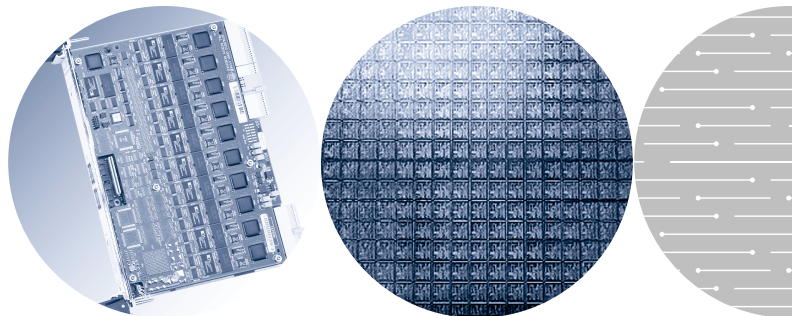




Computer Telephony: A Better Way to Connect to Your Customers!

Intel in
Communications



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Suppose that your computer telephony (CT) application is being used in a business where the volume of telephone traffic requires a private branch exchange (PBX), but the PBX isn't in your solution's configuration. Your customer could be losing valuable business information — and you could be missing a significant business opportunity.

The signals sent between a PBX and its manufacturer's digital phones, known as station sets, contain valuable information that is good for more than just interaction with the station set. This information can significantly enhance CT applications with features that effectively control such elements as calling and called number identification.

In the past, developers needed a great deal of patience and skill to put together a customer solution that used these elements. Much of the work involved integrating proprietary components that offered their own programming model and application programming interface (API). Fortunately, recent advancements in PBX integration have made it easier and more lucrative to create applications that take advantage of PBX call control information.

This white paper will detail the type of information available from PBXs and how easy it is to incorporate that information into CT applications with the Intel® Dialogic® D/82JCT-U, D/82JCT-U-PCI-UNIV, D/42JCT-U, and DSE PBX integration boards.

Introduction

A PBX is a privately owned, miniature version of a telephone company's central office (CO) switch. For businesses, the key advantage to owning a PBX is the efficiency and cost savings of sharing a specific number of telephone lines among a large group of users. Grouped with PBXs are key telephone systems (KTSS), generally a smaller version of a PBX that provides direct access to telephone lines.

PBXs offer users calling flexibility and numerous features, including direct inward dialing (DID). In addition, PBXs come equipped with digital telephones that offer dedicated function keys and ASCII display screens to access those features.

The information used to control these features is valuable not only for the digital phones, but also in CT applications. For example, a voice mail system can use the message waiting light indicator to signal the presence of new messages. There are many ways to make the most of the information available from a PBX. The integration of PBX data and CT typically involves accessing a set of features through

- Switch-specific in-band signaling (using the same band of frequencies as the audio signal; this is usually accomplished with touch-tone signals)
- Switch-specific out-of-band signaling (using a separate band of frequencies from the audio signal, such as a serial link or the D channel in a PRI ISDN link)
- A maze of APIs and hardware from multiple vendors

These features once provided formidable challenges to developers who were willing to take on the work. Fortunately, things are changing.

Intel® Dialogic® PBX integration boards make PBX integration easier and more accessible to a broad range of CT applications that include not only voice mail and call center solutions, but also any application that must process calls and record or retrieve information.

Looking Inside the PBX

PBX switching systems provide shared access to the telephone network for numerous users, as well as a host of other features, including

- Caller ID
- Called party ID
- Message waiting indication
- Positive disconnect supervision (for internal calls)
- Blind call transfers
- Supervised call transfers
- ASCII information (LCD display data such as the name of the person at the dialed extension and the length of the call)
- Other switch-specific features (such as conference and hold) that are available through standard and programmable keys

Caller ID

Caller ID is the phone number that identifies the person who is placing the call. These digits are typically transmitted at the beginning of a call, usually between the first and second ring.

While telephone companies sell a caller ID service to residential customers, the scope of commercially available caller ID is different from the caller ID feature available with many business PBXs. The caller ID from the telephone company is often referred to as automatic number identification (ANI) and identifies callers whose numbers are assigned by the telephone company. Caller ID from within the PBX identifies callers whose telephone extensions are assigned through the PBX.

Caller ID from within the PBX system has powerful business applications. For example, a voice mail application may use caller ID to let users reach their individual mailboxes without having to dial extra digits (i.e., auto-station login). Other applications may use caller ID to screen phone calls, letting employees respond to urgent calls first, as well as for automatic voice message reply so users don't have to redial the caller's extension. Caller ID is useful wherever you need to know who is calling and from where they are calling.

Called Party ID

Called party ID is the phone number that a caller used to reach a destination. Called party ID lets the PBX automatically direct an incoming call to the appropriate extension or group of extensions based on the number called (generally the last four digits).

Called party ID is very useful in CT applications where many agents, services, or categories are available. For example, a zoo may provide information about exhibits through an interactive voice response (IVR) application. The zoo in this scenario may publish several phone numbers to send the caller directly to the desired message.

- Aviary: 888-1202
- Aquarium: 888-1203
- Lizard house: 888-1205
- General information: 888-1200

An application could offer many such categories, accomplished with an Intel Dialogic PBX integration board. Without access to the caller and called party ID information from the PBX, callers would need to listen to a long list of prompts to obtain the four-digit extension code to access the desired information. By using Intel Dialogic PBX integration boards, you can create a more professional system that uses the valuable call information available from the PBXs to save money and customers' time.

Message Waiting Indication

Most PBX systems come with the capability to set the message waiting light on the station set phones when messages arrive, and to clear the light after messages are retrieved. These tasks can be handled either manually (by an attendant) or automatically (through a voice mail application). In either case, this notification is invaluable to users because it gives them an easy method to determine whether they received new messages.

Positive Disconnect Supervision

In any PBX-based phone system, a key function is the PBX's ability to accurately detect when an outside caller has hung up the phone. This capability allows the PBX to also hang up, completing the disconnection. Once the call is fully terminated, the phone line is available for other calls; more important, the phone company's billing charge for that call ends. One common way that a phone or PBX manages the call termination scenario is known as positive disconnect supervision.

In a typical external call scenario (where the call is placed through the phone company, not between extensions), the telephone company detects when the remote caller hangs up and then sends a message to the PBX at the other end. Depending on the PBX phone system, there are several ways in which positive disconnect supervision may be implemented.

In most systems, the PBX terminates the call as soon as it receives the disconnect message — immediately ending the billing charge for that call. In other systems, however, the PBX

effectively ignores this message, waiting instead for the user on the station side (the extension behind the PBX) to hang up before formally terminating the call.

In systems where the PBX waits for the station side to hang up, it is possible that billing could continue, even though one side of the call is terminated. For example, a person may stay on the line accidentally (rushing off to a meeting before hanging up properly, or just leaving the call on hold while obtaining reference information). For network planners, it is very important to carefully consider how the calls will be terminated when selecting a PBX or KTS system.

Intel Dialogic PBX integration boards provide a robust, board-level implementation of positive disconnect supervision. This advanced feature works reliably for receiving both external trunk and station-to-station disconnect supervision signals (note that these signals must be provided by the telephone company and the PBX in order to be received by the PBX board). In addition, disconnect supervision is seamlessly integrated into the standard voice programming mechanisms for handling call termination, eliminating the need for special application code development.

Blind Call Transfers

Many PBX systems have a transfer function that lets users automatically have a call transferred from one number to another. When this transfer function is used without operator or caller intervention, it is known as a blind call transfer. This type of transfer is implemented in most voice mail applications. All the user needs to do is press the transfer key on the PBX station set, dial a number, and then hang up.

The advantage of blind transfers is that the immediate transfer frees the voice processing resources to handle new calls, rather than present the caller with the choice of completing the transfer or returning to the main menu. The only potential drawback of a blind transfer is when phone traffic is heavy, in which case the application may need to handle a call overflow condition.

While you can create an application that includes blind transfers without special integration tools, to create a really robust application you need a PBX integration board like those from Intel. By using a PBX board to access the caller/called party ID information from the PBX, the application can differentiate between

- a new incoming call that needs to be processed: "Hello, and thank you for calling Intel."
- a call that was transferred at least once already and is bouncing back into voice mail: "You've reached the desk of Nikki Jones in Engineering. Please leave a message."

In this case, the application uses the called party ID to send the caller directly into the appropriate voice mailbox, allowing the caller to leave a message without having to navigate through a series of menus for a second or third time.

Supervised Call Transfers

Another way that applications can make the most of the PBX transfer function is by offering supervised call transfers. This type of transfer is equivalent to

- receiving a call
- placing the caller on hold
- pressing the transfer key
- dialing the destination number
- hanging up if the destination party answers (the transfer is complete)
- providing the caller with choices to leave voice mail, select another extension, or hang up if the destination party does not answer

While a supervised call transfer can be implemented without a PBX integration board (using hook flash), the availability and ease of implementation is inconsistent. By using Intel Dialogic PBX integration boards to perform all of the functions, from receiving the call to transferring the caller to the appropriate destination, you can offer consistent, high-performance call transfer features in your applications.

ASCII Information

Most PBX station sets have an LCD screen that can display ASCII text. The type of information that is displayed varies with the PBX manufacturer and the programming capabilities of the switch. Typical information includes calling and called party ID from within the switch, ANI digits from the telephone company, hook state, time and length of call, name assigned to the extension, and “message waiting” notification. With a PBX integration board, this information can be easily passed “unprocessed” to the application.

By capturing the same display messages that a phone set receives, your application can “see” and “record” the information. This ASCII display information is especially useful for a CT application’s troubleshooting and diagnostic features because it enables your customers to know what state the phone is in. Sophisticated applications used with a PBX that provides ANI digits from the telephone company may search the text string for, and use those digits to access, related database information.

Other Switch-Specific Functions

PBX station set phones come with both standard and programmable keys that give access to switch-specific functions. The most common of these features include

- transfer
- conference
- hold
- line
- intercom

Because Intel Dialogic PBX integration boards have the capability to emulate a PBX station set, they can also emulate any standard or programmable function for your application. Applications can capitalize on the most common features listed here, as well as less frequently used features like overhead paging. In addition, your application can reprogram keys as needed.

The Traditional Approach	Call Metering and SMDR Ports
<p>Each switch has a unique, proprietary protocol that is used by proprietary digital phone sets on the PBX. In the past, no user could access the protocol directly, even with a PBX board. Customers could only gain access to the PBX features that were available through DTMF signals, where even a basic voice board, such as the Intel® Dialogic® D/4PCIU voice board, could be connected to the PBX through a 2500 set compatible line, or through a serial port connection to a station message detail recording (SMDR) port on the PBX.</p> <p>However, to make use of digital information sent to the phone, a CTI control card/box would need to be added for each individual line. In addition, the developer would need to write the application differently for each switch using the various APIs provided by the switch manufacturer, CTI control card/box manufacturer, and voice card manufacturer — all of which may use very different design models.</p>	<p>The <i>18th Edition of Newton's Telecom Dictionary</i> offers this explanation of SMDR ports and call metering in PBX systems: “Modern PBXs and some larger key systems have a station message detail recording (SMDR) electrical plug, usually an RS232-C receptacle, into which one plugs a printer or call accounting system. The telephone sends information on each call made from the system to the outside world through the SMDR port. That information — who made the call, where it went, what time of day, etc. — will be printed by the printer or will be ‘captured’ by the call accounting system on the floppy or hard magnetic disk and later processed into meaningful management reports.</p> <p>Note that the Intel Dialogic PBX integration boards make this type of integration unnecessary.</p>

The Intel® Dialogic® Product Approach

The unified API from Intel enables the development of applications across a variety of manufacturers' switches (both KTS and PBX systems) through a single interface. The unified API provides a single set of basic, high-level calls that can be used for any supported switches and are sent directly to the switch through the PBX board, without additional hardware.

Functioning as an extension to the robust voice API, the unified API shortens development time by letting developers use a consistent, modular design approach for all supported switches. Developers can easily take advantage of both common and advanced switch-specific features (such as called/calling number ID and ASCII display information).

The unified API also includes utility functions that allow programmers to control the PBX board. The application can retrieve the PBX channel type, obtain and set PBX channel parameters, start and stop the PBX driver, retrieve PBX firmware/driver/library version numbers, and retrieve error information.

This unified API gives developers an edge in creating applications that support switches from several manufacturers (for example, the number of parameters used in a call may change from switch to switch, but the call and its functionality remain the same) and in porting these applications from operating system to operating system. This unified API opens applications to the broadest range of switches, letting developers venture into new markets.

Market Opportunities for PBX Integration Features

Market opportunities abound for CT applications that take advantage of the information available through PBX integration, especially for those encompassing

- Voice mail/voice messaging
- Unified messaging/unified communications
- Interactive voice response (IVR)
- Call centers
- Intelligent call queuing
- Call screening

Voice Mail/Voice Messaging

Voice mail/voice messaging systems provide call coverage and messaging services. Each person is assigned a voice mailbox where callers can leave recorded messages. Most systems allow remote access for retrieving messages and changing greetings. Other features include call screening, message forwarding, broadcasting messages, and paging.

With voice mail, businesses can deliver and receive messages during non-business hours, which is especially useful for international markets. Organizations can also efficiently distribute general information to large numbers of employees. Busy users can also screen callers to immediately answer important calls while deferring other calls to a more convenient time.

For voice mail applications that take advantage of PBX integration, caller ID lets callers reach an individual mailbox without having to dial extra digits. This capability is known as auto-station login. When a user calls from a desk phone, the application automatically asks for a password. From the caller ID, the voice mail system determines the appropriate mailbox number and jumps to requesting your password.

Other valuable features include positive disconnect supervision and setting/canceling message waiting lights to alert people that they have messages.

Besides creating voice mail applications for business, consider creating voice messaging applications for community services, travelers (hotel/travel/convention), transportation, and cellular phone users.

Unified Messaging/Unified Communications

Unified messaging (UM) systems, also known as unified communications (UC) systems, provide a universal mailbox that permits users to retrieve, manage, store, and forward voice mail, fax, and email messages via touch-tone phone or PC. From a PC, users can view a list of their messages and determine caller origin, message content, and urgency. They can skip

around to read or listen to the messages in their personal order of priority. From a desk or cell phone, users can listen to voice messages and have faxes and emails read to them.

More advanced UM systems offer features such as “find me” and “live reply.” The “find me” feature is beneficial to users who want to receive phone calls no matter where they are. If users do not answer their initial telephone call, the UM system automatically dials one or more pre-assigned telephone numbers until they answer their call. If a user is unavailable at all designated numbers, the call reverts to voice mail and the caller can leave a message. The “live reply” feature prompts callers to leave a return phone number. When users check messages, they can direct the system to call people back immediately.

PBX integration enables many of the inherent benefits of a unified messaging system based on the constant communication between the UM application and the PBX. The control data associated with each phone call is essential to the application in order to present call-related information on a screen, or to ensure that the call is accurately completed.

Interactive Voice Response (IVR)

IVR allows customers to manipulate information in a computer database, such as retrieving an account balance and transferring funds from one account to another. These applications range from systems that deliver a selection of messages to transaction-based systems that let callers access accounts and update information on a LAN-based or host-based database with fax confirmation.

One of the most valuable PBX integration features for IVR applications is the capability to retrieve caller profile information based on the caller ID (which trunk the call came in on) and customer identification number. Other valuable features include blind and supervised call transfers and positive disconnect supervision.

Call Centers

Call centers (both telemarketing and helpdesks) are partially or fully automated locations where a large number of agents or telephone operators process caller requests. With these types of applications, the system usually retrieves information about the callers and their requests before connecting them to agents.

One of the most valuable PBX integration features for call center applications is the ability to quickly and easily retrieve caller profile information. Other valuable features include supervised call transfers and positive disconnect supervision.

For more information on Intel's call center solution building blocks visit http://www.intel.com/network/csp/solutions/contact_cntr/

Intelligent Call Queuing

Intelligent call queuing, based on caller ID and/or called party ID, is useful in any automatic call distribution (ACD) application where the PBX doesn't provide such queuing.

Call Screening

Call screening applications connect some incoming callers directly to phone extensions while handling the other calls electronically. These applications include transfer criteria routines based on who is calling (identified by either an inside extension number or an outside trunk line), the called party, what the caller needs, and who is available.

Caller ID, called party ID, and supervised call transfer are all valuable to applications that include call screening.

PBX Integration: Enhancing Your Application's Intelligence

If you create any sort of application that is used in an environment with a PBX, you should be using the Intel Dialogic PBX integration boards to enhance your application's intelligence and value.

In addition to some of the industry's best voice processing technology, these PBX boards include the unified API from Intel to help you accelerate the time-to-market for your products. This unique API opens new commercial opportunities for developers to create applications with a common set of functions for switches from diverse manufacturers.

Intel® Dialogic® products continually incorporate features that can make your communications systems among the most competitive. And with the PBX series, the market reach of your products is broadened beyond the traditional single-switch focus. Start taking advantage of valuable PBX information today.

For additional and related information on Intel's CTI-based PBX and IP switch integration solution building blocks, visit <http://www.intel.com/design/network/products/telecom/index.htm>

Defining Computer Telephony Buzzwords for PBX Integration

2500 station set is a standard, single-line touch-tone telephone (as opposed to a rotary or pulse-dial telephone).

Automatic number identification (ANI) is a form of caller ID that is available commercially through many local telephone companies.

Blind call transfer uses the PBX transfer function to transfer calls. The transferring voice port hangs up as soon as the transfer digits are dialed. Call progress analysis is not performed.

Call center is a system that automates some of the tasks involved in processing calls for a large number of agents or operators, such as transferring an incoming call to the next available operator and displaying the customer's profile on an operator's computer screen.

Call screening is a service that uses the digits dialed by the caller to determine how calls should be handled.

Called party ID identifies the extension number of the person receiving the call on forwarded or transferred calls.

Caller ID identifies the phone number of the originating caller's telephone.

Direct inward dialing (DID) allows a caller to dial an extension within a company directly, without going through the operator or an attendant. For example, instead of dialing 567-3000 and asking an operator for extension 123, you can dial 567-3123 and ring that extension directly.

Dual-tone multifrequency (DTMF) is the set of tones used to identify the digits on the telephone keypad for push button or touch-tone telephones

Integrated service digital network (ISDN) is a high-speed network technology that facilitates the integration of voice and data through a digital network that uses a standard, out-of-band signaling system.

Interactive voice response (IVR) is a type of application where the caller uses touch-tone digits or voice commands to enter and retrieve information from a computer. Information is read to the caller through an electronic voice.

Key telephone system (KTS) is generally a smaller version of a PBX that gives direct access to the telephone lines.

Message waiting indication is one of the methods for a PBX to inform users that they have new voice messages.

Positive disconnect supervision is one of the methods in which a phone or PBX manages call termination.

Private branch exchange (PBX) is a privately owned, mini version of a telephone company's central office switch. Also referred to as private automatic branch exchange (PABX).

Q.931 is message-oriented signaling protocol for ISDN. Also known as ITU-T recommendation I.451.

Q.Sig is an implementation of Q.931.

Station message detail recording (SMDR)

is a type of telephone call accounting that is usually captured in ASCII text and sent to a printer or PC through an RS-232 connection. The information usually includes start of call indicator, trunk group, user name, calling party extension number, etc., and is useful for automated attendant and voice mail systems. Note that the D/42 series provides access to this type of information, making SMDR port integration unnecessary.

Station-to-station call is a direct dial call that bypasses operator intervention.

Supervised call transfer uses a voice resource and the PBX transfer function to handle unsuccessful transfers by providing the user with additional options.

Trunk is a communication line between switching systems, such as a telephone company's central office and a PBX.

Unified messaging is a system that gives users access to email, voice messaging, and fax through a common interface.

To learn more, visit our site on the World Wide Web at <http://www.intel.com>.

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