ISDN (BRI)

Trouble Shooting

at

Pacific Bell

Version 1.2

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Disclaimer: This is a collection of trouble shooting notes from a variety of sources. It should only be used to suggest areas for the trouble-shooter to explore. Many of the trouble examples are one-time only and not verified or duplicated. No inference should be made about the suitability of any of the products mentioned. All product names and trademarks are the property of their respective owners.

Lab notes from the
Pacific Bell
Market Applications Lab
510-823-1663

Index

tc "Introduction"§Introduction

Most ISDN setup problems are caused by the ISDN terminal adapter or the ISDN line being set to the wrong configuration at installation. This document describes some of the things you need to understand when setting up an ISDN line and describes the most common areas of confusion.
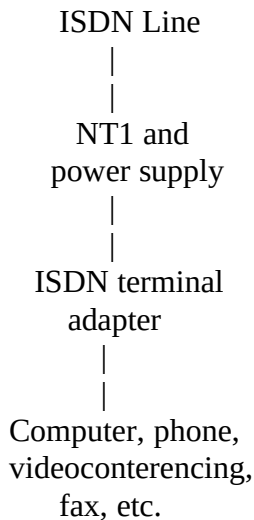
Much of this information is anecdotal, culled from conversations with experts. The reader should assume that situations described here are fluid and can vary with every situation.

If this list doesn't help, call the Pacific Bell Market Applications Lab at 510-823-1663.

tc "The Basics"§The Basics

Your ISDN line is connected to Pacific Bell's network at a piece of equipment called a "switch" located in a building called a "central office" in phone company language.

On the customer end of the ISDN line you generally find three types equipment attached in this order:

```
        ISDN Line
            |
            |
         NT1 and
       power supply
            |
            |
     ISDN terminal
         adapter
            |
            |
  Computer, phone,
  videoconterencing,
       fax, etc.
```

ISDN Line:

Every ISDN line has its signal logically divided into three "channels" which can be used individually or at the same time. The two largest channels are called the B channels (B1 and B2) with maximum speeds of 64 kbps each (although they are usually limited to 56 kbps by the network -- more on that in the Speed section). The B channels are usually

used for transmitting voice and/or data.

The third channel (called the D channel) is used for sending signals from the switch to your terminal adapter to control features. With the right equipment it can also be used to send data up to 16 kbps.

NT1:

The NT1 serves to change the two wires of your phone line into the four wires needed by ISDN on your end. It also performs some necessary bit coding. NT1s are generally trouble-free and require no special setup other than plugging in the cables.

Terminal Adapter:

The ISDN terminal adapter is the piece of equipment which is the source of almost all initial ISDN setup problems (once the ISDN line is correctly configured by Pacific Bell). The terminal adapter must be configured by the user, navigating through a sometimes bewildering number of options.

The terminal adapter function may be built-in to another piece of equipment -- like an ISDN phone -- but the configuration issues and language are the same.

The document which follows describes these options in simple language so you can understand what to ask for when you order your ISDN line and so you can configure your terminal adapter when the line is installed.

tc "Switch Type"§Switch Type

Pacific Bell uses two types of ISDN switches:

1. 5ESS (from AT&T)
2. DMS-100 (from Northern Telecom)

Your terminal adapter may only work with one type or may be configurable for either one. Some terminal adapters require different eproms (small plug-in devices) depending on which switch is providing your ISDN line. Other terminal adapters just require a software change.

In addition, a national ISDN standard called National ISDN-1 (NI1) exists, but is not yet implemented at Pacific Bell. If your terminal adapter requires NI1 capable switches it will not work on Pacific Bell's 5ESS switches at this time, but may work on the DMS-100 if the switch is operating with software generic version BCS35 or higher (or BCS34 with the correct feature packages -- for data only. Not all NI1 voice features are available).

tc "Voice or Data"§Voice or Data

Each B channel has to be designated at the switch by Pacific Bell as one of these choices:

Circuit Switched Voice

Circuit Switched Data

Circuit Switched Voice/Data

Packet Switched Data

You can't generally make a data call over a voice-only channel or vice-versa

(Some Terminal Adapters DO allow data calls over the voice channel as a way to make data calls without using a switched 56 data service from a long distance carrier. Digiboard makes such a product.)

If you have your ISDN line configured as voice/data then it can be used for either voice or data if you have the correct terminal adapter with the correct settings.

DMS-100 note:

On a DMS-100, using the voice/data line configuration may require four different phone numbers (2 for each B channel) unless the switch has been upgraded with a feature package to allow just one per B channel. But as a practical matter, virtually all of Pacific Bell's switches have the upgrade at this writing. If the switch still has a software generic lower than BCS32 it might be an issue.

tc "Speed"§Speed

Your terminal adapter may have an option for either 56 or 64 kbps speed for data calls. Until Pacific Bell upgrades its network for "clear 64 kbps" capability, choose 56 kbps speed.

If your application is asynchronous (e.g., the kind of application you might have done with an analog modem) it may be designed to run at more or less than 56 kbps, but set the terminal adapter at 56 kbps anyway because this refers to the ISDN line itself, not the amount used by your application.

If you have one terminal adapter configured for 56 kbps and one for 64 kbps you may have a situation where one side will not accept an incoming call from the other.

You can get away with using 64 kbps on both terminal adapters if both ends of the data

3

call are served by the same switch (i.e., the phone numbers have the same area code and prefix). In this case the network limitations do not apply. If you try to make a 64 kbps call over a 56 kbps link it will not work.

With the right equipment and software you can do X.25 packet over the D channel at speeds up to 16 kbps. Set your communications software at 19.2 kbps in this case.

tc "NCOS and PIC"§NCOS and PIC

The ISDN line has to be configured at the switch (a change in the software settings made by Pacific Bell) to have access to a switched 56 line for data calls outside of the phone number prefix area. The switched 56 line for calls outside your local calling area are provided by a long distance phone company.

The symptoms of this line setting being incorrectly set are that you can't make outgoing data calls to anyplace outside of your phone number prefix. However, you will be able to receive incoming data calls from anyplace.

DMS-100:

On a DMS-100 switch, the setting is called the PIC and related NCOS (Network Class of Service).

5ESS:

On an AT&T switch this setting is called a PIC (Preferred Interexchange Carrier).

tc "SPID (Service Profile IDs)"§SPID (Service Profile IDs)

DMS-100:

ISDN lines from a DMS-100 switch require the terminal adapter and the line to agree on a pair of identifying codes called SPIDs. Each B channel has its own SPID.

Your ISDN line is assigned a SPID for each B channel by Pacific Bell when the service is installed from a DMS-100 line. You will need to ask Pacific Bell for the SPID and enter it into your terminal adapter when you configure it.

There is no standard form for the SPID, but it is usually based on the phone number.

4

Some forms we've seen include:

Assuming the phone number for the first B channel is: 123-456-9999

On a DMS, the SPID might be...

1234569999
(full phone number, with area code, no suffix)

12345699991
(full phone number, with area code, one digit suffix)

123456999901
(full phone number, with area code, two digit suffix)

Where a suffix is involved, it would normally be 1 or 01 for the first B channel and 2 or 02 for the second B channel.

SPIDs may differ from these examples. Check with Pacific Bell to be sure.

5ESS:

On a 5ESS, SPIDs are only necessary in multipoint applications. (See the multipoint explanation in this document.)

If you request a multipoint line from the 5ESS -- because your application requires it -- your ISDN line is assigned SPIDs by Pacific Bell when the service is installed. You will need to get that information from Pacific Bell and enter it into your terminal adapter when you configure it.

On a 5ESS switch, the SPID might be...

0145699990
(prefix of 01, no area code, suffix of 0)

The prefix might be 03 if the line is being used for a packet-only device.

SPIDs may differ from these examples. Check with Pacific Bell to be sure.

tc "Multipoint or Point-to-point"§Multipoint or Point-to-point

Anytime your terminal adapter requires more than one identifying code called a SPID (see the SPID section) then it is Multipoint by definition (i.e. two DNs for one line).

5

Your ISDN equipment documentation will tell you whether you need SPIDs for your application.

For example, for X.25 packet applications using multipoint, several devices can be active at the same time on the same channel using packet technology on either the D or B channels.

DMS-100:

On a DMS-100 you normally have at least two SPIDs, which is Multipoint by definition.

5ESS:

On a 5ESS, many applications do not require SPIDS, and this situation is called point-to-point. For example, a basic ISDN application using voice and data on the two B channels requires no SPIDs.

Some ISDN terminal adapters won't work on a 5ESS line that is configured at the switch for multipoint (multiple SPIDs). Conversely, the application may require multipoint.

tc "DN (Directory Number)"§DN (Directory Number)

DMS-100:

On a DMS-100 switch, for data calls, the switch and your terminal adapter need to agree on the Directory Number (DN). This is usually the seven digit phone number for the B channel, but the terminal adapter may require you to enter a ten digit number in some cases. In other cases, the terminal adapter will be equally happy with a seven or a ten digit DN.

The DN is only used for incoming calls. The symptom of an incorrect DN setting is that you can make data calls out but you cannot receive data calls.

5ESS:

The DN may be requested by your terminal adapter during configuration for use with a 5ESS switch, but it will not actually be used and can generally be omitted.

6

tc "TEI (Terminal Endpoint Identifier)"§TEI (Terminal Endpoint Identifier)

If TEI is set differently in the Terminal Adapter than in the switch you won't get dial tone for voice applications. The options are "Dynamic" or a number from 0 to 63 (also known as "Static"). Refer to your equipment documentation.

5ESS:

For the 5ESS switch, set to Dynamic unless you have a packet data application. Refer to your equipment documentation.

DMS-100:

For the DMS-100, set to Dynamic or Static. Refer to your equipment documentation. Most of the time it will by Dynamic.

tc "Terminal Type"§Terminal Type

5ESS Only:

ISDN lines from the 5ESS switch need to be configured by Pacific Bell for the terminal type (A, B, C, D or E) of the terminal adapter you're using. The documentation for the terminal adapter should tell you which one it requires.

Some Common Terminal Adapter Types are:

Hitachi is C
Fujitsu 410 and 400 and 300s are A
Fujitsu 1050 and 2000 are D
Hayes is A
AT&T is D except for the model 7500 which is E
Combinet is C, D, E (all will work)
Teleos is D

Type E is generally used for data-only terminal adapters (ones that have no provision for adding voice capability). But this can be misleading because some terminal adapters that appear on the surface to be designed for data-only use may have some voice options built-in for optional use. Refer to the equipment documentation.

tc "EKTS (Electronic Key Telephone System)"§EKTS (Electronic Key Telephone System)

7

DMS-100 Only:

The EKTS setting is what activates the various voice features on the switch. For the DMS-100 switch, EKTS must be set to "yes" on the switch for any B channel that is to be used for voice with an ISDN phone.

(If you are simply plugging a non-ISDN analog phone into an ISDN terminal adapter that has an analog phone jack, set EKTS to "No."

For data applications, set EKTS to "no" for any B channel carrying data. Some data terminal adapters will not work if EKTS is set to "yes". Check your terminal adapter documentation to be sure.

tc "Release Key"§Release Key

DMS-100 only:

On an ISDN telephone, the number you assign at the switch for the Release Key is what maps the physical key on the ISDN phone set to be the release function (as in releasing a call). When ordering the ISDN line, have Pacific Bell set Release Key to the number specified in your ISDN phone documentation.

If it is a data-only terminal, there is no release key, so order the line with Release Key set to "no."

tc "Ringing Indicator"§Ringing Indicator

DMS-100 only:

Set to No for data-only terminals. Set to Yes for for voice applications.

tc "Functional or Stimulus Signaling"§Functional or Stimulus Signaling

DMS-100 only:

ISDN lines from a DMS-100 may be configured for either functional or stimulus signaling. Terminal adapters are built to work with one type or the other. Functional is the option for newer terminal adapters. Stimulus is an older signaling method.

tc "PVER or PVC or Version"§PVER or PVC or Version

DMS-100 only:

PVC, Version, PVER and Issue refer to the same thing.

Each terminal adapter that is designed to work with a DMS-100 switch has a PVER number which identifies which version of the DMS switch generic software it works with. Older terminal adapters will not work with newer (higher numbered) switch generics. But the ISDN line can be configured to provide a signal that looks like an older generic software version if your terminal adapter requires it.

This information may not be in the terminal adapter's documentation and often is a source of problems. Contact your terminal adapter vendor if you cannot find the PVER or PVC or Version information in your equipment documentation.

Order your ISDN line from Pacific Bell with the ISDN switch generic level that corresponds to what your terminal adapter requires.

If your terminal adapter PVER is...	Ask Pacific Bell to make your ISDN line set to switch generic
Version 0	BCS Level 30
Version 1	BCS Levels 31 - 34
Version 2	BCS Level 35

tc "ISDN Setup Problems and Solutions"§ISDN Setup Problems and Solutions

The following are common ISDN installation problems and their solutions.

NT1 Lights: Using an NTI NT1, the S/T light is red. Or using an AT&T NT1, the Terminal Error light is red.

You are not physically connected to the ISDN terminal adapter or the terminal adapter is not functioning. Check the cables. Reboot the terminal adapter by powering off then on.

NTI Lights: Using an NTI NT1, the U light is red. Or using an AT&T NT1, the Line Error light is red.

You are not connected to a working ISDN line. Check your wire connections.

You can make ISDN data calls to other locations within your telephone prefix, and you can receive incoming data calls, you can't make a data call outside your local calling area.

Note: Voice calls may work properly when data calls don't. Voice and data calls are routed over separate networks.

The switch is not properly configured to let your line make data calls across the switched 56 network. On the DMS-100 this is the NCOS setting; on the 5ESS it is the PIC setting. Pacific Bell must make the change at the switch.

For data calls from the 5ESS, a PIC of 10732 won't work because that's for voice only.

If your switched 56 service is AT&T's Accunet, and you're calling a relatively new area code, the number may not be entered in AT&T's routing tables yet. They can update their tables. Similarly, Pacific Bell's Tandem switches might require a table update for the location you're calling.

Your terminal adapter or the one at the called destination is set for 64 kbps instead of 56 kbps. (This refers to the ISDN line speed, not your application's speed which might be different.)

Everything is configured correctly for a data application but it still doesn't work or it gives garbage.

Reboot the terminal adapter by powering off then on. If that doesn't work, try replacing your data cables or phone cables. Bad cables are one of the most frequent sources of problems, especially new cables.

Try physically removing the phone line from the jack on the terminal adapter then powering off and on. Reconnect the phone line. Try again.

If you've tried your line several times, powering your terminal adapter on and off several times, your ISDN line can get hung up at the central office switch. It might self-correct in a few minutes (maybe up to half an hour) or it might be hung until it's cleared the next morning as part of normal switch surveillance and maintenance. This generally only happens when you're playing with the line, not in normal use.

Your terminal adapter may be an older type with T-Link or V.110 rate adaption instead of V.120, the current standard.

Even if you're sure you've ordered the ISDN line with the correct configuration, the line is configured by humans typing a large number of entries in data fields. Errors are not uncommon. You may want to ask Pacific Bell for a read-out of how the line is actually configured.

10

You may have ordered the line exactly as the terminal adapter vendor's documentation specified, but sometimes their documentation is incomplete. In particular, on a DMS-100 switch, make sure you have ordered the correct "version" for your terminal adapter. The version determines which software version of the switch is activated for your line, such as BCS 29, 30, 31, 32, 34, 35, etc.

If you're getting garbage or the system is locking up after the call is established, make sure your communications software on each end is set for hardware flow control (sometimes called RTS/CTS) instead of software flow control (sometimes called XON/XOFF). This setting only effects the buffering and flow of information between the local terminal adapter and the PC. Software flow control may be too slow for your application.

Try turning off the power on the terminal adapter, physically unplugging the phone wire from the back, then replug it and power up. This solves some problems.

You may be operating at a speed higher than your serial port on your PC can handle. Set your communications speed for 9600 and see if the errors disappear. Then try 19200 and 38400.

The NT1 light indicates I have a line or terminal problem, but the application works okay.

We've seen several NT1s where the light itself is bad. You may not have a problem. Substitute a good NT1 to see if the problem persists.

You can make a data call from a 5ESS line to a DMS-100 line okay, but if you originate on the DMS-100 line then the computer on the 5ESS line drops the call.

Set the terminal adapter configuration to 56 kbps on the DMS-100 side. It may be set for 64 kbps and doesn't adjust automatically.

There's no dial tone on your voice application, even though the NT1 lights are green and the cables are okay.

EKTS may be set to "no" on the switch. Or the phone set needs to be configured (or reconfigured) using the phone's documentation.

The videoconferencing application requires you to dial two phone numbers to get both of the B channels active on a device served by a DMS-100 line.

Have Pacific Bell put the phone number for the second B channel in a hunt group with

11

the phone number for the first B channel. When the first number is busy, the call automatically "hunts" to the second B channel so the caller need only dial the first number.

Your videoconferencing unit won't dial or receive calls. It is served by a 5ESS switch.

Your B channels may be configured for voice/data (both voice and data on each B channel) but you also need to have the line configured by specifying "Data channels = 2" in order for both channels to work. The video conferencing unit may not work at all unless both B channels are working.

Try entering the phone number without any dashes or separators. The dashes work okay for modem calls but may confuse the ISDN Terminal Adapter.

The terminal adapter is performing below its specified speed for an asynchronous data call.

If you're running a communications application under Windows (e.g., Procomm for Windows) you are limited by the speed that Windows can handle -- usually 19.2 kbps. Try running a communications program from DOS instead, or use a Macintosh. Or buy a software program called TurboCom, from Pacific Commware, that speeds up your com port speed under Windows.

Your terminal adapter may need an eprom upgrade to realize the higher speeds. It may be impossible to tell by looking at the device or the documentation whether it has been upgraded. There may be a sticker on the terminal adapter that makes reference to the upgrade. Call the terminal adapter vendor to verify the speed of your model.

If you have an IBM compatible PC earlier than a 486 (and even including some 486s), you may have UARTs that can't reliably handle speeds higher than 19.2 or 38.4. Your UARTs need to be the "xxx550" or newer to get higher speeds. The UARTs are part of your PC and control the speed on your com ports.

The terminal adapter on the far side of the call may be the limiting factor. You can only get as much throughput as the slowest terminal adapter on the data call.

You may have your communications software set for a lower speed than the terminal adapter can handle.

Your terminal adapter may have a speed configuration setting. Terminal adapters with external buttons and LED displays can be programmed for the required speed. This setting may be misleading because the terminal adapter probably sends at its highest speed regardless of this setting. And there is also a setting for 56 or 64 kbps on your terminal adapter -- but these refer to the maximum speed of your ISDN line, not the maximum speed of your terminal adapter.

12

In Smartcom II for Mac, be sure to turn off the "V Series" commands under the modem menu by selecting the "Use reduced command sets" box.

The communications software won't dial my V.120 terminal adapter using the ATDT command.

Try using ATD instead of ATDT, from the terminal mode of your software (i.e., type ATD5551234 when you can get an "ok" from the termminal adapter). Your dialing directory of the communications software may also automatically use ATDT instead of ATD. There may be a setting for changing this in your software configuration options.

Try entering the phone number without any dashes or separators. The dashes work okay for modem calls but may confuse the ISDN Terminal Adapter.

The terminal adapter won't answer an incoming asynchronous data call, even though it "sees" it (you can see a status display or status light that tells you a call has been detected).

Configure the terminal adapter to turn the "auto answer" function on. Refer to the terminal adapter documentation.

Your applications software on the receiving end should also be configured for "auto answer" or the user needs to enter a command to answer the incoming call.

Your application software may be expecting modem-like connect messages from the terminal adapter (e.g. CONNECT 9600). You may need to adjust your application software to recognize whatever connect messages are coming from the ISDN terminal adapter (e.g. CONNECT 57600).

The Face-to-Face groupware application doesn't connect over ISDN, even though the lines and applications are correctly configured.

You need a special Hardware Handshake Cable, not a standard RS232 cable. But they look alike, so it's easy to be mistaken. A Hardware Handshake Cable can be obtained from Hayes (part number 07-00681), telephone 404-840-9200 or System Connections, Inc. (part number CMA-023H-06), telephone 801-373-9800.

When you make a V.120 data call to the Pacific Bell BBS it sometimes locks up in the middle of the call, even using different terminal adapters and different lines from different ISDN switches.

This problem has been reported but not duplicated in the lab. The cause is unknown. But the caller was using slow 286-based PCs and also dumb terminals. (These problems

13

have not been noticed on 386-based PCs or Macintoshes in the lab.) When flow control settings and application speed are changed it doesn't help.