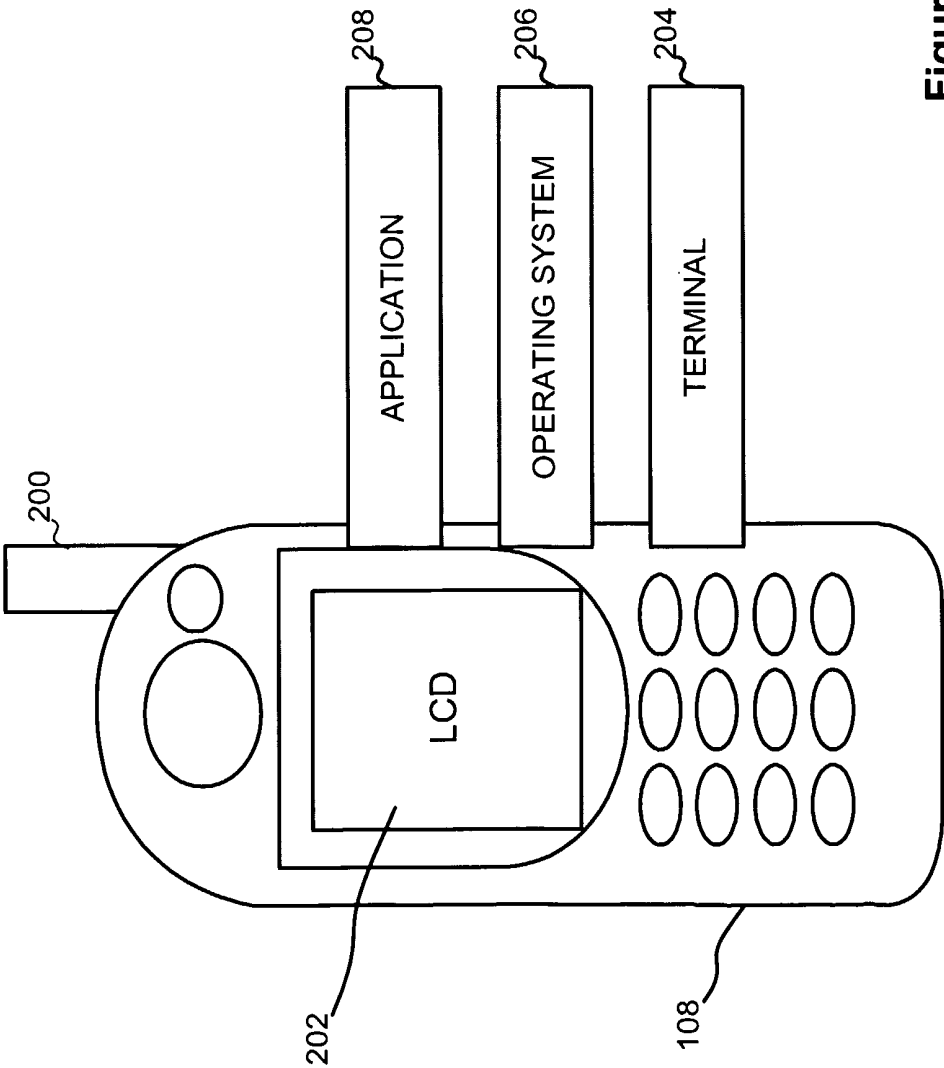
Figure 2
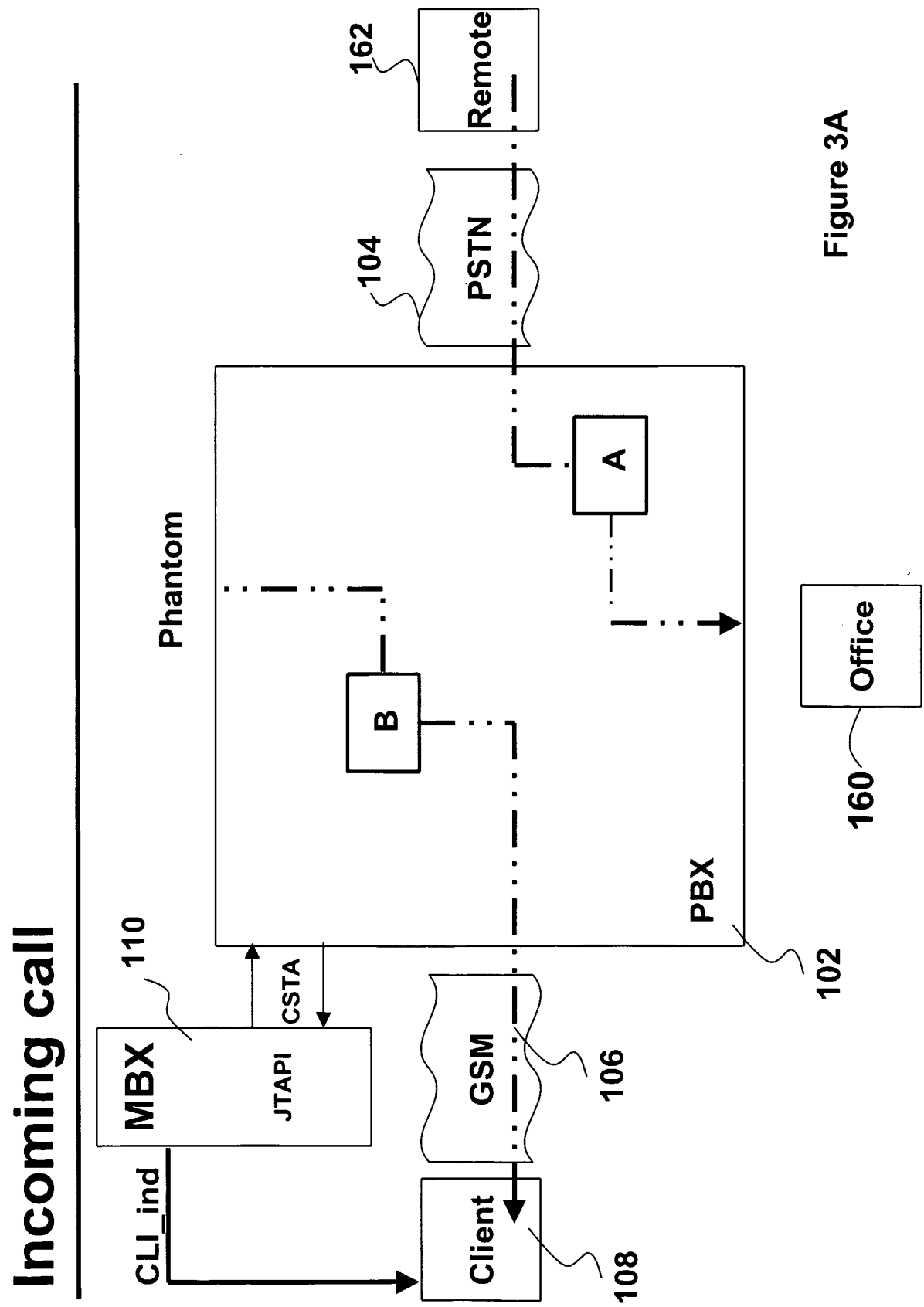
Incoming call

Figure 3A

Incoming call - answer
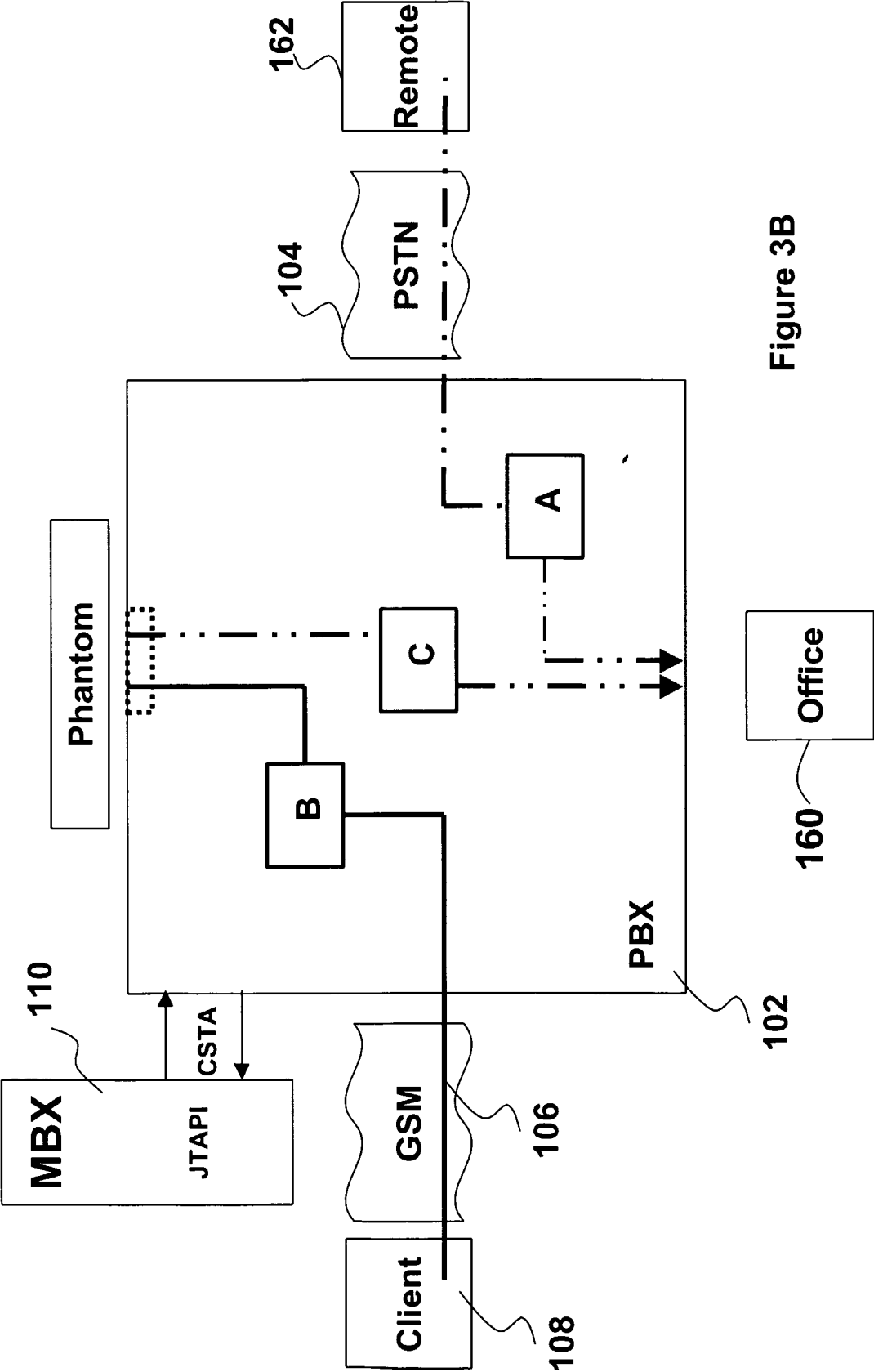
Figure 3B

Incoming call - answer
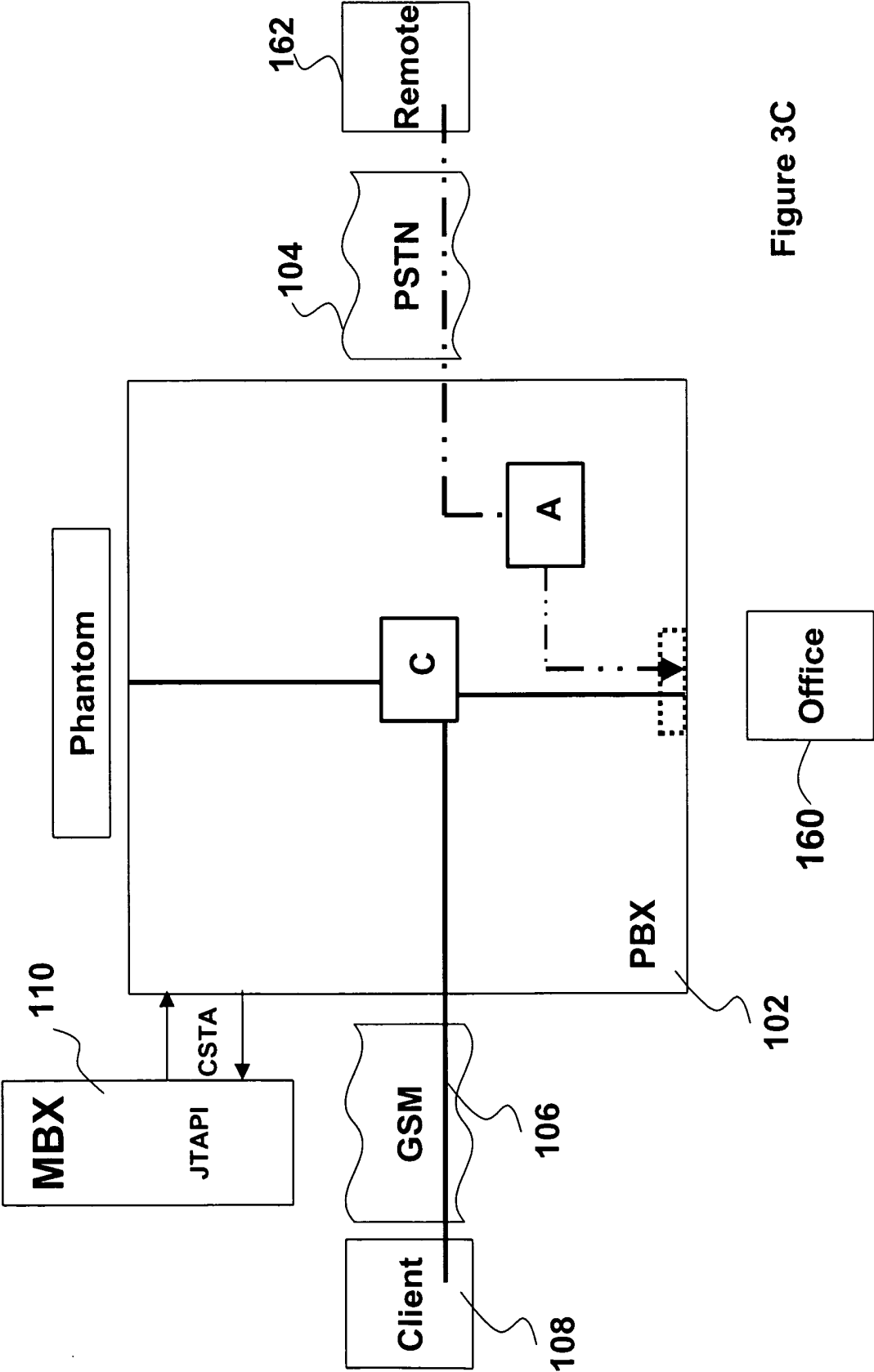
Figure 3C

Incoming call - answer
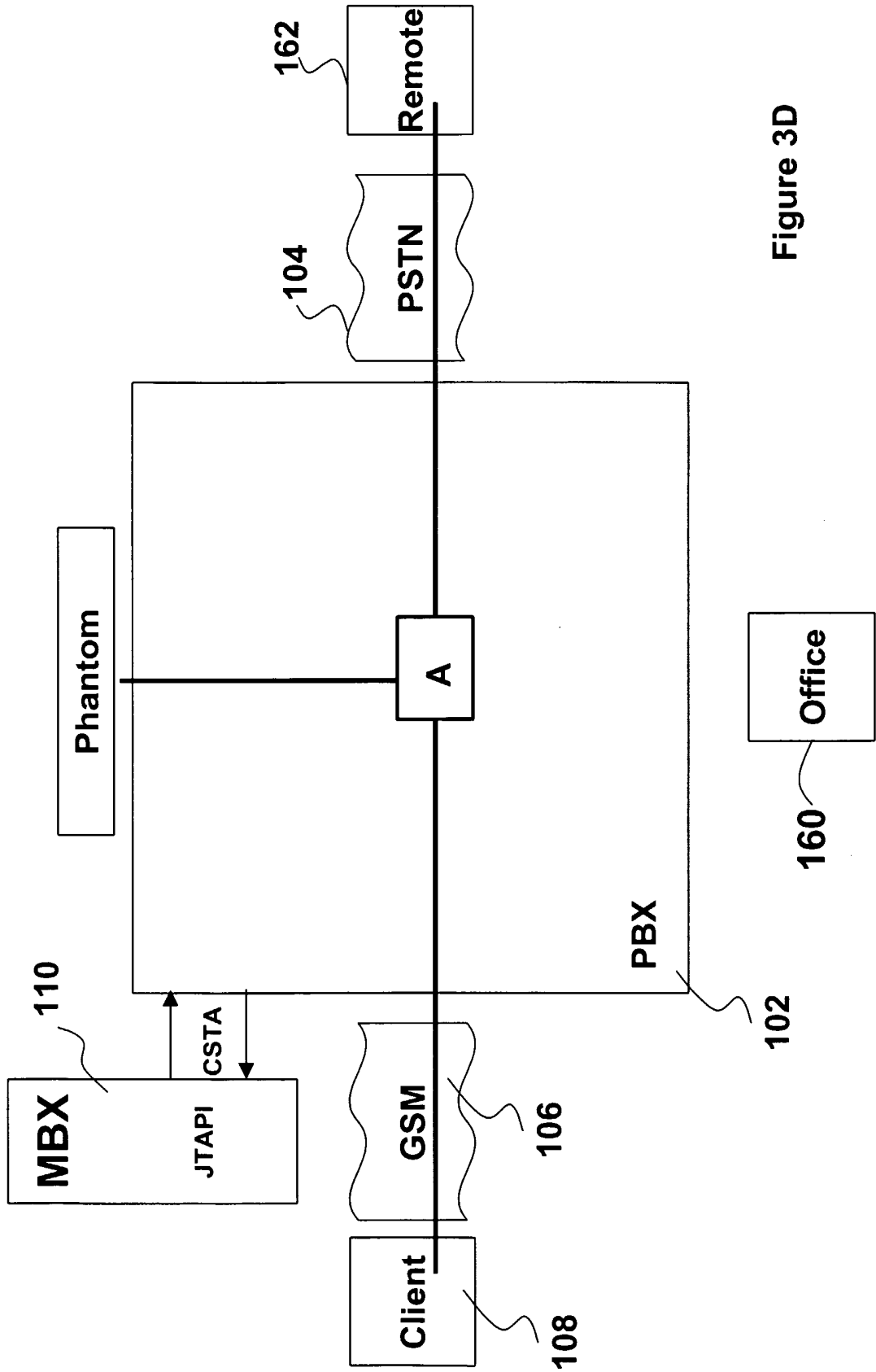
Figure 3D

Incoming call
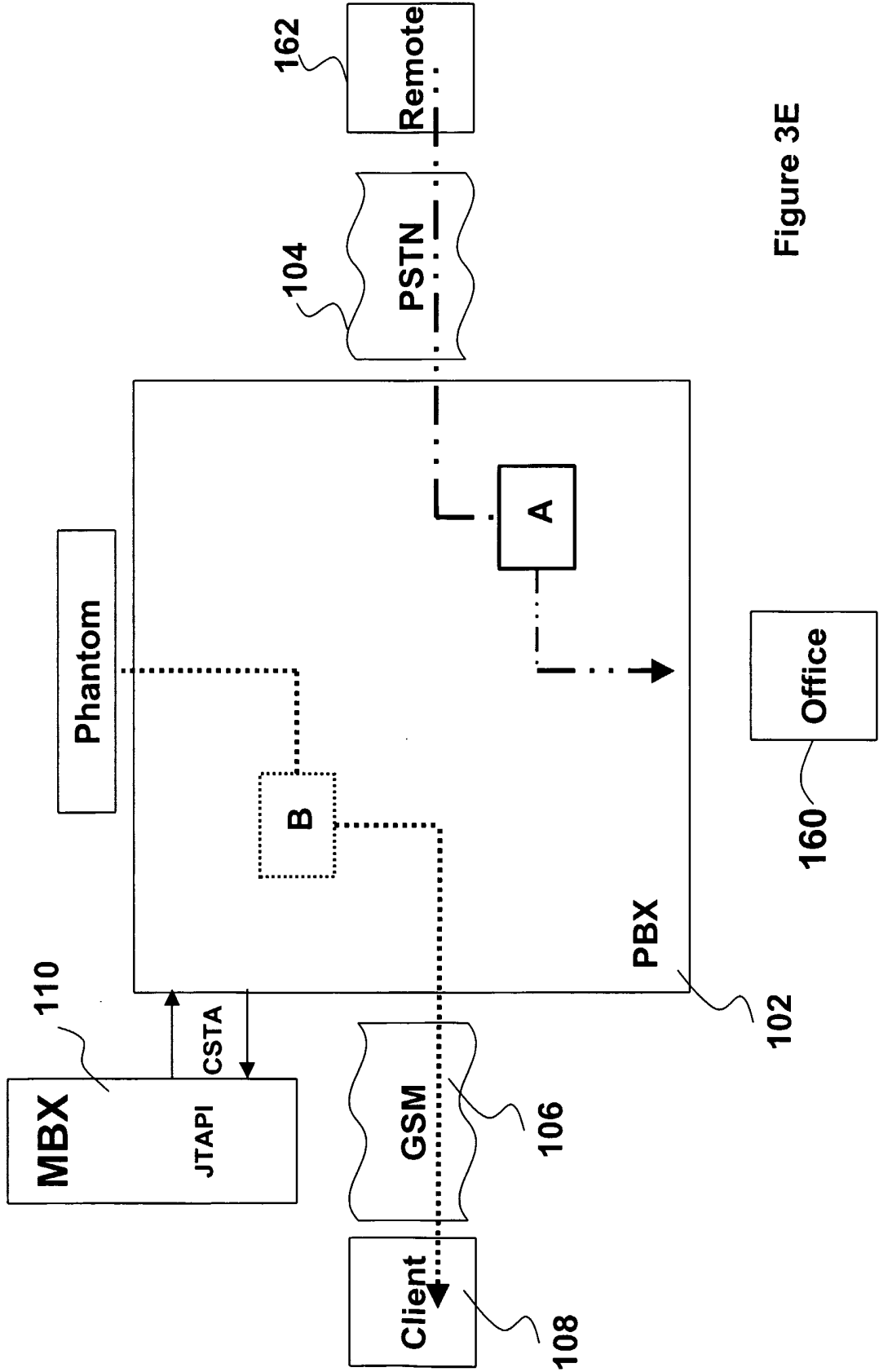
Figure 3E

Outgoing indirect call
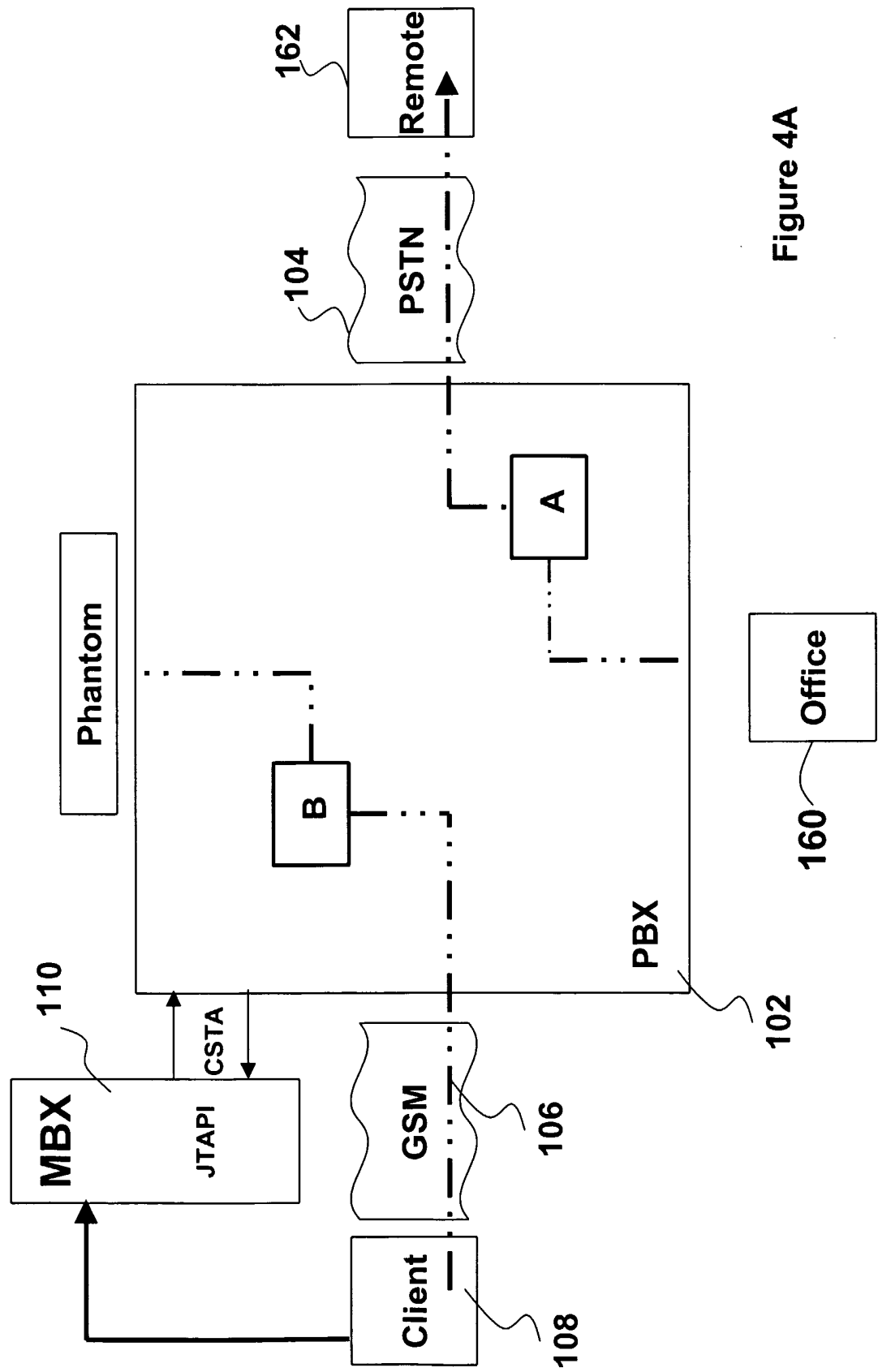
Figure 4A

Outgoing indirect call - answer
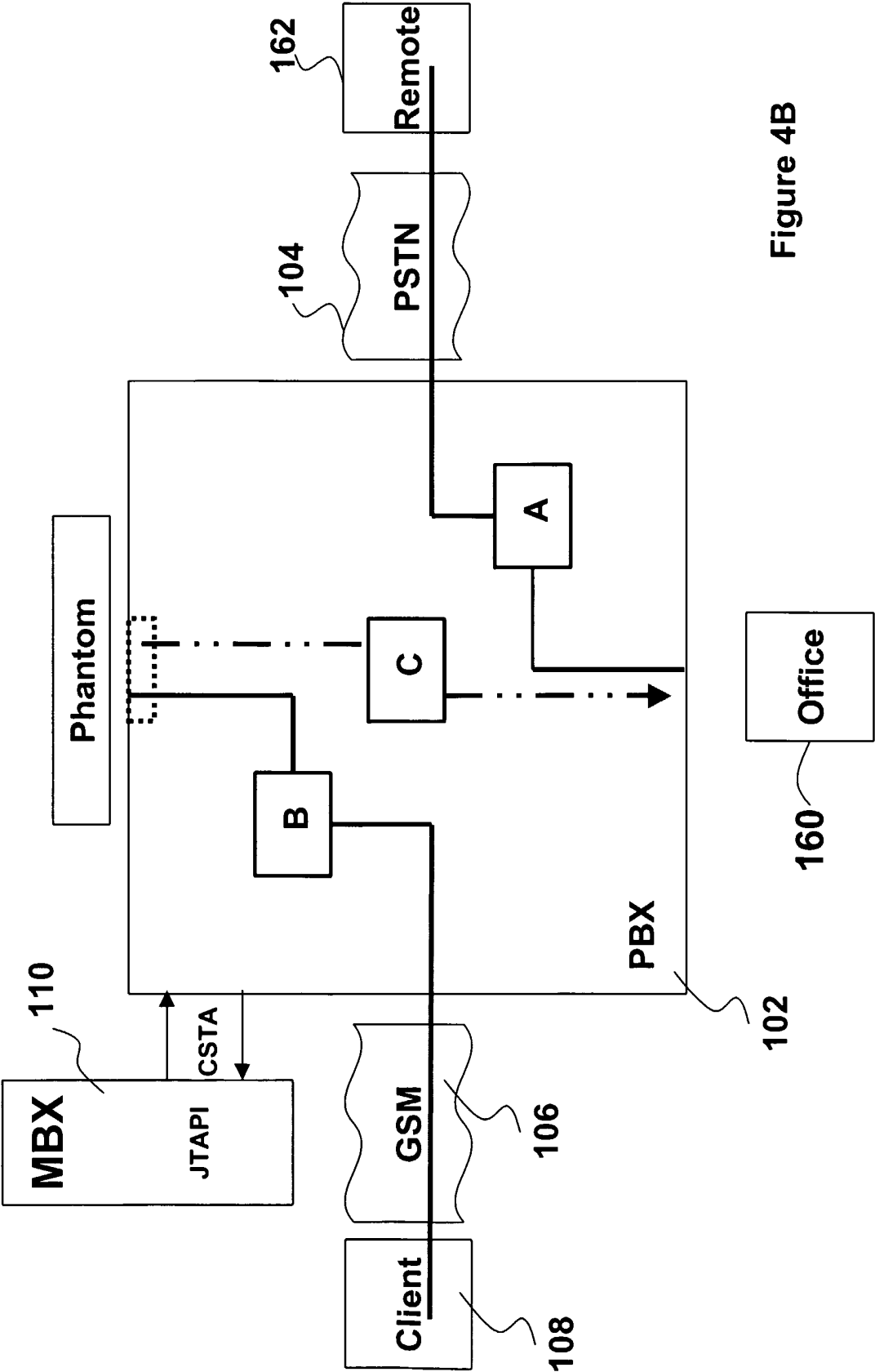
Figure 4B

Outgoing indirect call - answer
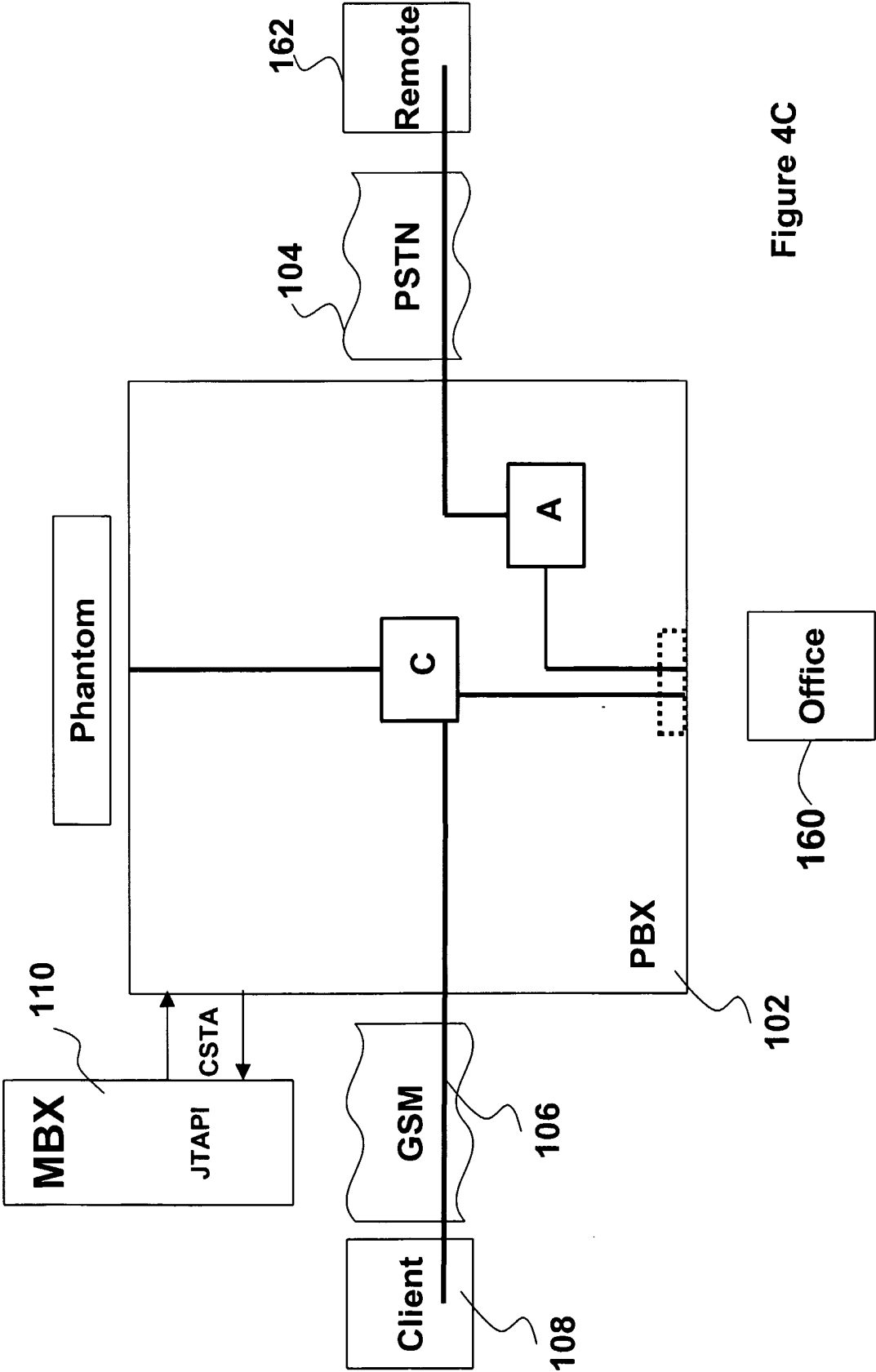
Figure 4C

Outgoing indirect call - answer
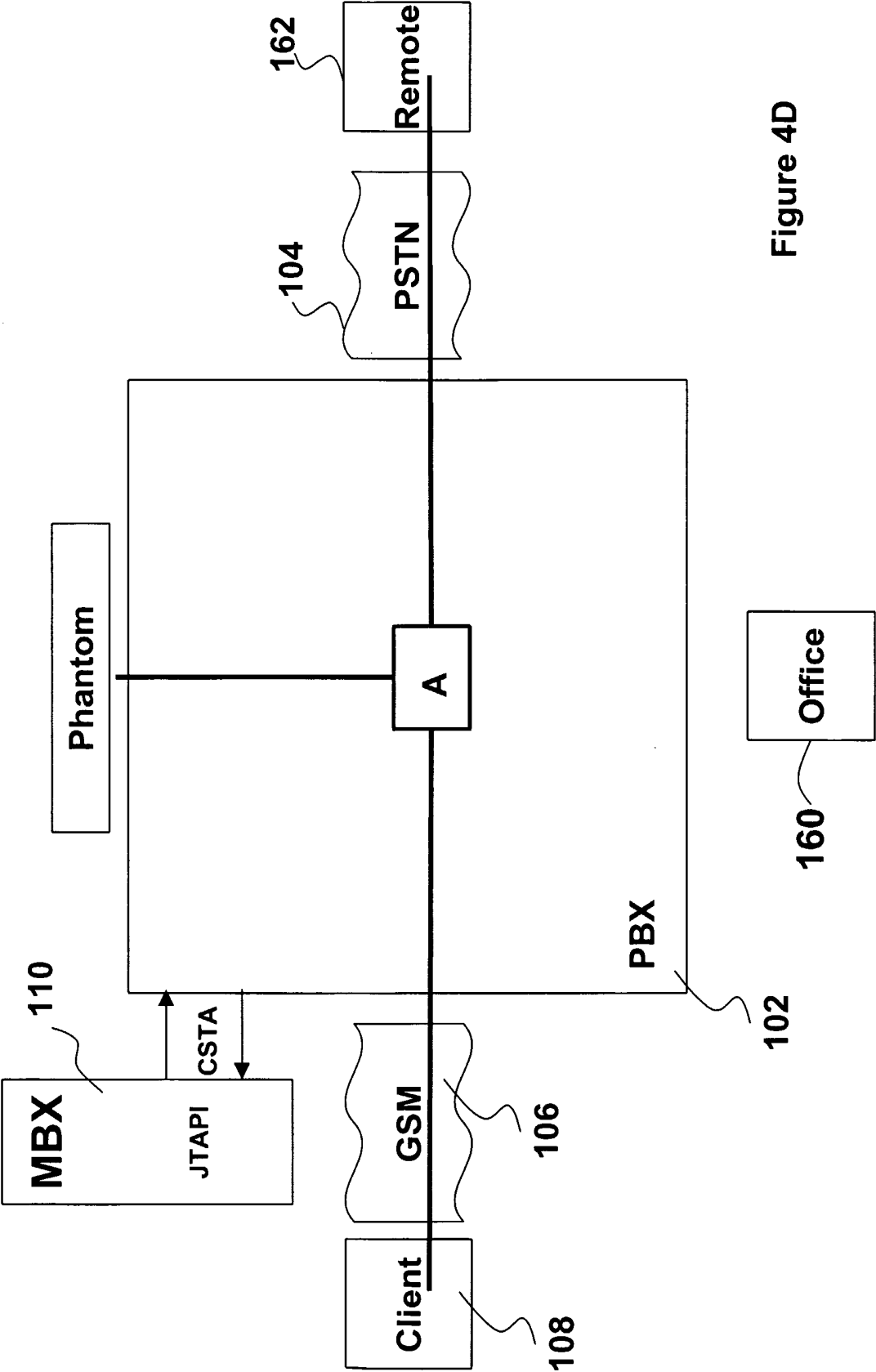
Figure 4D

Outgoing indirect call to MBX client
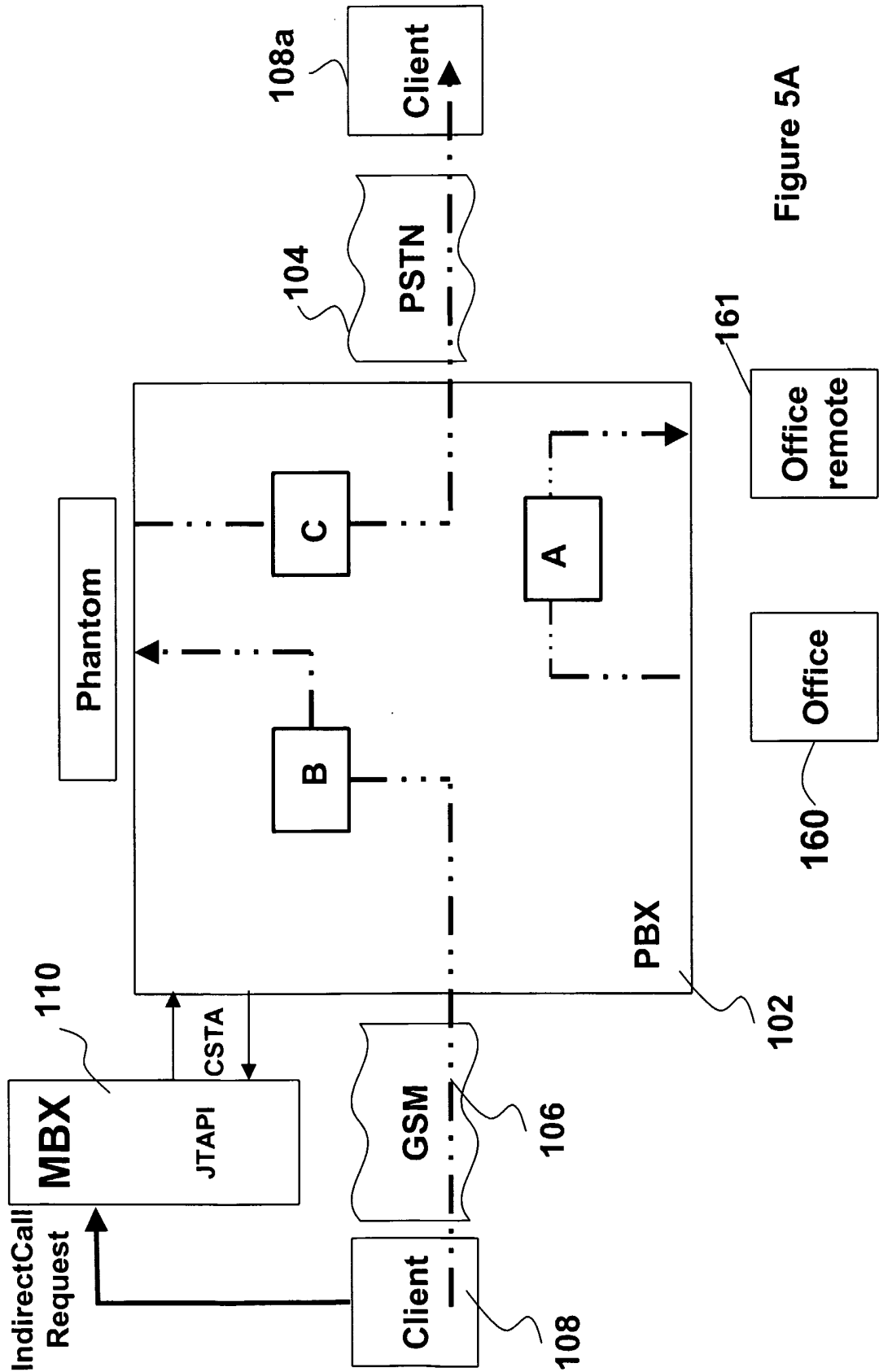
Figure 5A

Outgoing indirect call to MBX client
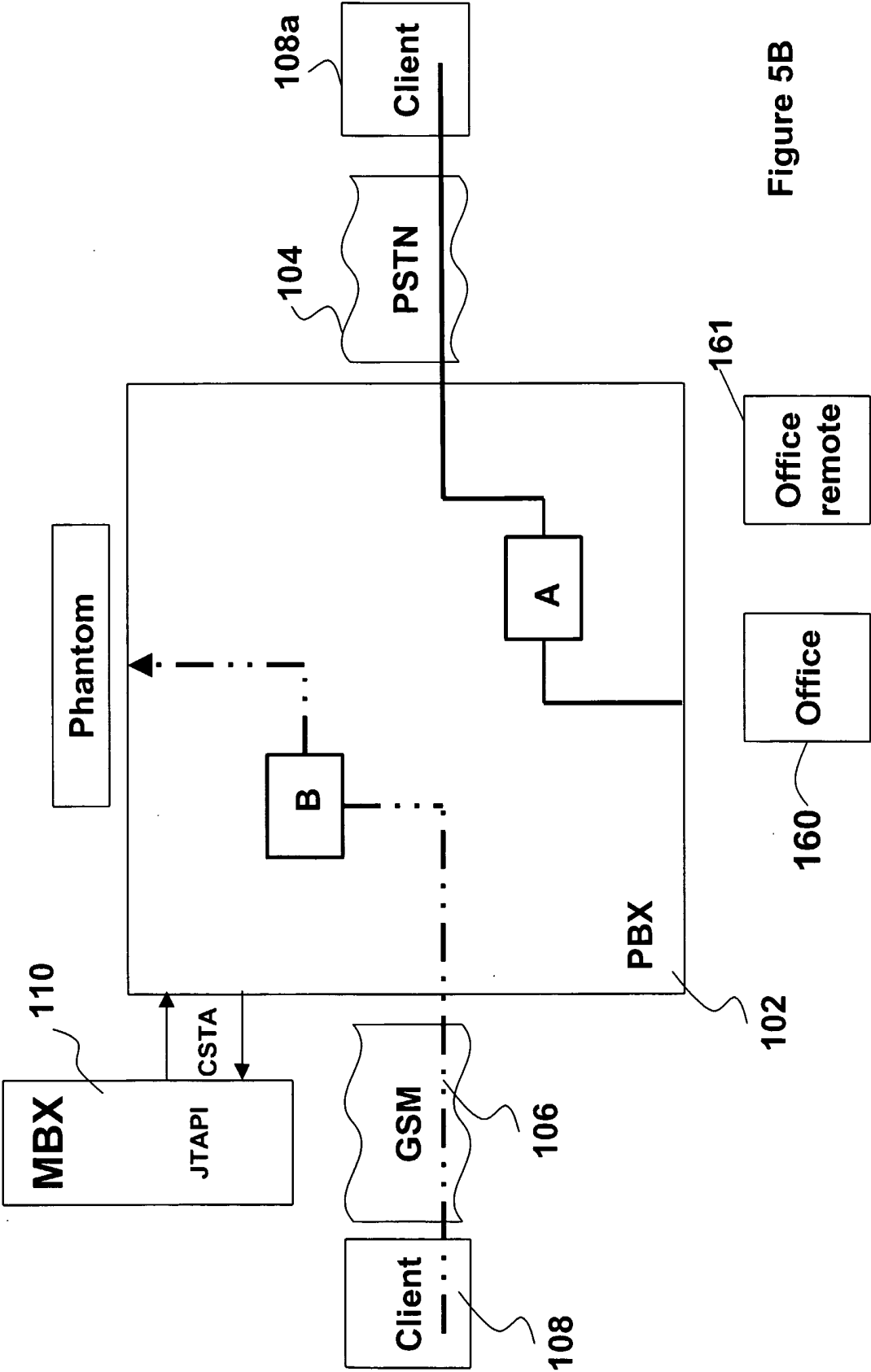
Figure 5B

Outgoing indirect call to MBX client
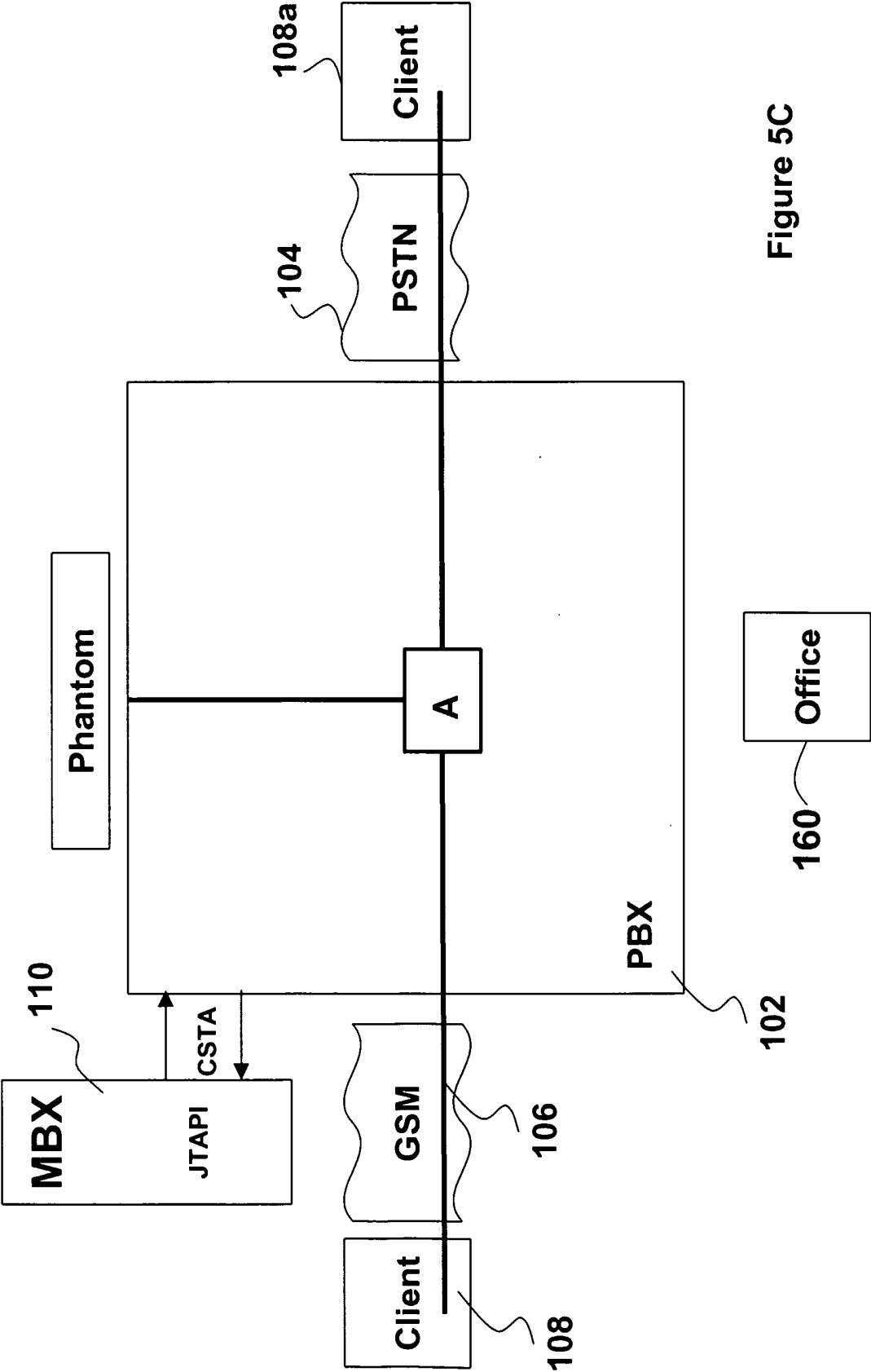
Figure 5C

Conference – outgoing – blind

Conf_Blind_Add
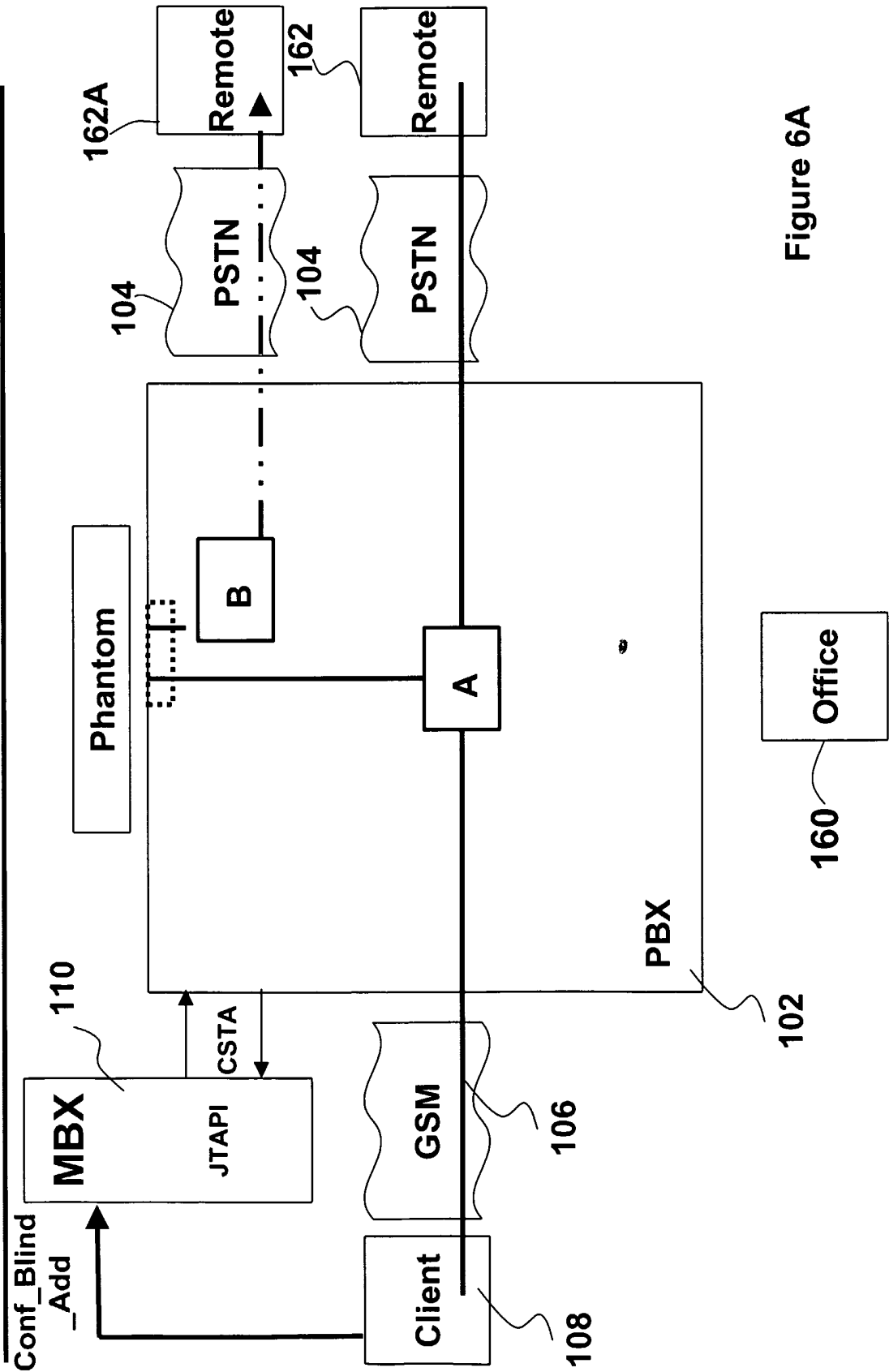
Figure 6A

Conference - outgoing - blind
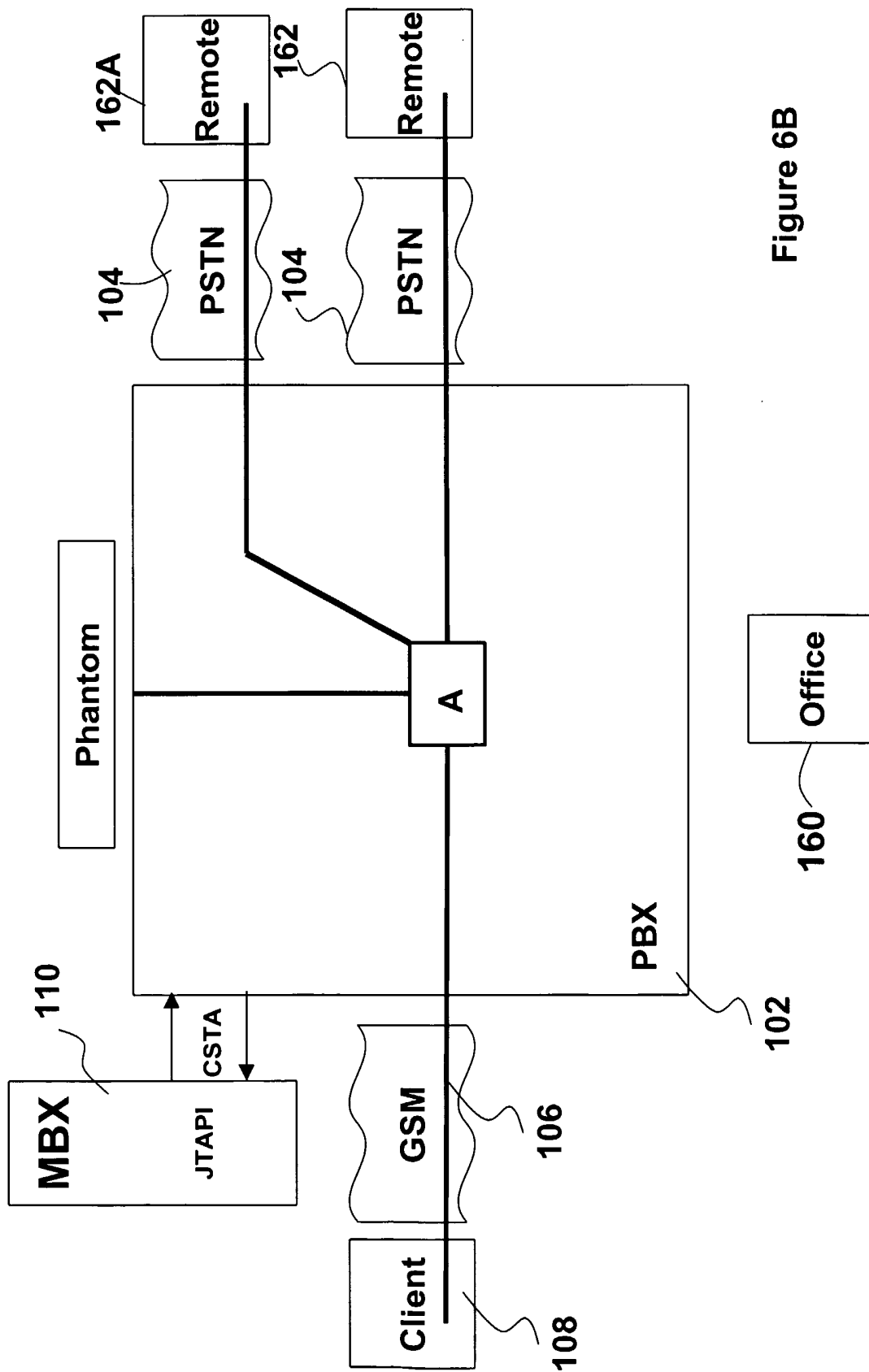
Figure 6B

Conference - incoming - blind

CLI_queued
_ind

MBX 110

JTAPI CSTA

Phantom

Client 108

GSM 106

C

A

Phantom

B

PBX 102

Office 160

PSTN 104

PSTN 104

Remote 162

Remote
162A
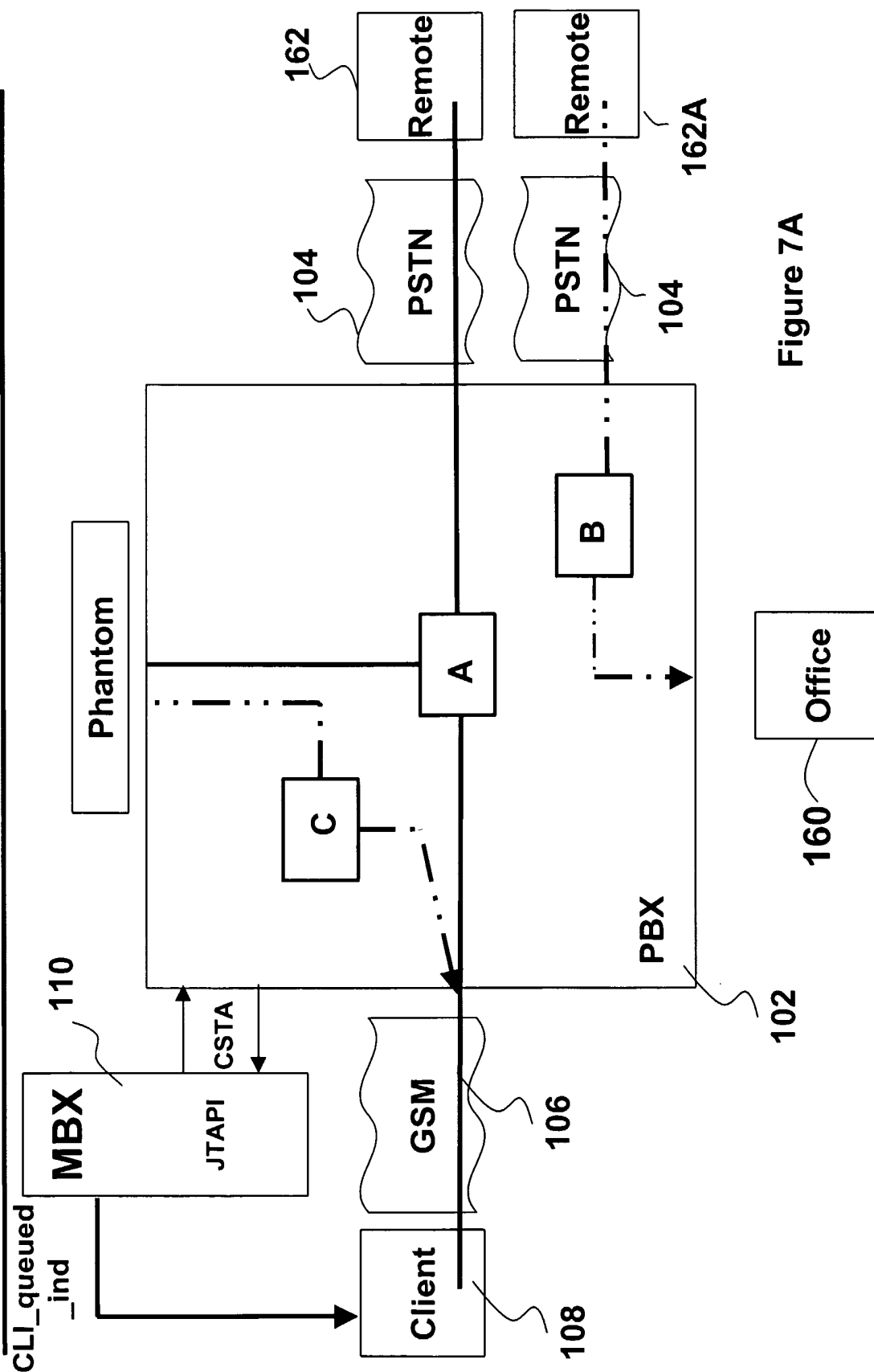
Figure 7A

Conference - incoming - blind

Conf_Blind
_Include

MBX 110

JTAPI   CSTA

Phantom

A

B

PSTN 104

PSTN 104

162A

Remote 162

Remote

GSM 106

Client 108

PBX 102

Office 160
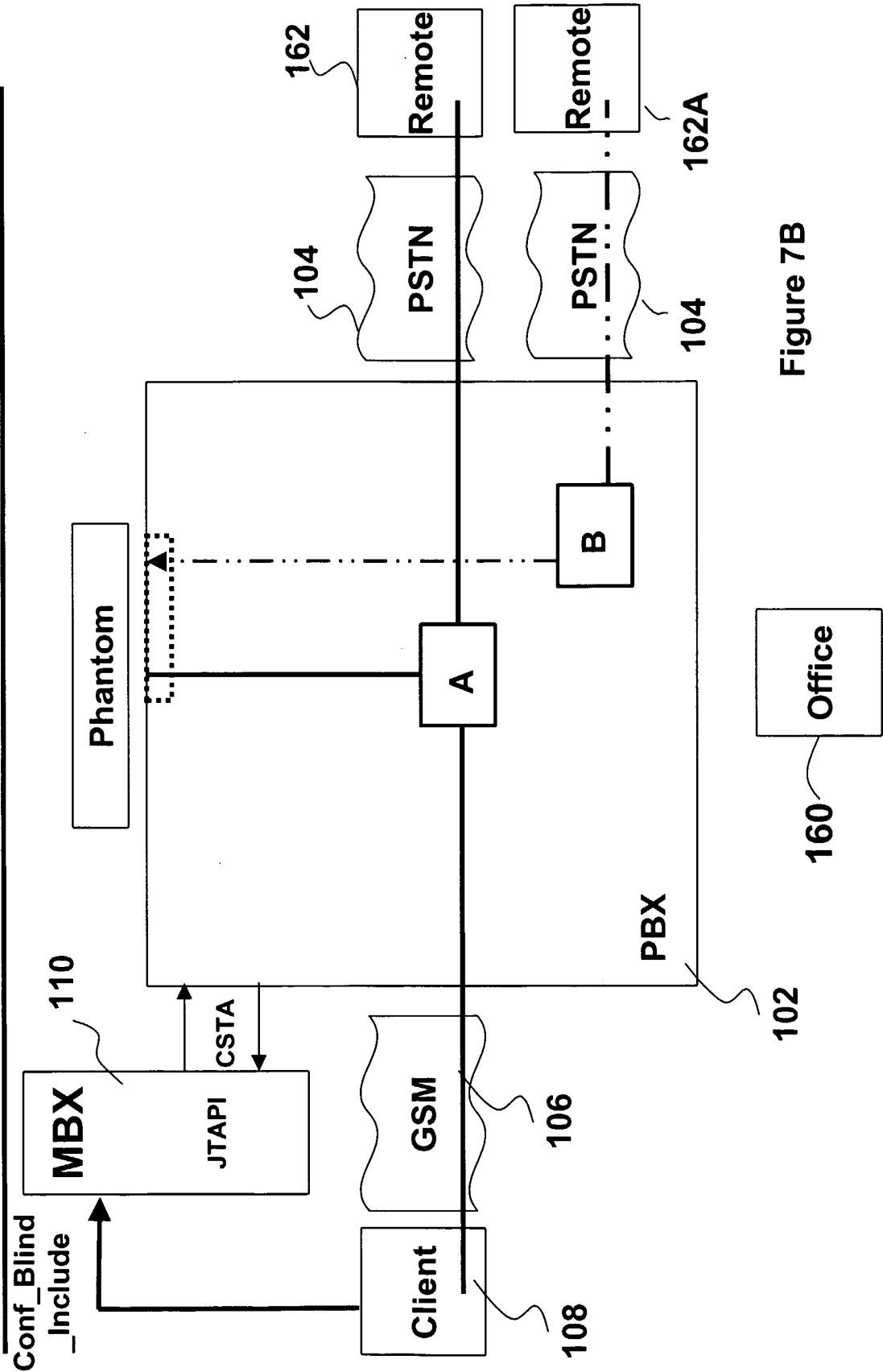
Figure 7B

Conference – incoming – blind
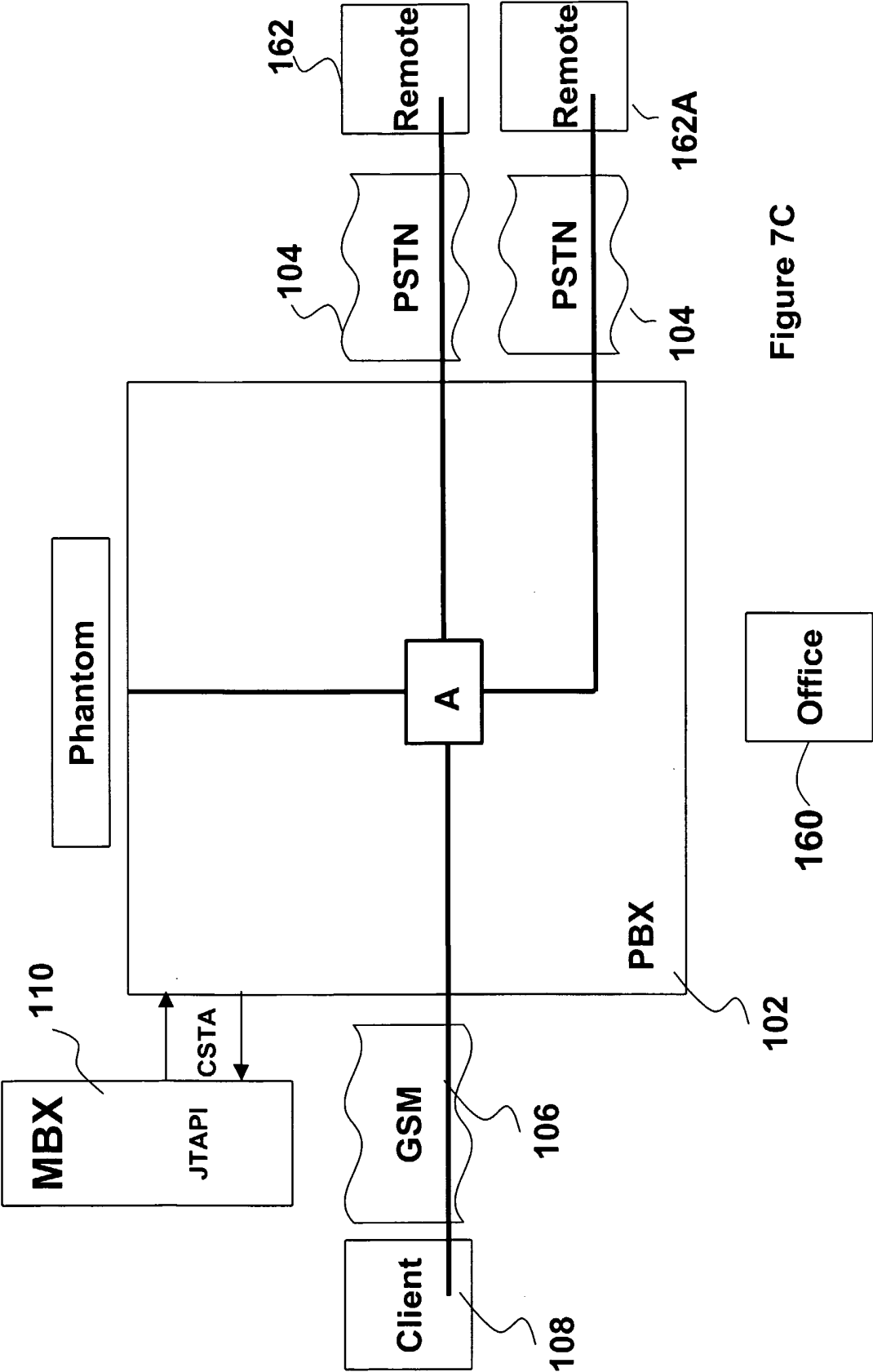
Figure 7C

Conference - incoming - blind - reject
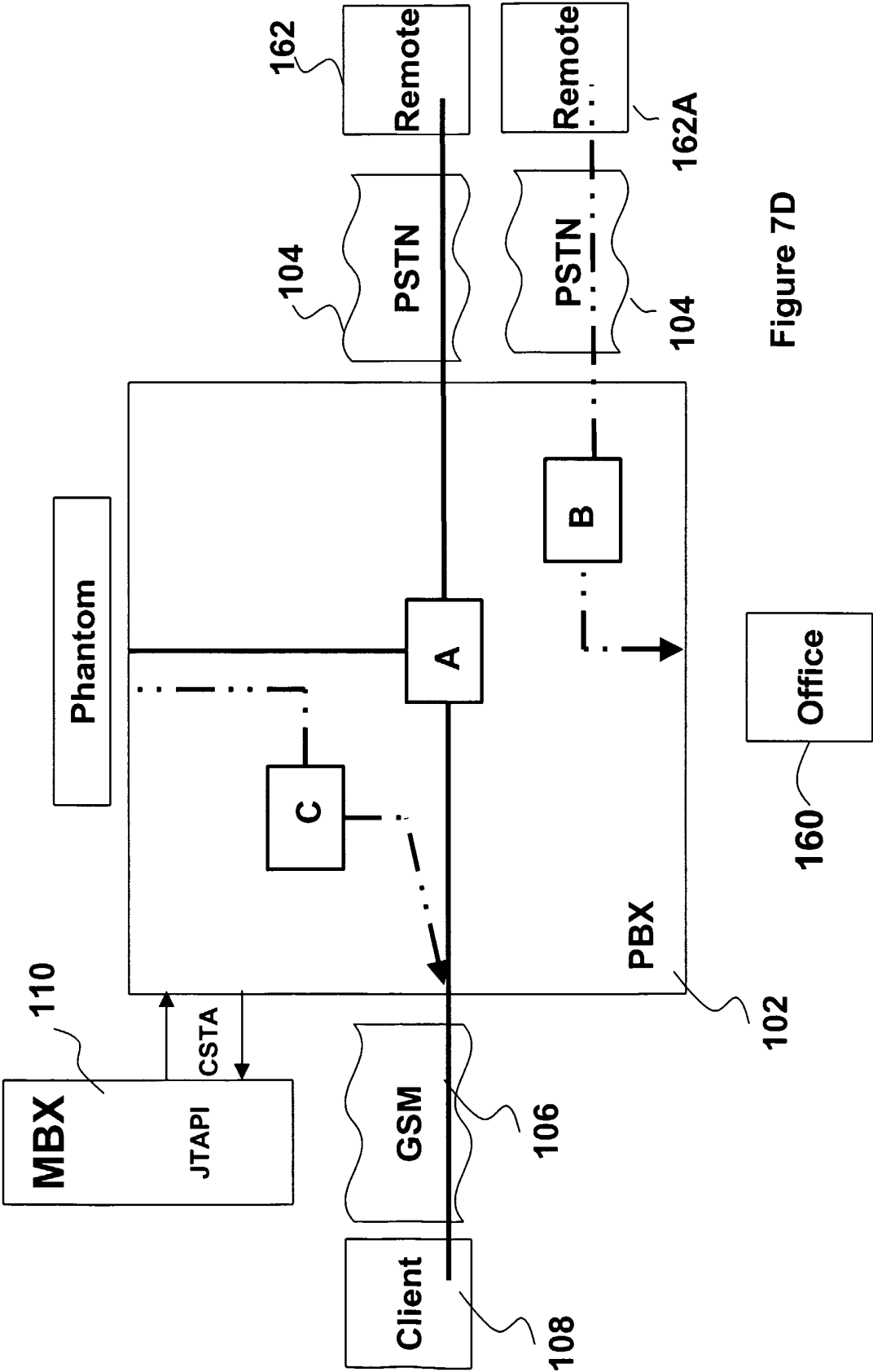
Figure 7D

Conference - incoming - blind - reject
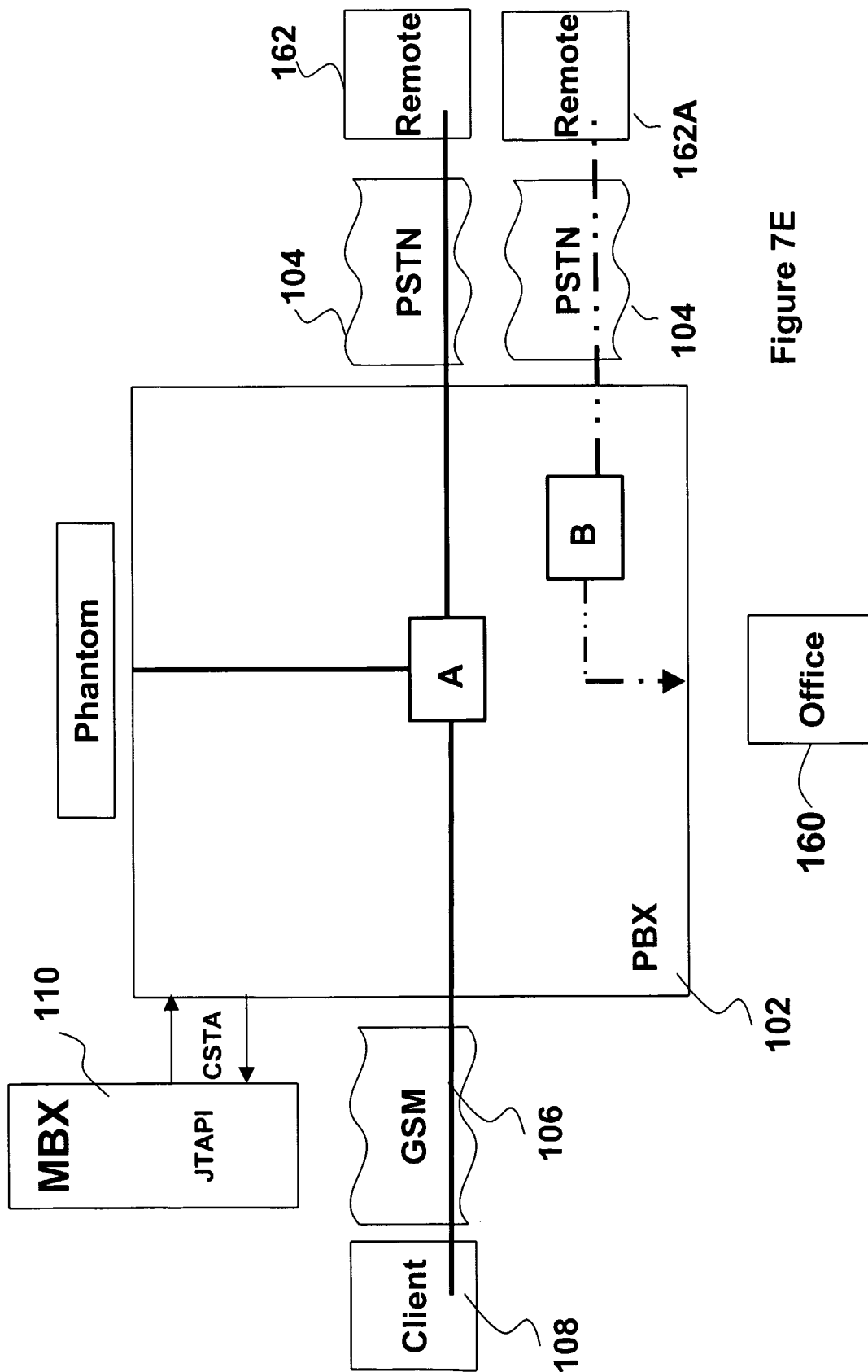
Figure 7E

Conference - lost participant

Conf_Party
_Lost
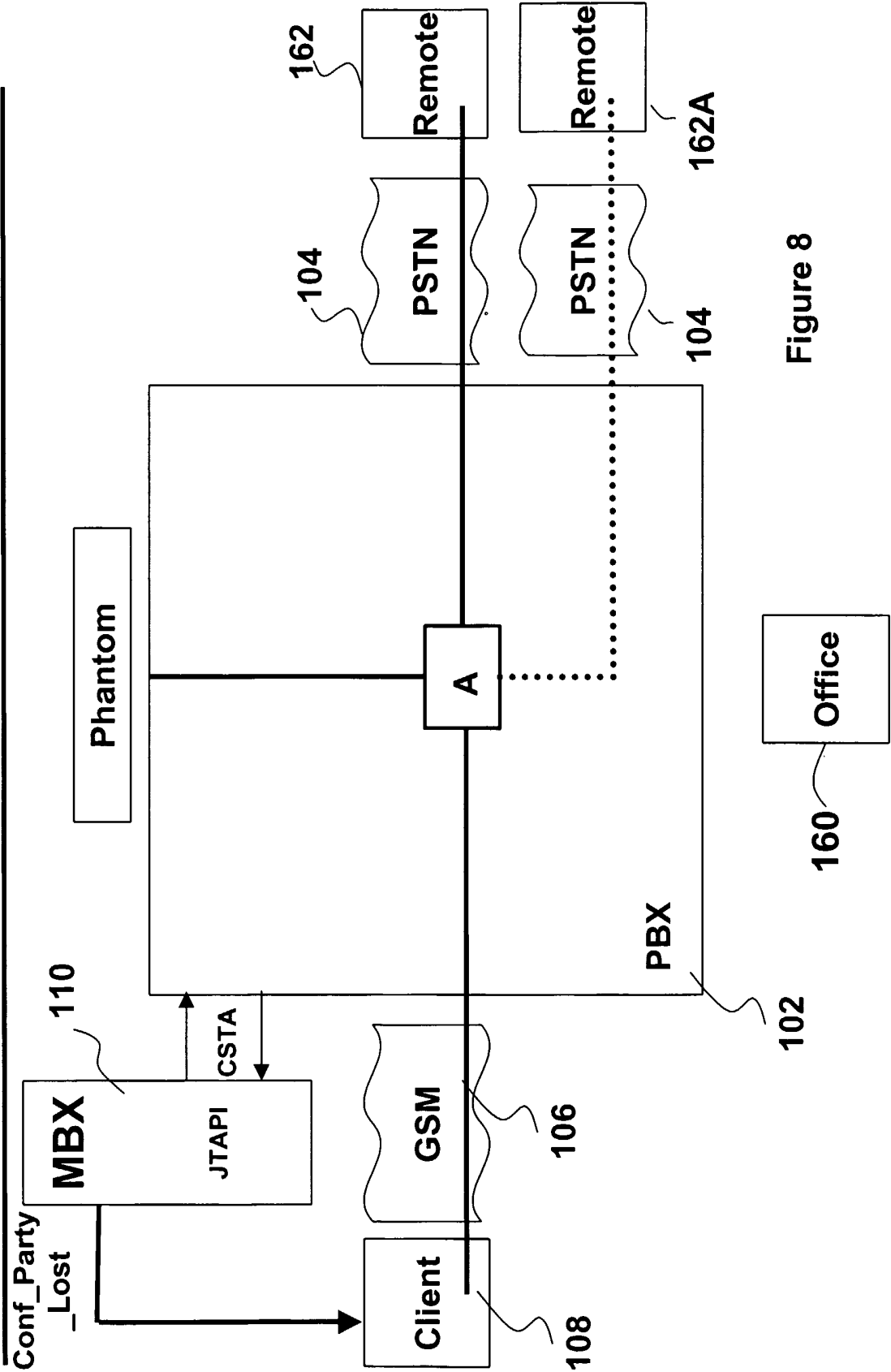
Figure 8

Conference – drop participant

Drop_Conf
_Party
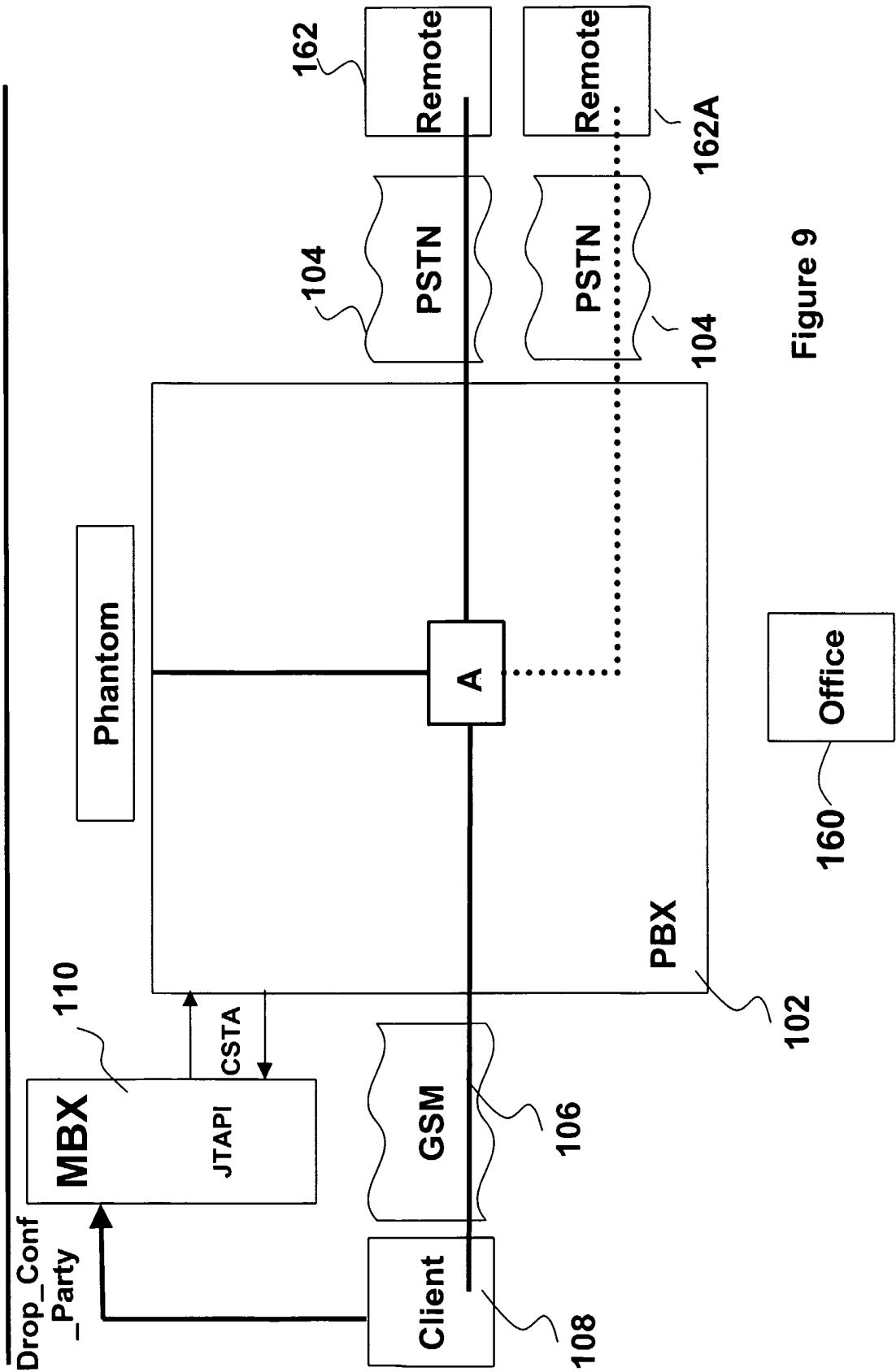
Figure 9

Forward call
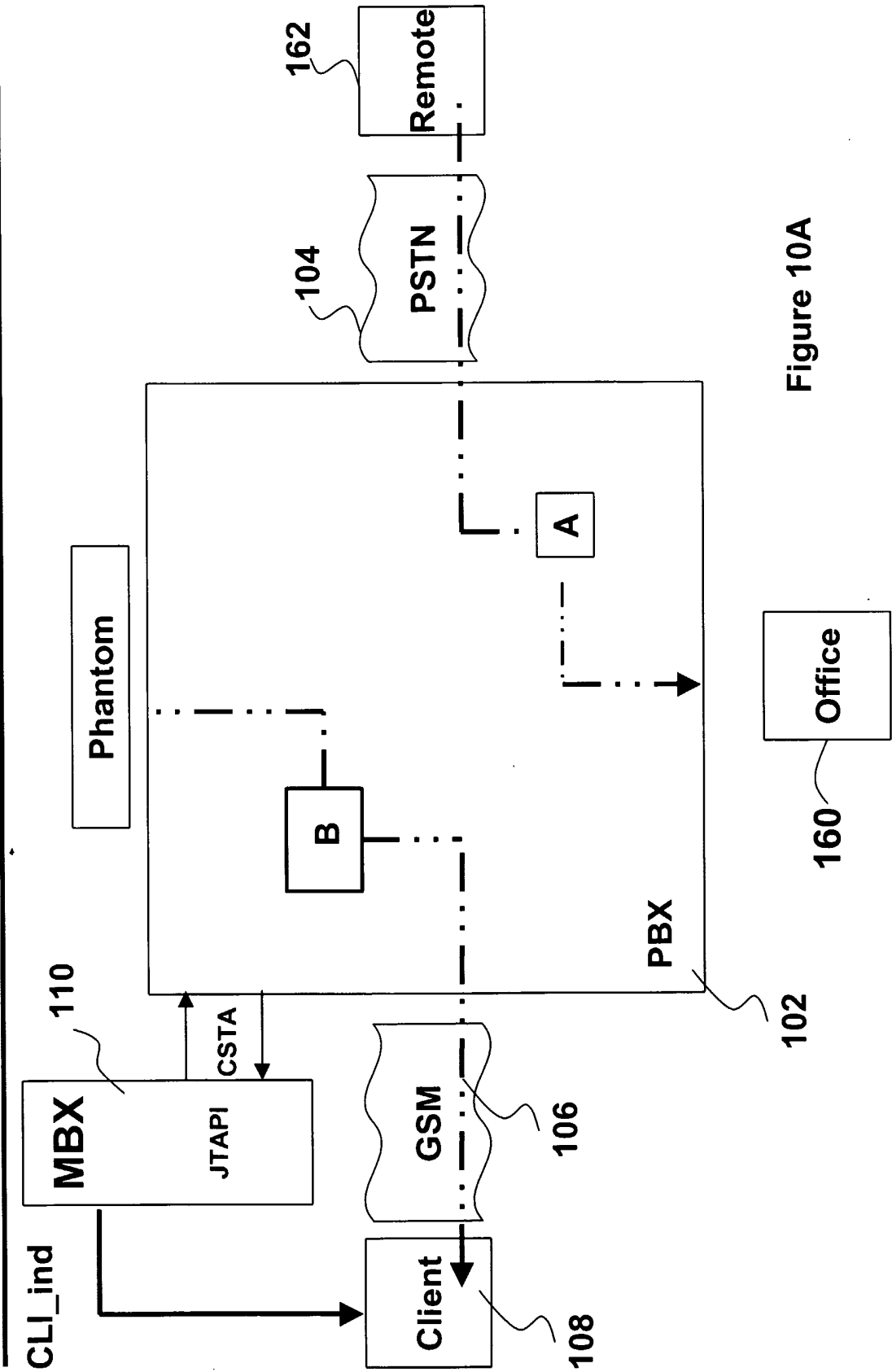
Figure 10A

Forward call

Forward
(x_no)

MBX
110

JTAPI
CSTA

GSM
106

Client
108

Phantom

B

A

PBX

x no

161
102

160

Office

PSTN
104

Remote
162
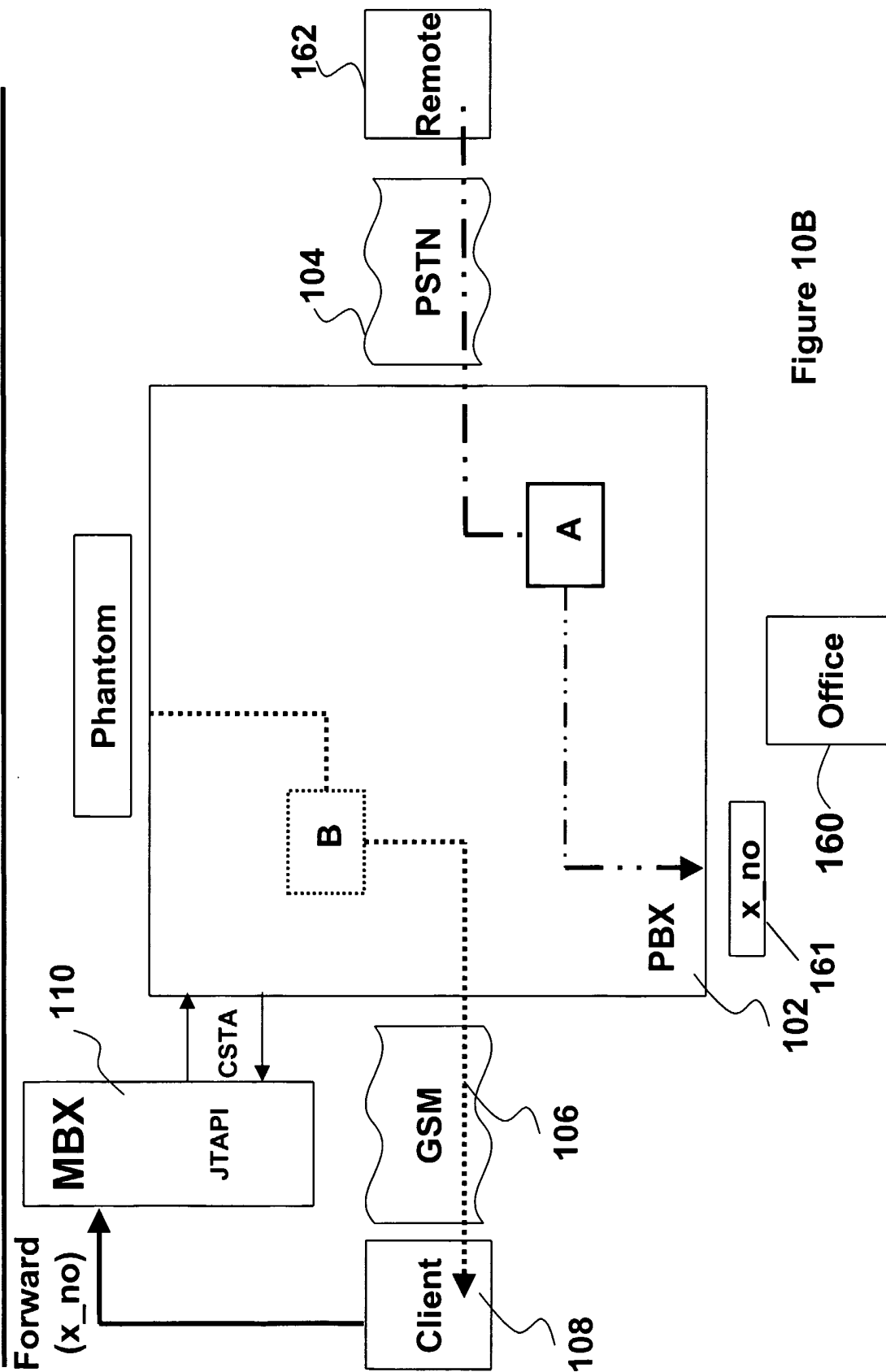
Figure 10B

Transfer Call

Conf_Blind
_Add(o_no)
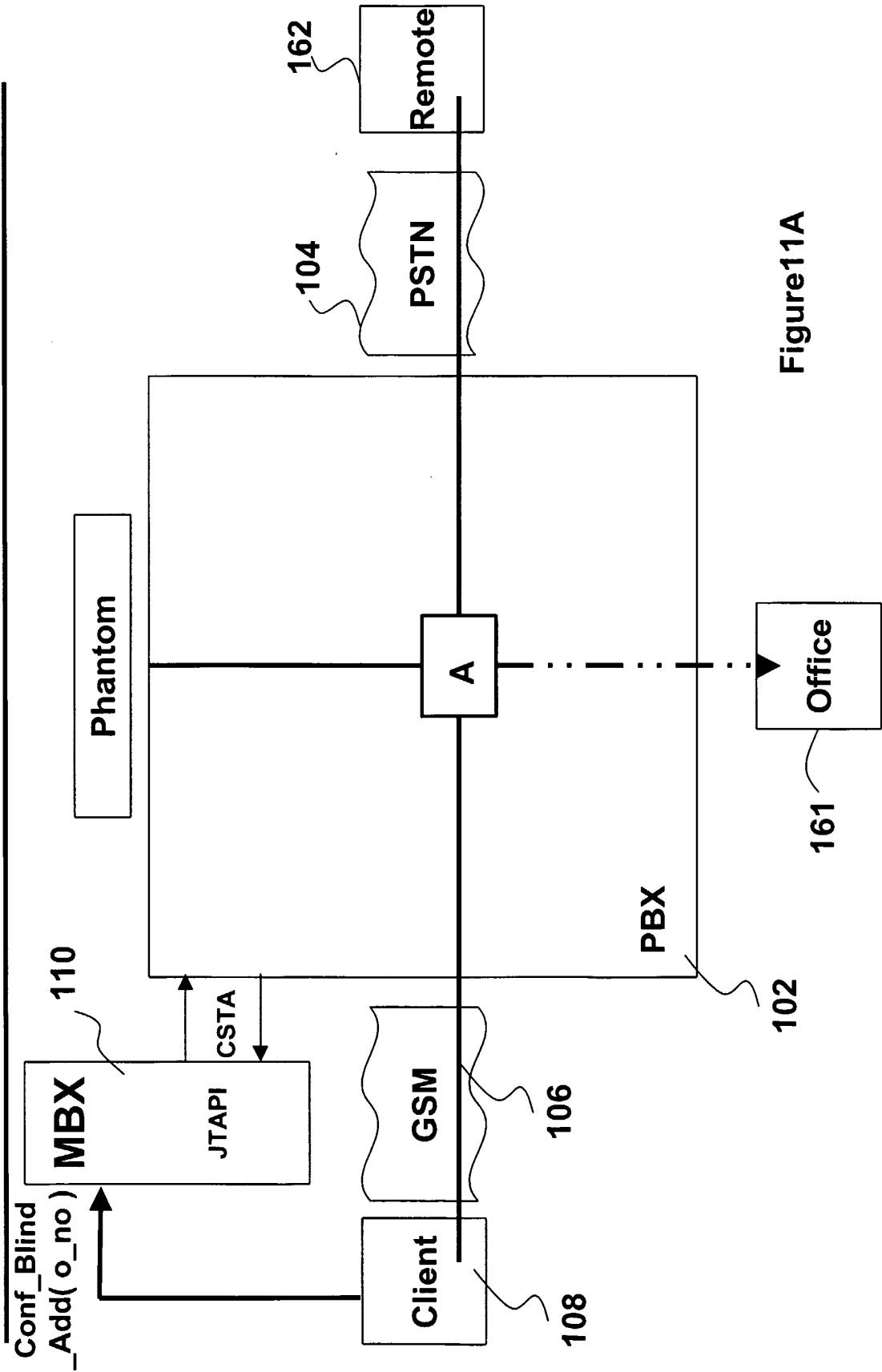
Figure11A

Transfer Call
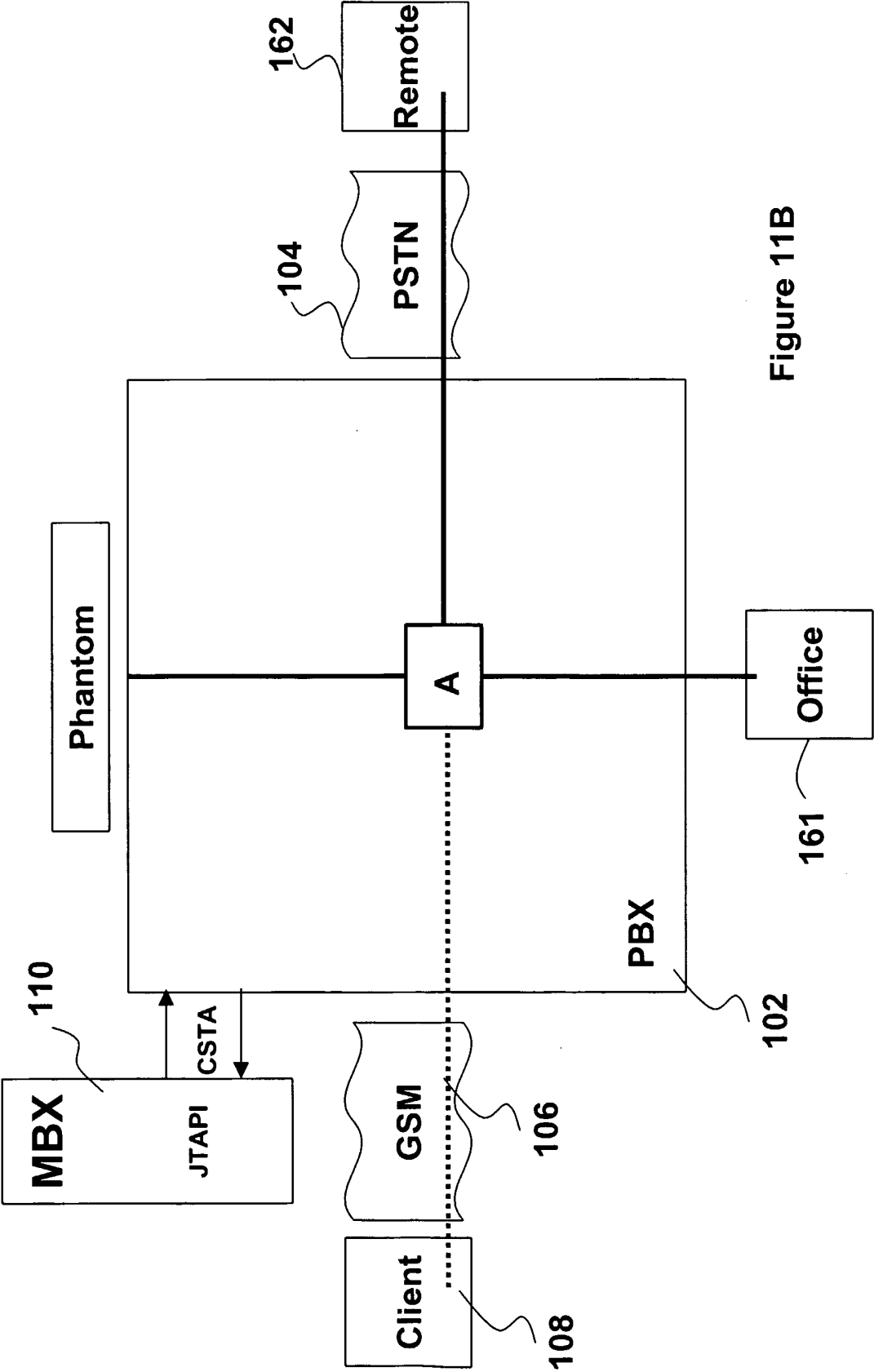
Figure 11B

Listen In - Forward
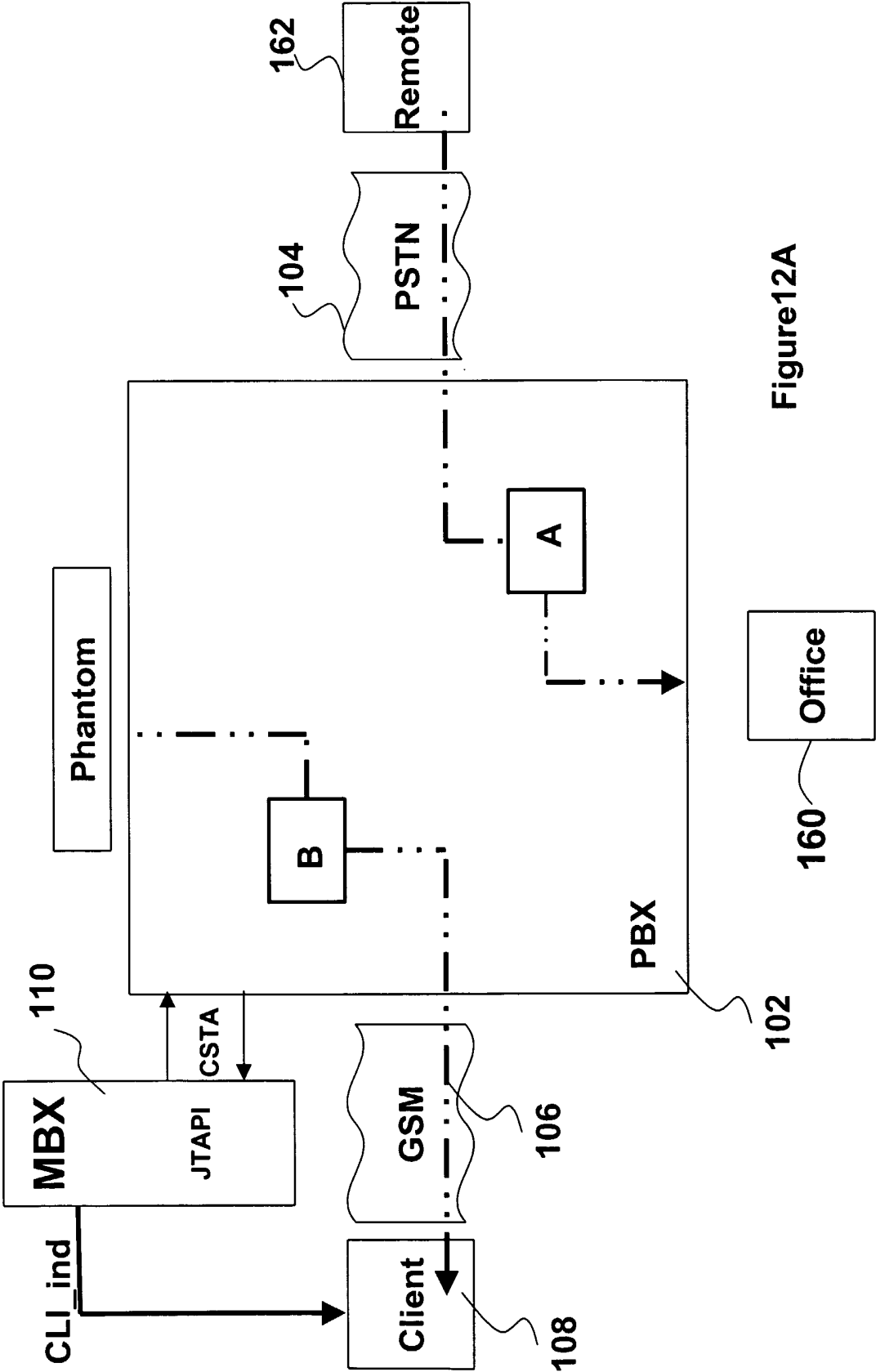
Figure12A

Listen In - Forward
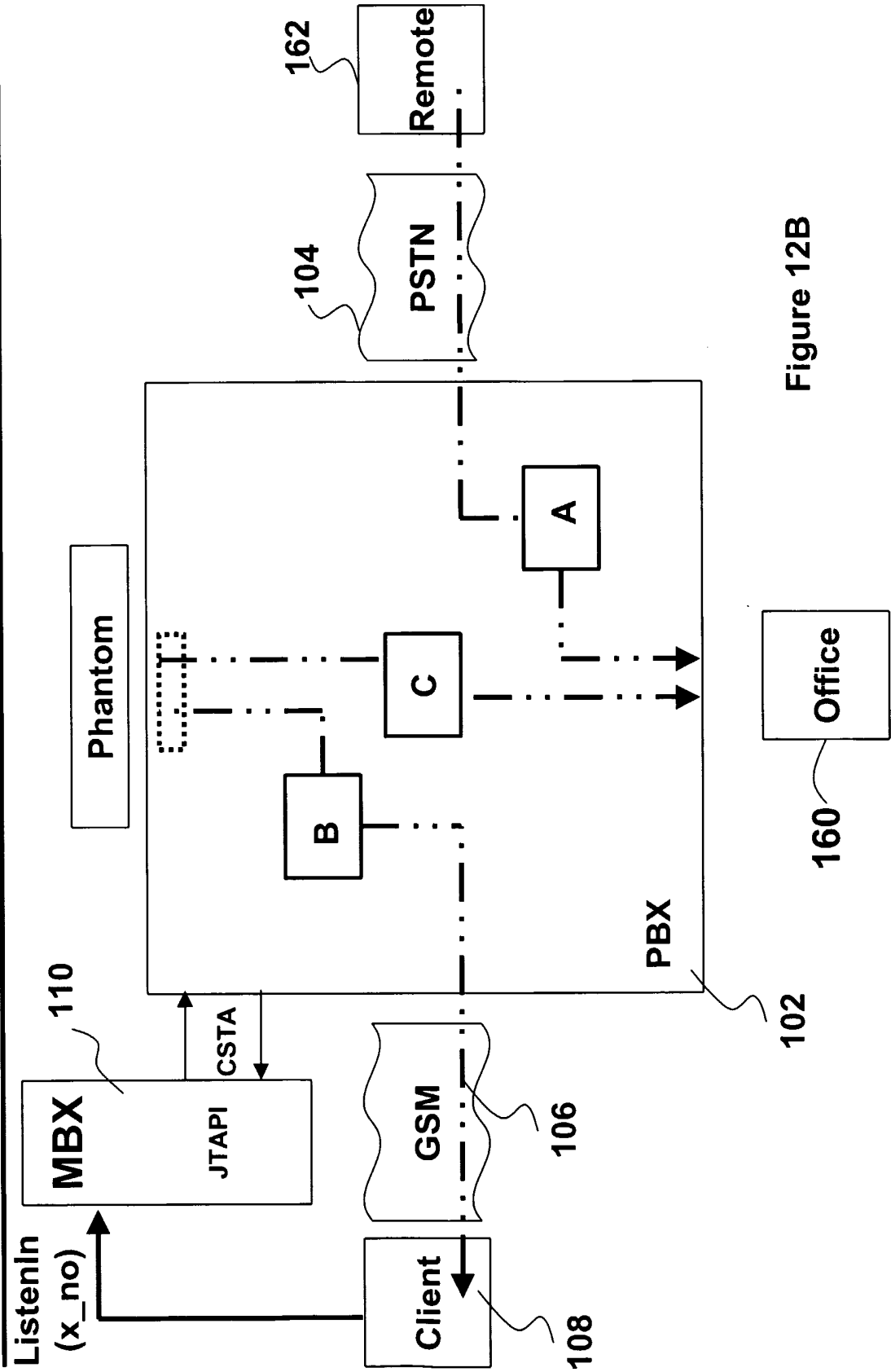
ListenIn (x_no)

Figure 12B

Listen In - Forward

Phantom

MBX
110

JTAPI   CSTA

C

Muted

PBX
102

GSM

106

Client
108

A

PSTN

104

Remote
162

Office
160
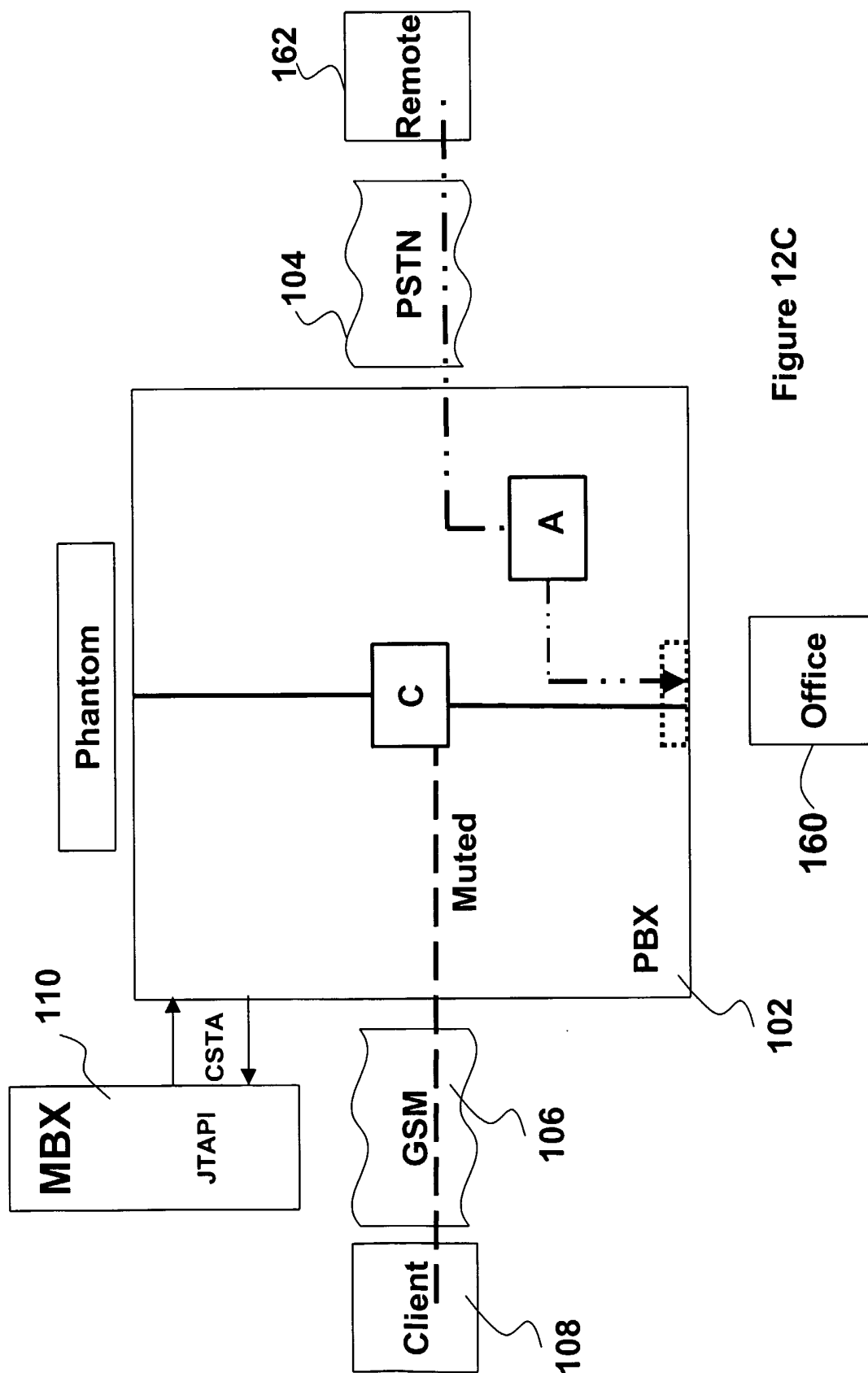
Figure 12C

Listen In - Forward
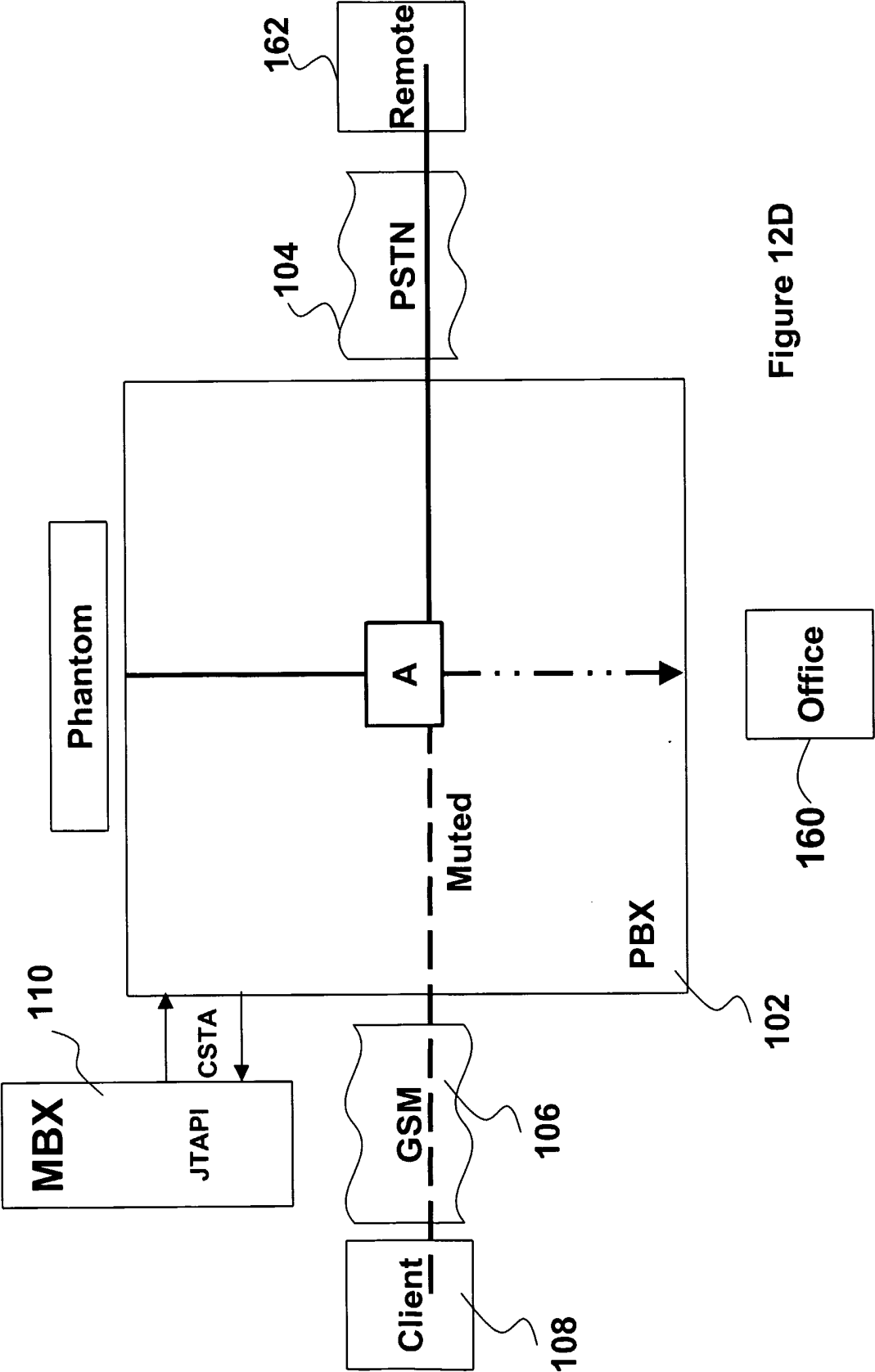
Figure 12D

Listen In - Forward
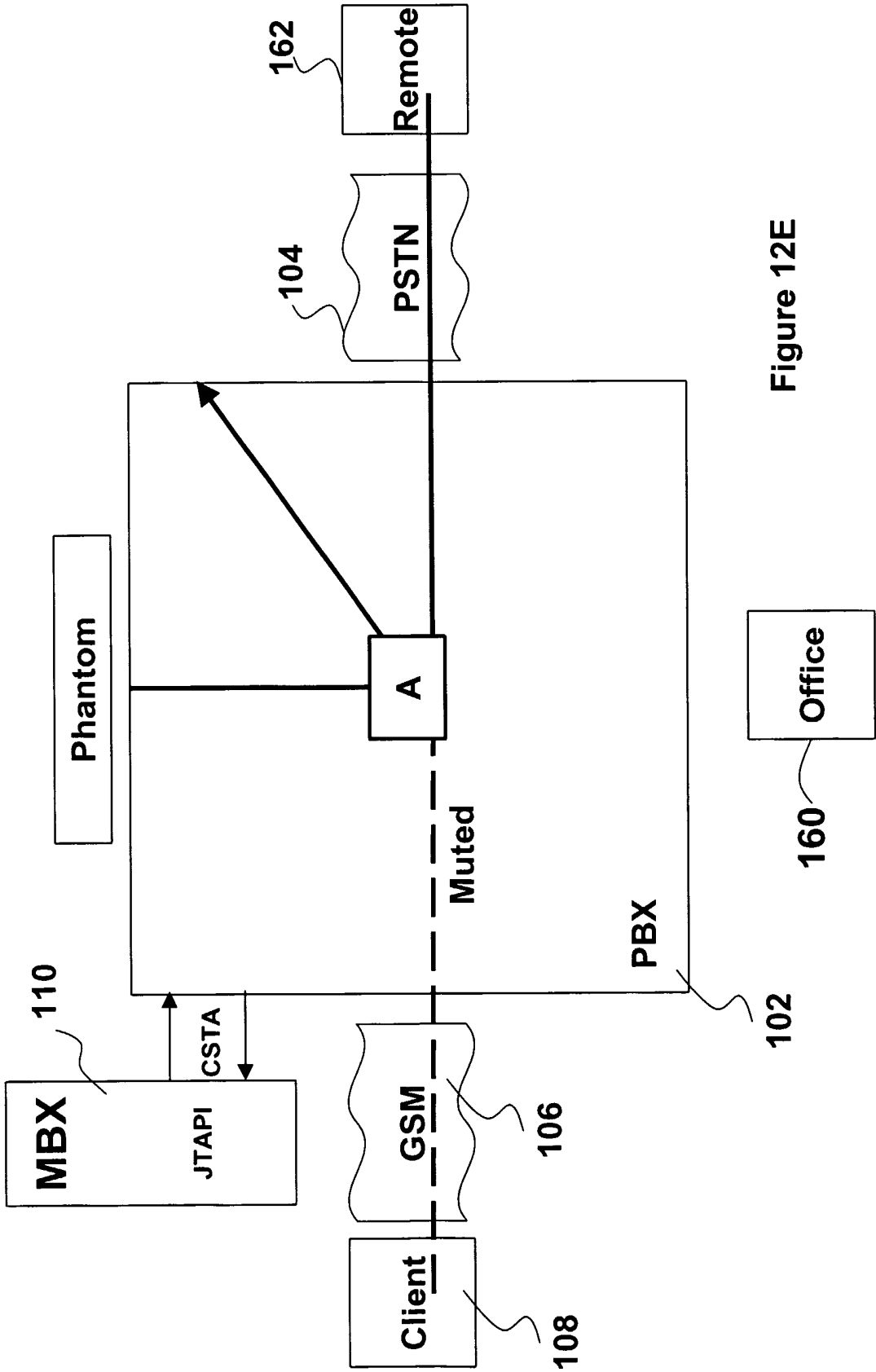
Figure 12E

Listen In - Intrude
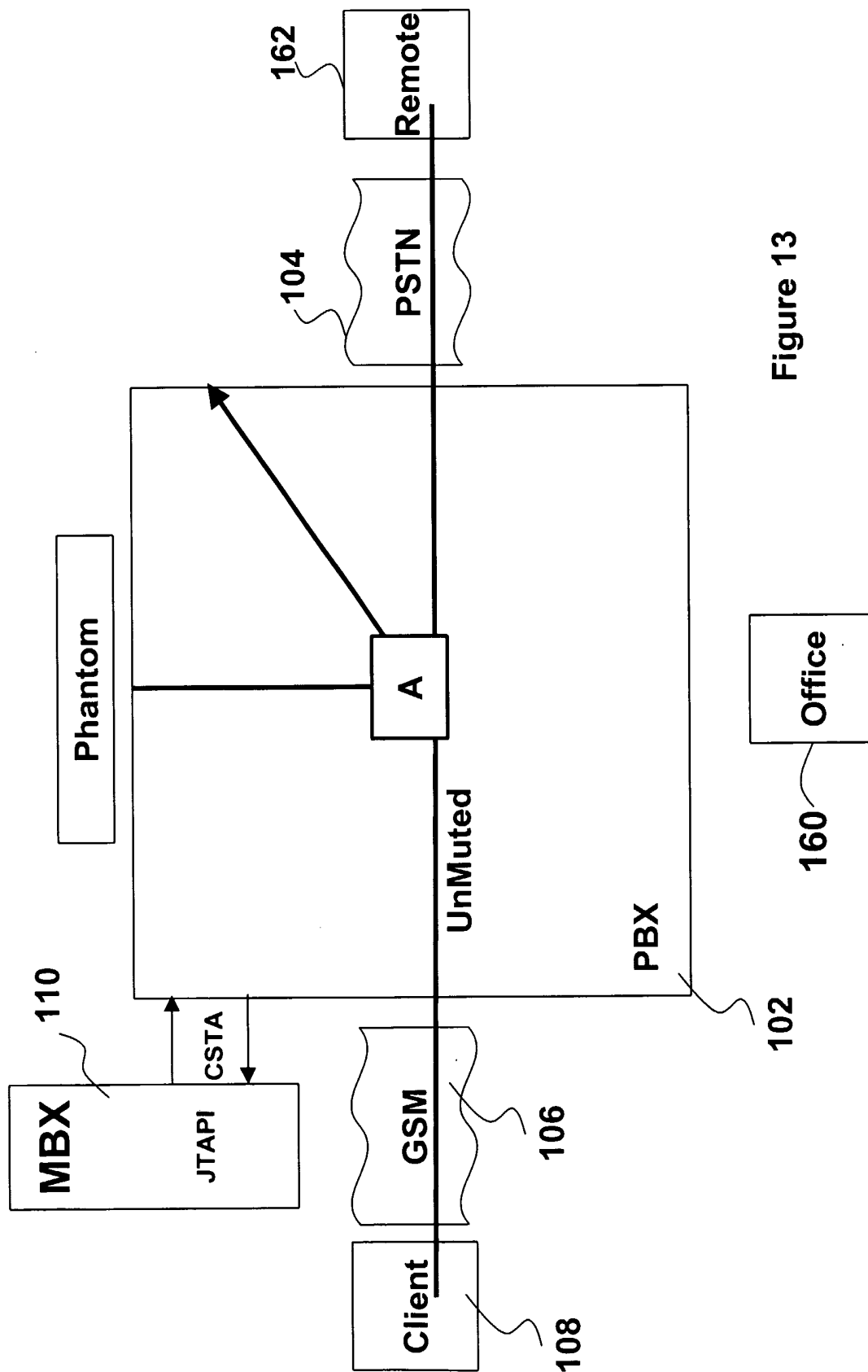
Figure 13

Figure 14
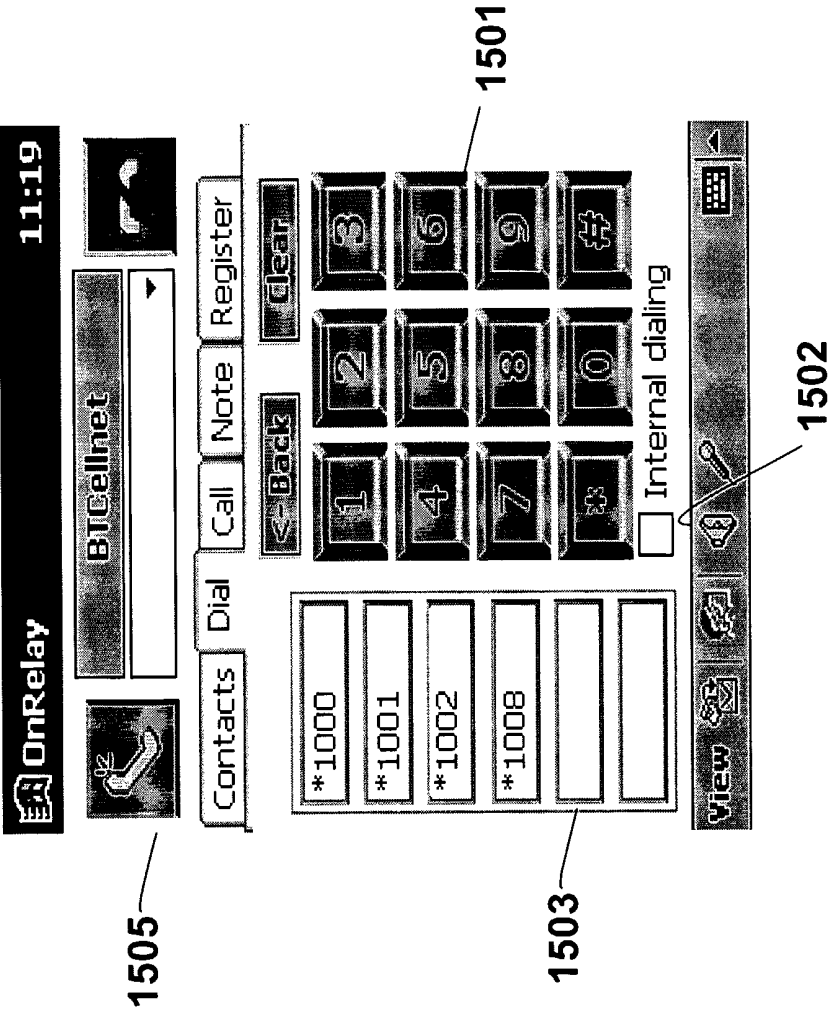
Figure 15
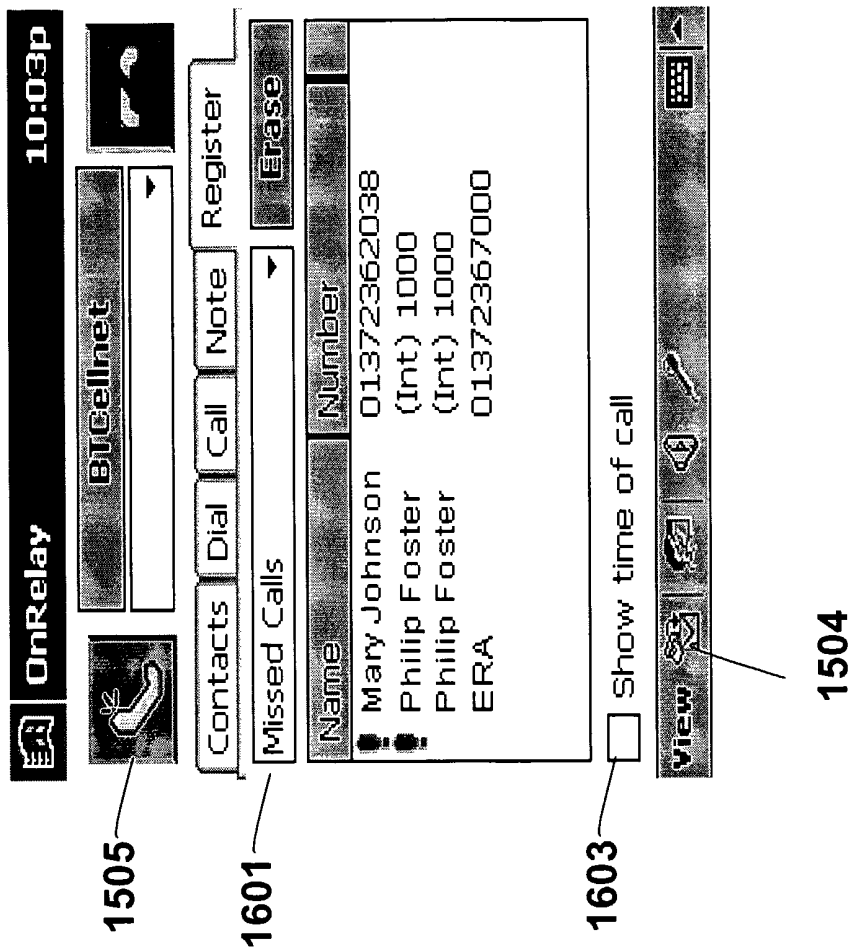
Figure 16
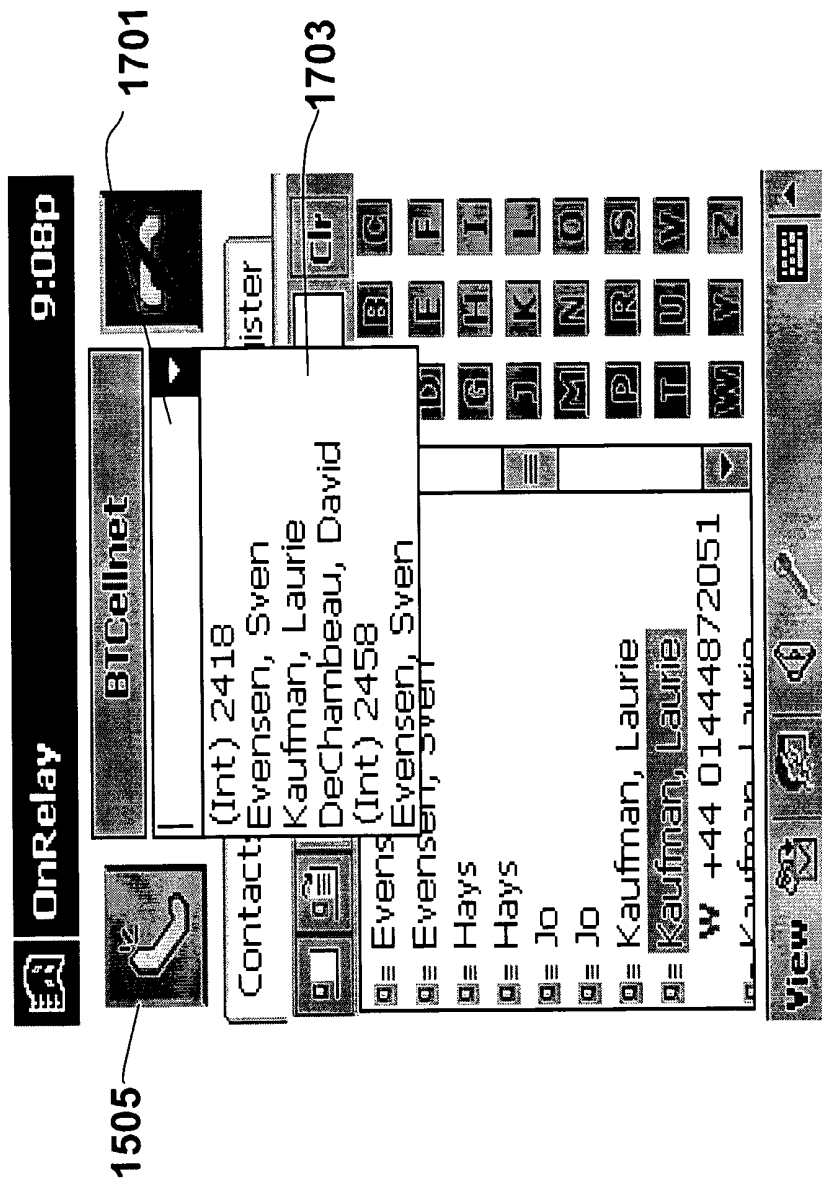
Figure 17
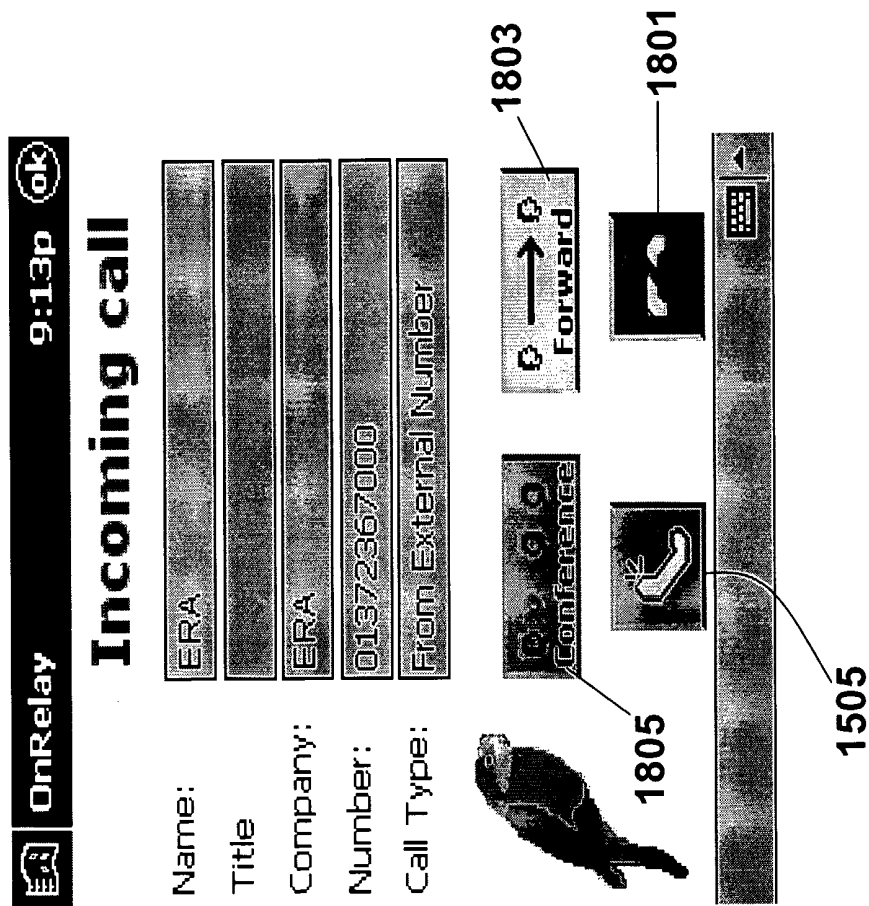
Figure 18
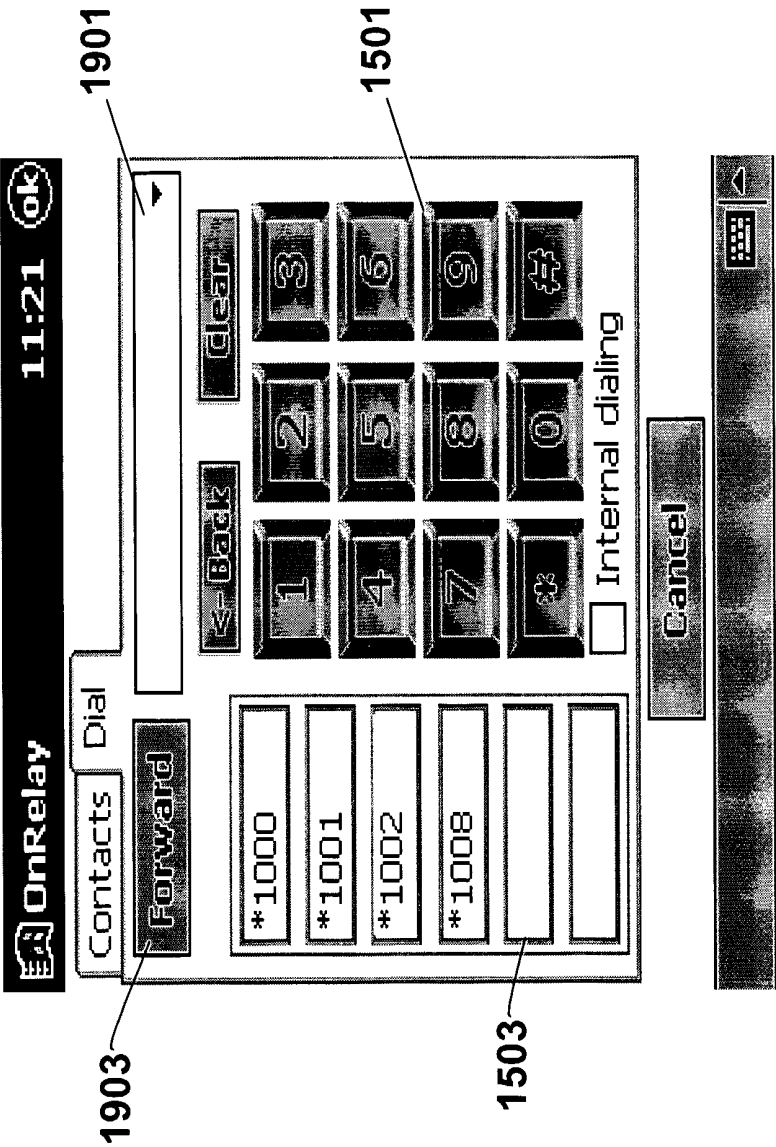
Figure 19
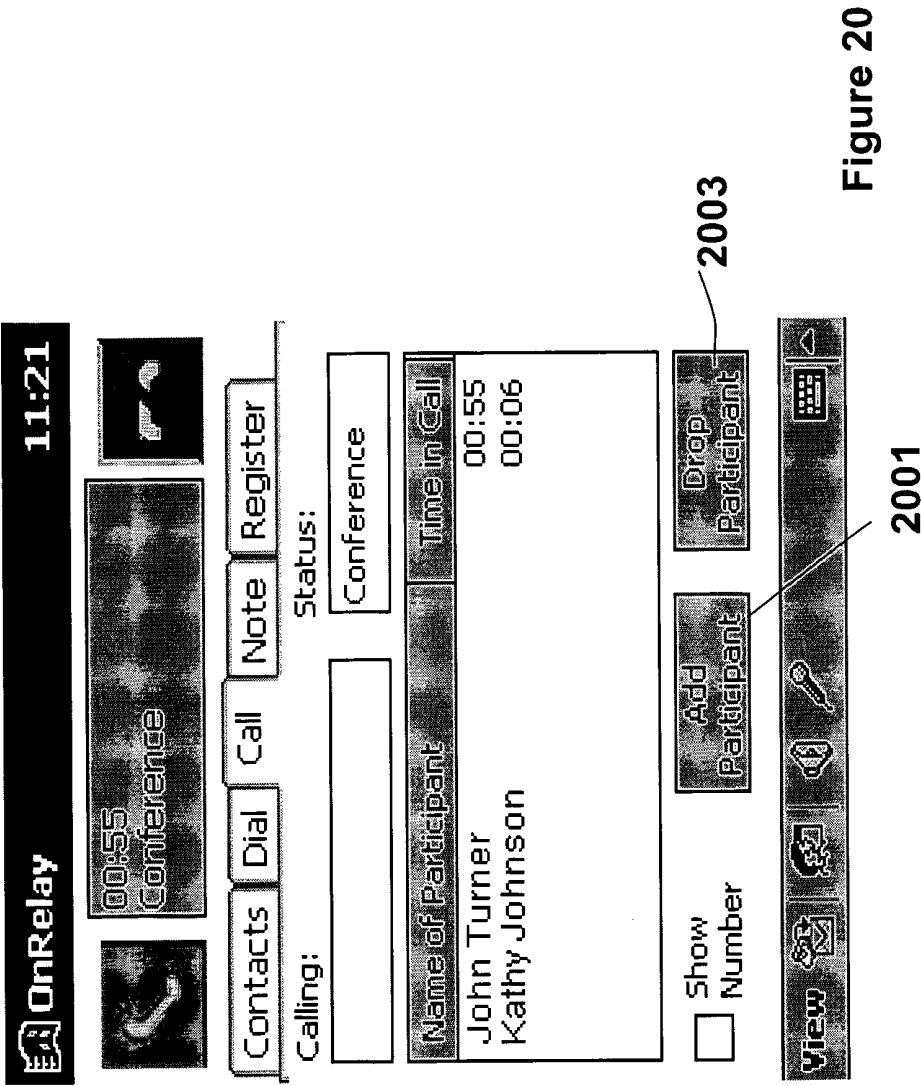
Figure 20
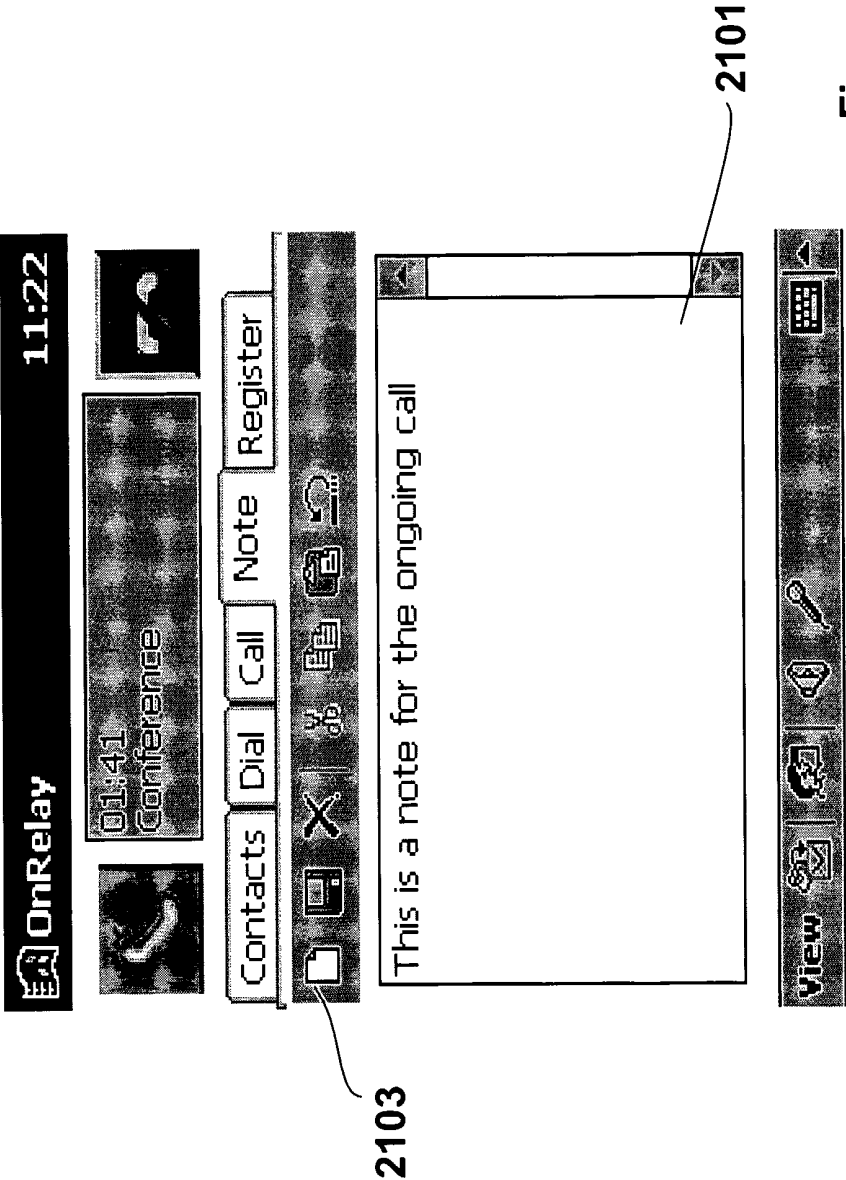
Figure 21

Calendar   12:54p

May 23, 00   S   M   **T**   W   T   F   S

Call to Evensen, Sven
11:22a-11:22a

Call from (Int) 1000
11:24a-11:25a

Call to DeChambeau, David
12:14p-12:14p

Call to (Int) 1008
12:19p-12:21p

Call from 01444872000
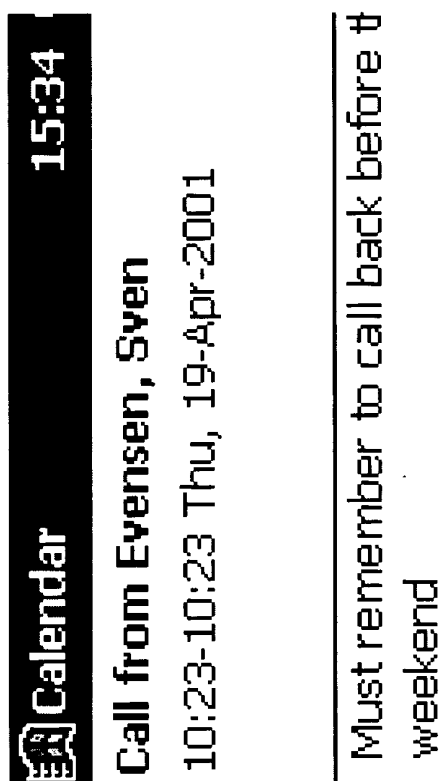12:52p-12:52p

New View Tools

Figure 22

Figure 23