NetWare® Driver

for

Digi's DataFire™ and PCIMAC™

Adapters

Installation and Configuration Guide

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Table of Contents

About this Manual

In this chapter

This chapter describes the purpose and intent of this manual. It discusses the following topics:

Audience

The audience for this manual is a system administrator familiar with NetWare® applications that will use the adapter, who has knowledge about using a Windows® connection to configure the driver, and who understands the requirements of the server in which the adapter will be installed.

Scope

This manual describes how to install the driver on the server and use the Windows-based configuration utility to setup calling profiles (Networks). It also provides information about the choices available with the driver and gives some general tips for ensuring proper connections.

Conventions Used In This Manual

Certain conventions are used in this manual with respect to keyboard entry and typefaces:

Keyboard entry

- Keystrokes are enclosed in angle brackets (for example, **<Enter>**, **<Esc>**, and so on.) Keys which are pressed while holding down another key are shown enclosed together in angle brackets. For example, **<Ctrl-A>** means hold down the **<Ctrl>** key while pressing the **<A>** key. Similarly, **<Alt-A>** means hold down the **<Alt>** key while pressing the **<A>** key.
- "Arrow keys" refers to the up, down, right and left arrow keys.

Typefaces

- Examples of output to your computer screen are shown in mono-spaced characters.
- Commands and data that you are to enter via your keyboard are shown in **bold** mono-spaced characters.
- Variable information is shown in italics. For example, if you are asked to provide *file_name*, you would provide the actual name of the file to be acted upon.

Related Documents

You may find the following documents useful as you install and use the DOS Client driver for Digi's ISDN adapter:

- Hardware manual for the adapter
- Documentation that came with your application

chapter **1**

Introduction

In this chapter

This chapter introduces Digi's NetWare Systems ISDN Device Driver for the DataFire and PC IMAC adapters. It discusses the following topics:

About the NetWare Driver

Feature Overview

The Digi International ISDN driver for NetWare provides the following:

- Support for NetWare versions 3.XX and 4.XX
- Easy integration into Novell NetWare systems
- Supports Digi's DataFire product (models DataFire U S1, DataFire S/T S1, DataFire/4 S/T S1), and PC-IMAC product (models PC-IMAC and PC IMAC/4)
- Supports up to 5 of these adapters (in any combination) in one server

These features provide a cost-effective means to utilize ISDN technology.

System Requirements

To install the driver on your server, you must have the following:

- Supervisor/administrator access to the server.
- A workstation running Windows 3.1, Windows for Workgroups, Windows 95, or Windows NT from which the server may be accessed.
- For PC IMAC or PC IMAC/4 adapters only—a free 16K window of memory on the server, at one of the following addresses: 0A0000H, 0A4000H, 0A8000H, 0AC000, 0C0000H, 0C4000H, 0C8000H, 0CC000H, 0D0000H, 0D4000H, 0D8000H, 0DC000H, 0E0000H, 0E4000H, 0E8000H, or 0EC000H.

chapter **2**

Before You Begin

In this chapter

This chapter examines what must be in place before you begin installing the driver on your server. It discusses the following topics:

Install the Adapter

Before you can install and configure Digi's NetWare driver on your server, you must first install all the adapters that you will be using with the driver. Follow the instructions in the hardware installation guide that came with the adapter(s).

Hardware installation notes

- For driver installation, your ISDN lines should be connected to the adapter(s)—or in the case of adapter models that are used with an NT1 purchased from a third-party vendor, a line to the NT1 from the adapter should be in place.
- During configuration of the driver, you must know the I/O Base address of each adapter you have installed. This address is set with DIP switches on the board. The DIP switch setting and the value you choose during configuration *must* match.
- *PC-IMAC adapters only*: During driver configuration you will need to specify a memory address for the adapter.

Contact Your Service Provider

As you are configuring your Digi product, you will need the following information that can be obtained from your ISDN service provider:

- Switch Type—This is actually the type of *software* used by the switch that is connecting your service.
- Number of Logical Terminals—This is the number of "endpoints" there will be on the line; the actual value is determined by the type of switch your provider is using and the type of service that you order.
- SPID (Service Profile Identifier) Numbers—Typically used only in North America, these numbers uniquely identify (for the switch) each terminal on a line. Some switches do not need a SPID. If you need a SPID, it will be supplied by your service provider. You must have a separate SPID for each Logical Terminal on a line.
- B Channel Phone Number(s)—These are referred to as the "Address"of the B Channel in most of the menus you will see. Whether you are assigned a separate phone number for each B Channel on your line depends on your service provider, but generally that is the case.

Note: Typically, it is only in North America that will you will need to use Logical Terminals and SPIDs. European service providers use only phone numbers.

Ensure Workstation Access

The configuration software for Digi's NetWare driver *must* be run in a Windows 3.1, Windows for Workgroups, Windows 95, or Windows NT environment. From the workstation you must be able to access the :SYS directory on the NetWare server.

You can also install the driver components from the workstation using a Digi batch file that copies the driver files to the correct locations on the server. When you use this method to install the driver components, you cannot choose to create a default configuration file that may save you some configuration steps.

When you install the driver components from the *server* console, you can choose to allow the SETUP program to scan the hardware you installed and use the information to create a default configuration file. The default configuration file is used by the ICONFIG program that you run at your workstation.

Read *Concepts and Usage* Chapter

The configuration of your driver requires that you make choices about how you want to setup the ISDN connection to your server. The choices you make will impact the performance and operation of your server. The following topics are discussed in the *Concepts and Usage* chapter starting on page 6-1 of this manual.

- About Digi's "Networks"
- Call Parameters
- Call Connection Management
- Link Statistics Monitoring

You should read and understand these concepts to enable you to choose wisely and efficiently during setup.

chapter **3**

Quickstart

In this chapter

This chapter provides a quick overview of the installation and configuration process, for experienced users. The information provided here is repeated in more detail in chapters 4 and 5. This chapter briefly discusses the following topics:

Starting Point

This chapter assumes that you have already:

- Installed the Digi adapter(s) in your server
- Contacted your ISDN Service Provider to obtain ISDN service
- Ensured access to the server from a workstation that can run Windows
- Taken time to understand Digi's configuration parameters and know how you want to set up your listening and/or calling Network(s)

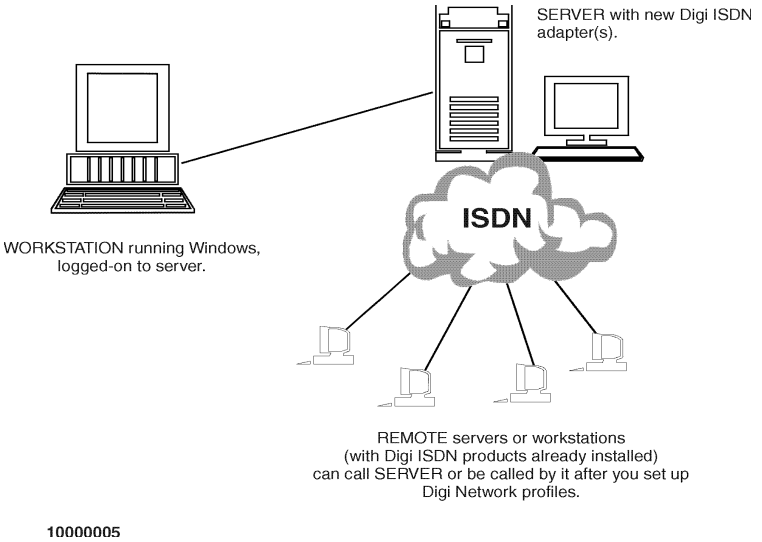

Figure 3-1. Overview of System

The figure above illustrates the components you will need to configure and use your Digi product:

- *Workstation:* Can be used to copy driver files to the server from the driver diskette, but *must* be used to configure the driver for the system. Files are copied using the CLINST.BAT file available on the driver diskette. Use the ICONFIG.EXE program to configure the driver.
- *Server:* The Digi ISDN adapters installed in the server can communicate with Digi products installed in remote systems using the Calling Profiles that you create during the Configuration process. You can create Listening and Calling profiles that will setup the adapters to receive calls from remote locations and intitiate calls to them.
- *Remote connections:* Other machines with Digi ISDN products that can call or be called by the server.

Step 1: Install Driver Components

To install at the server

To install the driver at the server, follow these general steps:

Note: You must have supervisor/administrator privileges to perform these steps.

a. Place Disk 1 into the server diskette drive.

b. At the server console type:

```
LOAD A:SETUP
```

c. To copy the driver files onto the server, type `Y` at the install prompt. When the program is ready for it, you will be prompted to insert Disk 2.

d. Once the files have been copied, you will see a prompt to create a default configuration file.

e. Type `Y` to allow the SETUP program to scan for installed DIGI adapters. and create a default configuration file. The default configuration can be modified during the configuration process. Default configuration:

Adapters: The I/O address and type of each adapter found during scan.

Network: Named NET00, supports IPX protocol using 802.3 frame type, assigned a Network Number of FEAD000, setup to listen for incoming calls.

Note: If you do not allow SETUP to define a basic configuration, all board parameters and network setup must be defined manually with the ICONFIG.EXE program.

f. When prompted to load the driver, type `Y`. This will load the file PCIMAC.NLM. This NLM *must* be loaded before running the configuration program.

g. If the driver loads successfully, you will see several start up messages, including a bind of IPX to NET00-0.

h. If you want PCIMAC.NLM to load automatically when your server is rebooted, you must edit the AUTOEXEC.NCF file to include a load statement like the following:

```
LOAD PCIMAC
```

You should place this statement at the end of the AUTOEXEC.NCF file. It *must* be placed *after* other LAN adapter LOAD commands in the AUTOEXEC.NCF file.

To install at a workstation

To install the driver from a remote workstation, follow these general steps:

Note: Before beginning, login (as supervisor/administrator) to the server, from the workstation and make sure that a local drive is mapped to the :SYS directory on the server.

a. Place Disk 1 into the workstation diskette drive.

b. Run the client install batch file (clinst.bat), located on the driver diskette, by typing a command with the following format at the DOS prompt:

CLINST *source drive*: *destination drive*:

The *destination drive* should be mapped to the server SYS: directory. The install process will automatically place the driver file (PCIMAC.NLM) in the SYS:\SYSTEM subdirectory and then create a subdirectory (SYS:\SYSTEM\PCIMAC) and move all other necessary files to it.

c. Using *rconsole*, load PCIMAC.NLM on the server. This NLM *must* be loaded before running the configuration program.

d. If the driver loads successfully, you will see several start up messages.

e. If you want PCIMAC.NLM to load automatically when your server is rebooted, you must edit the AUTOEXEC.NCF file to include a load statement like the following:

```
LOAD PCIMAC
```

f. You should place this statement at the end of the AUTOEXEC.NCF file; you *must* place it after other LAN adapter LOAD commands in the AUTOEXEC.NCF file.

Step 2: Start the Configuration Program

These steps are performed at a workstation attached to the server

Follow these general steps to start the configuration program:

a. The configuration program, *iconfig.exe*, is designed to be run under the Windows operating system. However, before you bring up Windows on the remote station you must login to the server as supervisor/administrator.

b. Start Windows.

c. Launch the ICONFIG.EXE program by double-clicking the file name in the Program Manager, or create an icon for the file.

ICONFIG will be located on the network drive in the SYSTEM\PCIMAC subdirectory.

Step 3: Configure the Board and Line

These steps are performed at a workstation attached to the server

Follow these general steps to configure the driver for the board(s) installed in the server and the line(s) installed in the board(s):

a. In the main ICONFIG window, the **NetWare Server** box will display LOCAL. From the drop-down list, select the server that contains the Digi boards that you will configure.

Once you select a server, a list of the Digi boards installed in the server will appear in the **Installed Boards** box. The I/O address, memory address, and IRQ setting for each board is displayed.

Note: The SETUP program scans for boards that are installed in the server. If you installed the driver components from a workstation or did not choose to create a default configuration file when SETUP prompted, there will be no boards displayed in the **Installed Boards** box. Skip to **step c**.

b. Check that the board parameters are set to the correct values. To change the parameters of a board listed in the **Installed Boards** box, highlight its name, and press the **Configure...** button to get to the **Configure Board** window.

c. If the board that you want to configure does not appear in the box, you must use the **Add Board...** button to configure the board from the **Add Board** window.

d. In the **Configure Board** (or **Add Board**) window select the correct parameters for the board.

If you are configuring a PCIMAC, you must select a valid memory address, and the IRQ must be set to NONE.

e. The **Installed Lines** box of the **Configure Board** (or **Add Board**) window will list one line. To configure this line, highlight it and press the **Configure** button at the bottom of the window.

In the **Configure Line** window you must choose a switch type and provide a SPID and line address (phone number) for each logical terminal (or endpoint) you will use.

Click **OK** when your selections are completed.

f. If your Digi ISDN adapter supports more than one line, press the **Add** button at the bottom of the **Configure Board** window. You will see a new line in the **Installed Lin**e box.

Note: Do not attempt to install lines that do not exist! Doing this will cause your server to hang.

Highlight the new line and press the **Configure** button as you did in **step d**. Repeat until all lines are configured.

g. Repeat **steps b** to **e** for all Digi boards in your system.

Step 4: Check the Line Configuration

These steps are performed at a workstation attached to the server

Follow these general steps to verify the configuration of the board(s) installed in the server and the line(s) installed in the board(s):

a. From the menu bar of the main window of the ICONFIG program, click

on **Diagnostics** and then choose **Line Status...** from the pull-down menu.

The **Line Status** window will display.

b. Use the **Line** box to select a line to check. You should see the following reported if Layer 3 has been established:

- State = “Active” or “Established, Waiting Restart”
- Service = “Full” or “Full TM, Non-initializing” or “Non-initializing TM”
- Style = the switch type you selected when you configured the line
- Tei = a value between 64 and 127
- SPID = the number you entered when you configured the line

c. If you see a message like “Awaiting Layer 2” in the State field, you should check layers 1 and 2.

From the **Layer** box, choose Layer 1 -S/T. You should see the following:

- Tx_Info_Pattern = INFO 3
- RX_Info_Pattern = INFO 4
- Tx and Rx Frames = incrementing values

From the Layer box, choose Layer 2-Q.921. You should see the following:

- State = Tei Assigned
- Tei = a value between 64 and 127
- Lap_State = Multiframe Established

Step 5: Set up Network (Connection) Profiles

These steps are performed at a workstation attached to the server

Follow these general steps to verify the default Digi Listening Network setup, and setup a Calling Network:

Set up a Listening Network

If you chose to setup a default configuration during installation, a listening Network is already setup in your configuration file. The configuration for your default Network is:

- IPX address = FEAD0000
- Telecommuting Hub = Listening for calls
- Network name = NET00
- IPX Optimization = ON

You can change any of these defaults from the main menu of the ICONFIG program, or add a listening Network to your setup by doing the following:

a. From the main menu of the ICONFIG program, select a server from the **NetWare Server** drop-down box.

b. Highlight a Network in the **Networks:** box and press the **Configure** button, or press the **Add Network** button.

The **Configure Network** or **Add Network** window will display.

c. Check the parameters enabled for the Network. Be sure that the Network is set up to operate in your environment. In particular, check the following:

- The Network Address displayed in the **Assigned Frame Types:** box matches the address assigned to a Calling Network.
- If you want the Network to answer only one specific Calling Network, the name of that Calling Network must be typed into the Remote box. The * in the Remote box will allow the server to answer any Calling Network.

Set up an IPX Link-Optimized Calling Network

The following instructions help you create a Calling Network profile that will call a remote site (with a Digi ISDN adapter already installed and setup to Listen).

Note: To use IPX Link Optimization, both sides of the connection must use IPX, both must be setup with the same Link Optimization parameters, and both must employ the same Frame Type.

a. From the main menu of the ICONFIG program, select a server from the **NetWare Server** drop-down box.

b. Click on the **Add Network** button.

The **Add Network** window will display.

c. Select **Virtual LAN Extension** from the **Network Type** drop-down box.

This sets up Network parameters for a Calling Network that uses Link Optimization.

d. Click on the **Add Channel** button in the **Add Network** window. (When creating a Calling Network, you must specify a phone number to be called.)

e. From the **Add Channel** window, make the following choices:

Address: Type the phone number to be called. Use only numbers between 0 and 9, with no spaces, commas, or dashes, etc. in between.

Line: From the drop-down menu, select a line to use to call out. **Do not** choose **Any**—it is not a valid option in this release.

Service Type: Select **Digital 64**, **Digital 56**, or **Voice 56** (your choice depends on your line characteristics).

Logical Terminal: Select **Any**, **1'st**, or **2'nd** (you should select Any to allow the most versatility).

B Channel: Select **Any**, **B1**, or **B2** (you should select Any to allow the most versatility).

Note: If you have a Northern Telecom switch, you *must* choose a logical terminal and a B channel, **Any** will not work.

f. Press the **OK** button to accept the Channel configuration.

The **Add Network** window will again display. In the **Assigned Channel** box, you should see a line that describes the channel you just configured.

g. Press the **OK** button to accept the new Network.

The Network will immediately attempt to call the remote site. If there is no answer after the **Call Attempts Limit** has been reached (default value is 20), the Calling Network will revert to a Listening state.

h. Repeat **steps d** and **e** until all the calling destinations for this Network profile are configured.

Notes on Network (Connection) Profiles

To optimize your connection to fit your needs, you can setup profiles that use Frame Activation, IPX Link Optimization, or use two channels for a call.

Note: Optimizing NetWare links using Frame Activation and/or IPX Link Optimization requires careful planning and monitoring to be sure unintended packets do not open the link and produce unexpected phone bills. Read more about Connection Management in the *Concepts and Usage* chapter starting on page 6-1.

Using Frame Activation

For any of the available protocols,IPX, TCP/IP, or Appletalk, you can save connect charges by choosing the *Frame Activated* option in the **Add Network** (or **Configure Network**) window. Setting this option causes the link to activate only when a frame is to be transferred.

Using IPX Link Optimization

If both sides of your link are setup for IPX, using Digi's IPX Link Optimization can save connection costs by preventing certain non-vital frames from activating the link.

Two-channel Calls

If your ISDN line has two B channels and you want to use both channels during a call, the following instructions will work in most situations:

a. Bring up the **Add Channel** window.

b. Select a line from the **Line:** pull-down box.

c. Type the first phone number of the **remote site** in the **Address** field.

d. Select **1'st** under **Logical Terminal** and **B1** under **B Channel**.

e. Press **OK**. You will see the channel you just added displayed under **Assigned Channels** in the **Add Network** (or **Configure Network**) window.

f. Repeat steps **a** to **e**, using the second phone number, and selecting **2'nd** for **Logical Terminal** and **B2** under **B Channel.**

g. Press **OK**. The **Add Network** (or **Configure Network**) window will display. You will see something like the following displayed under **Assigned Channels.**

What Next

- You can use the Connect, Hangup, Listen, and Reset buttons in the ICONFIG main window on a Network highlighted in the Installed Networks box.
- You may wish to check the status of your setups using the Network Status window. It is a good idea to check the connections so that you understand the type of ISDN access charges you will be incurring and take steps to reduce connection time if appropriate.

chapter **4**

Installation

In this chapter

This chapter provides step-by-step instructions to help you install the DIGI-ISDN driver on your NetWare server. It discusses the following topics:

Starting Point

This chapter assumes that you have already read the *Before you Begin* chapter that starts on page 2-1.

Install Driver Components

There are several files that must be copied to specific directories on your server. Choose one of these two ways to install the driver components:

From the server in which the hardware is installed—using this process you can let the SETUP program scan your hardware setup and create a default configuration file for use by the Digi configuration program. Setup time is reduced, but you must switch to a workstation running Windows when it is time to configure the driver.

From a workstation attached to the server—using this process, you can complete installation and configuration from the workstation, but you must add hardware setup and Network information manually.

To install at the NetWare server

To install the driver from the server that has the Digi ISDN adapters installed in it, follow these steps:

1. Place Disk 1 into the server diskette drive.
2. At the server console type:

   ```
   LOAD A:SETUP
   ```

3. The following prompt will display:

   ```
   Install/Update DIGIISDN for NetWare product files? [y/n]
   ```

4. Type `Y` to copy the driver files onto the server. When the program is ready for it, you will be prompted to insert Disk 2.
5. Once the files have been copied, you will see a prompt like this:

   ```
   Create default configuration.
   If PCIMAC.NLM is loaded, it will be unloaded. ? [y/n]:
   ```

6. Type `N` if you are performing a driver update only and wish to preserve the setup that exists in your driver configuration file (PCIMAC.CFG).

   Type `Y` to allow the SETUP program to create a new configuration in the driver configuration file (PCIMAC.CFG). To do this the SETUP program will:

   - Scan for the adapter type and I/O address of each installed Digi adapter.
   - Place adapter information from the scan and the following Digi Network values in the file:
     Network Name: NET00; supports IPX protocol using 802.3 frame type; assigned a Network Number of FEAD000; listens for calls from clients or other servers.

   This basic configuration can be modified with the ICONFIG program.

   Note: If the PCIMAC.CFG file does not already exist and you type `N`

at the prompt, an empty configuration file is created and all board parameters and Network setups must be defined manually with the ICONFIG.EXE program.

7. Next you will see the following prompt:

```
Start PCIMAC.NLM driver now? [y/n]
```

8. Type `Y to` load the DIGIISDN driver file (PCIMAC.NLM). This NLM *must* be loaded before running the configuration program.

If the driver loads successfully, you will see several start up messages, including a bind of IPX to NET00-0 (if you have a default configuration).

If you type `N`, you must manually load the driver before running the ICONFIG program.

9. If you want PCIMAC.NLM to load automatically when your server is rebooted, you must edit the AUTOEXEC.NCF file to include a load statement like the following:

```
LOAD PCIMAC
```

You should place this statement after other LAN adapter LOAD commands in the AUTOEXEC.NCF file.

What Next

Once all the driver components are installed on the server, you can setup your system to automatically make calls to or listen for calls from clients or servers. Details on configuring the driver are found in chapter 5.

To install from a workstation

Before performing the installation steps provided in this section, you must:

- Log on to the server as supervisor/administrator.
- Ensure access to the SYS: directory on the server (from the workstation) by mapping it to a local drive.

To install the driver do the following:

1. Place Disk 1 into the workstation diskette drive.

2. Run the install batch file (named *clinst.bat*) from the installation diskette by typing a command with the following format:

CLINST SOURCE PATH: DESTINATION PATH:

Example:

```
CLINST A: F:
```

The destination path must be mapped to the :SYS directory on the server.

The install process will automatically do the following:

- Place the driver file (PCIMAC.NLM) in the SYS:\SYSTEM subdirectory on the server.
- Create a subdirectory (SYS:\SYSTEM\PCIMAC) and move the supporting files into it.

3. Using *rconsole*, load the driver (PCIMAC.NLM).

Note: The driver must be loaded before you can run the configuration program.

If the driver loads successfully, you will see several start-up messages occur.

4. If you want the driver to load automatically when your server is rebooted, you must edit the AUTOEXEC.NCF file to include a load statement like the following:

```
LOAD PCIMAC
```

Note: You must place this statement after other LAN adapter LOAD commands in the AUTOEXEC.NCF file.

What Next

Once all the driver components are installed on the server, you can setup your system to automatically make calls or listen for calls from clients or servers. Details on configuring the driver are found in chapter 5.

chapter 5

Configuration

In this chapter

This chapter provides a step-by-step configuration instructions. It discusses the following topics:

Starting Point

This chapter assumes that you have successfully:

- Installed the driver components
- Loaded the driver on the server
- Read and understood the *Concepts and Usage* chapter and planned the Network setups you will configure

Start the Configuration Program

Follow these steps to start the configuration program on a workstation attached to your NetWare server:

1. Log on to the NetWare server as supervisor/administrator.
2. Start Windows.

   The configuration program, ICONFIG.EXE, is designed to be run under the Windows operating system.
3. Launch the ICONFIG.EXE program.

   Do this by one of the following means:

   - Create an icon for the program
   - Double-click on the ICONFIG.EXE file name in File Manager
   - Select Run from the File drop-down menu in File Manger, then type the path and file name in the box

   ICONFIG will be located on the network drive in the SYSTEM\PCI-MAC subdirectory.
4. You will see the ICONFIG main window display. A representation of the main window is shown below:

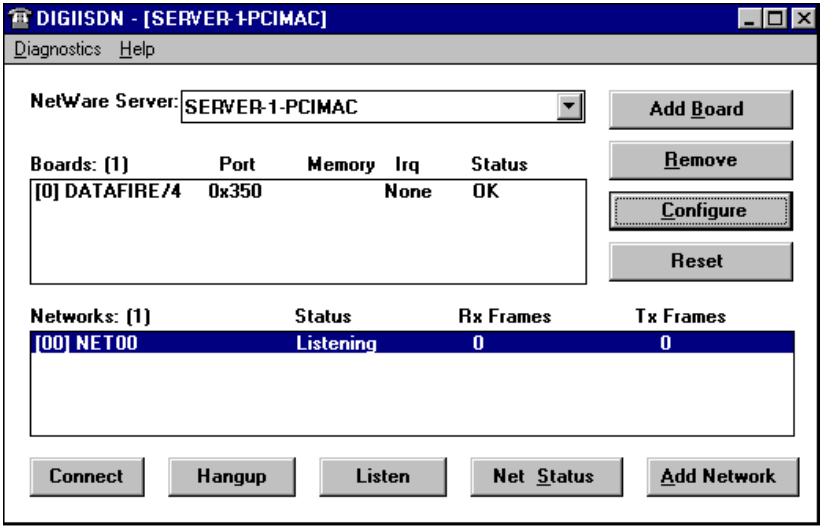

Figure 5-1. ICONFIG Main Window

The drop-down list in the **NetWare Server** box of the main window will at first display **LOCAL**. All servers that have the DIGIISDN driver loaded will be available in the drop-down list.

Configure the Board and Line

Follow these steps to configure the driver for the board(s) installed in the server and the line(s) installed in the board(s):

1. **Select a server.** From the drop-down list in the **NetWare Server** box of the main window, select the server with the Digi boards you installed.
   - If you installed from the server, *and* you chose to create a default configuration, a list of the Digi boards installed in the server will appear in the **Boards** box and a default Network configuration will appear in the **Networks** box.
   - If you installed from a workstation, or did not choose to create a default configuration when installing at the server, both the **Installed Boards** box and the **Networks** box will be blank
2. **Configure board parameters.** Use either the **Add Board** button or **Configure** button to get to a window with board configuration parameters. (The window you see when you press either button is the same, but the **Configure Board** window has current parameters displayed, while in the **Add Board** window board parameters are blank.):
   - If board parameters are displayed in the **Boards** box of the main ICONFIG window, check that **Status is OK**.

     Note: If **INT** is displayed instead of **OK**, the board has not initialized. The probable cause is an I/O conflict. You should change the I/O address on your Digi board. If you have a PCIMAC product, you could also try a different memory address.

     To change the parameters of a board listed in the **Installed Boards** box, highlight it's name, and press the **Configure** button to get to the **Configure Board** window.
   - If the board that you want to configure does not appear in the box, you must use the **Add Board** button, then configure the board from the **Add Board** window.

   In the **Configure Board** (or **Add Board**) window select the correct parameters for the board. See Figure 5-2.

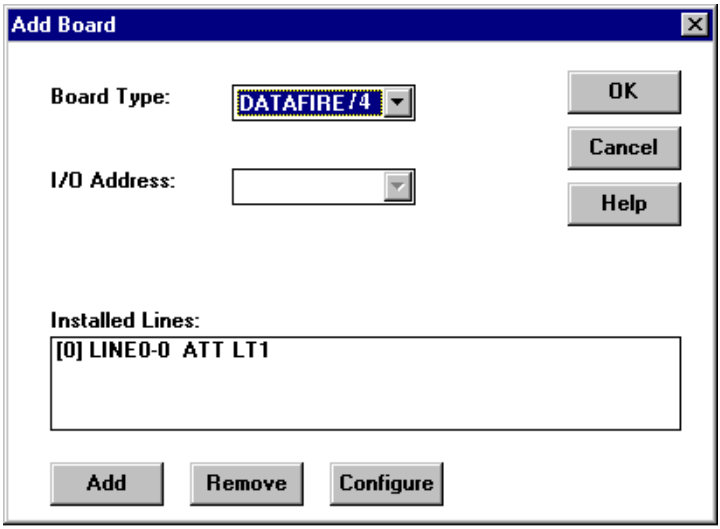

Figure 5-2. Add Board Window for DATAFIRE/4 product

When you add a board, you must select the type of board you are adding from the **Board Type** drop-down list. The options for PCIMAC adapters and DATAFIRE adapters are slightly different.

Note: If you are configuring a PCIMAC, you *must* select a valid memory address, and the IRQ *must* be set to NONE.

3. **Configure line parameters.** The **Installed Lines** box of the **Configure Board** (or **Add Board**) window will list one line, as shown in Figure 5-2. To configure this line, highlight it and press the **Configure** button at the bottom of the window. The **Configure Line** window will display.

   In the **Configure Line** window you must choose a switch type and provide a SPID and line address (phone number) for each logical terminal (or endpoint) you will use. This is shown in Figure 5-3.

   Supported Switch Types

ATT	AT&T 5ESS and Custom
ATT/TM	AT&T 5ESS with Terminal Management
Austel	Australia compatible switch
Definity	AT&T Definity PBX
Definity/TM	AT&T Definity PBX with Terminal Management
Generic	Generic CCITT/ANSI switch type
INS64	INS64 (Japan)
NET3	Euro ISDN
NI1	Any National ISDN-1 compatible switch
NTI	Northern Telecom DMS-100, Functional
Singapore	Singapore compatible switch
VN3	VN3 (France)
ITR6	ITR6 (Germany)
Auto	Auto-detect, select only if switch type is unknown

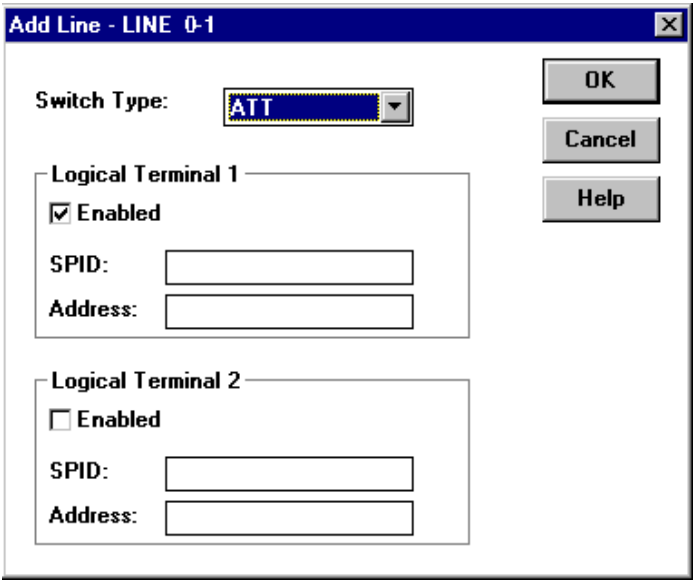

Figure 5-3. Add Line Window

Note: Listed switch vendors may use the National ISDN-1 software, *or* proprietary software. It is important to ask your Service Provider what type of software is used by the switch. If National ISDN-1 is used, you should select NI1 for a switch type even if the hardware model name is listed.

You should enable both Logical Terminals if you received two phone numbers and SPIDs from your Service Provider. If you are only using one phone number, you should enable only one Logical Terminal.

Note: The phone number you enter in the **Address** field must contain only digits between 0 and 9, with no commas, spaces or dashes in between digits.

Click OK when your selections are completed.

4. **Add more lines if they are supported by your adapter.** If your Digi ISDN adapter supports more than one line, press the **Add** button at the bottom of the **Configure Board** window (see Figure 5-2). You will see a new line in the **Installed Lines** box.

   Note: You will HANG your machine if you try to install lines on a PCIMAC / 4 if the IDP modules (that provide the additional lines) are not installed.

   Highlight the new line and press the **Configure** button as you did in step 3. Repeat until all lines are configured.

5. **Repeat steps 2 to 4 for all Digi boards in your system**.

Check the Line Configuration

Before continuing, you should verify the configuration of the board(s) installed in the server and the line(s) installed in the board(s):

1. **Start the Diagnostics**. From the menu bar of the main window of the ICONFIG program, click on **Diagnostics** and then choose **Line Status...** from the pull-down menu.

   The **Line Status** window will display:

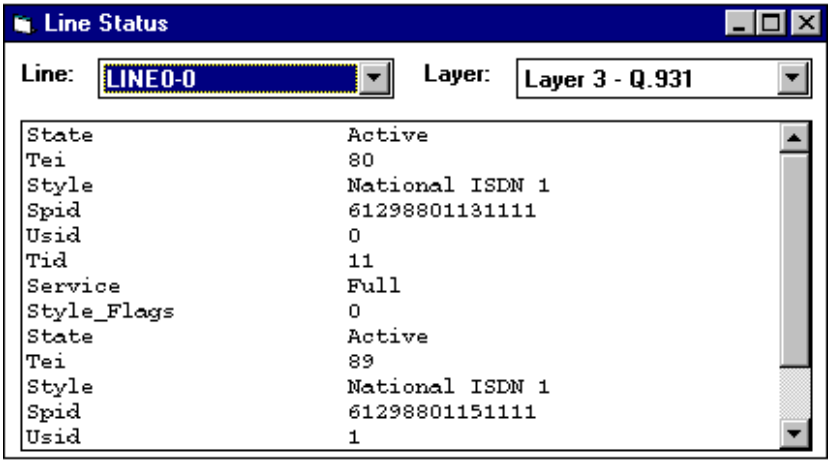

Figure 5-4. Line Status Window

2. **Select a line and check layer 3.** Use the **Line** box to select a line to check from the drop-down list. You should see the following reported if Layer 3 has been established:
   - State = “Active” or “Established, Waiting Restart”
   - Service = “Full” or “Full TM, Non-initializing” or “Non-initializing TM”
   - Style = the switch type you selected when you configured the line
   - Tei = a value between 64 and 127
   - SPID = the number you entered when you configured the line

   Note: If you have configured the line for two Logical Terminals, you will see separate status for each terminal. Figure 5-4 shows a line configured for two terminals.

   If layer 3 is not properly established, you will not be able to place or receive ISDN calls successfully.

3. **If layer 3 is not established, check lower layers.** If you see a message

like “Awaiting Layer 2” in the State field, you should check layers 1 and 2.

From the **Layer** box, choose **Layer 1 -S/T**. You should see the following:

- Tx_Info_Pattern = “INFO 3”
- RX_Info_Pattern = INFO 4
- Tx and Rx Frames = incrementing values

From the Layer box, choose **Layer 2-Q.921**. You should see the following:

- State = Tei Assigned
- Tei = a value between 64 and 127
- Lap_State = Multiframe Established

If your line status indicates problems, please refer to the *Troubleshooting* chapter on page 7-1 for more information about what to do.

Set up Network (Connection) Profiles

The next step is to setup the parameters that control remote connections to and from your server. To do this, you will need to know how you want the Digi adapters in your system to connect to remote sites, and then setup one or more Digi Network profiles to control the connections.

Networks can:

- Listen for and respond to calls from remote locations.
- Optimize an IPX link, using Digi's IPX Link Optimization feature so as to keep down the cost of ISDN calls.
- Automatically call out, establish, and keep a connection to a remote location.

Digi offers three pre-defined Network setups for you to easily setup your server to perform any one of the functions listed above. This section describes how to setup the first two functions: a Listening Network and a Link Optimized Calling Network.

See chapter 6 for details about use of Digi's Network profiles.

Setup a Listening Network

If you installed the DIGIISDN driver at the server and chose to create a default configuration, the default Network configuration, which is a Listening Network, will already be setup on your system. The configuration for a default Network is:

- IPX address = FEAD0000
- Telecommuting Hub = Listening for calls
- Network name = NET00
- IPX Optimization = ON

You can change any of these defaults or add a Listening Network:

1. **Configure Network.** Use either the **Add Network** or **Configure Network** window to set the parameters used by the Listening Network.
   - If already there, highlight a Network in the **Networks:** box of the main ICONFIG window. Click the **Configure** button.
   - If you wish to add a Listening Network, press the **Add Network** button.

   The **Configure Network** or **Add Network** window will display. (The window you see when you press either button is the same, but the **Configure Network** window has current parameters displayed, while the **Add Board** window displays default parameters.)

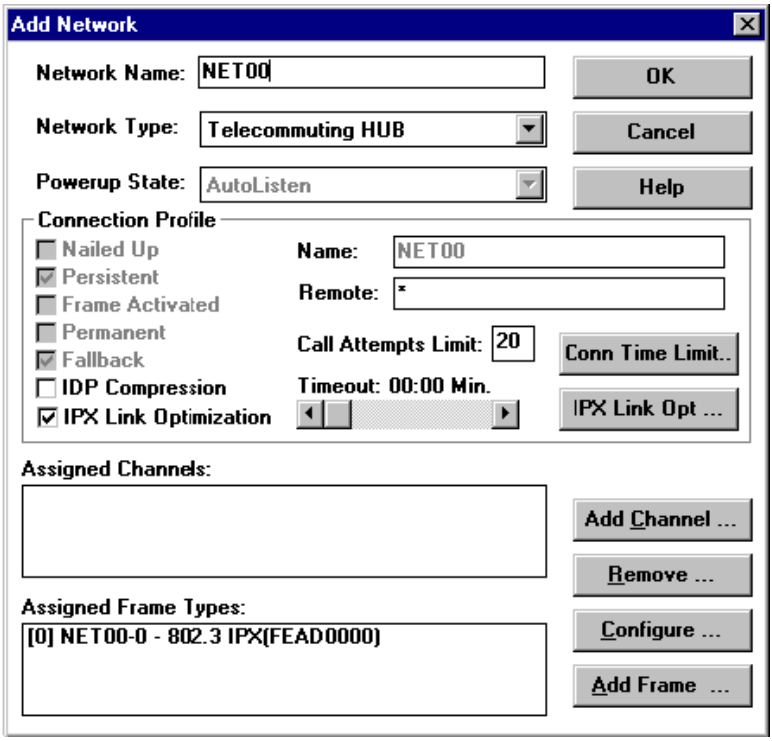

Figure 5-5. Adding a Listening Network

2. **Check the parameters enabled for the Network.** Be sure that the Network is setup to operate in your environment. In particular, check the following:

   - The **Assigned Frame Types** window displays the protocol that will be used over the link.

   Note: If using IPX protocol, the Network Address (in Figure 5-6 it is FEAD0000) displayed in the **Assigned Frame Types:** box must match the address assigned to a Calling Network.

   - If you want the Network to answer only one specific Calling Network, the name of that Calling Network must be typed into the Remote box. The * in the Remote box will allow the server to answer any Calling Network.

3. Once all parameters are set, press the **OK** button to return to the main window.

Setup an IPX Link-optimized Calling Network

The following instructions help you create a Calling Network profile that will use IPX Link Optimization during calls to a remote site (with a Digi ISDN adapter already installed and setup to Listen).

Note: To use Digi's IPX Link Optimization feature, both sides must be using IPX, both sides must be setup with the same Link Optimization parameters, and both must be using the same Frame Type. See page 6-16 for more information about IPX Link Optimization.

1. **Add a new Network**. Click on the **Add Network** button.

   The **Add Network** window will display.

2. **Choose a Calling Network Type.** Select **Virtual LAN Extension** from the **Network Type** drop-down box.

Note: This sets up Network parameters for a Calling Network that uses IPX Link Optimization with Frame Activation.

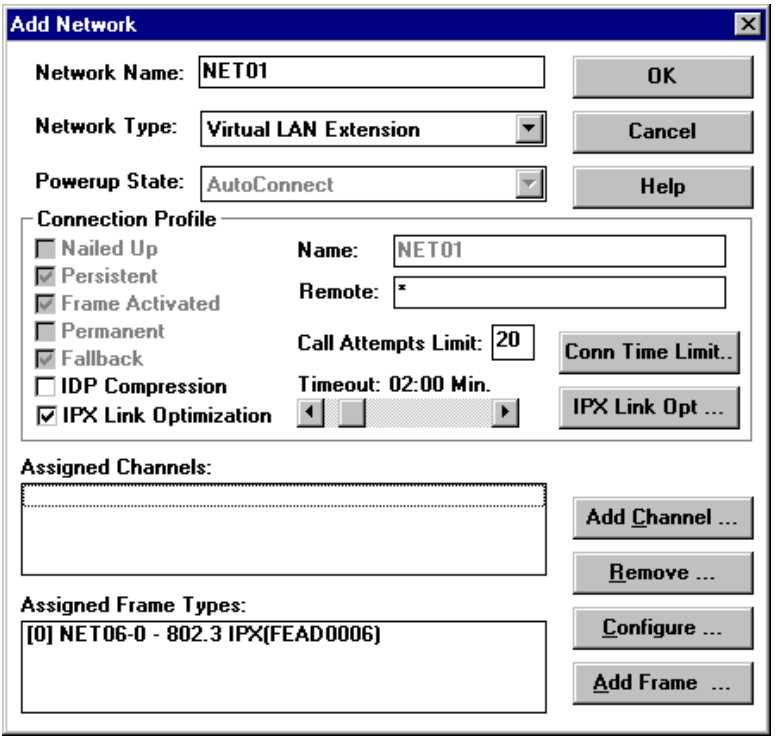

Figure 5-6. Adding a Calling Network

3. **Assign Channels.** When creating a Calling Network, you must specify a phone number (or numbers) to be called by the Network.

   Click on the **Add Channel** button in the **Add Network** window to get to the **Add Channel** window. From this window, make the following choices:

   Address: Type the phone number to be called.

   Line: From the drop-down menu, select a line to use to call out. (Do not select **Any**, it is not supported in this version of the driver.)

   Service Type: Select **Digital 64**, **Digital 56**, or **Voice 56** (your choice depends on your line characteristics).

   Logical Terminal: Select **Any**, **1'st**, or **2'nd** (you should select Any to allow the most versatility).

   B Channel: Select **Any**, **B1**, or **B2** (you should select Any to allow the most versatility).

   Note: If you have a Northern Telecom switch, you *must* choose a logical terminal and a B channel, **Any** will not work.

4. **Return to Add Network window**. Press the OK button to accept the Channel configuration.

   Note: If you want to use both B Channels for one call, see the instructions on page 5-12.

   The **Add Network** window will again display. In the **Assigned Channel** box, you should see a line that describes the channel you just configured.

   Note: The Network will immediately attempt to call the remote site. If there is no answer after the **Call Attempts Limit** has been reached (default is 20), the Calling Network will revert to a **Listening** state.

5. Repeat steps **3** and **4** until all the calling destinations for this Network profile are configured.

6. Once all parameters are set, press the **OK** button to return to the main window.

Notes on Network Profiles

Two-channel Calls

Two-channel calls can speed your data transfers across the ISDN link. Use the **Add Channel** window to setup a Network to use two channels:

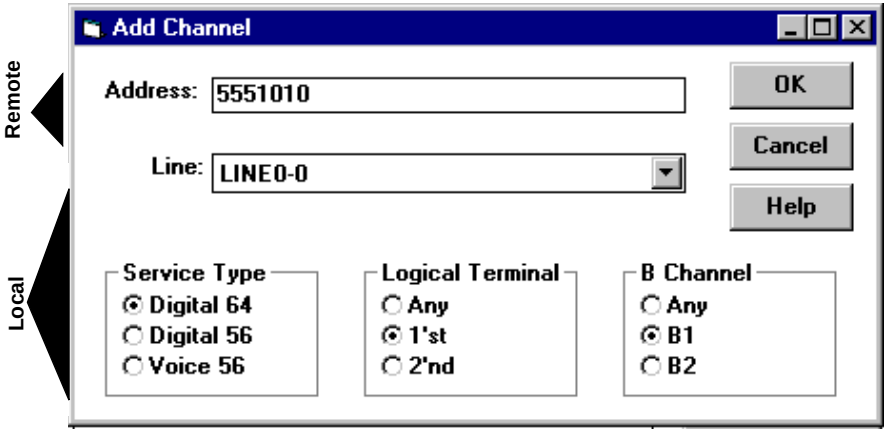

Figure 5-7. Using the Add Channel Window to set up a Two-channel call

To find this window: Press the **Add Channel** button in the **Add Network** or **Configure Network** window.

Figure 5-7 shows Two-channel call setup depends on properly configuring both local and remote lines:

- *If both local and remote services have 2 phone numbers and/or SPIDs do the following:*
  - **a.** Bring up the Add Channel window.
  - **b.** Select a line from the **Line:** pull-down box.
  - **c.** Type the first phone number of the remote site in the **Address** field. Use only numbers between 0 and 9, with no commas, spaces, dashes, etc. in between digits.
  - **d.** Select **1'st** under **Logical Terminal** and **B1** under **B Channel**.
  - **e.** Press **OK**. You will see the channel you just added displayed under **Assigned Channels** in the **Add Network** (or **Configure Network**) window.
  - **f.** Repeat steps **a** to **e**, using the second phone number, and selecting **2'nd** for **Logical Terminal** and **B2** under **B Channel**
  - **g.** Press **OK**. The **Add Network** (or **Configure Network**) window will display. You will see something like the following displayed under **Assigned Channels**:

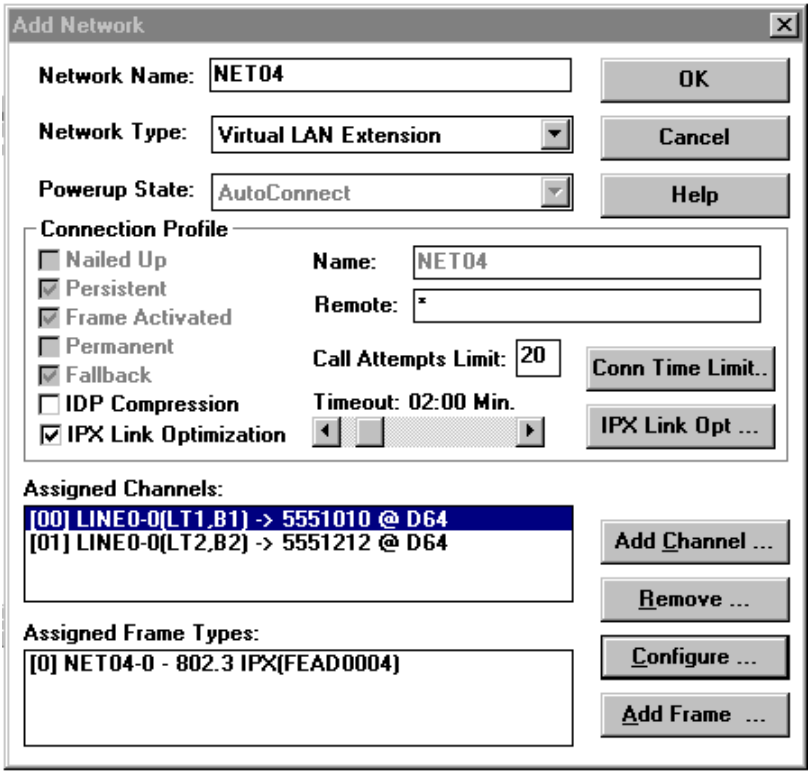

Figure 5-8. Assigned Channels for a Two-channel call

- *If the local service provides two phone numbers, but the remote service has only one phone number, do the following:*

  Follow steps **a** through **g** above, but instead of using a second phone number in step **f**, repeat the same phone number. **Assigned Channels** field will look similar to:

  (00) LINE0-0(LT1, B1)->5551010@D64
  (01) LINE0-0(LT2, B2)->5551010@D64

- *If local service provides one phone number, and the remote service provides two, do the following:*

  Follow steps **a** through **g** above, but in step **f**, select **1'st** again for **Logical Terminal**, still selecting **B2** under **B channel**. The **Assigned Channels** field will look similar to:

  (00) LINE0-0(LT1, B1)->5551010@D64
  (01) LINE0-0(LT1, B2)->5551212@D64

Using Frame Activation

With any of the available protocols, IPX, TCP/IP or Appletalk, you can save connect charges by choosing the *Frame Activated* option in the **Add Network** (or **Configure Network**) window. Setting this option causes the link to disconnect after a period of inactivity and then re-activate when a frame is to be transferred. Used in conjunction with a reasonable timeout value (selected using the sliding **Timeout** selector in the same window), you can control the length of time each connection will remain up after a frame has been transferred. For more information see page 6-13.

What Next

- You can use the **Connect**, **Hangup**, **Listen**, and **Reset** buttons in the ICONFIG main window. These buttons intiate action on a Network highlighted in the **Installed Networks** box.
- You may wish to check the status of your setups using the **Network Status** window described in the *Concepts and Usage* chapter on page 6-21. It is a good idea to check the connections so that you understand the type of ISDN access charges you will be incurring and take steps to reduce connection time if appropriate.

chapter **6**

Concepts and Usage

In this chapter

This chapter introduces concepts important to proper usage of your Digi product. Read this chapter to understand how the features of Digi's driver can help you reduce ISDN service costs. This chapter discusses the following topics:

About Digi's "Networks"

Definition of the term

The term "Networks" is used by Digi to describe a set of ISDN call parameters that are stored in the driver configuration file and which are used to control the characteristics of calls placed between Digi products.

Typically you will set up one or more *Calling Networks* and *Listening Networks*. There are a lot of setup parameters to choose from, and many of them must match so that a Listening Network will respond properly to a Calling Network and both will "know" what to do if you select any of the Call Management features described on page 6-12.

To make it easier to quickly configure a "Network" for use, Digi has created three pre-defined types of Networks:

- Telecommuting Hub
- Dedicated Wan Link
- Virtual Lan Extension

If none of the pre-defined Networks suits your needs, you can choose the following Network option:

- Custom Network

Each of the pre-defined Networks and the call parameters that you can choose to make up a Custom Network are described in this chapter.

Types of Pre-defined ISDN Networks

Refer to Table 6-1 for a quick look at the call parameter defaults for each pre-defined Network type.

A Telecommuting Hub *is a Listening Network*

Use this type of Network if you want the Digi ISDN adapter in your server to listen for and answer incoming calls from clients or other servers with a Digi product installed, but initiate no calls.

This is the default Network type.

A Dedicated Wan Link *is a Calling Network*

Use this type of Network if you want the Digi ISDN adapter in your server to call, connect to, and stay connected to a Digi product (with an active Listening profile) used in a client or another server. This type of connection must be terminated manually.

A Virtual Lan Extension *is a Link-Optimized Calling Network*

Use this type of Network if you want the Digi ISDN adapter in your server to call, connect to, and then monitor the connection to a Digi product (with an

active Listening profile) used in a client or another server. This option uses Digi's Call Connect Management features to hang-up the line when no "real" traffic is apparent within a specified time, and to "spoof" expected acknowledgments so the hang-up is not detected. The connection is re-established when important traffic must pass.

Note: Incorrect configuration of IPX Link Optimization and/or use of incompatible frame types may result in excessive connection charges. Any use of the IPX Link Optimization feature should be closely monitored for correct operation. For more information about this and other features, see *Call Connection Management*, on page 6-12.

Creating a Custom Network

If you do not want to use one of Digi's pre-defined Networks to specify the call-control parameters for your connections, you can create Custom Networks that incorporate any combination of the parameters listed in Table 6-1. Refer to the definitions that follow for more information about how the call-control parameters work.

Call Parameters

Call parameters for the three pre-defined Network types are listed below. See the *Understanding the Call Parameters* section for detail about how these parameters work:

Table 6-1: Call Parameters

Call Parameter	Pre-defined Network Type		
	Telecommuting Hub	**Dedicated Wan Link**	**Virtual Lan Extension**
Powerup State	AutoListen	AutoConnect	AutoConnect
Network Name	NET00	NET00	NET00
Remote	Any	Any	Any
Nailed Up			
Persistent	X	X	X
Frame Activated			X
Permanent		X	
Fallback	X	X	X
Call Attempts	20	20	20
Timeout	00:00	00:00	02:00
IDP Compression			
IPX Link Optimization	X (no Header Compression)	X (no Header Compression)	X (no Header Compression)
Conn Time Limit	Statistics/Warn	Statistics/Warn	Statistics/Warn
Assigned Channel	None	None	None
Assigned Frame Type	IPX 802.3	IPX 802.3	IPX 802.3

Note: The gray shading in the table above indicates a parameter setting that cannot be changed in the pre-defined network. All other boxes indicate the default setting for the parameter (**X** means that it is enabled). Unshaded defaults can be changed using the **Configure Network** window (shown in Figure 6-1).

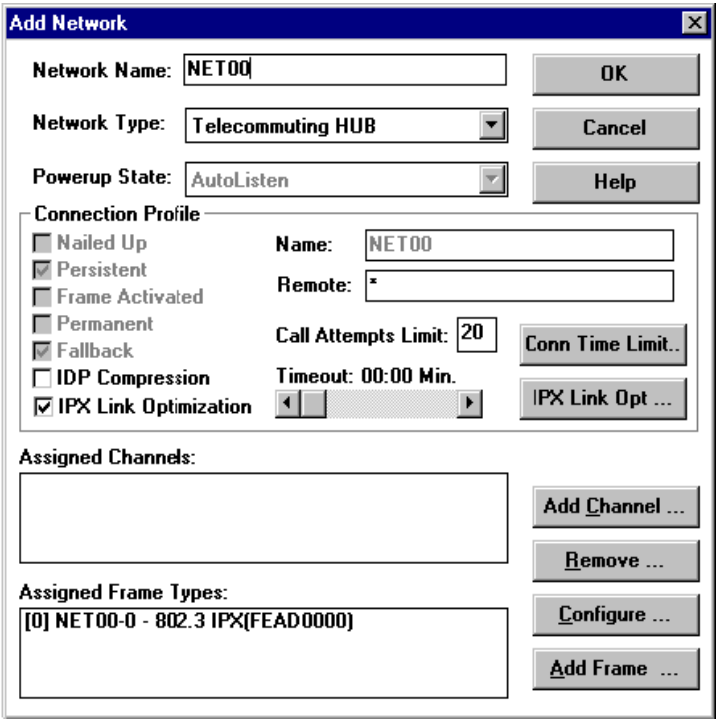

Figure 6-1. Add Network window

To find this window: In the main window, press the **Add Network** button or highlight a Network name and press the **Configure** button.

Understanding the Call Parameters

This section describes each of the parameters available to use when configuring a Network. Options that are important to Digi's Connection Management system are indicated using the symbol shown at left. See page 6-12 for details about Connection Management.

CM

Powerup States: AutoListen, AutoConnect, Passive

Powerup state defines what action the Digi ISDN adapter in your server should take on powerup or reset of the server:

AutoListen—Start listening immediately, answer ISDN calls and establish connection.

AutoConnect—Place ISDN calls immediately, typically to Digi ISDN products in other servers configured as AutoListen.

Passive—Do nothing automatically. A connection or listening state must be initiated using the *iconfig.exe* program.

Network Name

By default the first Network is named NET00, the second NET01, and so on. You can change this name to one that is meaningful to your setup. Each time a Network is added to a server's configuration, it receives a unique name.

Remote (Listening Networks only)

By default this field has an asterisk (*) in it. This "wild card" character means that the Digi ISDN adapter in your server can connect to remote Digi devices that have any *Network Name*.

Alternatively, you can type a specific *Network Name* in this box. The Digi ISDN adapter in your server can then only answer calls from a remote Digi product that has been configured with a matching *Network Name*.

Note: You can use the wildcard characters (*,?) in this field to replace a single character (?) or a range of characters (*), in the same way you would under DOS or UNIX.

Nailed Up

Use this parameter when you are using leased, point-to-point ISDN lines. In this case, no dialing procedures will be required by the Digi driver because the lines are assumed to be dedicated.

CM ***Persistent***

This parameter defines the behavior of a Digi Network when it is being disconnected after the Timeout value is reached. An AutoConnect Network with the Persistent parameter enabled will go into Frame-activation mode after a time-out (if enabled). An AutoListen Network goes back to "listening" when the calling side disconnects from it after it times out.

If you disable this parameter, your Network will go into Idle mode when it or a connecting Network times out.

CM ***Frame-activated/Permanent (Calling Networks only)***

Whether you choose Frame-activated or Permanent depends on whether you want the Digi ISDN adapter in your server to disconnect when there is no traffic. **Do not select both parameters—they are mutually exclusive.**

Frame-activated—Activates a link as soon as Ethernet packets destined for the remote side of the connection are detected. In IPX Link Optimization only non-spoofed/non-filtered frames

Permanent—Once connected, maintains the link. If a disconnect occurs due to ISDN line failures, cable faults, NT-1 problems or a disconnect by the remote site, attempts to re-connect immediately.

Fallback

This parameter causes a Calling Network to keep trying progressively lower ISDN call types until a connection is established. If a Service Type of Digital 64 is selected for B Channels assigned to the Calling Network, the fallback sequence is as follows: Digital 64; Digital 56; Voice 56.

This parameter also permits multiple B channel calls to be established with less than the number of channels specified, if all channels cannot connect successfully.

Call Attempts (Calling Networks only)

This parameter controls the maximum number of successive call failures allowed before a Calling Network ceases calling and switches to Listen mode.

> *Example:* When one site calls another which does not have a matching profile (for example, because it is set to Idle or the name in the Remote field is incorrect) the calling site will go to Listen after the Call Attempts limit is reached. This avoids excessive line usage charges and also puts the calling side into a state that will not require manual intervention at that site for contact to be made.

A call can fail even though a connection was established on one or more B channels.

> **Warning:** Setting this value to zero specifies NO Call Attempt limit which may result in excessive ISDN line usage charges.

CM ***Timeout***

Use this parameter when you also choose the Frame-activated option, as a means to set the amount of time a Frame-activated Network will pause after packet traffic ceases, before suspending the link.

Timeout value is registered in minutes and seconds (MM:SS). A 30 second time-out would be registered as 00:30, a two-minute time-out as 02:00, and so on. The time-out range is from 00:00 (no time-out) to 20:00 (20 minutes).

Note: Setting the Timeout value to 00:00 programs the Network to never time-out. When you have also selected the Frame-activated parameter, your Digi Network will auto-connect by frame-activation, but will never suspend, and Call Management benefits will not be realized.

IDP Compression

This parameter enables Digi's implementation of on-board data compression.

IPX Link Optimization

CM You can only use this feature if you are using the IPX protocol. This feature is part of Digi's Call Connection Management scheme; see page 6-16 for more information.

CM *Conn Time Limit*

This feature is part of Digi's Call Connection Management scheme; see page 6-13 for more information.

Assigned Channels (Calling Networks only)

To build a Calling ISDN Network, you must assign B Channels that the Calling Network will use to call a Listening Network on another server. Assigning a channel does two things: defines the channel to be used for the call, and provides the address to call. For instructions on how to setup a two-channel call, see page 5-12.

Note: You can assign as many as eight B Channels to a given Calling Network profile (provided your Digi ISDN adapter has that many installed).

To add a B Channel to the Network, use the **Add Channel** window:

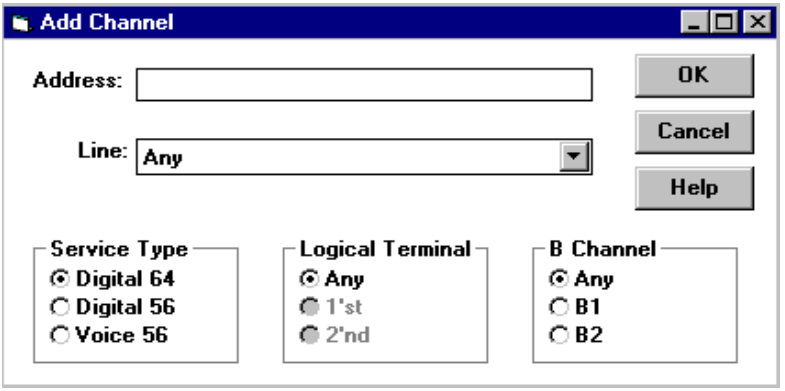

Figure 6-2. Add Channel Window

To find this window: Press the **Add Channel** button in the **Configure Network** (or **Add Network**) window.

Address: Enter the telephone number of the B Channel (on the Listening Network) that will be called. Use only digits between 0 and 9, with no commas, spaces or dashes, etc. in between digits.

Line: This is the line that the Calling Network will use to call out; it must be explicitly specified. Since you can have multiple adapters in one server and (depending on the model) each adapter can control multiple lines, line numbers are specified by adapter number and line number (starting with 0-0).

Example: If you have two adapters, the first with four ports, the second with two, the following lines would be available to configure: 0-0, 0-1, 0-2, 0-3 (first adapter) and 1-0, 1-1 (second adapter).

Note: **Any** is not a valid Line selection in this driver release.

Service Type: This defines the type of channel (quality of service) requested/used in the connection:

Digital 64 = 64K bps bearer channels
Digital 56 = 56K bps bearer channels
Voice 56 = basic voice channel

Operation over voice-grade channels is only guaranteed when end-to-end digital voice connectivity is present at all times.

Logical Terminal: If you choose **Any**, B channels will be used interchangeably. In some cases your ISDN service will not allow two B channels to connect to one phone number at once. In that case, you will need to define two Logical Terminals, each on a separate B Channel. This is always true when you have Northern Telecom ISDN service.

B Channel: Defines the bearer channel to be used for the connection. If you choose **Any** the next available channel (B1 or B2) will be used. If you are specifying Logical Terminals for this line, you must choose a different channel for each Logical Terminal.

Assigned Frame Types

The concept of Frame Types allows you flexibility in your Network setup.

- An Ethernet Frame Type must be assigned and configured for each network protocol run over a Digi Network. The Digi driver supports four Ethernet Frame Types: ETHERNET_802.2; ETHERNET_802.3, ETHERNET_II, ETHERNET_SNAP; and three protocols: IPX, TCP/IP and AppleTalk.
- You can configure a single Digi Network to use multiple Frame Types and then assign each Frame Type a different type of network protocol: IPX, TCP/IP, or AppleTalk. *For example:* IPX using ETHERNET_802.3, TCP/IP using ETHERNET_II, and AppleTalk using ETHERNET_SNAP.
- You can run the same protocol with different Frame Types simultaneously over a link (using the protocol/frame type combinations in Table 6-2 only). The window shown in Figure 6-3 allows you to choose a particular protocol to be bound to a unique name (Network Board Name) and a particular Frame Type.

Note: You must adhere to the combinations presented in Table 6-2 because in Novell environments, some of the available Ethernet Frame Types do not support certain protocols.

Table 6-2: Valid Combinations of Frame Type and Protocol

	IPX/SPX	IP/ARP/RARP	AppleTalk/AARP
ETHERNET_802.2	Supported	Not supported	Not supported
ETHERNET_802.3	Supported	Not supported	Not supported
ETHERNET_II	Supported	Supported	Supported
ETHERNET_SNAP	Supported	Supported	Supported

Example: If you set up a Listening Network with two Frame Types, ETHERNET_802.2 and ETHERNET_II, both supporting IPX protocol, traffic from two different remote workstations running IPX with different Frames Types could be accepted by the Network.

Note: The default Frame Type is IPX and ETHERNET_802.3 with a Network Number of FEAD0000

The **Add Frame** window is shown below:

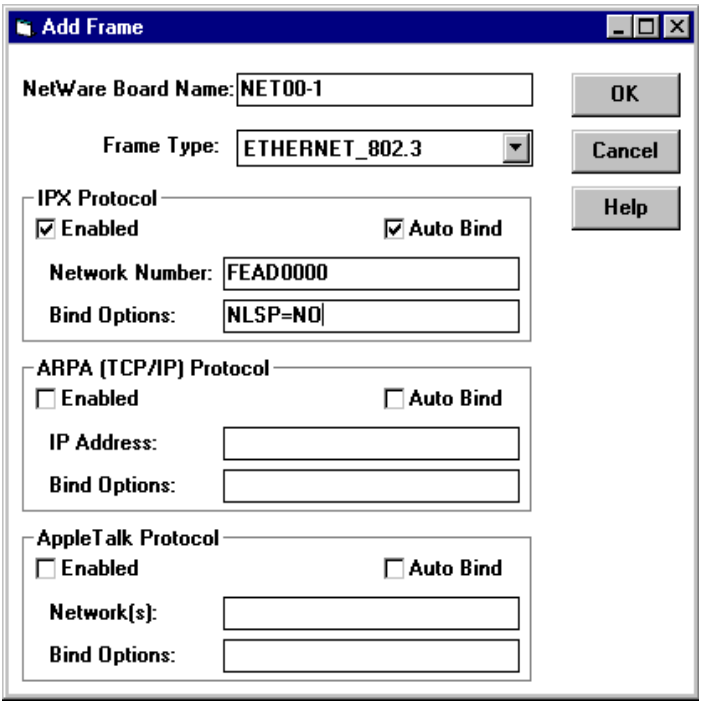

Figure 6-3. Add Frame Window Enabling IPX Protocol for NetWare 4.1

To find this window: Press the **Add Frame** button or highlight a name in the **Assigned Frame** box in the **Configure Network** (or **Add Network**) window.

Network Board Name: This field represents a logical name for the Frame Type you are configuring. The name in the field defaults to the same naming convention as the Network Name (NET00-0 for example). You can change it to any meaningful text.

Frame Type: Choose one of the four options keeping in mind the constraints described in Table 6-2.

*IPX Protocol***:** Check the **Enabled** button to use this protocol and provide the appropriate **Network Number** and any **Bind Options** to use.

Note: A Digi Calling Network using IPX can only talk to an IPX Listening Network that is configured with the same Network number. For example, the default Network (installed with SETUP) is a Listening Network set to an ETHERNET 802.3 frame type, IPX protocol, with an address of FEAD0000. To set up a Calling Network for use with this Listening Network, you *must* set the IPX Network Address to FEAD0000 as well.

IMPORTANT! If you are running NetWare version 4.1 and want to use IPX Link Optimization, you must put the following in the **Bind Options** field: **NLSP=NO**. NLSP replaces the RIP/SAP convention used in previous versions of NetWare. NLSP cannot be spoofed.

ARPA (TCP/IP) Protocol: Check the **Enabled** button to use this protocol and then enter the **IP Address** of the remote LAN or node and any **Bind Options** you want to use.

AppleTalk Protocol: Check the **Enabled** button to use this protocol and then enter the **Network(s)** and **Bind Option** information in the appropriate boxes.

Auto Bind: When you choose this option with any of the protocols listed above, keep in mind the following:

- Checking this box causes the protocol you have enabled to bind to the logical Network Board Name automatically.
- Automatic binding will initially occur when you have clicked **OK** to exit the **Configure Network** (or **Add Network**) window. Subsequently, automatic binding will occur whenever the NLM is loaded (with a LOAD PCIMAC command issued at the system console or from the AUTOEXEC.NCF file).
- All bindings can be observed on the server's system console and look similar to this:

```
:bind IPX NET01-0 net=FEAD0000
IPX LAN protocol bound to Digi ISDN Server Driver v1.05
```

- If Auto Bind is not checked, a bind command must be manually issued from the system console, or a bind command added to the AUTOEXEC.NCF file (after the LOAD PCIMAC command).

Call Connection Management

Comprehending the mechanics and operational characteristics of Digi's Call Connection Management scheme is key to understanding the capabilities of the software to overcome the limitations of the operating system, and key to realizing its benefits. Once you understand how the elements of Call Management work, you will be able to implement them in your WAN environment effectively.

Implementing Call Connection Management effectively is important because any communication product that can be programmed to dial-on-demand and can automatically place toll calls on public networks (for example, the telephone company's networks) has the inherent capability to generate unexpected charges unless properly managed and monitored. Digi provides help with both managing and monitoring by offering these features:

- Frame Activation and Timeouts
- Connection Time Limits
- IPX Link Optimization
- Link Statistics Monitoring

It should be noted that even with these features, LAN/WAN Administrators must plan networks properly, understand and maintain control over server and workstation-based applications deployed in the WAN, and actively monitor the day-to-day operational status of the WAN.

Who can use it

You can use Call Connection Management between sites if the following is true:

- All sites are equipped with Digi products
- All sites use compatible setup parameters
- For IPX Link Optimization: NetWare servers are running the IPX protocol on the WAN link and clients are running Digi software capable of IPX protocol

Frame-activation and Timeouts

Timeout and frame-activation directly inter-operate to manage your connection by controlling when a connection is made and how long it lasts. When a Digi Network activates to pass data, an event timer starts "counting down" from the Timeout value. Additional data received by the Network (after its initial connection but before the Timeout value is reached), resets the event timer and it will again begin counting down from the Timeout value.

If the event timer reaches the Timeout value, the Network's WAN link (that is, the B Channel connection) is disconnected (suspended), and the Network goes into a **Waiting Activation** state.

IMPORTANT: *In this implementation, the Network that originates the connection(s) controls link suspension by time-out.*

For example, if there are two servers that are both setup for Frame-activation and Timeout, if Server 1 calls Server 2, the time-out value of Server 1 must be reached before the link will be suspended. Even if the Timeout value of Server 2 has been reached the connection will remain until the Server 1 Timeout value is reached, because Server 1 initiated the call.

- See page 6-6 for information about enabling the Frame-activation parameter and page 6-7 for information about Timeouts.

Connection Time Limits

You can set the following automatic parameters to reduce the likelihood of incurring excessive ISDN line usage charges:

- Amount of time a Network can be connected (calling or called) within a 24-hour period
- Action to be taken when the time limit is reached

Access this feature using the **Connection Time Limit Options** window, shown on the next page.

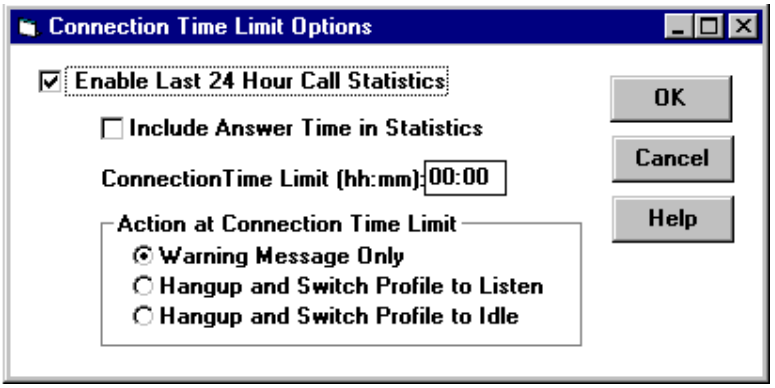

Figure 6-4. Connection Time Limits Window

To find this window: Press the **Conn Time Limit** button in the **Configure Network** (or **Add Network**) window.

Enable Last 24 Hour Call Statistics (Default=Enabled)

If you want to choose a Connection Time Limit, you *must* leave this option enabled; if you disable it, all other options in the window become grayed. Disable it only if you need to conserve memory and do not need the Connect Time Limit feature.

The statistics that are collected can be viewed using the **Network Status** window. (See page 6-22 for information on viewing status.)

Include Answer Time In Statistics (Default=Disabled)

When disabled, only accumulated calling time is used to determine when the Connection Time Limit is reached and only call-outs are included in the statistics.

When enabled, both calling and called time are used to determine the Connection Time Limit and both are recorded in statistics.

Connection Time Limit (Default=00:00-No Time Limit)

The default value of 00:00 means there is ***no*** Connection Time Limit. To use this feature you *must* type a meaningful value in this box. Values are expressed in hours and minutes (hh:mm) Valid values are 00:00 (no limit) to 23:59 (23 hours and 59 minutes).

Warning: If you leave this option at 00:00 you may incur excessive ISDN line usage charges!

Action at Connect Time Limit (Default=Warning Message Only)

You can choose one of three actions to automatically occur when the Connection Time Limit is reached:

- *Warning Message Only:* Leaves connection active and displays a warning message on the NetWare server console when the Connection Time Limit has been exceeded. New warning messages will be posted to the console every five minutes until: the connection is manually hung up, the 24 Hour Statistics are reset, or the accumulated call time falls below the Connection Time Limit.

  Warning: With this option, you are not protected against excessive ISDN usage charges because an automatic disconnect will *not* occur.

- *Hang-up and Switch Profile to Listen:* Hangs up the B Channel connection(s) and switches to a Listening mode. This will also cause the other side of the connection to switch to Listening if it has been similarly configured. Once both sides are in a Listening state, no calling will occur until you manually intervene.

  The advantage of reverting to a Listening state lies in the ability to reconnect without specifically setting the remote side to Listen.

  Warning: This option forces an automatic hang-up when the Connection Time Limit is reached. User sessions will be disrupted when the link is disconnected which may result in lost or corrupted data.

- *Hang-up and Switch Profile to Idle:* Hangs up the B Channel connection(s) and switches to Idle mode. The remote side will switch to Listen. A call cannot be established with a server in Idle mode, therefore calling will cease until you manually change the mode out of the Idle state.

  Warning: This option forces an automatic hang-up when the Connection Time Limit is reached. User sessions will be disrupted when the link is disconnected which may result in lost or corrupted data.

Notes on Using the Call Connection Limit Option

- The default setup that enables statistics but sets the limit at 00:00 is useful if you only wish to gather statistics. You may wish to leave the setting at the default and then, after 24 hours, examine the statistics so that you will know how much traffic normally occurs across your link. This will help you set a realistic Call Connection Limit value.

IPX Link Optimization

What it does

This section is important if you are going to use IPX protocol in your Network setup. Digi's IPX Link Optimization provides:

- Dial-on-demand (DOD) functions to reduce service costs in ISDN WAN environments. The DOD features keep the ISDN B Channel connections down when only maintenance communication is requested by the server, thereby reducing ISDN service charges. The disconnected B Channel connection(s) are re-established when there is useful IPX data traffic.
- Header compression capabilities (on 802.3 frames ONLY) to enhance data throughput. Compression of the packet headers works to reduce the size of the packets, and thereby reduce their transfer time.

Note: Incorrect configuration of IPX Link Optimization and/or use of incompatible frame types may result in excessive connection charges. Any use of the IPX Link Optimization feature should be closely monitored for correct operation. See additional notes on page 6-20.

Choosing Elements of IPX Link Optimization

Digi's implementation of IPX Link Optimization combines several elements. To create a Network that will provide the type of Optimization you want for the system you have, consider the following:

- Frame Types in use by the sites that must connect (discussed next)
- Enabling header compression for 802.3 Frame Types (see page 6-18)
- Choosing which Packets to optimize with filtering and spoofing (see page 6-18)
- Selecting the Frame-activation parameter and a Timeout value (see page 6-13)

Choosing a Frame Type

The rule for choosing a Frame Type to use between Digi products is:

> *Digi products on both sides of the connection must be setup to use the* ***same*** *Frame Type.*

As is shown in Figure 6-5, the WAN frame type can differ from the LAN frame type.

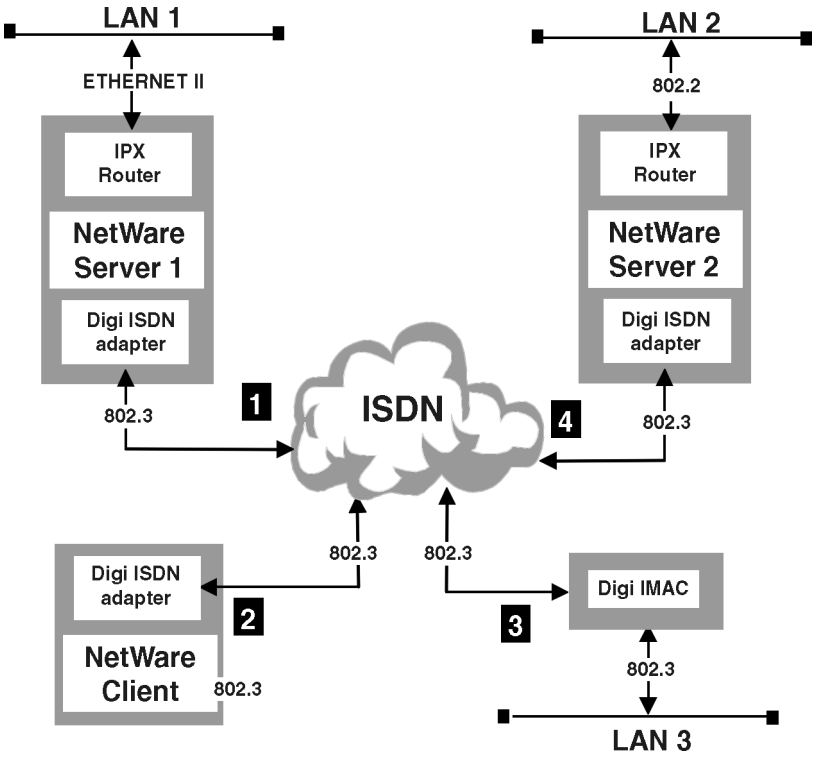

Figure 6-5. Frame Types Overview

The illustration above demonstrates several different types of connections you may need to make, and depicts the frame types that could be used:

1 to 4 In this case, LAN 1 is using Ethernet II frames, LAN 2 uses 802.2 frames and the Digi ISDN adapters are both set to IPX Link Optimize using 802.3 frames. Even with three different types of frames in use, this works because the IPX Routers on both servers will handle the differences in frame types.

1 to 2 Data from LAN 1 using Ethernet II frames is sent successfully to the NetWare client because the IPX Router splits off the Ethernet II header and repackets the data for 802.3. Since both the Digi adapter in Server 1 and the Digi adapter in the client are set to 802.3, the transfer works. Note that the NET.CFG file on the client must explicitly setup NetWare client software for 802.3 as well.

1 to 3 Since the Digi IMAC is a bridge, and not a router, the frame type used by LAN 3 must match the frame type used by the Digi adapter sending the data.

Choosing IPX Header Compression

This optimizing feature increases data throughput over the ISDN link by "tokenizing" IPX packet headers before sending the packets through the link, and "de-tokenizing" them on the other side.

Note: This feature only works if you are using the 802.3 frame type.

You can choose this option from the **IPX Link Optimization** window (shown in Figure 6-6).

Filtering and Spoofing the Packets

The following discussion describes how and why Digi keeps various type of packets from activating a Network. You should read this section to help you decide which packets to include in your Link Optimization. You can choose to include any of the following options in your optimization scheme:

- RIP/SAP Filtering
- Watchdog Suppression
- NetBIOS Propagation Optimizations
- NetWare Serialization Optimization

You can select/deselect these options from the **IPX Link Optimization** window:.

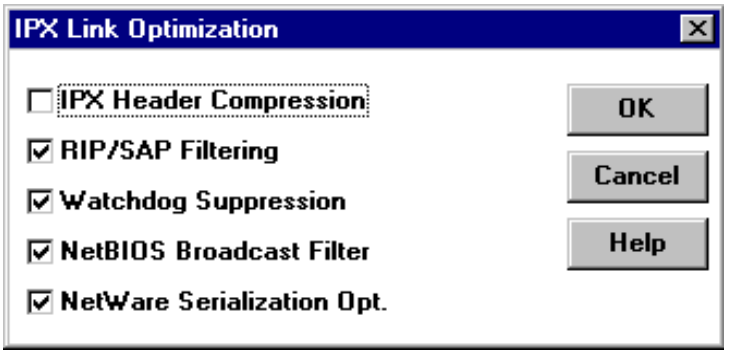

Figure 6-6. IPX Link Optimization Options Window

To find this window: Press the **IPX Link Opt...** button in the **Configure Network** (or **Add Network**) window.

About Spoofing—IPX spoofing is basically the action of replying to a NetWare packet on behalf of the intended destination device. This spoofs (or fools) the sending device into believing it is communicating with the intended destination device, when in fact it is not. If an IPX packet sent to a remote device can be successfully spoofed, a connection does not need to be made to allow actual transmission of the packet over the link.

Watchdog packets and some RIP and SAP packets are spoofed.

About Filtering—The IPX filtering incorporated into Digi's Link Optimization is basically designed to prevent non-essential NetWare maintenance IPX packet traffic from triggering a Frame-activated Digi Network. The mechanics of IPX filtering involves the identification and discarding of IPX packets which meet certain criteria.

NetBIOS Broadcast packets, NetWare Serialization packets, and some RIP/SAP packets meet the filtering criteria.

IPX RIP and SAP Packet Processing

Processing of the RIP (Router Information Protocol) and SAP (Service Advertising Protocol) packets involves both filtering and spoofing. Response is made to RIP requests and SAP broadcasts with the best information available, without opening the WAN link.

At the time the link is active, the latest RIP and SAP data is recorded. Subsequently this data is sent out to the local network about once a minute to keep the local IPX router from "aging out" its router table entries. When the link is active again the recorded RIP and SAP data is updated.

Note: Changes indicative of exceptional network events found in RIP/SAP packets will trigger frame-activation.

Watchdog Suppression

NetWare servers use a "keep alive" scheme to verify that NetWare client workstations logged in to it are still "alive" and on-line. Servers periodically send IPX watchdog packets to client workstations; clients are expected to respond to these packets. If a set number of watchdog packets are sent by the server and no replies are received from a client, the server closes the connection to free the slot for use by another user.

Digi's IPX spoofing provides watchdog packet replies on behalf of client workstations to prevent time-out of the user's connection slot while the ISDN link is suspended.

NetBIOS Propagation Optimization

NetBIOS Broadcast packets are identified by socket number, frame-type, and destination address. Digi's IPX filtering does not forward NetBIOS broadcast packets.

NetWare Serialization Optimization

NetWare Serialization packets are identified by socket number, frame type, and size of frame. Once identified, packets of this type are discarded.

Notes on IPX Link Optimization

- IPX Link Optimization works only with IPX protocol.
- IPX packets that are not explicitly filtered and/or spoofed by Digi's Link Optimization software are considered to be carrying useful data and will activate Digi Networks configured for frame-activation.
- Non-IPX packet traffic (that is, TCP/IP, Apple EtherTalk traffic, etc.) will also cause frame-activation.
- Unexpected and uncontrolled frame-activation of Digi Networks will increase variable ISDN service costs.
- WAN administrators must actively monitor Digi Network statistics to track frame-activated Network operation and behavior to limit service costs incurred.
- When a link is active ALL packets, including RIP/SAP, Watchdogs, NetBIOS, and NetWare serialization are sent to the other side. No spoofing or filtering occurs while the link is up. The event timer, however, is not reset for these types of packets.
- IPX Link Optimization will work with all frame types, but Header Compression is available only with 802.3 Frame Types. Header Compression may increase performance because transfers may take less time.
- You do not need to use the same frame type across your ISDN connection as a LAN attached to the server uses.

Important!

Incorrect configuration of IPX Link Optimization and/or use of incompatible frame types may result in excessive connection charges. Any use of the IPX Link Optimization feature should be closely monitored for correct operation.

Link Statistics Monitoring

You can view several types of status at any time using the *iconfig.exe* program:

- Network Status
- Channel Status
- Frame Status

Status is displayed in a window like the following:

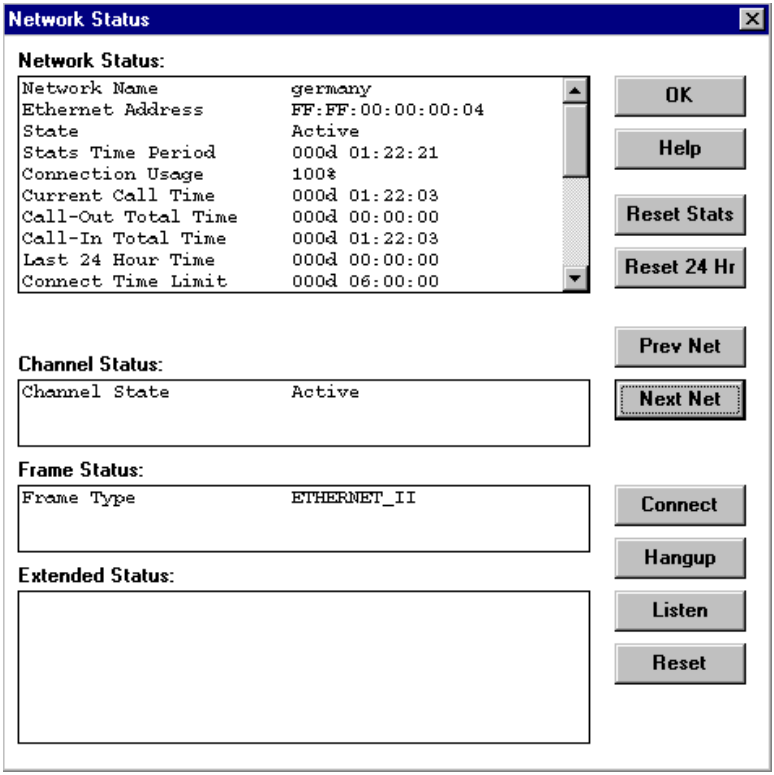

Figure 6-7. Network Status Window

To find this window: Press the **Status** button from the main window.

Using the buttons

- Use the **Prev Net** and **Next Net** buttons to scroll through the status of all the Networks that you have configured.
- Use the **Connect, Hangup, Listen,** or **Reset** buttons to change the state of the Network currently highlighted.
- Use the **Reset Stats** button to reset all current statistics for the Network that is highlighted in the **Network Status** box.
- Use the **Reset 24 Hr** button to reset ONLY the **Last 24 Hour Time** line in the **Network Status** box for the Network currently displayed.

Network Status Box

Use the statistics in this box to understand how the Network(s) that you have set up are operating. You should monitor these statistics to be sure that your Call Management scheme is working. The following lines appear in the box:

Network Name	Name of the Network whose status is displayed.
Ethernet Address	Address of the local DIGI ISDN adapter.
State	Current state of the Network (Active if the link is “up”).
✶ **Stats Time Period**	Amount of time since statistics were last reset.
Connection Usage	Percentage of Stats Time Period in which there were active Calls-Out and/or Calls-In.
✶ **Current Call Time**	If connected, amount of time current call has been connected.
✶ **Call-Out Total Time**	Amount of accumulated time for all calls out from the Network.
✶ **Call-In Total Time**	Amount of accumulated time for all calls in to the Network.
✶ **Last 24 Hour Time**	If configured—amount of time this Network has been connected within the last 24 hours.
✶ **Connect Time Limit**	If configured—amount of time this Network can be connected in one 24-hour time period before action is taken.
✶ **Time Since Last Frame**	Amount of time since last “vital” frame was detected. Use to determine when an Idle Timeout might take effect.
Call-Out Attempts	Number of times a call out has been initiated.
Call-Out Successful	Number of times an initiated call has connected to the site being called.
Call-In Attempts	Number of times a call in has been tried.
Call-In Successful	Number of times a call has been answered.
Out of Rcv ECB’s	Number of times a NetWare buffer resource was unavailable for receive data.
Tx Queue Overflow	Number of times a NetWare buffer resource was unavailable for transmit data.
RX Fragment Discards	Number of fragmented packets not recovered, over multiple-channel calls.

✶ **The format used for these statistics has the following meaning: xxxd = # of days, xx:xx:xx = hh:mm:ss**

Last 24 Hour Statistics

In particular, if you enabled collection of 24 hour statistics, you should examine this line to see how much time the link has been up. This total reflects the total connection time for the Network in the last 24 hours from the time you are examining it. Each minute the connection time for the minute which occurred 24 hours ago is subtracted from the accumulated total.

Channel Status Box

This box reports the current channel status for all B Channels associated with the Network you are viewing.

To view additional status for a particular channel, highlight a channel in the box, then look in the **Extended Status** box for additional information:

Line	Identifies the line using the convention
Logical Terminal	LT1 or LT2 describes to which Logical Terminal the channel is assigned.
Address	Phone number called by the channel, or, for a Listening Network, the field shows “unknown”.
B Channel	B1, B2, or Any describes which channel is assigned to this Network.
Type	Digital 64Kbs, Digital 56Kbs, or Voice 56Kps
Speed (bps)	Speed of the channel 64000 bps or 56000 bps.
Channel state	Active, Idle, Waiting

Frame Status Box

This box displays the Frame Type(s) associated with the Network you are viewing.

To view additional status for a particular frame type, highlight a line in the box, then look in the **Extended Status** box for additional information:

Name	Name you assigned to the Frame Type.
Frame Type	ETHERNET 802.2, ETHERNET_802.3, ETHERNET_II, or ETHERNET_SNAP
LSL Board Number	Link Support Layer board number assigned to the Frame Type.
Received Frames	Number of Ethernet frames (of this type) received over the line.
Transmitted Frames	Number of Ethernet frames (of this type) transmitted over the line.
Auto Bound Protocol	Network protocol automatically bound to the Frame Type.
Binding Parameters	Bind parameters used when the protocol was bound.

Extended Status Box

This box reports additional status for channels and frames.

chapter **7**

Troubleshooting

In this chapter

This chapter provides information you can use to verify that your installation works. It discusses the following topics:

Starting Point

This chapter assumes that you have already installed the driver.

Using Line Status

In order to place or receive ISDN calls, layers 1, 2, and 3 must be properly established. This section describes how to check the status of the layers.

The Line Status Window

From the menu bar of the main window of the ICONFIG program, click on **Diagnostics** and then choose **Line Status...** from the pull-down menu.

The **Line Status** window will display. Use the **Line** box to select a line to check from the drop-down list. You will see a window like this display:

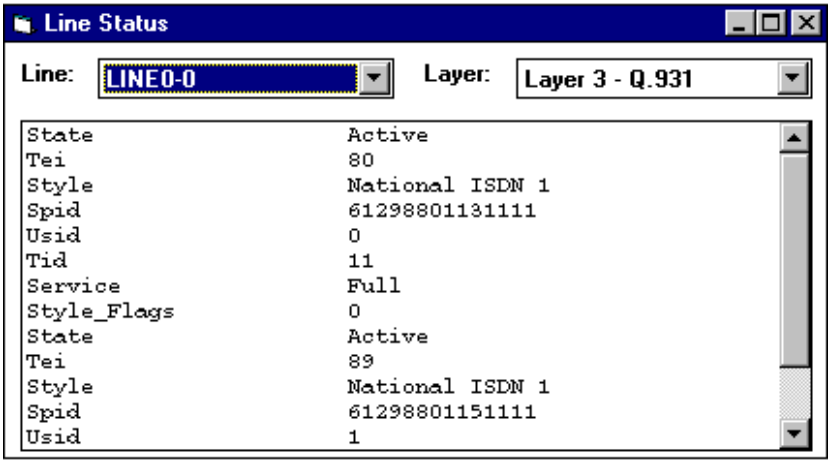

Figure 7-1. Line Status Window

Is Layer 3 established?

You should see the following reported if Layer 3 has been established:

- State = “Active” or “Established, Waiting Restart”
- Service = “Full” or “Full TM, Non-initializing” or “Non-initializing TM”
- Style = the switch type you selected when you configured the line
- Tei = a value between 64 and 126
- SPID = the number you entered when you configured the line

Note: If you have configured the line for two Logical Terminals, you will see separate status for each terminal. Figure 7-1 shows a line configured for two terminals.

“Awaiting Layer 2” message

If the layers 1 and 2 have not been established, layer 3 cannot be established. Instead of **Active** you will see **Awaiting Layer 2** for **State**. You should move down to examine the status of the lower layers.

Is Layer 1 Established?

From the **Layer** box, choose **Layer 1 -S/T**. You should see something similar to the following:

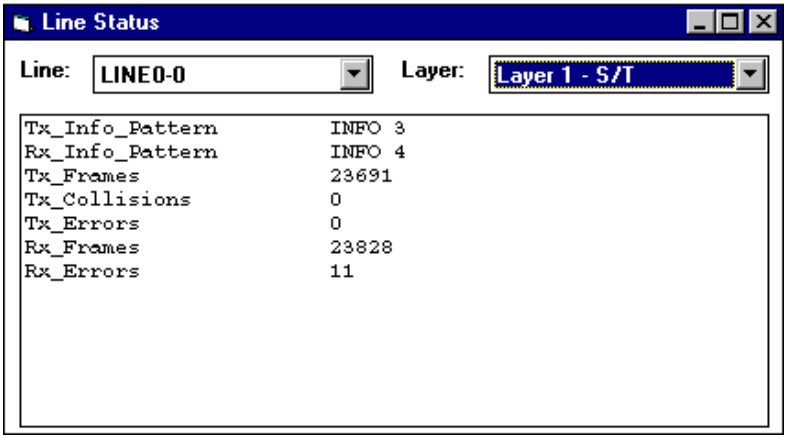

Figure 7-2. Layer 1 Line Status

- **Tx_Info_Pattern** must equal **INFO 3**, not INFO 0 or INFO 1
- **RX_Info_Pattern** must equal **INFO 4**, not INFO 0 or INFO 2
- **Tx Frames** and **Rx Frames** should be an incrementing value, perhaps incrementing as you watch
- **Tx Errors** and **Rx Errors** should be a small number, and not increase

If you see these values, you know that the physical layer is operating properly and you should check Layer 2 next.

Failure Cause

If the values you see are different, your Digi adapter is not communicating with the switch.

Action

Problems like this are typically caused by a physical problem: You should:

- Check all cabling. Be sure that the cables are firmly attached and of the right type.
- Check your NT1 hardware.
- Verify that the switch type you used during configuration is correct.
- If you use SPIDS, verify that you have entered the correct numbers.

Is Layer 2 Established?

If you observed the proper values reported on layer 1, the physical connections must be good. Next you must check layer 2. From the drop-down list in the **Layer** box, choose **Layer 2-Q.921**. You should see a window similar to the following:

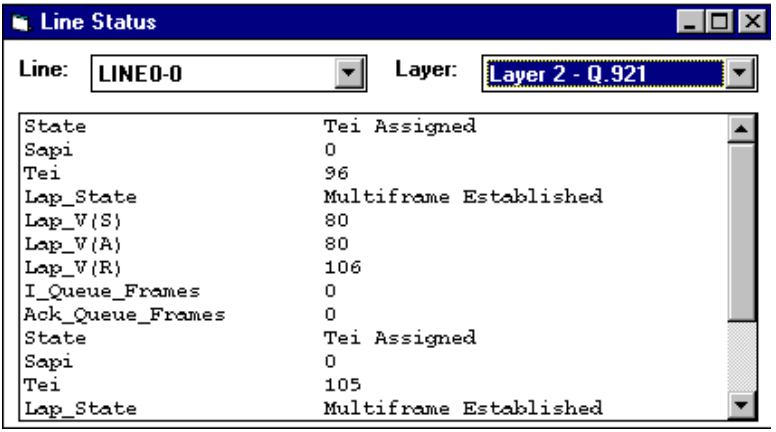

Figure 7-3. Layer 2 Line Status

- State must equal **Tei Assigned**
- Tei must equal a value between 64 and 127
- Lap_State must equal **Multiframe Established**

Failure Cause and Action

If layer 2 shows a Tei of 127, you must send a reset to the switch. Do this by uplugging the ISDN line from the adapter and then replugging it.

Performing a Loopback Test

This test uses the one B channel to call the other B channel. This will confirm that the ISDN line is working.

To perform the text, you will be adding two new Networks profiles to your configuration. These can be removed after the test is complete.

1. From the main ICONFIG window, press the **Add Network** button. The Network that is created will be the default: Telecommuting Hub—a Listening Network. Press **OK** to return to the main window.
2. Press **Add Network** again. This time, choose **Custom** from the **Network Type** drop-down list. You will be creating a custom Calling Network.

   a. Select the following parameters for this Network:

   - Powerup State = Passive
   - Nailed Up = OFF
   - Persistent = OFF
   - Frame-activated = OFF
   - Permanent= OFF
   - Fallback = ON
   - IDP Compression = OFF
   - IPX Link Optimization = ON

   b. Press the **Add Channel** button. In the **Address** box of the **Add Channel** window, type in a phone number for the line to use. Select one of the lines in the **Line** drop-down list. You should not need to change any other parameters. Press **OK** to return to the **Add Network** window.

   c. Press **OK** to return to the main ICONFIG window.
3. Two new Networks should be listed in the **Installed Networks** box. The state of the first Network you added should be **Listening** (the Telecommuting Hub) and the second should be **Idle** (the custom Calling Network).
4. Highlight the custom Calling Network in the **Installed Network** box and then press the **Connect** button. The state of both Networks should change to **Active**.

   Note: After the connection is **Active**, you will see a message saying **"Router Config Errors"** on the server console. This is due to a mismatch of FEAD numbers. This mismatch is unavoidable in a loopback test and should be ignored.
5. Once you see the Active state, press the Hangup button to disconnect the call.
6. Repeat this test for each of the lines available.

Other Diagnostics

There are two other options in addition to **Line Status...** available from the pull-down **Diagnostics** menu on the main window of the ICONFIG program:

- Trace
- Log

Most often you will use these under direction from someone in Digi's Technical Support department to help diagnose a problem. However, each are described briefly in this section to provide an overview.

Trace

With this option you can view the ongoing line activities, in a window like the one shown below:

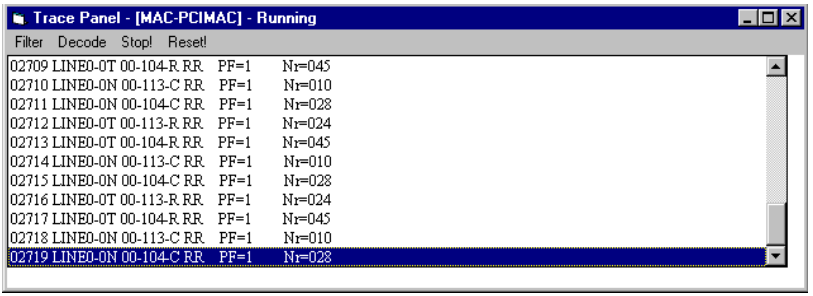

Figure 7-4. Trace Window

Using the pull-down menus in the Trace window, you can Start/Stop and Reset the trace, and also choose to Filter and Decode the following elements:

- Filter—TEI Management, Layer 2(RR/RNR)
- Decode—Q.931 Elements

Log

You may be asked to provide a log file of line transactions to help a Digi Support Engineer understand the communication taking place over your line. Using the Log option allows you to save specific transactions to a specific file.

The window you see will look similar to that shown in Figure 7-5.

The following options are available:

Debug Log

Modules—None, <All>, NA1, MTL, IDD, IO, SPF, CM

Q931 Trace—Off, L3 Only, All Frames
ECB Trace—Off, Hdr Only, Hdr & Data, First Tx
MTL Trace—Off, Hdr Only, Hdr & Data
Call Log—Off, Channel, Network, Both

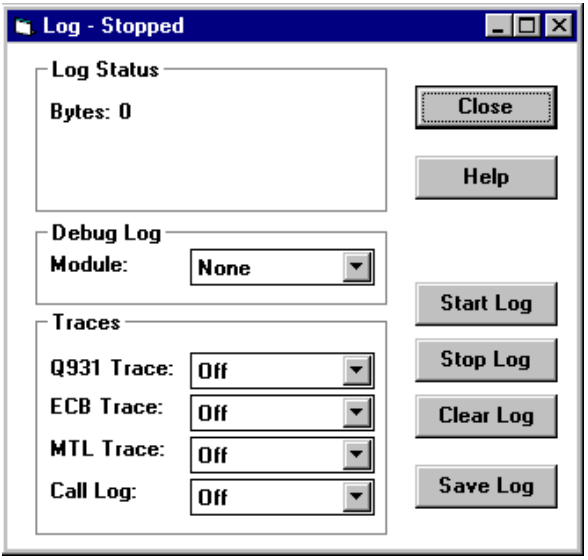

Figure 7-5. Trace Log Window

To save the log to a specific file, click on the **Save Log** button and then choose a directory and filename.

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