ISDN User's Guide

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Introduction to ISDN

Integrated Services Digital Network (ISDN) lets you communicate with other systems and networks via a high-speed telephone line the same way as you communicate with other systems and networks via an Ethernet cable. Once you set up and establish an ISDN connection, you can use the same UNIX® commands and Indigo Magic™ desktop methods to log in to other systems and transfer files.

If you wish to establish an ISDN connection, you must order the *PCI-BRI ISDN* card from Silicon Graphics®, unless you have an Indy workstation, in which case the hardware and software are built in.

This guide shows you how to order additional hardware and services, set up your connection, and use ISDN. Specifically, it contains these chapters:

- Chapter 2, "Setting Up an ISDN Connection," contains detailed information on setting up the hardware, software, and services needed to use ISDN. It also contains troubleshooting information.

- Chapter 3, "Using ISDN," shows you how to use *Point to Point Protocol* (PPP) to start and stop an ISDN connection and how to log in and transfer files between your system and systems on the ISDN network.

- Chapter 4, "ISDN Reference," contains technical background information on ISDN and advanced information on more complex ISDN configurations.

In addition, a glossary of terms appears at the end of the guide.

Setting Up an ISDN Connection

Several steps are involved in setting up your workstation so it can communicate across an *ISDN* connection. It may take several weeks to set up the connection, depending on how quickly you can obtain the appropriate hardware and services from your local telephone company.

This chapter guides you through all the steps in the process. Read "Prerequisites for Using ISDN" first; if your situation does not satisfy those prerequisites, you will not be able to use an ISDN connection.

This chapter contains the following sections:

- "Prerequisites for Using ISDN"
- "Ordering ISDN Services and Hardware"
- "Setting Up ISDN Hardware"
- "Setting Up ISDN Software"
- "Turning On and Testing the ISDN Connection"
- "Letting Other ISDN Systems Access Your System"
- "Troubleshooting the ISDN Connection"

Prerequisites for Using ISDN

An *ISDN* connection is basically a network connection between two systems that transfers information over a high-speed telephone line rather than an Ethernet connection. If you wish to establish an ISDN connection, you must order the PCI-BRI ISDN card from Silicon Graphics (unless you are using an Indy workstation, in which case the hardware and software are part of the system). See the manual or flier that comes with your hardware for installation instructions.

To use ISDN, your situation and location must have these characteristics:

- The remote system that you plan to connect to must already be set up to use ISDN; that is, it must already have ISDN hardware, software, and services in place. See also "Requirements for Remote ISDN Systems."

- Your system must be located near a telephone switching office that offers ISDN services, typically, within two or three miles (three or five kilometers) of such an office. See also "Ordering ISDN Services and Hardware."

- You need a telephone jack. If you have a standard jack that supports only one telephone number, your local telephone company can split the jack so it can support both the existing telephone number and a new, dedicated ISDN telephone number.

  If you do not have a jack, or you already have two telephone numbers on your existing jack, you can have the telephone company or an electrician install a new telephone wire and jack.

Ordering ISDN Services and Hardware

If your situation meets all the prerequisites listed in "Prerequisites for Using ISDN," you are ready to order your services and hardware.

Ordering ISDN Services

Contact your telephone company and go through the questions and ordering requests in this section with a person qualified to set up *ISDN* services.

1. Make sure your telephone company can provide *Basic Rate Interface* (*BRI)* ISDN services to your location. Typically, your system must be within two or three miles (three or five kilometers) of a telephone switching office that offers ISDN.

2. Tell the telephone company that you want a BRI (not *PRI)* ISDN connection.

3. When they ask about the *B channels* and *D channel*, say this:

   • You want circuit-switched data on both B channels. You do not want X.25 (also called packet-switched data); you do not want voice or any of the additional voice-related services (such as call hold, consultation hold, 3-way conference, and so on).

   • You want standard signaling on the D channel. You do not want X.25 (also called packet-switched data) or any additional services.

4. *U.S. customers only*: Ask what type of *switch hardware* and *switch software* your telephone company uses. It will be one of four types:

   • 5ESS hardware running 5ESS custom software

   • 5ESS hardware running 5ESS National ISDN 1 software (also called NI1 software)

   • DMS100 hardware running BCS level 31, 32, 33, or 34 (Protocol Version 1) software

   • DMS100 hardware running BCS level 35 or higher (Protocol Version 2) software (also called DMS100 National ISDN 1 or NI1 software).

   The telephone company representative may know the hardware type or the software type but not both. If this is the case, ask the representative to research both the software and the hardware types.

5. *U.S. customers only*: The telephone company will request information about your workstation. They may refer to the workstation as an ISDN terminal, Customer Premise Equipment (CPE), or a Terminal Adapter (TA). The information the telephone company needs depends on the type of switch software the telephone company uses.

   Note: Some telephone companies do not require the detail listed here; they automatically assume you have a type D terminal, which provides you with a superset of the services you need.

   The list below shows the switch software type and the appropriate information.

   5ESS custom   Terminal type: E
   Number of call appearances: None
   Display: No
   Idle call appearances: None
   Autohold: No
   One touch: No
   No. of circuit-switched data channels: 2
   EKTS: No
   Data line class: *point to point*

       Note: If you plan to connect more than one device to the ISDN line, your data line class is *point to multipoint*, or just multipoint.

   5ESS NI1   Terminal Type: A
   Number of call appearances: None
   Display: No
   Idle call appearances: None
   Autohold: No
   One touch: No
   No. of circuit-switched data channels: 2
   EKTS: No

   DMS100 BCS level 31, 32, 33, or 34 (Protocol Version 1)
   Dynamic TEI: Yes
   Maximum number of keys: 3
   Ringing indicator: No
   EKTS: No

   DMS100 NI1   Dynamic TEI: Yes
   Maximum number of keys: 3
   Ringing indicator: No
   EKTS: No

6. *U.S. customers only*: The telephone company may ask these additional questions:

    • Does the system have automatic or fixed Terminal End Identifier (TEI)? It has automatic TEI.

    • Is the system functional or stimulus? (This applies only if the telephone company's hardware is DMS100.) It is functional.

7. *German customers only*: Ask the telephone company whether their switch runs 1TR6 or NET3 software.

8. Ask for your ISDN telephone number(s) and Service Profile Identifier *(SPID)* number(s). The information the telephone company provides depends on the type of switch software it uses. The list below shows the switch software type and the information you need.

    • 5ESS custom: One telephone number. The telephone company may provide you with a corresponding SPID number; you need to know the SPID number only if you are setting up a *point-to-multipoint* connection rather than the standard *point-to-point* connection.

    • 5ESS NI1, DMS100 BCS level 31, 32, 33, or 34 (Protocol Version 1), or DMS100 NI1: Two telephone numbers and two corresponding SPID numbers.

    • NTT, 1TR6, or NET3 (also known as Euro-ISDN or DSS-1): One telephone number.

    Write down your switch software type, the telephone number(s), and, if necessary, the SPID number(s).

9. This should be enough information for the telephone company to set up your ISDN service. If they need more information about your system, see "Technical Background" for more-detailed technical information.

    Before you end your conversation with the telephone company, ask whether you're speaking with a person who can do the following:

    • Order additional hardware from the telephone company or from a vendor that the telephone company recommends. See "Ordering ISDN Hardware."

    • Set up long-distance calling service for the line if you plan to connect to systems that are located outside your area code.

Ordering ISDN Hardware

If you live in Japan or Germany, after you've ordered your ISDN services as described in "Ordering ISDN Services," your local telephone company automatically ships you the additional ISDN hardware you need to connect to a telephone jack.

If you live in the United States, you must explicitly order additional ISDN hardware from your local telephone company or from a vendor that the telephone company recommends. When you order the hardware, make sure it includes all the appropriate cables. The list below itemizes the equipment and cabling you need to connect your workstation to a standard telephone jack.

- An *NT1 device*: This small device (about the size of a standard VHS videotape) converts the standard 2- or 4-wire telephone jack signal (also called a *U interface*) to an 8-wire ISDN signal (called an *S/T interface*).

- A power supply unit for the NT1 device: This is roughly the same size as the NT1 device; it supplies power from a standard AC outlet to the NT1 device.

- A power cable: This connects the power supply unit to the AC outlet. Typically this cable is already connected to the power supply unit.

- A short, straight-through *RJ-45 cable*: This connects the NT1 device to the power supply unit. It is usually included with the power supply unit.

- A long, straight-through *RJ-11 cable*: This is the standard cable that connects a telephone to a standard jack. With an ISDN connection, it connects the power supply or NT1 device to the jack.

- A 5- to 7-foot straight-through RJ-45 cable: This 8-wire high-speed cable with RJ-45 connectors on both ends connects the NT1 device to your workstation.

  Note: This is not the same type of cable that is used for a 10-BaseT connection.

  If your telephone company does not supply this cable, you can order it from a number of vendors, including Silicon Graphics and Inmac.

When your hardware arrives and your ISDN services are ready (see "Ordering ISDN Services"), go to "Setting Up ISDN Hardware."

Setting Up ISDN Hardware

A wide variety of NT1 devices is available in different countries. This section shows a sample setup that consists of a workstation, a Northern Telecom Meridian *NT1 device*, a Northern Telecom Meridian power supply unit for the NT1, and a telephone wall jack.

Set up the connection as follows, regardless of the type of NT1 device you have:

1. The wall jack supplies a standard RJ-11 telephone jack; this is called the *U interface*.

2. Connect one end of a standard 4-wire *RJ-11 cable* to the wall jack (U interface) and connect the other end to the RJ-11 port on the power supply unit (if you have one) or the NT1 device. This port should be labeled with a *U*.

   If you have both a power supply unit and an NT1 device, connect the RJ-11 cable to the wall jack and the U port on the power supply, then connect the short RJ-45 cable to the jacks labeled with a U and a solid and dashed line on both the power supply unit and the NT1 device. Connect the power cable on the power supply unit to a standard AC outlet.

3. Connect one end of a straight-through 8-wire *RJ-45 cable* to either of the RJ-45 ports on the NT1 that are labeled S/T. Connect the other end of this cable to the ISDN port on the workstation.

See Figure 2-1 for a setup that includes both an NT1 device and a power supply unit.

RJ-45 cable - connects the $\underline{\underline{U}}$ + ports on the power supply unit and the NT1 device

Power supply unit

RJ-11 cable - to workstation
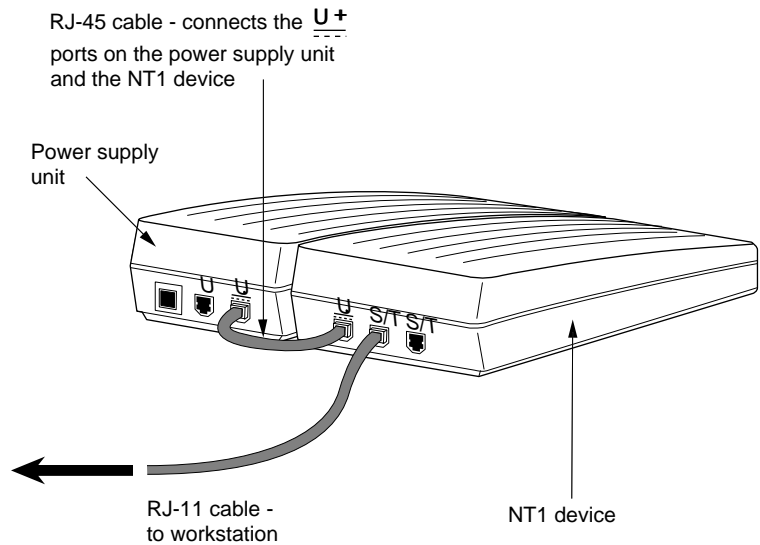
NT1 device

Figure 2-1   ISDN connection between a workstation, an NT1 device, and a power supply unit.

When all the hardware is set up, see "Setting Up ISDN Software."

Setting Up ISDN Software

You need root privileges to set up *ISDN* software. It involves these three steps:

1.   Install the *UUCP, PPP,* and ISDN software. This online book is part of the ISDN software, so UUCP, PPP, and ISDN are already installed.

2.   Configure system files for basic ISDN use; see "Setting Up Basic ISDN."

3.   Build a list of remote ISDN systems and networks that you want to access; see "Building a List of Remote ISDN Connections."

Once your ISDN software is set up and you are able to access other systems, you can provide your ISDN information to them so they can access your system; see "Letting Other ISDN Systems Access Your System."

Using the Interactive Guides

The following sections describe how to use the interactive guides, available in the System Manager to set up ISDN. To access the guides, follow these steps:

1. Choose System Manager from the System Toolchest.

2. In the System Manager, select the Network and Connectivity category.

    A list of guides appears in the right-hand column of the window.

3. To open a guide, click its name in the right-hand column.

The guides display text that describes how to proceed and allows you to enter the appropriate information.

Note: To perform many of the operations described below, you need to know the *root* password or be logged into the root account.

Setting Up Basic ISDN

Before you use this task, refer to "Setting Up ISDN Hardware."

1. After the ISDN line is installed, have available the following information from the telephone company:

    1. The type of switch software; for example, DMS100 or NT1.

    2. The SPID number or numbers. Depending on the type of switch software, you may not be given an SPID number or you may be given one or more SPID numbers.

    For 5ESS point to multipoint, you need one SPID number, which you obtained in "Ordering ISDN Services." DMS100 BCS level 31, 32, 33, or 34 (Protocol Version 1) and DMS100 NI1 have 2 *SPIDs*.

You also need a *hostname* and an *IP address* for your system. This information is available from the network administrator of the network to which you plan to connect.

To set up basic ISDN, follow these steps:

2. Select Network and Connectivity in the left-hand column of the System Manager window (see "Using the Interactive Guides" above). In the right-hand column, click Set Up ISDN; then follow the steps in the interactive guide to complete the configuration. When you are finished, ISDN is up and running.

If you haven't assigned a hostname and IP address to your system or haven't turned on basic networking, perform this step now.

If you do not have an Ethernet cable connected to your system (if ISDN is the only type of networking you're using), perform Step 3.

3. Select the Network and Connectivity category in the left-hand column of the System Manager window (see "Using the Interactive Guides" above). In the right-hand column, click Start Up Networking; then follow the steps in the guide to complete the setup.

4. Select the Network and Connectivity category in the left-hand column of the System Manager window (see "Using the Interactive Guides" above). In the right-hand column, click Modify Network Settings. On the page headed Set the State of Ethernet, in the guide, select Disable; then go to the end of the guide and click OK.

The basic ISDN software is set up. Go to "Building a List of Remote ISDN Connections."

Building a List of Remote ISDN Connections

Once your basic *ISDN* software is set up (see "Setting Up Basic ISDN"), you can build a list of the remote locations (systems and networks) that you want to communicate with using your ISDN connection.

You can set up to an outgoing or an incoming ISDN connection:

- To call out to a computer at a remote location, use the Add an Outgoing PPP Connection guide.

- To allow an incoming call from a computer at a remote location, use the Add an Incoming PPP Connection guide.

1. Select the Network and Connectivity category in the left-hand column of the System Manager window (see "Using the Interactive Guides" above). If you want to call a remote site, select Add an Outgoing PPP Connection, in the right-hand column, and complete the steps in the guide. If you want to specify which remote sites can call you, select Add an Incoming PPP Connection and follow the steps.

Note: If you do not specify an incoming PPP connection, any remote site can call you.

Go to "Turning On and Testing the ISDN Connection."

Turning On and Testing the ISDN Connection

Once you have set up the basic *ISDN* software (see "Setting Up Basic ISDN"), you can test the connection.

1. Select Network and Connectivity in the left-hand column of the System Manager window (see "Using the Interactive Guides" above). In the right-hand column, select ISDN Manager.

2. Click the Confidence Test button to start the test. If there is a problem, one or more error messages appear, in which case, see "Troubleshooting the ISDN Connection." If there are no error messages, ISDN is working properly.

3. Select the Network and Connectivity category in the left-hand column of the System Manager window (see "Using the Interactive Guides" above). In the right-hand column select PPP Manager; then double-click the icon of the outgoing connection that you want to establish. A status panel appears.

4. Click the *Open Connection* button and check the status ("The connection is CLOSED" or "The connection is OPEN").

5. To verify whether the remote system has accepted your password and is running PPP, in the right-hand column of the ISDN Manager window, click the *Line Status* button. A window appears that displays the activity of your ISDN lines.

6. Choose Open Unix Shell from the Desktop Toolchest.

7. In the shell window that appears, type

   `/usr/etc/ping` *<hostname>*

   For example, if the hostname is mars, type

   `/usr/etc/ping mars`

   After ten seconds, press `<Ctrl-c>`.

   If you see a message that reports 0% packet loss, the connection is working. Go to the next step.

   If the message reports a large percentage of packet loss, the connection or network routing is not working. See "Troubleshooting the ISDN Connection."

8. Close the connection by clicking the *Close Connection* button.

9. Customize your ISDN setup or start using the connection now.

   • To let other ISDN systems access your system, see "Letting Other ISDN Systems Access Your System."

   • To log in to other systems and transfer information, see Chapter 3, "Using ISDN."

Adding Remote Systems to the /etc/hosts File

The *etc/hosts* file contains a list of all the remote systems that your system can access once the ISDN connection is open. Each line of the file contains an *IP address* and a *hostname*. You can use the Modify Network Settings guide to add a new system (*host*) to your *etc/hosts* file. Follow these steps:

1. Select the Network and Connectivity category in the left-hand column of the System Manager window (see "Using the Interactive Guides" above). In the right-hand column, click Modify Networking Settings.

2. Then go to the page titled Add an Entry to the Host File and enter the hostname and IP address of the remote system.

   For example, enter the hostname *saturn.accompany.com* and the IP address 192.0.2.9.

3. Go to the last page of the guide and click OK to add the system to your *etc/hosts* file.

Letting Other ISDN Systems Access Your System

To let other ISDN systems access your system, do the following:

1. Select the Network and Connectivity category in the left-hand column of the System Manager window (see "Using the Interactive Guides" above); then click Add an Incoming PPP Connection and follow the steps.

   Note: If you do not use Add an Incoming PPP Connection, any remote site can call you.

   If you are concerned with system security, see "Using a System Security Scheme."

Troubleshooting the ISDN Connection

The troubleshooting information in this section covers many common error conditions. If you need more-detailed information, see the *ppp* man page.

This section shows you how to use a shell window and issue direct PPP commands to troubleshoot efficiently.

Troubleshooting Guidelines

1. Make sure that all physical connections are solid and that the *NT1 device* is powered on. If you had to solidify a connection or power on the NT1 device, restart the system and try using ISDN again.

2. Open the ISDN Manager.

   Select the Network and Connectivity category in the left-hand column of the System Manager window (see "Using the Interactive Guides" above). In the right-hand column, click ISDN Manager.

3. In the ISDN Manager window, click the *Confidence Test* button to start the test.

   If there is a problem, one or more error messages appear. If the notifier reports a problem, follow the instructions that the confidence test gives you for correcting the problem.

4. To see startup status messages for testing purposes, type

   ```
   ppp -r <connection name> -d
   ```

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Error Messages During the Initial Setup

This section lists various error messages that you may encounter during your initial setup of ISDN. Typically you'll see these messages after trying to connect to a remote system for the first time by typing **ppp -r** *<connection name>* -d. The message generally appears in your shell window, although some of them appear in the */var/adm/SYSLOG* file.

To obtain information on error or status messages, follow these steps:

1. Open another shell window and in the new window type

   isdnstat

   When you place the call in the next step, *isdnstat* reports on the progress of the call. For more details, see the *isdnstat* man page. To stop *isdnstat* from running, type:

   q

2. In the shell window in which you're logged in as root, place the call and request additional information from *PPP* by typing

   ppp -r *<connection name>* **-d**

   You do this in the shell window because the debug messages are displayed in the shell window as

   ppp [xxx] *<connection name>*:*<error message>*

   The window in which you started *isdnstat* shows the progress of ISDN, and the window in which you typed the *ppp* command gives you information about PPP.

   You can request more information by adding additional **-d** flags to the *ppp* command line, but this will introduce security problems. See the *ppp* man page for details.

This section covers these error conditions:

- "Unknown Switchtype"
- "Login Failed"
- "System Not in Systems File"
- "Failed to Find Entry in /etc/ppp.conf"
- "Missing Devices or Device Types"

Unknown Switchtype

Unknown switchtype "*\<switchtype\>*"

This message indicates a problem in ISDN's configuration.

1. To verify that the switch software type is correct, select Network and Connectivity in the left-hand column of the System Manager window (see "Using the Interactive Guides" above). In the right-hand column, select Set Up ISDN.

Login Failed

ppp[348] *\<connection name\>*: fatal error "LOGIN FAILED" on try #2

ppp[348] *\<connection name\>*: giving up for now

This message may appear immediately (within three seconds) after you try to make the connection, or may appear after several more seconds.

If you see the message immediately, your system cannot access the ISDN line through your *NT1 device*, typically because the NT1 is powered off or the telephone line is unplugged. Check that all connections are solid and that the NT1 is powered on, then follow these steps:

1. Open a shell window, log in as root, then type

    /etc/init.d/isdnd stop

    /etc/killall ppp

    /etc/init.d/isdnd start

2. Wait 30 seconds, then try again, requesting more error or status information, by typing

    ppp -r *\<connection name\>* **-d**

3. If you see the same error message, there may be a problem with the telephone company's switching software. Contact the telephone company to report the problem.

If you see the `Login Failed` message after several seconds, there is a different problem; for example, the remote system may be down or its ISDN connection may already be in use. For more information, follow these steps:

1. Open another shell window and in the new window type

    isdnstat

    When you place the call in the next step, *isdnstat* reports on the progress of the call. For more details, see the *isdnstat* man page. To stop *isdnstat* from running, type

    q

2. In the shell window in which you're logged in as root, place the call and request additional information from *PPP* by typing

    ppp -r *<connection name>* **-d**

    The window in which you started *isdnstat* shows the progress of ISDN, and the window in which you typed the *ppp* command gives you information about PPP.

System Not in Systems File

ppp[434] *<connection name>*: `fatal error "SYSTEM NOT IN Systems FILE" on try` `#2`

ppp[348] *<connection name>*: `giving up for now`

The above message means that there is a problem with the outgoing connection that you added.

Use the Modify an Outgoing PPP Connection guide to correct any errors with the connection.

1. Select the Network and Connectivity category in the left-hand column of the System Manager window (see "Using the Interactive Guides" above) and click ISDN Manager.

2. Select the connection that isn't working and click the *Modify* button.

    The Modify an Outgoing PPP Connection guide appears.

3. Check your settings (see "Building a List of Remote ISDN Connections"). In particular, be sure of the following:

    If the telephone number is outside your area code, the telephone number entry must exactly match what you would dial on a telephone to call the number. For example, for connections between two U.S. locations that are in different area codes, the entry must consist of 11 digits (1 +the area code + a 7-digit phone number).

    The word CONNECTED should appear at the end of each line.

    The rate should be appropriate for your location (typically 56 within the United States, 64 elsewhere); see also "About Transfer Rates" in Chapter 4.

Failed to Find Entry in /etc/ppp.conf

```
ppp[483] <connection name>: failed to find entry labeled 'mars' in
/etc/ppp.conf -- assume defaults

ppp[483] <connection name>: fatal error "LOGIN FAILED" on try #2

ppp[483] <connection name>: giving up for now
```

The message shown above means that there is a problem with adding a PPP connection.

1. Select the Network and Connectivity category in the left-hand column of the System Manager window (see "Using the Interactive Guides" above). and click "ISDN Manager."

2. Select the connection that isn't working and click the *Modify* button.

    The Modify an Outgoing PPP Connection guide appears.

3. Check your settings (see "Building a List of Remote ISDN Connections").

Missing Devices or Device Types

```
Device Type ISDN wanted
Requested Device Type Not Found
Call Failed: NO DEVICES AVAILABLE
```

One or more of the above messages indicates that the file */etc/uucp/Devices* is either missing information or is corrupted.

Verify that the file contains these two lines:

```
ISDN isdn/modem_b1 - 38400 direct
ISDN isdn/modem_b2 - 38400 direct
```

If the lines are missing, add them to the file and save the changes. Then restart the connection, as follows:

1. In the panel that appears when you double-click the icon of the connection you want to use (in the PPP Manager), click Open Connection.

Error Messages From an Established Setup That Usually Works

This section lists various error conditions and messages that you may encounter when starting an ISDN connection that usually works. The messages may appear in your shell window or in the */var/adm/SYSLOG* file.

For more informative error or status messages when trying to make a connection, follow these steps:

1. Open a shell window and in the new window type:

   isdnstat

   When you place the call in the next step, *isdnstat* reports on the progress of the call. For more details, see the *isdnstat* man page. To stop *isdnstat* from running, type

   q

2. In another shell window in which you're logged in as root, place the call and request additional information from *PPP* by typing

   ppp -r *<connection name>* **-d**

   The window in which you started *isdnstat* changes to show the progress of ISDN, and the window in which you typed the *ppp* command gives you information about PPP.

   You can request more information by adding additional **-d** flags to the *ppp* command line, but this will introduce security problems. See the *ppp* man page for details.

This section covers these error conditions:

- "Login Failed"
- "Network is Unreachable"
- "Unknown Host"

Login Failed

ppp[348] *<connection name>*: `fatal error "LOGIN FAILED" on try #2`

ppp[348] *<connection name>*: `giving up for now`

This message may appear immediately (within three seconds) after trying to make the connection, or may appear after several more seconds.

If you see the message immediately, your system cannot access the ISDN line through your *NT1 device*, typically because the NT1 is powered off or the telephone line is unplugged. Check that all connections are solid and that the NT1 is powered on, then follow these steps:

1. Open a shell window, log in as root, then type

    /etc/init.d/isdnd stop

    /etc/killall ppp

    /etc/init.d/isdnd start

2. Wait 30 seconds, then try again, requesting more error or status information, by typing

    ppp -r *<connection name>* **-d**

3. If you see the same error message, there may be a problem with the telephone company's switching software. Report the problem to the telephone company.

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If you see the `Login Failed` message after several seconds, there is a different problem; for example, the remote system may be down or its ISDN connection may already be in use. For more information, follow these steps:

1. Open a shell window, and in the new window type:

   isdnstat

   When you place the call in the next step, *isdnstat* reports on the progress of the call. For more details, see the *isdnstat* man page. To stop *isdnstat* from running, type

   q

2. In another shell window in which you're logged in as root, place the call and request additional information from *PPP* by typing

   ppp -r *<connection name>* **-d**

   The window in which you started *isdnstat* shows the progress of ISDN, and the window in which you typed the *ppp* command gives you information about PPP.

Network is Unreachable

<connection name>: `Network is unreachable`

The above message means that your system cannot determine the correct route to the remote system. To add a route to the remote system:

1. Select Network and Connectivity in the left-hand column of the System Manager window (see "Using the Interactive Guides" above). In the right-hand column, click Modify an Outgoing PPP Connection and follow the directions.

2. On Page 9 of the guide, select Add Route.

Note: The `add_route` line establishes a static default route. If your *Internet service provider* or network administrator requires a different type of routing (for example, if you have a *routing daemon* turned on), contact that person and describe your problem. See also "Changing Network Routing" and the *gated* and *routed* man pages.

3. Open another shell window and in the new window type:

   isdnstat

   When you actually place the call in the next step, *isdnstat* reports on the progress of the call. For more details, see the *isdnstat* man page. To stop *isdnstat* from running, type

   q

4. In the shell window in which you're logged in as root, place the call and request additional information from *PPP* by typing

   ppp -r *<connection name>* **-d**

   The window in which you started *isdnstat* changes to show the progress of ISDN, and the window in which you typed the *ppp* command gives you information about PPP.

If you still cannot access the system, see "Changing Network Routing" in Chapter 4.

Unknown Host

<hostname>: Unknown host

The above message means that the system you are trying to access does not appear in your */etc/hosts* file.

To repair the error, add the system to the */etc/hosts* file as described in "Adding Remote Systems to the /etc/hosts File."

Using ISDN

To use ISDN, initiate a connection to a remote system or network using the ISDN Manager, then use a shell window to log in to or transfer files between your system and the remote system or network.

The connection uses *PPP* (Point-to-Point Protocol). For more information, see the *ppp* man page.

This chapter contains these sections:

- "Starting a Connection"
- "Logging In to Remote Systems"
- "Transferring Files Across an ISDN Connection"
- "Stopping a Connection"

Starting a Connection

When you start a connection, you are placing a telephone call from your system to another system. The telephone company charges you by the minute as long as the connection is open, regardless of whether you are actively transferring files or are logged in to a remote system. Be sure to close the connection when you are not using it (see "Stopping a Connection").

To start an ISDN connection you need the root password or the necessary privileges.

To start a connection, follow these steps:

1. Open the ISDN Manager.

    Select the Network and Connectivity category in the left-hand column of the System Manager window (see "Using the Interactive Guides" in Chapter 2). In the right-hand column, click ISDN Manager.

2. Click the *Line Status* button.

To monitor the progress of ISDN, start an ISDN connection whose information you entered in "Building a List of Remote ISDN Connections" as follows:

1. Open the PPP Manager.

    Select the Network and Connectivity category in the left-hand column of the System Manager window (see "Using the Interactive Guides" in Chapter 2). In the right-hand column, click PPP Manager.

2. In the list of PPP connections that appears, double-click the connection you want to open.

3. In the PPP Status Panel that appears, click the *Start Connection* button.

    The status line informs you that the connection is open.

4. To close the connection, click the *Close Connection* button.

    The status line informs you that the connection is closed.

Note: Be sure to close the connection when you are not using it. As long as the connection is open, the telephone company charges you just as it does for a standard telephone call.

To monitor the progress of PPP, open a shell window, and type

```
netstat -C
```

When you place the call, the asterisk (*) next to the ppp0 listing should disappear. For more details, see the *netstat* man page. To stop *netstat* from running, type

```
q
```

Logging In to Remote Systems

Once the connection is open (see "Starting a Connection"), you can log in to the following:

- The remote system to which you connected using ISDN.

- Any remote system that's on the same network as the system to which you connected and whose *hostname* and *IP address* appear in your */etc/hosts* file. For more information, see "Adding Remote Systems to the /etc/hosts File."

To log in to a remote system, follow these steps:

1. Choose Open Unix Shell from the Desktop Toolchest.

2. You can log in to the system using either the *rlogin* command or the *telnet* command.

    - To use *rlogin*, position your cursor over the shell window and type

      rlogin *<remote hostname>* **-l** *<your login name>*

      You are logged in when you see the remote system's prompt. For more information, see the *rlogin* man page.

      If you do not see the prompt after several seconds, press

      <Ctrl-c>

      Then see "Troubleshooting the ISDN Connection."

    - To use *telnet*, position your cursor over the shell window and type

      telnet *<remote hostname>*

      The remote system responds with a login prompt. Type your login name and, if requested, your password. For more information, see the *telnet* man page.

      If you do not see the prompt after several seconds, press:

      <Ctrl-c>

      Then see "Troubleshooting the ISDN Connection."

3. To log out of a remote system, type

    logout

4. When you are finished using the remote system, you may want to close your ISDN connection; see "Stopping a Connection."

Transferring Files Across an ISDN Connection

Once the ISDN connection is open (see "Starting a Connection"), you can transfer files between your system and the following:

•   The remote system to which you connected using ISDN.

•   Any remote system that's on the same network as the system to which you connected, and whose *hostname* and *IP address* appear in your */etc/hosts* file. For more information, see "Adding Remote Systems to the /etc/hosts File."

You can transfer files using any of several transfer utilities. See "Accessing Remote Files and Directories" in Chapter 10 of the *Desktop User's Guide* for details on copying files graphically using the desktop, and for an overview of *rcp* and *ftp*. For more details on *rcp* and *ftp*, see their man pages.

If you encounter any problems copying files, make sure that you can successfully log in to the remote system; see "Logging In to Remote Systems." If you cannot log in, see "Troubleshooting the ISDN Connection." If you can log in but still cannot successfully transfer files, see the man page for the utility you are using or see the *Desktop User's Guide*
.

Stopping a Connection

To stop (close) a connection, you need the root password or the necessary privileges. Be sure to close the connection when you are not using it; the telephone company charges you by the minute as long as the connection is open, regardless of whether you are actively transferring files or are logged in to a remote system.

To close the connection, follow these steps:

1.   Open the PPP Manager.

     Select the Network and Connectivity category in the left-hand column of the System Manager window (see "Using the Interactive Guides" in Chapter 2). In the right-hand column, click PPP Manager.

2.   In the list of PPP connections that appears, double-click the connection you want to close.

3.   In the PPP Status Panel that appears, click the *Close Connection* button.

ISDN Reference

This chapter contains advanced information on the implementation of *ISDN*, and on using *PPP*. It contains these sections:

- "Technical Background"
- "Using ISDN and Other Networks Simultaneously"
- "Using Advanced ISDN Configuration Options"
- "Summary of UUCP, IRIX, ISDN, and PPP Configuration Files"

Technical Background

Your ISDN hardware provides a *BRI* (Basic Rate Interface) *S/T interface*. There are two *B channels*, each capable of transferring up to 64 Kbits/second, and one *D channel*, capable of transferring 16 Kbits/second. For more information, see "About Transfer Rates."

The B channels carry the actual data. The hardware supports only data communications (no voice communications) at this time. The D channel carries signaling and protocol data only. You cannot transmit user data over the D channel.

A daemon, *isdnd*, listens on the D channel for incoming calls. It also makes calls on behalf of local applications. Point-to-Point Protocol (*PPP*) is shipped with IRIX and can make ISDN calls and talk over ISDN B channels. The *isdnd* daemon also accepts ASI messages from ASI program entities; see the *ISDN Release Notes* for details.

Standards Supported

ISDN supports both *PPP* and ASI. The implementation of PPP supports these standards:

- magic numbers
- LCP address and control field compression
- LCP protocol field compression
- Asynchronous control character map
- IP header compression (also called VJ compression)
- PAP authentication
- CHAP authentication
- IP address negotiation
- demand dialing
- a nonstandard (but not proprietary) multilink protocol

Requirements for Remote ISDN Systems

The remote system must use ISDN and either:

- IETF PPP

   (If you're using the security scheme described in "Using a System Security Scheme," it must support the PAP authentication/password scheme.)

   or

- ASI

About Transfer Rates

Although each B channel can transfer 64 Kbits/second, many U.S. and international calls cannot transfer at this rate because the telephone company uses 1 bit out of every 8 to send the data between *switch hardware*. This makes the actual rate on each B channel 56 Kbits/second.

You can transfer information within the United States at 64 Kbits/second only if both your system and the remote ISDN system use the same physical switch hardware. In most cases, this would require that both systems be located in the same general geographic location (e.g., in the same city) and that the calls be placed to each other in the same central switching office.

You can also increase your transfer rate by using both B channels simultaneously; see "Optimizing Connection Speed."

Using ISDN and Other Networks Simultaneously

If your system is connected to a standard Ethernet network, and you also want to use ISDN to connect to a different network, you must work closely with the administrator of the ISDN network to set up network routing on your workstation.

This typically involves these steps:

1. Configure *gated* (the *routing daemon* you need to use when your system uses two or more networks simultaneously) by editing the */usr/etc/gated.conf* file. A sample file appears at the end of these steps.

2. Turn off *routed*, turn on *gated*, and restart networking by logging in as root and typing

   /etc/chkconfig routed off

   /etc/chkconfig gated on

   /etc/init.d/network stop

   /etc/init.d/network start

3. Delete the add_route line from every entry in the */etc/ppp.conf* file.

4. Try the connection.

   If you have routing problems (i.e., you see an error message that says *<hostname>*: Network is unreachable), contact the administrator of the remote system or network.

Sample /usr/etc/gated.conf

In the example below, 192.0.1.1 is the IP address of the local system for both its PPP and
Ethernet interfaces; 192.0.1 is the local Ethernet network. For more information, see the
gated man page.

```
# gated.conf
#
# gated configuration file for automatic PPP

RIP yes supplier
HELLO no
EGP no

# Trace options
traceflags internal external

# Do not time out the PPP interface. This keeps gated
# from timing out if it doesn't hear RIP packets from
# the local system.
passiveinterfaces 192.0.1.1

# Broadcast this system as a gateway at all times,
# even when the PPP link is not active.
net 192.0.1.0 gateway 192.0.1.1 metric 1 rip

# Do not waste bandwidth by sending RIP packets to
# the local system.
noripoutinterface 192.0.1.1
```

Using Advanced ISDN Configuration Options

This section covers a few common options for using *PPP* across an ISDN line. For more
information, see the *ppp* man page.

Using a System Security Scheme

You can authenticate the user name and password that your system will accept from a specific system by adding an incoming PPP connection as follows:

1. Open the Add an Incoming PPP Connection guide.

    Select the Network and Connectivity category in the left-hand column of the System Manager window (see "Using the Interactive Guides" in Chapter 2). Select Add an Incoming PPP Connection and follow the steps.

Note: If you do not use Add an Incoming PPP Connection, any remote site can call your system.

Give a password to each connection to make it secure and be sure that only the appropriate users know the user name and password.

Changing Network Routing

Network routing can be very complex. Before you change your routing scheme, contact your network administrator.

You control network routing using either of the following:

*   a *routing daemon* (*routed* or *gated*)

    or

*   a static route

To do so, follow the directions in "Setting Up Basic ISDN" to add a PPP connection and choose Add Route on page 9.

Do not use a static route and a routing daemon at the same time. This will disrupt the routing, and you will not be able to reach remote systems. For more information, see the *routed*, *gated*, and *ppp* man pages.

Optimizing Connection Speed

The system supports a nonstandard method for optimizing connection speed that works best between two workstations. It uses both *B channels* simultaneously; consequently, it doubles your telephone usage costs.

Follow the directions to add a connection in "Using a System Security Scheme" and choose the Heavy Traffic option on page 6 of the guide.

Using Quiet Mode

PPP's quiet mode starts *PPP* on demand (when you try to access a system using PPP) and closes the connection after a certain amount of idle time. This makes the PPP connection nearly as seamless as an Ethernet network connection and also ensures that you do not inadvertently leave an idle connection open and incur unnecessary telephone charges.

Quiet mode has complex routing implications. Contact your network administrator and see the *ppp* man page for more information.

Summary of UUCP, IRIX, ISDN, and PPP Configuration Files

This section summarizes the configuration files that you edit in Chapter 2 to set up your ISDN connection.

- */etc/config/isdnd.options* is an ISDN file in which you specify the *switch software* type that your telephone company uses.

- */etc/uucp/Devices* is a UUCP file in which you specify an ISDN line as an available device.

- */etc/uucp/Systems* is a UUCP file in which you specify the name and telephone numbers of systems to which you will connect via ISDN.

- *   */etc/ppp.conf* is a *PPP* file in which you can customize PPP for each system to which you will connect via ISDN. See also "Using Advanced ISDN Configuration Options."

- *   */etc/hosts* is a networking file in which you specify the *hostname*, *hostname alias*, and *IP address* of each system to which you will connect via ISDN, as well as each system that you will access after establishing an ISDN connection.

- *   */usr/etc/gated.conf* is a networking file that controls the behavior of the *gated routing daemon*. See also "Using ISDN and Other Networks Simultaneously."

Glossary

Administrator

The person who can use root, the most privileged account. The administrator must have a personal login account for daily use, but, when there are serious system problems to correct, he or she logs in to the root account to change system information using the graphical tools or using the IRIX shell.

The administrator has all the capabilities of a privileged user, plus the capability to change information in the root account (such as the password) and to log in to an IRIX shell as root. Because there is only one root account, there is only one administrator per system. The Information Panel for a particular system includes the name of the system's administrator so that other users know who to contact for help.

Basic Rate Interface (BRI)

An ISDN service that includes two B channels and one D channel.

B channels

Two separate conduits across which ISDN transfers data on your workstation. Each B channel is capable of transferring up to 64 Kbits/second. *See also D channel.*

confidence test

A test to ensure that a particular device (such as the keyboard, mouse, or ISDN) is set up and working properly.

Customer Premise Equipment (CPE)

A term that the telephone company uses to describe the end-user equipment needed to make an ISDN connection.

D channel

A single conduit across which ISDN on your workstation transfers signalling and protocol data (but no user data). The D channel can transfer up to 16 Kbits/second. *See also B channels.*

hostname

A unque name that identifies each host (system) on the network.

hostname alias

A short version of a hostname. For UUCP applications, it must be seven characters or less.

hubname

The hostname of a system through which all ISDN connections to a particular network are made.

Integrated Services Digital Network

A combination of software, hardware, and telephone services that lets you communicate with other systems and networks over a high-speed telephone line just as you communicate with other systems and networks over an Ethernet cable.

Internet Service Provider

The person or agency that administers the system or network to which you connect via ISDN.

IP address

The unique number that identifies each system on the network.

ISDN

See Integrated Services Digital Network.

login account

Information about a person who can log in to the system, including the person's full name, login name, contact information, and the name of a home directory in which the person can store directories and files.

login name

A short version of your own name or your initials; you type it to log in to the system, and the system uses it to label files that belong to you. If your system is on a network, the network administrator usually must approve of the name to make sure it is unique.

NT1 device

A small external hardware device (often the size of a standard VHS videotape) that converts the standard 2- or 4-wire telephone jack signal (the U interface) to an 8-wire ISDN signal (the S/T interface). Some NT1 units may need a companion power supply unit.

password

A combination of letters and/or numbers that only you know; it is an optional element of your login account. If you specify a password for your account, you must type it after you type your login name for the system to let you access files and directories.

permissions

The information attached to each directory and file that specifies which users can access it and to what degree.

point to multipoint

A connection made using the PPP protocol and ISDN hardware and software where there is more than one device (e.g., a telephone and a workstation) on one end of the connection and a single device (e.g., a server located at an Internet service provider's offices) at the other end.

point to point

A connection that uses the PPP protocol and ISDN hardware and software with one device (point) on each end of the phycical connection. *See also* point to multipoint.

Point-to-Point Protocol

a standard communications protocol for transmitting network data over point-to-point links using modems or ISDN lines. You can use it to transfer data between systems that use TCP/IP or UDP/IP.

PPP

See Point-to-Point Protocol.

PRI

See Primary Rate Interface.

Primary Rate Interface (PRI)

An ISDN service that requires a T1 link or PBX line; it is used for high-end video teleconferencing or for a large volume of outbound calls. It will not work over a standard telephone line; some workstations cannot use PRI. *See also BRI.*

prompt

A character or word that the system displays in an IRIX shell to indicates that the system is ready to accept commands. The default prompt for regular user accounts is %; the default prompt for the *root* account is #.

RJ-11 cable

The standard, 4-wire cable that you use to plug a telephone into a standard wall jack. In an ISDN connection, it connects the NT1 device or power supply unit to the wall jack.

RJ-45 cable

A high-speed 8-wire cable that looks similar to the RJ-11 (standard telephone cable) but has larger connectors. In an ISDN connection, it connects the NT1 device to the ISDN port on the workstation. If you have a companion power supply for the NT1 device, use a second, shorter RJ-45 cable to connect the NT1 device to the power supply unit.

root account

The standard IRIX login account reserved for use by the system administrator. This account's home directory is the root (/) directory of the filesystem; the user of the root account has full access to the entire filesystem (that is, can change and delete any file or directory). The user of this account is sometimes referred to as the *superuser.*

routing daemon

A continuously running program that determines the network route by which data will be transferred. *gated* and *routed* are the two standard routing daemons available on your system.

Serial Line Internet Protocol (SLIP)

Standard system software that lets you connect to a network using a serial cable and a modem rather than an Ethernet cable. Once you're connected, you can use the network as if you were connected by an Ethernet cable.

SLIP

See Serial Line Internet Protocol.

Service Profile Identifier (SPID)

A number that typically consists of 11 to13 digits. For each ISDN telephone number, the telephone company assigns a corresponding SPID number. You need to know your two SPID numbers for these switch software types: 5ESS National ISDN 1; DMS100 BCS level 31, 32, 33, or 34 (Protocol Version 1); DMS BCS level 35 or higher (Protocol Version 2).

SPID

See Service Profile Identifier.

S/T interface

The 8-wire high-speed port used to transfer data using ISDN. The NT1 device's S/T interface port is usually labeled S/T; the S/T interface port on the workstation (the ISDN port) is labeled with a telephone icon. These ports accept an RJ-45 cable.

subsystem

A portion of a software product. Each product consists of several subsystems; some are requred and some are optional.

superuser

An alternate name for the user of the *root* login account. *See also system administrator.*

switch hardware

The large computer located in the telephone company's central switching office through which telephone calls are routed. In the United States, the two types of switch hardware are 5ESS and DMS100. *See also switch software.*

switch software

The type of software that runs on the switch hardware. In the United States, switch software types include 5ESS Custom, 5ESS NI1, DMS100 BCS level 31, 32, 33, or 34 (Protocol Version 1), and DMS100 BCS level 35 or higher (Protocol Version 2); the last type is also sometimes called DMS NI1. In Germany, switch software types include 1TR6 or NET3 (also known as Euro-ISDN or DSS-1). The rest of Europe has NET3 switch software, and Japan has NTT.

System Toolchest

The toolchest in the upper-left portion of the screen from which you can access all system administration tools.

TA

See Terminal Adapter

TCP/IP

The standard networking software that's included in the system software.

Terminal Adapter (TA)

Technically, a device that allows terminals to access ISDN through serial lines. It has become a generic term for ISDN end-user equipment. For example, the telephone company may refer to the workstation as a TA.

U interface

The standard, 2- or 4- wire wall jack port for a telephone. It accepts an RJ-11 cable.

UUCP

Standard system software that lets you connect to a network using a serial cable and a modem rather than an Ethernet cable. Once you're connected, you can log into a single system through one window; your system essentially behaves like a dumb terminal.

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