digium™ | Asterisk™

The Open Source PBX

B410P

User Manual
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Release 1.1

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Safety Certification and Agency Approvals

Safety:

IEC 60950-1:2001 First Edition
AS/NZS 60950

Telecom:

AS/ACIF S031
TBR3
TBR4 November 1995 as amended by TBR4/A1 December 1997

Emissions:

EN 55022:1998 Class B / EN 55022:1998 Class B Radiated and
Conducted
EN 55024:1998 / IEC 61000

Immunity:

EN55024 ITE, EN61000

Introduction to B410P Documentation

This manual contains product information for the B410P card. Be sure to refer to any supplementary documents or release notes that were shipped with your equipment. The manual is organized in the following manner:

Chapter/ Appendix	Title	Description
1	Overview	Identifies the features of your card. This chapter covers applications and uses of the B410P in the real world.
2	Card Installation	Provides instructions for installing the card in your PC, acquiring correct drivers, and checking device compatibility.
3	Configuration	Provides steps for configuring and verifying the install of your B410P was successful.
4	Troubleshooting	Explains resolutions to common problems and frequently asked questions pertaining to card installation and usage.
A	Pin Assignments	Lists the connectors and pin assignments.
B	Specifications	Details card specifications.
C	Dial Plan Applications	Defines configuration features in the extensions.conf file.
D	Glossary and Acronyms	Defines terms related to this product.

Symbol Definitions

Caution statements indicate a condition where damage to the unit or its configuration could occur if operational procedures are not followed. To reduce the risk of damage or injury, follow all steps or procedures as instructed.

The ESD symbol indicates electrostatic sensitive devices. Observe precautions for handling devices. Wear a properly grounded electrostatic discharge (ESD) wrist strap while handling the device.

The Electrical Hazard Symbol indicates a possibility of electrical shock when operating this unit in certain situations. To reduce the risk of damage or injury, follow all steps or procedures as instructed.

Important Safety Instructions

User Cautions

Servicing.
Do not attempt to service this card unless specifically instructed to do so. Do not attempt to remove the card from your equipment while power is present. Refer servicing to qualified service personnel.

Water and Moisture.
Do not spill liquids on this unit. Do not operate this equipment in a wet environment.

Heat.
Do not operate or store this product near heat sources such as radiators, air ducts, areas subject to direct, intense sunlight, or other products that produce heat.

Static Electricity.
To reduce the risk of damaging the unit or your equipment, do not attempt to open the enclosure or gain access to areas where you are not instructed to do so. Refer servicing to qualified service personnel.

Save these instructions for future reference.

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Chapter 1
Overview

The Digium B410P is a four port BRI line termination card, compatible with Euro-ISDN. It is capable of serving as Terminal Equipment (TE) or as a Network Termination (NT) device. When configured as an NT device, it is the source of BRI lines as shown in Figure 1. The B410P can also improve voice quality in environments where software echo cancellation is not sufficient with hardware echo cancellation onboard.
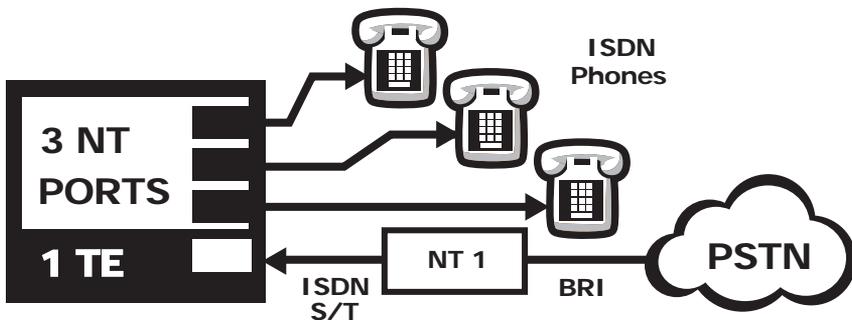
Figure 1: Sample Application

What is Asterisk?

Asterisk is the first Open Source PBX. Since it runs on Linux, it inherits all of the power and stability of that operating system. The name Asterisk is derived from the all-inclusive "wildcard" symbol in UNIX. It is representative of the wide range of opportunities it opens for developers worldwide to create solutions which would otherwise be cost-prohibitive.

Asterisk allows you to create a PBX solution that rivals the features and functionality of traditional telephony switches. Current PBX solutions are expensive and proprietary. International companies are discovering that Asterisk is cost effective, low maintenance, and flexible enough to handle all of their voice and data networking. Combined with Digium hardware and a common PC, anyone can replace an existing setup, existing hardware, or a common PC. Asterisk will integrate with most standards-based IP telephone handsets and software. Analog phones and ADSI-screen phones are also supported.

Chapter 2
Card Installation

This chapter provides the following information:

- **Unpacking the Card** on page 11
- **Inspecting the Shipment** on page 12
- **Identifying Communication Ports** on page 12
- **Selecting NT or TE Mode** on page 14
- **Terminating the NT Mode Line** on page 15
- **Installing the Hardware** on page 16
- **Installing the Software** on page 17

Unpacking the Card

When you unpack your card, carefully inspect it for any damage that may have occurred in shipment. If damage is suspected, file a claim with the carrier and contact your reseller from which the card was purchased, or Digium Technical Support (+1.256.428.6161). Keep the original shipping container to use for future shipment or proof of damage during shipment.

Note: Only qualified service personnel should install the card. Users should not attempt to perform this function themselves.

Inspecting the Shipment

The following items are included in shipment of the B410P:

- B410P card.
- User manual.

Identifying Communication Ports

The B410P card has of four RJ45 ports and four status LEDs. The ports are used for connecting Basic Rate ISDN (BRI) lines. See Figure 2 on page 13 to locate the ports and LEDs.

Each port can be configured as either TE or NT operation. The ports are numbered in sequence from one to four. The top port is Port 1 and the bottom port is Port 4. See Figure 2 on page 13 for appropriate identification of these ports.

Note: It is important to know which type of BRI line each port is configured for, either TE or NT. You will need this information during the Asterisk configuration.
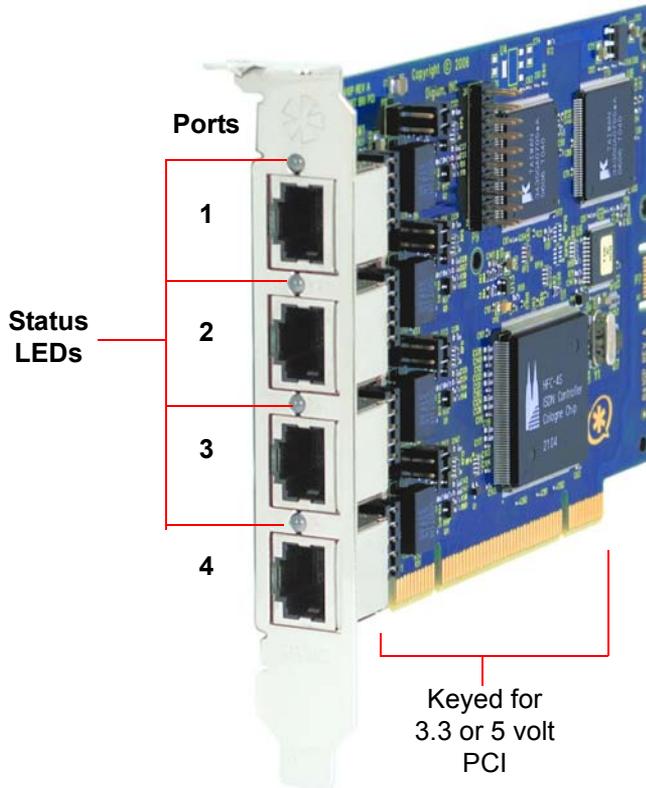
Figure 2: B410P Card

Selecting NT or TE Mode

There is a 5-position jumper on the board for each port to select between NT and TE mode. This must be set before installing the card. Each of the four ports can be set for TE or NT mode independently. This eliminates the need to use a crossover cable. Place the jumper on the left side of the connector for NT mode, or place it on the right side for TE mode as shown in Figure 3. The default setting is TE mode. Notice in Figure 5 on page 16 there are an additional set of jumpers which are reserved for future use. These are not to be used at this time.

There is a risk of electrical shock due to lightning when this device is utilized in TE mode. Take safety precautions when using the card in this manner.

Note: Be careful when changing the jumper position.
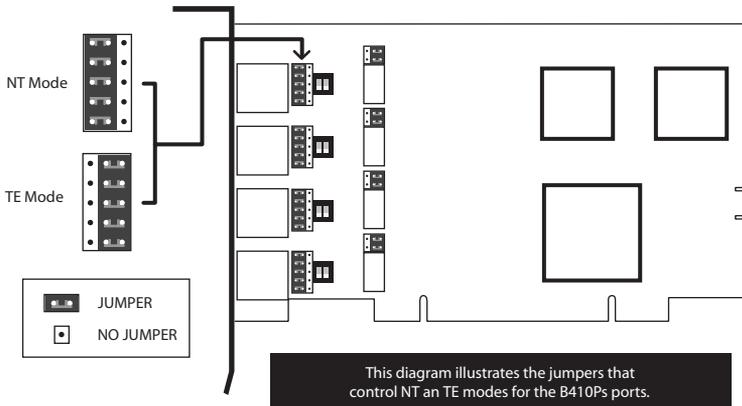
Figure 3: NT and TE Mode Jumper Positions

Terminating the NT Mode Line

There are DIP switches for each port used to add a 100 ohm termination when the B410P is in NT mode. This switch should only be turned on in those instances where a BRI is daisy-chained and terminated on the B410P in NT mode. See Figure 4 for a detailed illustration of this setting. This switch must not be turned on in TE mode. The default setting is Off.

Caution.
Only qualified service personnel should continue with hardware installation and configuration of the B410P card. Users should not attempt to perform these functions themselves.

ON

NT Mode with 100ohm termination

OFF

NT Mode without 100ohm termination

OFF

TE Mode without 100ohm termination

This diagram illustrates the DIP switches that control resistance. In TE mode, the switches are to remain off. In NT mode, the switches may be turned on when 100ohm resistance is required.
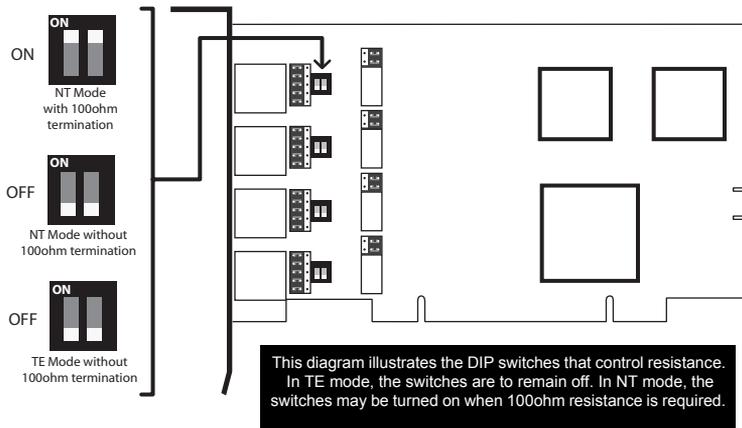
Figure 4: NT Termination Switches

NOT USED
Reserved for
future use.

Default: OPEN

This diagram illustrates jumpers that are reserved for future use.
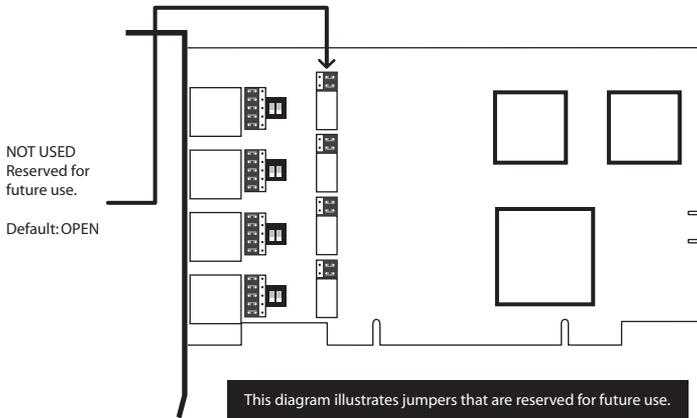
Figure 5: Jumpers Reserved for Future Use

Installing the Hardware

1. Now that you are acquainted with the card, power down your computer and unplug it from its power source.

2. Attach a static strap to your wrist and open the case.

3. Check the jumper setting to ensure it matches your equipment configuration.

4. Remove the bracket place holder and insert the card into the PCI slot. See Figure 6.
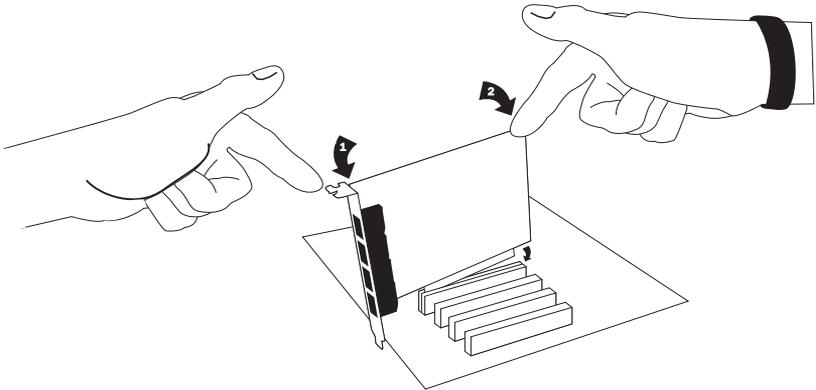
Figure 6: Insert the Card

5. Replace the cover to your computer.

6. Plug all ISDN equipment cables into the RJ45 ports as needed.

Installing the Software

The card is only supported under Linux. Digium, Inc. recommends Debian, Fedora, and Red Hat, however, all other distributions are supported by Digium Technical Support. Digium hardware requires drivers and libraries that are integrated with the Linux kernel. You can obtain the source code from ftp.digium.com. Detailed instructions are provided in this section.

To install software for your B410P card, you will need:

- Full Linux kernel 2.6 (or later) source code.
- Development libraries and headers for zlib and openssl.
- Development libraries and header for libncurses (only necessary for Asterisk).
- Asterisk 1.2.11 (or later) and Zaptel 1.2.8 (or later) driver package.

1. Check your **lspci** PCI device listing. Boot the computer into Linux. After the machine has loaded, log in and execute the following:
   # lspci

   Confirm your **lspci** PCI device listing by scanning for the following information in the output screen:

   0000:01:0e.0 ISDN controller: Unknown device d161:b410 (rev 01)

   A Digium B410P ISDN Controller should be identified. If you do not identify this controller, then your machine is not PCI 2.2 (or higher) compatible and the card will not work with your equipment.

2. Download the latest released version of Asterisk (1.2.11 or later).
   Asterisk can be downloaded using ftp or http.
   It is accessible via ftp from ftp://ftp.digum.com/pub/asterisk.
   It is also accessible via http from http://ftp.digium.com/pub/asterisk.

Expand the downloaded tarballs:
```
# tar -zxvpf asterisk-1.2.11.tar.gz
# cd zaptel-1.2.11/
# make
# make install
```

3. Download the latest Zaptel drivers (1.2.8 or later).
The Zaptel drivers can be downloaded using ftp or http.
They are accessible via ftp from ftp://ftp.digum.com/pub/zaptel.
They are accessible via http from http://ftp.digium.com/pub/zaptel/.

Expand the downloaded tarballs:
```
# tar -zxvpf zaptel-1.2.8.tar.gz
# cd zaptel-1.2.8/
# make
# make install
```

Note: If you don't already have configuration files installed, you can type **make samples** to install the default sample configuration files.

4. Install the Zaptel drivers. Compiling the directories is straight forward. Change to each directory and type **make install**. Compile in this order: Zaptel and Asterisk.

Type the following:
```
# cd /usr/src/zaptel
# make clean
# make install
```

5. Install the drivers by executing this command:
```
# make b410p
```

Note: If the build fails, it may be because you are missing one of the build dependencies, the kernel source, or development tools. Feel free to contact your reseller where the card was purchased, or call Digium Technical Support (+1.256.428.6161) for assistance.

6. Install Asterisk.
```
#cd /usr/src/asterisk
#make
#make install
#make samples
```

Note: This step installs sample configuration files which are necessary for Asterisk. You will make changes to these configuration files to set up your dial plan and customize Asterisk to suit your particular needs.

Complete instructions for installing Asterisk are available at www.asterisk.org.

Chapter 3
Configuration

The B410P card should be installed and ready to configure. The previous chapter covered installing the card and acquiring the software. This chapter will provide steps for configuring the card and verifying its setup.

Configure the driver

1. Execute the following:
   /etc/init.d/misdn-init config

2. Edit the following appropriately (it is self documented):
   /etc/misdn-init.conf

3. Then load it by executing this command:
   /etc/init.d/misdn-init start

Verify the previous step

1. Make sure the driver successfully loaded:
   lsmod | grep hfcmulti

2. The **hfcmulti** driver should be listed.

Verify the card was found

Make sure the card was found by executing:
   dmesg | grep Digium

Configure the interface to Asterisk

Configure the interface to Asterisk by editing the following:

   /etc/asterisk/misdn.conf

The **misdn.conf** file contains detailed comments documenting the options that are available and their meaning. It is recommended that you carefully review the options to set them appropriately. An example **misdn.conf** is provided below.

Be sure to set the MSNS properly (MSNS are like DIDs). In order to accept all incoming DIDs, set **msns=***. Also, don't forget to specify a **ports** setting as well in your specified category within **misdn.conf**. Be sure that **echotraining=no** in your **misdn.conf**, as this will interfere with the hardware echo cancellation.

misdn.conf

```
; default settings before this
context=default
; more default settings ....
echotraining=no
; default settings after this ....
[myoutsidelines]
msns=*
ports=1,2,3,4
context=default
```

Enabling Echo Cancellation

The B410P card is enhanced with built-in echo cancellation. It improves voice quality in environments where software echo cancellation is not sufficient. The B410P reduces CPU overhead required for software echo cancellation, freeing resources for other processes such as codec translation. The B410P provides 64ms of echo cancellation simultaneously on all eight B-channels. Echo cancellation is enabled by setting **echocancel=yes** in **misdn.conf**.

Verify all the above steps

Verify the Asterisk interface is properly configured by placing a phone call. In order to call out over a port, the **Dial( )** command is formatted as follows:

```
Dial(misdn/1/${EXTEN})
```

If you would like to dial out over a group (groups are defined by the categories, or bracket-enclosed titles within misdn.conf), simply use the group name appended to **g:** like so:

```
Dial(misdn/g:myoutsidelines/${EXTEN})
```

Note: More information can be obtained by contacting Digium Technical Support (+1.256.428.6161) or visiting the website at www.digium.com. You may also contact your distributor or reseller from which the card was purchased for assistance.

Chapter 4
Troubleshooting

This chapter provides frequently asked questions as identified from Digium Technical Support and possible resolutions. Multiple resources are available to obtain more information about Asterisk and Digium products. These resources are listed on page 27.

I can't receive DID calls even though I have it enabled in extensions.conf.

Make sure the ports are set to the correct jumper setting and that their **misdn-init.conf** matches this setting. Phone calls will not work without this being correct.

Common Fixes for all cards

1. Check for shared interrupts by entering the following:

```
cat /proc/interrupts
```
and
```
lspci -vb
```

If a conflict exists, try moving the card to another PCI slot.

2. Check to see if X windows is running by entering the following:
ps aux|grep X

If X windows is running, stop the application since it may cause a conflict with Asterisk.

3. Check to see if your IDE hard drives are running with DMA levels set. Advance user can perform an **hdparm** on your hard drive interface.

> ⚠ *Use hdparm with caution as the man page states that hard drive corruption can occur when using incorrect settings. Please review the man page for hdparm and make sure you understand the risks before using this tool.*

Check the current mode using this command:
hdparm -vi /dev/[IDE Device**]**

Use this command to set the drives into UDMA2 mode:
hdparm -d 1 -X udma2 -c 3 /dev/[IDE Device**]**

If you are still having problems, contact your reseller from which the card was purchased, or Digium Technical Support (+1.256.428.6161).

How can I enable more features?

To view all of the options available to add to your dial plan, type the following command from within Asterisk:
show applications

Where can I ask even more questions?

There are several places to inquire for more information about Asterisk Digium products:

1. Digium Technical Support (+1.256.428.6161) is available 7am-7pm Central Time (GMT -6), Monday - Friday.
2. Asterisk users mailing list (asterisk.org/lists.digium.com).
3. IRC channel **#asterisk** on (irc.freenode.net).

Maintenance Support Program

Digium is dedicated to supporting your Asterisk system by offering full technical support through our Maintenance Support Program. The Maintenance Support Program covers all Digium hardware and the complete Asterisk software suite. Through this program, we guarantee that your business will always have a working Asterisk system, no matter what happens. To obtain a quote for maintenance please contact Asterisk Express sales at +1.256.428.6060 or express@digium.com.

Appendix A
Pin Assignments

All four ports on the B410P bracket are 8-pin RJ45 ISDN BRI S/T ports. The pin assignments are identified in Table A-1.

Table A-1: RJ45 ISDN BRI S/T Port Connector
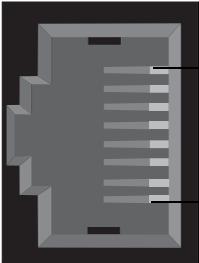
	Pin	TE	NT
Pin 1 ... Pin 8	1	Unused	Unused
	2	Unused	Unused
	3	Tx+	Rx+
	4	Rx+	Tx+
	5	Rx-	Tx-
	6	Tx-	Rx-
	7	Unused	Unused
	8	Unused	Unused

Appendix B
Specifications

This appendix provides specifications, required environmental conditions, and maximum power consumption for the B410P card.

Physical.

Size: 5.5" × 3.75" × 0.735" (13.97 x 9.53 x 1.86 cm)
             PCB size, does not include the PCI bracket
Weight: 3.5 oz (109gm)

Interfaces.

Local Loop Access: ISDN S/T BRI; RJ45
PCI Bus: 3.3V or 5V bus slot, half-length slot minimum size, 33MHz minimum bus speed, compliant with PCI 2.2 or greater.

Environment.

Temperature: 0 to 50° C (32 to 122° F) operation
             -20 to 65° C (4 to 149° F) storage
Humidity: 10 to 90% non-condensing

Hardware and Software Requirements.
800-Mhz processor or better
64MB RAM
Available 2.2 PCI Slot (as described previously)

Table B-2: Maximum Power Consumption

Model	Power
B410P 3.3V 5V	 2.5 Watts 5.3 Watts

Appendix C
Dial Plan Applications

This appendix details the applications available for configuring the dial plan. The dial plan is customized in the extensions.conf file which is created during the initial installation of Asterisk. This file controls how all calls are handled and routed. To change any of the following options, edit the extensions.conf file, saving the file upon completion. The following defines each feature:

AgentCallbackLogin
Call agent callback login

AgentLogin
Call agent login

AGI
Executes an AGI compliant application

Answer
Answer a channel if ringing

Authenticate
Authenticate a user

BackGround
Play a file while awaiting extension

BackgroundDetect
Background a file with talk detect

Busy
Indicate busy condition and stop

Dial
Place a call and connect to the current channel

Directory
Provide directory of voicemail extensions

DISA
DISA (Direct Inward System Access)

Goto
Go to a particular priority, extension, or context

GotoIf
Conditional goto

GotoIfTime
Conditional goto on current time

Hangup
Unconditional hangup

Macro
Macro Implementation

Monitor
Monitor a channel

MusicOnHold
Play music on hold indefinitely

Playback
Play a file

Queue
Queue a call for a call queue

Record
Record to a file

SetCallerID
Set CallerID

SetCallerPres
Set CallerID presentation

SetCIDName
Set CallerID name

SetCIDNum
Set CallerID number

VoiceMail
Leave a voicemail message

VoiceMailMain
Enter voicemail system

Zapateller
Block telemarketers with SIT

Appendix D
Glossary and Acronyms

ANSI   *American National Standards Institute*

An organization which proposes and establishes standards for international communications.

asynchronous

Not synchronized; not timed to an outside clock source. Transmission is controlled by start bits at the beginning and stop bits at the end of each character. Asynchronous communications are often found in internet access and remote office applications.

attenuation

The dissipation of a transmitted signal's power as it travels over a wire.

bandwidth

The capacity to carry traffic. Higher bandwidth indicates the ability to transfer more data in a given time period.

bit

The smallest element of information in a digital system. A bit can be either a zero or a one.

bps   *bits per second*

A measurement of transmission speed across a data connection.

broadband

Broadband transmission shares the bandwidth of a particular medium (copper or fiber optic) to integrate multiple signals. The channels take up different frequencies on the cable, integrating voice, data, and video over one line.

channel

A generic term for an individual data stream. Service providers can use multiplexing techniques to transmit multiple channels over a common medium.

Cat5

Category of Performance for wiring and cabling. Cat 5 cabling support applications up to 100 MHz.

Cat5E

Category of Performance for wiring and cabling. Category 5 Enhanced wiring supports signal rates up to 100 MHz but adheres to stricter quality specifications.

CLEC *competitive local exchange carrier*

A term for telephone companies established after the Telecommunications Act of 1996 deregulated the LECs. CLECs compete with ILECs to offer local service. See also *LEC* and *ILEC*.

CO   *central office*

The CO houses local switching equipment. All local access lines in a particular geographic area terminate at this facility (which is usually owned and operated by an ILEC).

CPE   *customer premises equipment*

Terminal equipment which is connected to the telecommunications network and which resides within the home or office of the customer. This includes telephones, modems, terminals, routers, and television set-top boxes.

DS0   *Digital Signal, Level 0*

A voice grade channel of 64 Kbps. The worldwide standard speed for digitizing voice conversation using PCM (Pulse Code Modulation).

DS1   *Digital Signal, Level 1*

1.544 Mbps in North America (T1) and Japan (J1) -up to 24 voice channels (DS0s), 2.048 Mbps in Europe (E1) - up to 32 voice channels (DS0s). DS1/T1/E1 lines are part of the PSTN.

DS3   *Digital Signal, Level 3*

T3 in North America and Japan, E3 in Europe. Up to 672 voice channels (DS0s). DS3/T3/E3 lines are not part of the PSTN

DTMF   *Dual Tone Multi-Frequency*

Push-button or touch tone dialing.

E1

The European equivalent of North American T1, transmits data at 2.048 Mbps, up to 32 voice channels (DS0s).

E3

The European equivalent of North American T3, transmits data at 34.368 Mbps, up to 512 voice channels (DS0s). Equivalent to 16 E1 lines.

EMI   *Electromagnetic Interference*

Unwanted electrical noise present on a power line

full duplex

Data transmission in two directions simultaneously.

G.711

The International Telecommunications Union recommendation for an algorithm designed to transmit and receive mulaw PCM voice and A-law at digital bit rate 64 Kbps. This algorithm is used for digital telephone sets on digital PBX.

G.729

An International Telecommunications Union standard for voice algorithm.

H.323

An International Telecommunications Union standard for multimedia communications over packet-based networks.

IAX   *Inter-Asterisk eXchange*

A VoIP protocol used by Asterisk. It is used to enable VoIP connections between Asterisk servers, and between servers and clients that also use the IAX protocol.

iLBC   *internet Low Bitrate Codec*

A free speech codec used for voice over IP. It is designed for narrow band speech with a payload bitrate of 13.33 kbps (frame length = 30ms) and 15.2 kbps (frame length = 20 ms).

ILEC   *incumbent local exchange carrier*

The LECs that were the original carriers in the market prior to the entry of competition and therefore have the dominant position in the market.

interface

A point of contact between two systems, networks, or devices.

ISO   *International Standards Organization*

LED   *light-emitting diode*

Linux

A robust, feature-packed open source operating system based on Unix that remains freely available on the internet. It boasts dependability and offers a wide range of compatibility with hardware and software. Asterisk is supported exclusively on Linux.

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loopback

A state in which the transmit signal is reversed back as the receive signal, typically by a far end network element.

MGCP   *Media Gateway Control Protocol*

multiplexing

Transmitting multiple signals over a single line or channel. FDM (frequency division multiplexing) and TDM (time division multiplexing) are the two most common methods. FDM separates signals by dividing the data onto different carrier frequencies, and TDM separates signals by interleaving bits one after the other.

MUX   *multiplexer*

A device which transmits multiple signals over a single communications line or channel. See multiplexing.

PBX   *private branch exchange*

A smaller version of a phone company's large central switching office. Example: Asterisk.

PCI   *peripheral component interconnect*

A standard bus used in most computers to connect peripheral devices.

POP   *point of presence*

The physical connection point between a network and a telephone network. A POP is usually a network node serving as the equivalent of a CO to a network service provider or an interexchange carrier.

POTS   *plain old telephone service*

Standard phone service over the public switched telephone network (PSTN). This service provides analog bandwidth of less than 4 kHz.

PPP   *point-to-point protocol*

Type of communications link that connects a single device to another single device, such as a remote terminal to a host computer.

PSTN   *public switched telephone network*

A communications network which uses telephones to establish connections between two points. Also referred to as the dial network.

QoS   *quality of service*

A measure of telephone service, as specified by the Public Service Commission.

RJ11

A six-pin jack typically used for connecting telephones, modems, and fax machines in residential and business settings to PBX or the local telephone CO.

SIP   *Session Initiation Protocol*

An IETF standard for setting up sessions between one or more clients. It is currently the leading signaling protocol for Voice over IP, gradually replacing H.323.

T1

A dedicated digital carrier facility which transmits up to 24 voice channels (DS0s) and transmits data at 1.544 Mbps. Commonly used to carry traffic to and from private business networks and ISPs.

T3

A dedicated digital carrier facility which consists of 28 T1 lines and transmits data at 44.736 Mbps. Equivalent to 672 voice channels (DS0s).

TDM   *time division multiplexer*

A device that supports simultaneous transmission of multiple data streams into a single high-speed data stream. TDM separates signals by interleaving bits one after the other.

telco

A generic name which refers to the telephone companies throughout the world, including RBOCs, LECs, and PTTs.

tip and ring

The standard termination on the two conductors of a telephone circuit; named after the physical appearance of the contact areas on the jack plug.

twisted pair

Two copper wires commonly used for telephony and data communications. The wires are wrapped loosely around each other to minimize radio frequency interference or interference from other pairs in the same bundle.

V   *volts*

VoIP   *Voice over IP*

Technology used for transmitting voice traffic over a data network using the Internet Protocol.

Zaptel (Zap)

Zapata Telephony Project dedicated to implementing a reasonable and affordable Computer Telephony platform into the world marketplace.