

Digital Clusters for Windows NT

Configuration and Installation Guide

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This manual describes how to configure and install the hardware and software for the Digital Clusters for Windows NT™ environment.

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About This Manual

This manual describes how to configure and set up the Digital Clusters for Windows NT hardware and software.

Audience

This manual is for system administrators who will configure and set up the hardware and software. The manual assumes that you are familiar with the tools and methodologies needed to maintain your hardware, operating system, and network.

Organization

This manual consists of six chapters and two appendices, as follows:

- | | |
|-----------|---|
| Chapter 1 | Describes some basic hardware configuration concepts, as well as the supported hardware and any restrictions on those hardware components. |
| Chapter 2 | Summarizes the process of setting up a cluster. |
| Chapter 3 | Describes how to set up the hardware for the cluster environment, including preparing the individual hardware components and then connecting them to the shared SCSI bus. |
| Chapter 4 | Describes how to install the cluster server software. |
| Chapter 5 | Describes how to install the cluster client software. |
| Chapter 6 | Describes how to maintain or reconfigure the cluster hardware. |

- Appendix A Describes how to uninstall the cluster software.
- Appendix B Contains a list of frequently asked questions and commonly encountered problems.
-

Conventions

Digital Clusters for Windows NT systems must use standard SCSI-2 components. The SCSI-2 components supported must be compliant with the architecture defined in the *American National Standards Institute (ANSI) Standard SCSI-2*. This standard defines extensions to the SCSI-1 standard. For ease of discussion, this guide uses either term SCSI or SCSI-2 to refer to the SCSI-2 implementation as specified in the ANSI Standard SCSI-2 document X3T9.2, Rev. 10L.

Related Documents

For additional information about Digital Clusters for Windows NT, see the *Digital Clusters for Windows NT Administrator's Guide*.

You also should have available the hardware documentation for the systems, SCSI bus adapters, disk storage enclosures, and other hardware you will use in your cluster. If you are using a StorageWorks™ RAID subsystem, you also should refer to *Getting Started — RAID Array 310/410 for Windows NT Clusters*.

Chapter 1

Planning the Hardware

This chapter describes how to plan the hardware configuration for your Digital Clusters for Windows NT environment.

Understanding Hardware Configurations

A Digital Clusters for Windows NT hardware environment consists of four components:

- Cluster server systems
- SCSI adapters
- Storage devices (disks)
- Shared SCSI buses

A cluster consists of two server systems networked together using either FDDI or ethernet and running the Digital Clusters for Windows NT server software. The cluster exports services to clients via standard communications interconnects and protocols, and is viewed by the clients as a single system.

Each server system has access to one or more disks on one or more SCSI buses shared with the other server system. The number of shared buses is limited by the number of I/O slots available on the server systems. Shared buses must be *external* buses and must be separate from the system bus.

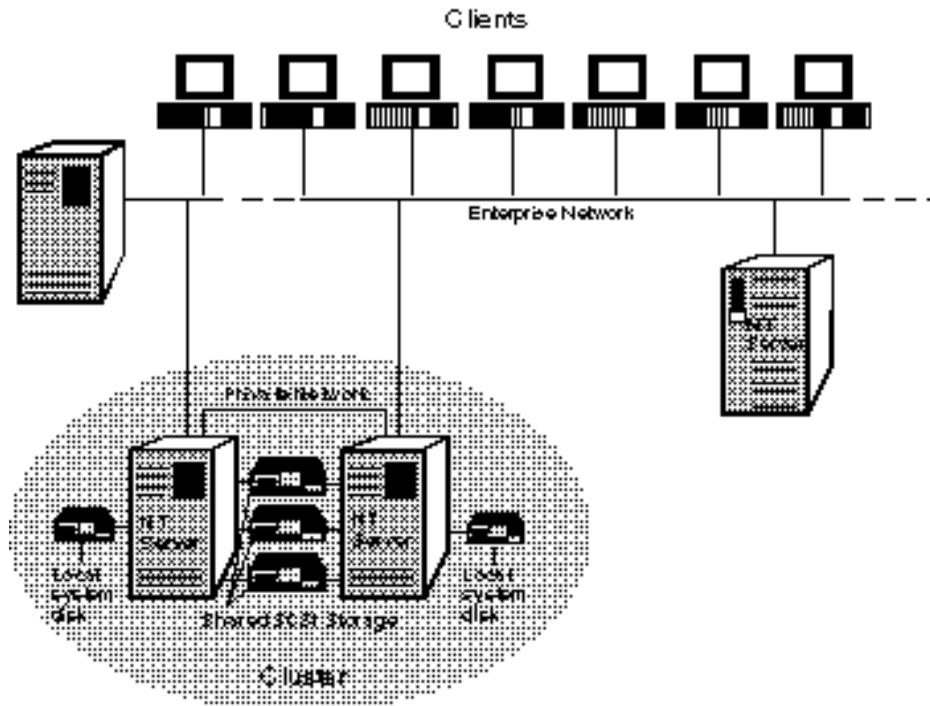
Both servers can access disks on the same shared bus, but each disk can be accessed by only one system at a time. The devices on the shared bus must be writeable disks; other SCSI devices such as CD-ROMs, tapes, or printers may not reside on the shared bus.

Each server system connects to the shared bus via a SCSI adapter installed in an I/O bus slot. The server systems communicate with each other and monitor the shared disks through both the shared bus and the network. Digital strongly recommends that you install

a second dedicated ethernet connection between the two servers to provide redundant interserver communication in the event of a primary local area network (LAN) failure.

The following figure shows a typical Digital Clusters for Windows NT hardware configuration. It includes two server systems sharing a bus connecting to a storage enclosure containing disk devices.

Typical Digital Clusters for Windows NT Configuration



ZK-8758A-FH5

Minimum Cluster Configuration

The minimum configuration for an NT cluster is as follows:

- Two systems running Windows NT Server Version 3.51 with Service Pack 4 connected over a LAN; Digital strongly recommends a dedicated secondary ethernet connection between the servers.
- Two SCSI adapters, one in each system, providing one shared external bus.
- At least one disk drive in a storage enclosure on the shared bus.
- SCSI cables and terminators.

Cluster server systems must be in the same Windows NT domain and cannot be members of multiple clusters. However, multiple clusters are supported within a single domain.

Each server system must have a system disk on a local (nonshared) bus.

SCSI Concepts and Terminology

To properly configure and set up a shared SCSI bus, it is important to understand a number of issues that affect the viability of a bus and how the devices connected to it operate.

SCSI Transmission Methods

Devices on a SCSI bus can use one of two transmission methods:

- **Single-ended.** Devices using single-ended transmission establish a signal connection using one data lead and one ground lead. Although this method is generally less expensive, it is prone to noise problems and requires strict adherence to maximum cable lengths.

Note

Digital Clusters for Windows NT does not support single-ended bus adapters.

- **Differential.** Devices using differential transmission establish a signal connection such that neither lead is at ground potential. This effectively cancels noise on the bus. Because of this immunity to noise, differential transmission permits the use of longer cables and faster bus speeds. However, it is generally more expensive to implement than single-ended transmission.

Only one transmission method is used on a single SCSI bus. However, you can configure devices with different transmission methods by installing a signal converter between them. (See Chapter 3 for more information on configuring the SCSI bus with devices having different transmission methods.)

Caution

Single-ended and differential devices must not be connected together except through a signal converter. Attempting to do otherwise can damage your hardware.

SCSI Buses

On a physical bus, each device must be connected only to a bus using the same transmission method. That is, single-ended devices must connect to single-ended buses, and differential devices must connect to differential buses.

If you want to mix single-ended and differential devices on the same shared bus, you must install a signal converter between the two devices. Signal converters convert single-ended SCSI signals to differential SCSI signals.

The figure on the following page shows the possible SCSI bus connections between single-ended and differential devices.

In this guide, the term *shared SCSI bus* refers to the total interconnect between the server systems and the shared storage. In practice, however, the shared bus typically consists of multiple *bus segments*, with each segment itself being an electrically complete bus. In the first two examples in the figure, the devices are connected by a bus consisting of a single segment. However, the third example shows a device interconnect with two segments, and the fourth example shows a device interconnect with three segments.

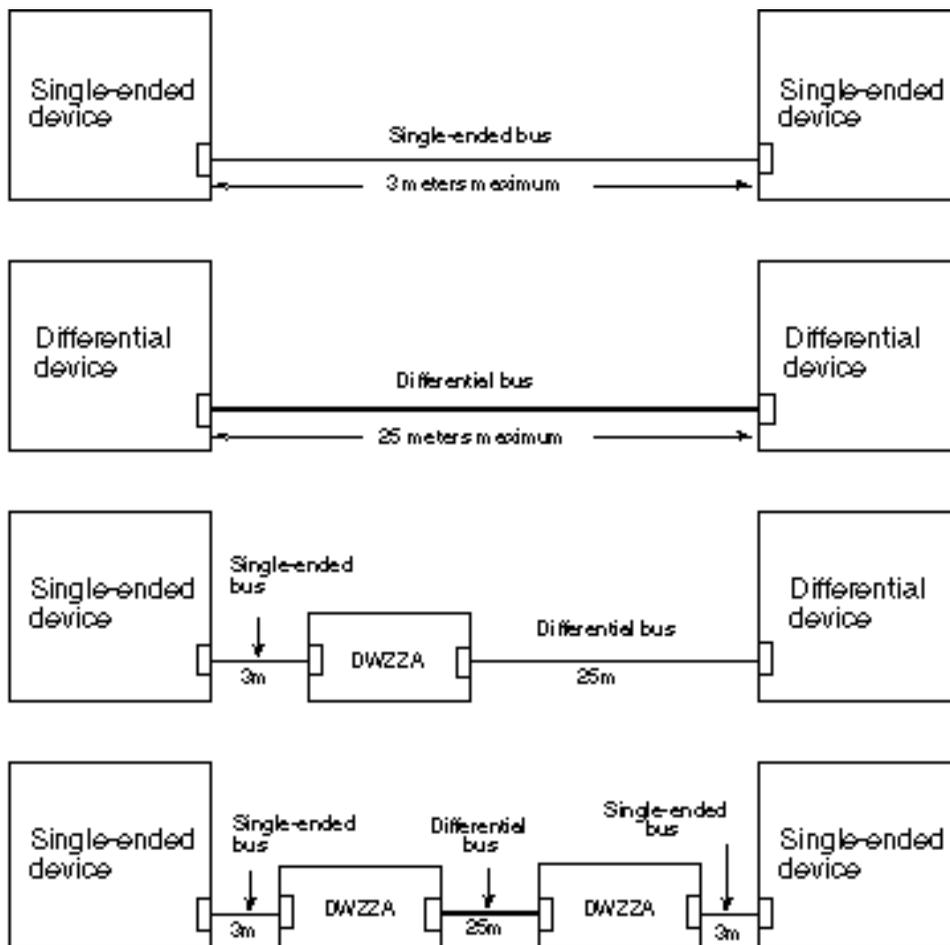
The rules concerning bus termination and cable length (described in the following sections) apply to the individual bus segments within the shared SCSI bus.

SCSI Bus Termination

Each physical SCSI bus must be terminated only at the ends of the bus. Some devices and adapters include internal termination that must be removed if the device is not at the end of the bus. Digital recommends removing all internal bus termination and using Y cables or tri-link connectors to implement external bus termination. This allows the device to be removed for maintenance without affecting the rest of the devices on the bus.

See the section Terminating the Bus and Isolating Devices in Chapter 3 for more information.

Possible SCSI Bus Connections



ZK-8690A-R15

SCSI Data Path Sizes

Devices on a SCSI bus can have one of two data path sizes:

- **Narrow.** Narrow devices use an 8-bit data path. They are usually single-ended devices, although narrow differential devices do exist.
- **Wide.** Wide devices use a 16-bit data path. They can be either single-ended or differential.

Both narrow and wide devices can exist on a single shared SCSI bus.

SCSI Bus Speed

SCSI devices can operate in two speeds: fast and slow. Slow devices have a maximum data transfer rate of 5 MB per second, and fast devices can perform data transfers up to 10 MB per second. All devices supported for use with Digital Clusters for Windows NT use fast SCSI bus speed.

All the devices on a SCSI bus do not have to be set to the same bus speed. However, using fast speed on *any* device decreases the maximum cable length of a single-ended bus. (See the next section in this chapter, SCSI Cables and Connectors.)

SCSI Cables and Connectors

The type of cable you need to connect your devices depends on the width of the data path of your bus, and in some cases, on the transmission method of the bus.

The data path capacity of a cable is reflected by its connector. Connectors have either 50 or 68 pins. Connectors with 50 pins always have a narrow data path, and most are single-ended. Connectors with 68 pins can be either narrow (usually single-ended) or wide (usually differential).

You also must determine whether you need high- or low-density connectors, as well as which connector configuration (straight or right angle) and latching mechanism (thumb latches, thumb screws, and so on) you need. These characteristics are dictated by the connectors on your devices.

Terminators and tri-link connectors also are either high- or low-density and either narrow or wide. They can be connected only to cables with the same type of connector.

SCSI Cable Length

A SCSI bus segment must adhere to a strict cable length limit. The maximum cable length is determined by both the transmission method and the bus speed.

The following table shows the maximum cable length for each type of bus segment:

Maximum Length of SCSI Bus

Type of Bus	Bus Speed	Maximum Length
Single-ended	Slow	6 meters
Single-ended	Fast	3 meters
Differential	Fast or Slow	25 meters

The total cable length for a bus segment is calculated from one terminated end to the other.

Note

This length must include any cable located inside each system and storage enclosure, a length that varies depending on the device. For example, the length of the internal SCSI bus in a BA350 storage enclosure is 1.0 meter. (Refer to the hardware documentation for each of your devices to determine this internal cable length.)

SCSI Bus Adapters

This section provides information about some of the issues and options you must consider when installing a SCSI bus adapter in a server system.

Choosing a Port or Channel

SCSI bus adapters can be either single-port or dual-port. Single-port adapters connect to one bus, and dual-port adapters can connect to two buses. Note that both ports (or channels) of a dual-port adapter do not need to be used, but the unused port must be terminated.

If you are using dual-port adapters with an external and an internal port, use the external port for the shared bus.

Choosing an I/O Bus Slot

The number of slots available for a SCSI bus adapter depends on the type of server system you are using. Refer to your system documentation for information about the number of I/O bus slots in which you can install adapters.

Bus Reset

SCSI bus adapters can be set to issue a Bus Reset command when the system power is turned on. This feature should be disabled for adapters on the shared bus.

Number of SCSI Devices

A SCSI bus can have a limited number of devices. On an 8-bit SCSI bus, the SCSI specification limits the number of devices to eight, and each device (SCSI controller or disk) must have a unique SCSI ID (0 to 7). A 16-bit SCSI bus can have up to 16 devices, numbered 0 to 15.

SCSI IDs

Each device (bus adapter or disk) on a bus must have a unique SCSI ID. On a narrow (8-bit) bus, the SCSI specification limits the number of devices to eight, numbered from 0 to 7. On a wide (16-bit) bus, there may be 16 devices, numbered from 0 to 15. (Note, however, that narrow devices cannot address any device with an ID higher than 7.)

Note

Signal converters are not considered “devices” and are not assigned SCSI IDs.

SCSI bus adapters usually have an initial SCSI ID of 7. On a shared bus, you will have to reassign the ID for at least one of the adapters. Higher numbered IDs are generally of a higher priority than lower numbered IDs, except that in all cases, IDs 6 and 7 are the highest priority. Therefore, when assigning SCSI IDs on the shared bus, use 7 and 6 for the adapters.

Supported Hardware

This section describes the hardware that is supported in a Digital Clusters for Windows NT environment. It includes pertinent information about each supported device, as well as any restrictions imposed on the use of each particular type of hardware component.

Note that some of the hardware components listed in this section require specific hardware and firmware revision levels. You must ensure that your hardware meets these requirements or it will not function properly in your cluster environment.

Supported Server Systems

A Windows NT cluster has two server systems. The following tables lists the supported servers.

Note

Mixed architecture systems are not supported. Both servers must be the same hardware architecture — that is, both AlphaServer™ or both Digital Prioris® systems.

Supported AlphaServer Systems

System	I/O Bus	I/O Slots	Min ECU	Min ARC Firmware
AlphaServer 2100 4/xxx	EISA/PCI	8/3	V1.81	V4.36
AlphaServer 2000 4/xxx				
AlphaServer 2100 5/xxx	EISA/PCI	8/3	V1.81	V4.34
AlphaServer 2000 5/xxx				
AlphaServer 2100A	EISA/PCI	3/8	V1.81	V4.4
AlphaServer 1000	EISA/PCI	5/3	V1.8	V4.25
AlphaServer 1000A	EISA/PCI	3/7	V1.8	V4.46
AlphaServer 400	ISA/PCI	6/4	V1.8	V5.5
AlphaServer 4100	EISA/PCI	3/8	V1.9	V4.44.0

Supported Prioris Server Systems

System	I/O Bus	I/O Slots	SCU	System BIOS
Prioris HX Server	EISA/PCI	3/6	V1.02 upgrade	V1.09
Prioris XL Server	EISA/PCI	4/3	V1.08	V2.04
Prioris ZX Server	EISA/PCI	6/5	V3.30	V1.00.07.BGO

Supported SCSI Adapters

Each server system must have a supported SCSI adapter installed on the system expansion bus, in addition to any internal bus adapter shipped with the system. The following table describes the supported SCSI adapters.

Supported SCSI Adapters

Adapter	Bus	Min BIOS	Driver	Comments
Digital KZPSA-BB	PCI	A10	deckzpsx.sys (V1.3)	Alpha only
Adaptec AHA-2944W	PCI	1.12*	aic78xx.sys	Prioris and Alpha*

* See the following restrictions.

The following restrictions apply to SCSI bus adapters:

- The Adaptec AHA-2944W adapter is supported on all AlphaServer systems except the 4100. However, it must be configured on a Prioris system.
- The Adaptec AHA-2944W bus adapter requires a jumper when used in a multihost configuration. If you are using the adapter's internal termination, install the jumper at the J5 jumper block.

Note that Digital strongly recommends that you disable or remove all internal termination and use Y cables or tri-link connectors to implement external termination.

- BIOS versions 1.2x for the Adaptec AHA-2944W adapter are *not* compatible with Digital Clusters for Windows NT because these versions of the BIOS provide no way of disabling bus reset.
- The Adaptec AHA-2944W adapter is not compatible with the HSZ40 RAID controller on AlphaServer systems.

Supported Storage Enclosures

The following table describes the supported disk storage expansion enclosures.

Supported Storage Enclosures

Storage Enclosure	Transmission Method	Data Path Size
BA346-KB	Single-ended	Wide
BA350-KB	Single-ended	Narrow
BA356-KC	Single-ended	Wide

Supported RAID Controllers and Subsystems

The following table describes the supported RAID controllers and subsystems. Note that all RAID controllers and subsystems are fast, wide differential devices.

Supported RAID Controllers and Subsystems

Controller (C) or Subsystem (S)	Firmware
Digital HSZ40-BA (C)	V3.0
Digital RAID SW-410 (S)	V3.0
Digital RAID SW-310 (S)	V3.0

Supported Disk Devices

The following table describes the supported disk devices.

Supported Disk Devices

Disk Device	Minimum Firmware	Data Path
RZ26L-VA	440C	Narrow
RZ26L-VW	442E	Wide
RZ28B-VA	0006	Narrow
RZ28C-VA	0004	Narrow
RZ28D-VA	0008	Narrow
RZ28D-VW	0008	Wide
RZ29B-VA	0014	Narrow
RZ29B-VW	0014	Wide

Supported Signal Converters

Signal converters convert single-ended SCSI signals to differential SCSI signals. They are used to connect single-ended and differential bus segments to allow communication between devices with different transmission methods or to overcome cabling length restrictions on single-ended buses. Some signal converters also can be used to connect narrow single-ended devices to a wide differential bus. You can have a maximum of two signal converters installed between devices.

The following table describes the supported signal converters.

Supported Signal Converters

Signal Converter	Minimum Hardware	Minimum Firmware	Data Path	Comments
DWZZA-AA	E02	n/a	Narrow/ Wide	External, independently powered unit
DWZZB-AA	E01	A02	Wide/ Wide	External, independently powered unit
DWZZA-VA	F02	n/a	Narrow/ Wide	StorageWorks building block; installs in disk slot 0 in a BA350 storage enclosure
DWZZB-VW	E01	A02	Wide/ Wide	StorageWorks building block; installs in disk slot 0 in a BA356 storage enclosure

Supported SCSI Cables

The type of cables you need for your cluster depends on the hardware configuration. The following table describes the supported cables and the context in which each cable would be used. Note that each supported cable comes in a variety of lengths. You must select cables such that the total length of the bus segment does not exceed its specified maximum.

Supported SCSI Cables

Cable	Connector Densities	Use
50-Pin ("A")		
BN21V-0B	One high, two low	This Y cable attaches to narrow devices and can be terminated, if necessary.
BC19J-nn*	Two low	This cable connects narrow devices and Y cables.
BN21H-nn*	Two high	This cable connects narrow devices.
BN23G-nn* or BN21R-nn*	One high, one low	These cables connect devices and cables with different connector densities.
68-Pin ("P")		
BN21W-0B	Three high	This Y cable attaches to wide devices and can be terminated, if necessary.
BN21K-nn* or BN21L-nn*	Two high	These cables connect BN21W Y cables or wide devices.

* nn denotes the cable length, in meters.

Supported Bus Terminators and Connectors

You will need terminators and connectors for your shared SCSI bus. The following table describes the supported terminators and connectors and the context in which you would use them.

Supported Terminators and Connectors

Type	Pins	Density	Use
Terminator			
FR-PCXAR-WJ	68-pin	High	Terminates wide cables.
H8574-A	50-pin	Low	Terminates narrow single-ended cables.
H879-AA	68-pin	High	Terminates a tri-link connector or wide differential cables.
Connector			
H885 tri-link	Three 68-pin	Three high	Attaches to high-density, 68-pin cables or devices. Can be terminated if necessary. Electrically the same as a BN21W-0B Y cable.

Chapter 2

Setting Up Your Cluster

To set up your cluster, you must perform several tasks involving both the hardware and the software.

Note

You are not required to create the physical cluster (step 2) before installing the server software (step 4). However, you at least must have installed the external shared SCSI bus adapter (step 1a) so that you can specify the adapter port during the server software installation process.

These tasks are as follows:

1. Prepare the hardware.
To prepare the cluster hardware, you must do the following:
 - a. Install the external SCSI bus adapters in each server system, assign appropriate SCSI IDs to each adapter, and install the adapter device drivers. (See the section Setting Up the Server Systems in Chapter 3 for details.)
 - b. Install the disks to be shared by the cluster servers in a supported storage enclosure, and assign appropriate SCSI IDs to each disk. (See the section Setting Up Disks and Storage Enclosures in Chapter 3 for details.)
2. Create the physical cluster by cabling the shared SCSI bus and connecting the shared storage to each of the servers. (See the section Creating the Physical Cluster in Chapter 3 for details.)
3. Prepare the shared disks for use in the cluster, and verify that each server can access the disks. (See the section Preparing the Disks and Verifying the Cluster Configuration in Chapter 3 for details.)

Caution

If the disks on your shared bus contain data that you wish to preserve, you should install the cluster software on each of your server systems *before* creating and connecting the shared bus. There is danger of disk corruption if you turn on the system power for both server systems with the shared bus connected when the cluster software is not installed.

4. Install the Digital Clusters for Windows NT server software on each server. (See Chapter 4 for details.)
5. Using the Cluster Administrator and Windows NT File Manager, configure the cluster server software by assigning the shared disks to groups and creating Windows NT shares. (See the *Digital Clusters for Windows NT Administrator's Guide* for details.)
6. Install the Digital Clusters for Windows NT client software on those client systems that need to access the cluster using the cluster alias. (See Chapter 5 for details.)

Chapter 3

Installing the Hardware

This chapter describes how to set up the hardware for a Digital Clusters for Windows NT environment. Refer to Chapter 2 for a summary of the steps necessary for setting up your cluster.

Preparing the Hardware

Before you can set up your hardware as a cluster, you must prepare each of the components for use in the Digital Clusters for Windows NT environment.

Note that this guide does not provide detailed information about installing specific systems, storage enclosures, and SCSI adapters. It describes only how to set up the hardware in the context of a cluster. To install the individual components of your cluster, refer to the documentation that came with your hardware.

Setting Up the Server Systems

To set up your server systems for use in the cluster, you must install an external SCSI bus adapter for each shared bus you plan to have. Install each adapter by doing the following:

1. Determine if you have the correct version of the adapter firmware.
2. Enable or disable the internal termination for the SCSI adapter, as necessary. (See the section Terminating the Bus and Isolating Devices in this chapter for information on bus termination.)
3. Turn off the system power.
4. Configure an I/O bus slot for use and install the SCSI adapter.
5. Turn on the system power.

6. Display the system hardware configuration and update the SCSI controller firmware, if necessary.
7. Use the configuration utility that came with your adapter to set various operational parameters.
 - Set the SCSI ID for the adapter. (See the section SCSI IDs in Chapter 1 for information on SCSI IDs.)
 - Disable the adapter BIOS.
 - Enable fast SCSI bus speed for the adapter. (See the section SCSI Bus Speed in Chapter 1 for information on bus speed.)
 - Disable the SCSI bus reset on initialization feature for the adapter. (See the section Bus Reset in Chapter 1 for information on the Bus Reset feature.)
8. Install the adapter driver.
9. Shut down the system and turn off the system power.

The following sections describe how to prepare your server systems for use in your cluster.

Preparing an AlphaServer System

Note

The Adaptec AHA-2944W SCSI adapter is supported on all AlphaServer systems except the 4100. However, you must configure the adapter on a Prioris system before installing it into an AlphaServer system.

To install the SCSI bus adapter into an AlphaServer system and prepare your server system for use in your cluster, do the following:

1. Check that your adapter has the required hardware and firmware revision levels. See Chapter 1 for the revision levels required for your adapter.
2. Disable the adapter's internal termination if you are not using the adapter to terminate the shared bus. Note that Digital strongly recommends that you do *not* use the adapter to terminate the shared bus. (See the section Terminating the Bus and Isolating Devices in this chapter for more information.)

Note

If you are using an Adaptec AHA-2944W bus adapter, do not execute steps 3 to 7 in this section. Instead, install the adapter in a Prioris system and then execute steps 4 to 7 of the section Preparing a Prioris System later in this chapter. When you have completed configuration of the adapter, remove it from the Prioris system and install it in your AlphaServer system. Then go to step 8, in this section.

3. Install the adapter in a PCI slot of the server system. (Note that you must be sure to properly configure the PCI slot before installing the adapter. See the documentation that came with your system.)
4. After the adapter is installed, reboot your system. At the SRM console, enter the `arc` command to load the ARC console.
5. Insert the distribution media that came with your adapter (either a floppy disk or a CD-ROM) into the appropriate drive, and if necessary, run the program to update your adapter firmware. (Refer to the documentation that came with your adapter for instructions on how to update the firmware.)
6. Run the configuration utility program for your adapter and specify the following parameters:
 - Disable the bus reset on initialization feature.
 - Enable or disable fast bus speed, as desired.
 - Set the SCSI ID of the adapter. Note that you can change the SCSI ID of your adapter at a later time using the `set pk n0_host_id # console` command.(Refer to the documentation that came with your adapter for instructions on how to run the configuration utility program.)
7. Exit the configuration utility and then exit the ARC console, returning to the SRM console main menu. Select the option to boot Windows NT.
8. When Windows NT is up and running, install the device driver for your adapter. (See the section Installing the Adapter Device Driver later in this chapter for instructions on how to install an adapter device driver.)

Preparing a Prioris System

To install your SCSI bus adapter into a Prioris server system, do the following:

1. Check that your adapter has the required hardware and firmware revision levels. See Chapter 1 for the revision levels required for your adapter.
2. Disable the adapter's internal termination if you are not using the adapter to terminate the shared bus. Note that Digital strongly recommends that you do *not* use the adapter to terminate the shared bus. (See the section Terminating the Bus and Isolating Devices in this chapter for more information.)
3. Install the adapter in an I/O slot of your server system. (Note that you must be sure to properly configure the I/O slot before installing the adapter. See the documentation that came with your system.)
4. After the adapter is installed, reboot your system. Respond as directed on the screen to enter the Setup program for your bus adapter.
5. When the Setup program starts, verify the firmware level of your adapter. If the firmware level does not match the required revision level as listed in Chapter 1, consult the documentation that came with your adapter for instructions on how to update the firmware.
6. Refer to the documentation that came with your adapter for instructions on how to specify the following parameters:
 - Set the SCSI ID of the adapter.
 - Enable fast bus speed.
 - Disable the adapter BIOS.
 - Disable the bus reset on initialization feature.
7. Exit the Setup program. The system will restart the boot process, posting messages for each device it finds, starting again with the first I/O slot.
8. When Windows NT is up and running, install the device driver for your adapter. (See the next section, Installing the Adapter Device Driver, for instructions on how to install an adapter device driver.)

Installing the Adapter Device Driver

To complete the installation of your SCSI bus adapter and prepare your server system for use in your cluster, you must install the adapter device driver. To install the driver, do the following:

1. Be sure Windows NT is running. From Program Manager, select Windows NT Setup.
2. Select Add/Remove SCSI devices.
3. If your adapter appears in the pull-down list of devices, the device driver is on the Windows NT distribution CD-ROM. Select the device and select OK. Load the Windows NT distribution disc when you are prompted to by the Setup program.
4. If your adapter does not appear in the pull-down list, select the entry for Third Party Devices at the bottom of the pull-down list. Insert the distribution media (either a floppy diskette or CD-ROM) that came with your adapter into the appropriate drive, specify the drive letter, and select OK. Confirm the device when prompted by the Setup program.
5. Exit the Setup program and restart Windows NT.

Setting Up Storage Enclosures

Disk devices used in the shared bus must be located in a supported storage enclosure. Before you connect the enclosures to the shared bus and create the physical cluster, you must install the disks in the storage enclosures. For detailed information about installation and configuration, refer to the documentation that came with your storage enclosure and disks.

Assigning SCSI IDs

Each device on a shared bus must have a unique SCSI ID.

The IDs for disks in a BA350 storage unit correspond to the slot in which the disk resides. The BA350 has seven slots, numbered 0 to 6, so the disk residing in slot 0 has an ID of 0. Note that on the shared bus in a cluster, the bus adapters installed in the server systems use IDs 6 and 7. Therefore, disks can be installed only in slots 0 to 5 in the BA350.

If two BA350 disk storage units are connected to the same shared bus, the disks within the units must be installed in unique slots for the disks to have different SCSI IDs on the bus. For example, if the server systems use IDs 6 and 7 and one BA350 has disks in slots 0 and 1, the other BA350 can have disks only in slots 2 to 5.

The SCSI IDs for disks in a BA356 storage unit are set by the device address switches on the personality module. The default settings are the same as on the BA350 — slot 0 maps to ID 0, and so on. See your hardware documentation for details.

Note

If you are installing a StorageWorks DWZZx signal converter in a BA350 or BA356 enclosure, it should be installed in slot 0.

The HSZ40–AX RAID subsystem can be configured for up to four different SCSI IDs. See your hardware documentation for details.

Internal Termination

Some disk drives and storage enclosures have internal termination. You may have to remove this termination, depending on your hardware configuration. For example, if the storage enclosure is located in the middle of the shared bus, you must remove the internal termination. Digital strongly recommends you remove this termination from *all* devices and use external termination. (See the section Terminating the Bus and Isolating Devices later in this chapter for more information about bus termination.)

See the documentation that came with your storage unit for instructions on how to disable your unit's internal termination.

Creating the Physical Cluster

Once you have prepared the individual hardware components, the next step typically is to connect them together into a physical cluster configuration before you install the software.

Caution

If the disks on your shared bus contain data that you wish to preserve, you should install the cluster software on each of your server systems *before* creating and connecting the shared bus. There is danger of disk corruption if you turn on the system power for both server systems with the shared bus connected when the cluster software is not installed.

This section assumes that you are setting up your cluster for the first time. Refer to Chapter 6 for information on adding or removing devices from an existing cluster.

Before you can connect the cables and create the physical cluster, you must ensure that the following requirements are met:

- The SCSI adapters must be installed in an I/O bus slot on each server system and configured with unique SCSI IDs.
- The SCSI adapter firmware must be compatible with the cluster software requirements and must be updated, if necessary.
- Disks must be installed in the appropriate storage enclosure slots and configured with unique SCSI IDs.

Refer to the section *Preparing the Hardware* earlier in this chapter for information on preparing the individual hardware components for use in your cluster.

Setting Up a Shared SCSI Bus

The shared SCSI bus is the heart of the Digital Clusters for Windows NT environment. For the cluster to operate properly, the shared bus must be terminated and cabled according to strict guidelines.

Terminating the Bus and Isolating Devices

The shared SCSI bus must be terminated correctly for it to operate properly in the Digital Clusters for Windows NT environment. Each SCSI bus segment must have exactly two terminators and they must be located at the two ends of the segment.

There are a number of ways to terminate a bus segment.

- **SCSI adapters.** All SCSI adapters have internal termination that can be used to terminate the bus. Note, however, that Digital does not recommend this method of bus termination. If the system is disconnected from the shared bus, the bus will not be terminated properly and will be inoperable.
- **Storage enclosures.** The internal termination of a storage enclosure can be used to terminate the bus if the enclosure is located at the end of the bus.
- **Y cables.** Y cables can be attached to certain devices. If the device is located at the end of the bus, you can attach a terminator to one branch of a Y cable to terminate the bus. To use this method of termination, you must remove or disable the device's internal terminators.
- **Tri-link connectors.** Tri-link connectors can be attached to certain devices. If the device is located at the end of the bus, you can attach a terminator to one of the tri-link connectors to terminate the bus. To use this method of termination, you must remove or disable the device's internal terminators.

Note

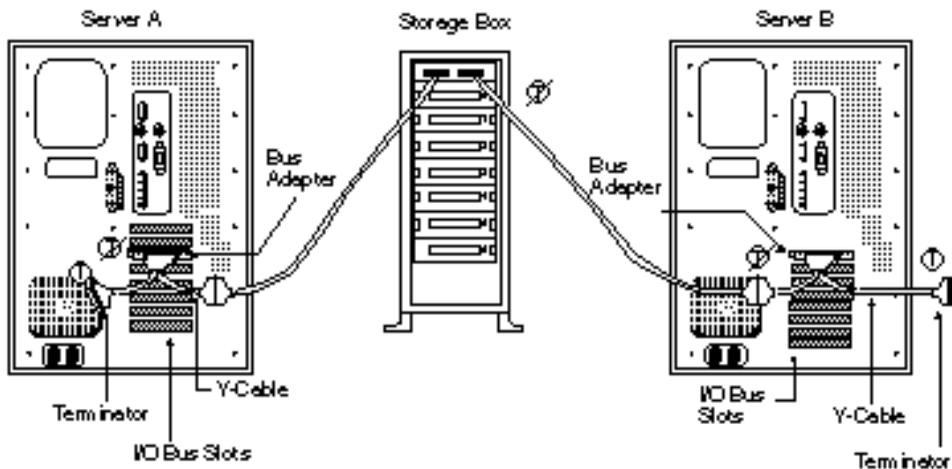
If your device is not located at the end of the shared bus, you must disable its internal termination.

Digital strongly recommends that you use Y cables or tri-link connectors to terminate the bus. In addition to providing termination, Y cables and tri-link connectors provide a way for you to isolate systems and storage enclosures from the shared bus without affecting the bus termination. Therefore, your shared bus can remain operable while you perform maintenance on a device or change the configuration.

Example 1

The configuration shown in the following figure has a system located at each end of the bus, with the storage enclosure in the middle. A Y cable is attached to the unterminated port of each adapter. The bus is terminated by terminators attached to each Y cable. The internal termination of the storage enclosure is disabled.

Shared Bus with the Storage Enclosure in the Middle

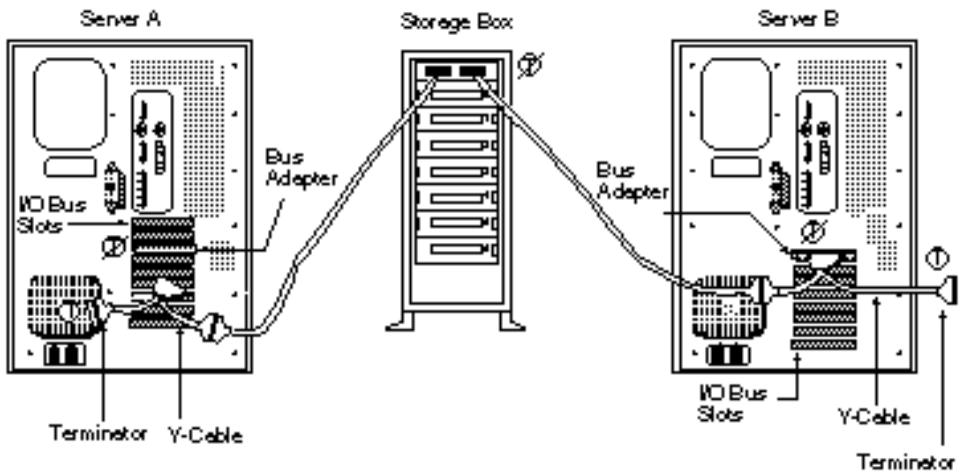


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Note that with this configuration, if one of the Y cables is disconnected from the adapter port (as shown in the following figure), the shared bus is still properly terminated. Thus, even though the disconnected server system is no longer available, the cluster is still operable with the remaining server.

Note, however, that in this configuration there is no Y cable at the storage enclosure. If the shared storage is disconnected, the bus will be inoperable. If you have more than one storage enclosure on the bus, you should use a Y cable or a tri-link connector to connect each enclosure to the bus. In this way, the integrity of the bus will be maintained if one of the enclosures is disconnected.

Disconnecting a Y Cable



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Example 2

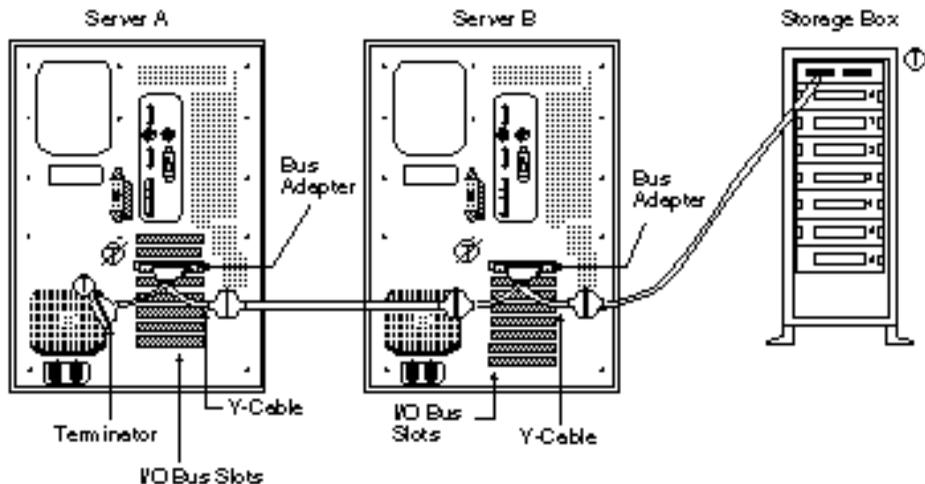
The configuration shown in the following figure includes the same hardware components as that shown in Example 1. However, in this example, one of the server systems has been placed in the middle of the shared bus. The storage enclosure is placed at the end of the bus and its internal termination is used to terminate the bus.

Note

Digital recommends “end-bus” configurations such as this (where the storage enclosure is placed at the end of the shared bus) over “mid-bus” configurations (where the storage enclosure is configured between the server systems).

As was the case in Example 1, either server system can be isolated from the cluster (by disconnecting the appropriate Y cable) without affecting the termination of the shared bus. However, if the storage enclosure is disconnected, the shared bus will be inoperable because the bus will no longer be properly terminated.

Shared Bus with the Storage Enclosure at the End



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Setting Termination Power

The bus terminators are powered from the SCSI bus line called TERMPWR. All supported bus adapters and enclosures supply the TERMPWR line. Both bus adapters should be configured to supply termination power so that as long as one server system is on line, the bus will remain properly terminated.

There should be no more than two sources of termination power on a bus segment.

Using Signal Converters

Signal converters convert single-ended SCSI signals to differential SCSI signals. They are used to provide communication between devices with different transmission methods or to overcome cabling length restrictions on fast single-ended buses. Some signal converters can also be used to connect narrow (single-ended) devices to a wide (differential) buses.

Note that you must not install more than two signal converters between devices.

The following table summarizes the transmission methods and data path widths of all supported devices.

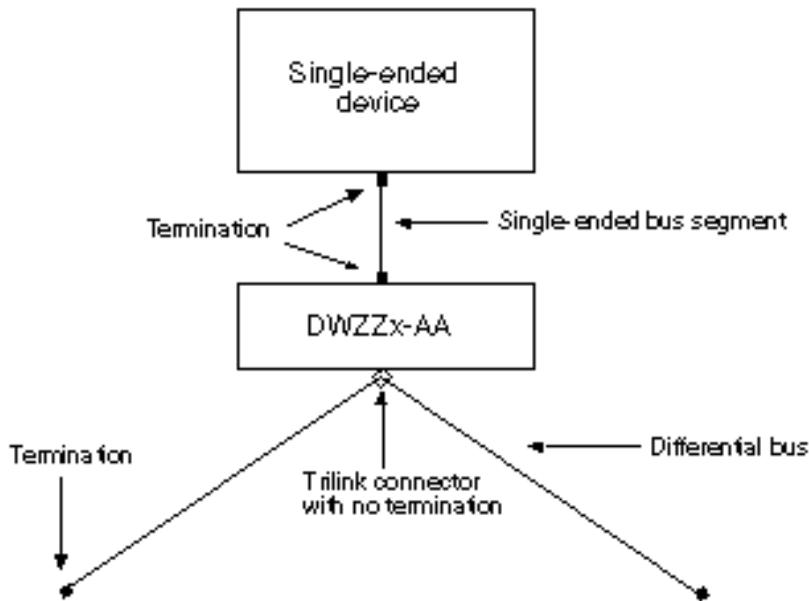
Device Transmission Methods and Widths

Device Type	Transmission Method	Data Path Width
Bus Adapters		
Adaptec AHA-2944W	Differential	Wide
Digital KZPSA-BB	Differential	Wide
Storage Devices		
Digital BA346-KB	Single-ended	Wide
Digital BA350-KB	Single-ended	Narrow
Digital BA356-KC	Single-ended	Wide
Digital HSZ40	Differential	Wide
Digital SW-410	Differential	Wide
Digital SW-310	Differential	Wide

Signal converters have two sides: a single-ended side and a differential side. You connect the single-ended side to single-ended buses and the differential side to differential buses. Both sides of the converter have removable termination. Whether or not you remove this termination depends on your configuration.

For example, the following figure shows a conceptual view of a single-ended device connected to a differential bus using a desktop signal converter. The signal converter is connected to the middle of the shared differential bus using a tri-link connector. The differential side of the converter has the internal termination removed. However, the termination on the single-ended side has been retained because it is the end of the single-ended bus segment between the converter and the storage device. (Note that the internal termination of the storage device is also retained.)

Using a Signal Converter



ZK-0694A-R15

Sample Configurations

This section describes cluster configurations for specific Digital Clusters for Windows NT hardware environments.

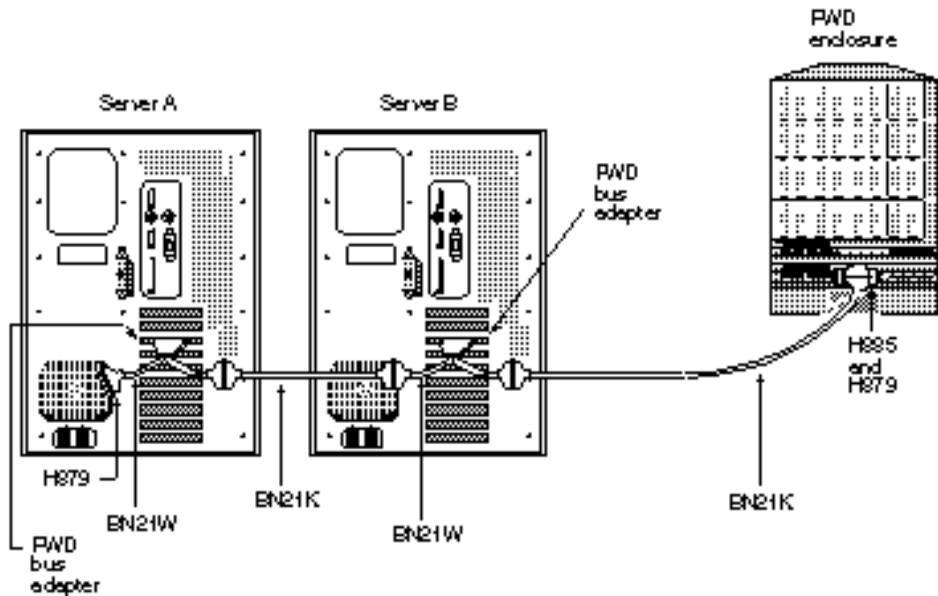
Note

The examples in this section are not meant to be an exhaustive description of all possible hardware configurations. There are many ways to connect the shared SCSI bus. These examples are intended merely to give you some guidelines for the most commonly used configurations.

Configuring a Differential Bus with Differential Storage

The following figure shows one way to configure a differential bus. This example uses a differential storage device and a straightforward connection using Y cables and external termination.

Configuring a Differential Bus with Differential Storage



ZK-9695A-RH5

To configure a cluster like the one shown in the previous figure, you will need the following:

- Two fast wide differential (FWD) bus adapters
- Two BN21W-0B Y cables
- One H885-AA tri-link connector
- Two H879-AA terminators
- Two BN21K cables

Because the Y cables consume a total of 0.6 meters of the total bus length, the combined length of the BN21K cables must not exceed 24.4 meters.

Remove or disable the internal termination of both bus adapters, as well as that of the storage enclosure.

Note

Although Digital strongly recommends that you implement external termination in all cases, external termination is not strictly required at the storage enclosure in this example. (See the section *Terminating the Bus and Isolating Devices* earlier in this chapter.) If you choose not to use this external termination, you will not need the tri-link connector and one of the H879-AA terminators. Retain the internal termination of the storage enclosure and remember to include the internal SCSI bus length of the storage enclosure in the total length of the shared bus.

Configuring a Differential Bus with Single-Ended Storage

To configure a differential bus using a single-ended storage device, you will need the same components listed in the previous section, as well as a StorageWorks signal converter installed in slot 0 of the storage enclosure. If you are configuring a single-ended narrow storage enclosure (such as the BA350), use the DWZZA-VA. If you are configuring a single-ended wide storage enclosure (such as the BA356), use the DWZZB-VW. Remove the internal termination from the differential side of the signal converter. Leave the personality module installed.

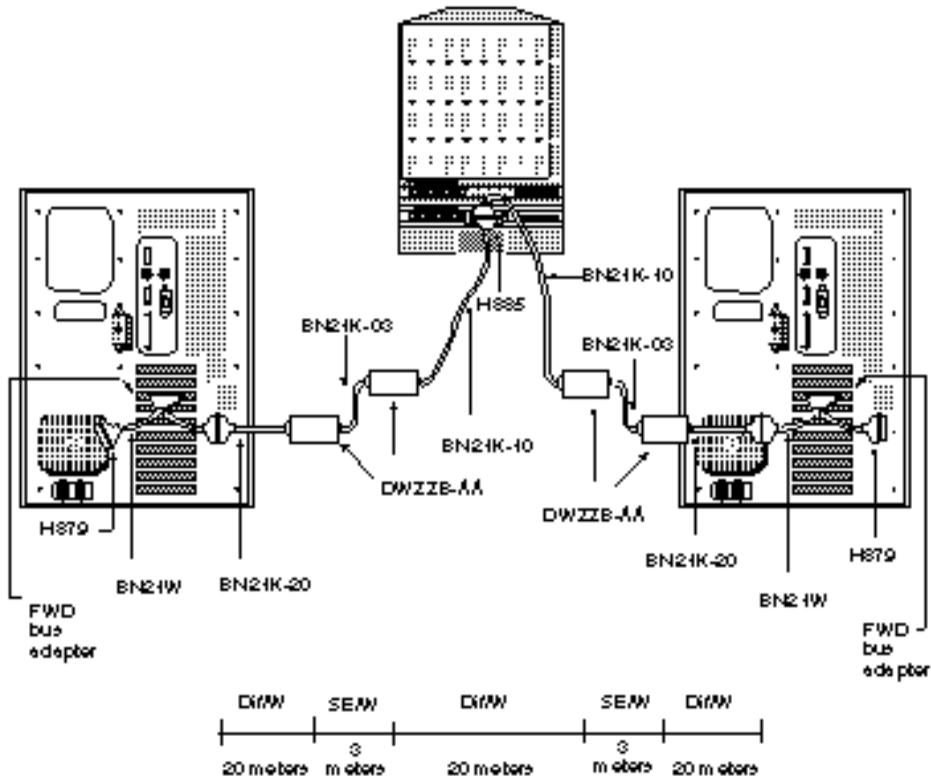
The figure on the following page shows a differential bus with single-ended storage.

Extending the Bus Using Signal Converters

If the characteristics of your cluster environment require that your server systems and shared storage be further apart than permitted by standard cabling, you can extend the length of the shared SCSI bus using signal converters.

The following figure shows a configuration that uses signal converters to divide the SCSI bus into five segments and more than triple its total length.

Extending the Bus Using Signal Converters



ZK-8704A-FHE

To duplicate this configuration, you will need the following:

- Two fast wide differential (FWD) bus adapters
- Two BN21W-0B Y cables
- Four DWZZB-AA desktop signal converters
- Two BN21K-03 cables (3 meters each)
- Four BN21K-xx cables (two BN21K-20 cables, 20 meters each, and two BN21K-10, 10 meters each)
- One H885-AA tri-link connector
- Two H879-AA terminators

You must remove or disable the internal termination of both bus adapters, as well as the internal termination of the storage enclosure, but retain the internal termination on both sides of each signal converter.

Without the signal converters, the shared SCSI bus would consist of one differential bus segment with a total length of a little over 20 meters. (Note that the longest available cable length for BN21K cables is 20 meters.) Using the signal converters adds four bus segments (two single-ended and two differential) and an extra 46 meters.

Extending the shared bus in this fashion can degrade performance.

Additionally, you cannot extend the shared bus indefinitely. Remember that you can install no more than two signal converters between any two devices. For example, the configuration shown in the figure is valid only if the shared storage is a differential device. If the shared storage were single-ended (a BA356, for example), you would need another signal converter to connect to the differential bus. But this would add a *third* converter between the storage and the bus adapter, violating the SCSI bus configuration rules.

Preparing the Disks and Verifying the Hardware Configuration

If any of your shared disks are new, you must prepare them for use in the cluster before configuring your cluster shares.

Note

The steps listed in this section describe how to prepare your disks before you have installed the cluster software. For information on preparing disks to be added to a running cluster, see the section Adding a Disk in Chapter 6.

To prepare your disks for use in your cluster, do the following:

1. Turn on the system power for *one* of your server systems while leaving the second server system turned off.
2. Turn on the power for the shared storage.

Caution

Be sure you turn on power for only *one* server system at this time. There is danger of disk corruption if both server systems are turned on with the shared bus connected when the cluster software is not installed.

3. Run Windows NT Disk Administrator.
4. If Disk Administrator detects disks that do not have disk signatures, it will ask you if it should add signatures to those disks. A disk signature is a 32-bit value that uniquely identifies the disk. Select OK and Disk Administrator will write the signatures.

Caution

Writing a signature can corrupt certain types of disks. In particular, writing a signature to a disk that has been formatted for use with the UNIX® operating system will damage the UNIX boot block.

5. Partition your shared disks as needed.

6. Format the partitions using the NTFS file system. Note that the use of this file system is not enforced by the cluster software, but is required to prevent possible data loss during failover. NTFS uses logging techniques that minimize the potential for such data loss.

Note that fault tolerant storage sets — such as those created with Windows NT FTDISK — are *not* supported for shared disks.

7. You should assign fixed drive letters to the partitions so that each disk will have a consistent set of drive letters each time the disk is brought on line. Note that these drive letters are the drive letters of your shared disks *on this system*.

Assign these drive letters beginning in the middle of the alphabet (for example, with “G” or higher) to ensure that they do not interfere with the Windows NT dynamic assignment of secondary partitions.

Windows NT permits a maximum of 26 drive letters. When assigning drive letters to your shared storage, you must consider not only the total number of disks (both shared and local) that will be on line during normal operations, but also the number that will be on line in the event of a failover from the other server. If this number exceeds the 26-drive maximum, you will not be able to bring all disks on line at one time.

8. Digital recommends that you label your shared disks. You should choose a meaningful label because the Cluster Administrator will use the label, if provided, as the default name of the disk. Unique labels also help you determine that all your shared disks are recognized by both server systems.

Once you have prepared your disks, you should verify that they also are recognized by the second server. To do this, perform the following steps:

1. Shut down the server you were just working on and turn *off* the system power.
2. Reboot the other server.

Caution

Be sure you turn on power for only *one* server system at this time. There is danger of disk corruption if both server systems are turned on with the shared bus connected when the cluster software is not installed.

3. Run Windows NT Disk Administrator. You should see the disks that you prepared and labeled on the other server.
4. Again, you should assign fixed drive letters to each partition. Digital recommends that you use the same drive letters for each partition on both server systems so that the drive letters will remain the same after a failover. Note, however, that this is not required.

When you have verified that both server systems recognize your shared disks, shut down the second server and turn off the system power. Turn off the power for the shared storage.

Chapter 4

Installing the Server Software

Once your cluster hardware environment is set up, you must install the Digital Clusters for Windows NT server software on both your server systems. Both server systems must be running the Windows NT Server operating system.

Refer to Chapter 2 for an overview of the steps necessary for setting up your cluster.

For information on installing the Digital Clusters for Windows NT client software on a client system that will access the cluster using the cluster alias, see Chapter 5.

System Requirements for Server Software

The following table shows the software and hardware requirements for installing and running the Digital Clusters for Windows NT server software:

Operating system	Microsoft Windows NT Server Version 3.51 with Service Pack 4
Microprocessor	Prioris or Digital Alpha
Hard disk space (approximate)	5 MB
Distribution media	CD-ROM

You also should consider the following when installing the Digital Clusters for Windows NT server software:

- The server system must be running in an ethernet or FDDI network, using one of the following PC-LAN protocols:
 - IPX/SPX
 - NetBEUI
 - TCP/IP

Note

The two cluster server systems must have at least one protocol in common.

- The system must be running as a member of a Windows NT Server domain.
- You should have Windows NT server licensing for your system that is sufficient to handle the total number of clients that potentially can be routed to the system in the event of failover from the other cluster server.

Before You Begin

There are a number of things you should do before installing the cluster server software:

- Ensure that your hardware is properly installed, as described in Chapter 3.

Caution

If the disks on your shared bus contain data that you wish to preserve, you should install the server software on each of your server systems *before* creating and connecting the shared bus. There is danger of disk corruption if the system power is turned on for both server systems with the shared bus connected when the cluster software is not installed.

- Be sure that Service Pack 4 is installed on your system *before* installing the server software. Service Pack 4 is provided on the Digital Clusters for Windows NT distribution CD-ROM.

- When you install the server software, the Setup program will ask you to input the user name, domain name, and password of the account to be used as the cluster administrator account. This account must be in the Domain Administrators group and have the advanced user rights to log on as a service.

Digital recommends that you create such an account specifically to serve as the cluster administrator account and suggests using "ClusterAdmin" as the user name. To create such an account, do the following:

1. Start Windows NT and log into an account with Domain Administrator privileges.
 2. Start the User Manager for Domains and create an account with user name "ClusterAdmin" in the Domain Administrators group.
 3. Set up the account rights using the Policy menu and give the account the advanced user right to log on as a service.
- At one point during the installation procedure, Setup scans the system hardware for bus adapters and asks you to specify which buses are shared. You should know the port and bus numbers of your shared buses before you begin the installation process.

To identify your shared buses, do the following on each server system:

1. Run Registry Edit, found at `\winnt35\system32\regedt32.exe`, and click on the following:
 - HKEY_LOCAL_MACHINE
 - Hardware
 - DeviceMap
 - Scsi
2. Double-click on all the Scsi Port keys to expand them. For each bus on each port you will see a display containing the following information:
 - Adapter type, as identified by its associated driver
 - SCSI ID of the adapter (the Initiator Id)
 - SCSI IDs of all disks controlled on the bus (the Target Ids)
 - Disk type of each disk
3. Look for the port and bus with the appropriate adapter type and the combination of disk types and SCSI IDs that match the configuration of your shared bus.
4. Make note of the port and bus numbers of all your shared buses.

Software Installation Overview

To install the server software, perform the following steps. Note that each step is described in detail in later sections:

1. Turn off the power for the shared storage and turn on the power for both the server systems.
2. Install the server software on the first server, as described in the section Installing the Software on the First Server later in this chapter. When you have completed the installation, leave the server turned on but do not reboot it.
3. Install the server software on the second server, as described in the section Installing the Software on the Second Server later in this chapter. When you have completed the installation, leave the server turned on but do not reboot it.
4. Turn on the power for the shared storage, and reboot the servers *one at a time*. (See the next section, Rebooting Your Server Systems, for instructions on how to reboot your servers.)
5. With the power on for the entire cluster, verify that the software was installed properly and that you can see all your shared disks. (See the section Completing and Verifying the Installation.)
6. Use the Cluster Administrator and Windows NT File Manager to configure the software by assigning shared disks to groups and creating Windows NT shares.

Rebooting Your Server Systems

When you have completed the installation of the software on both your server systems, you will see instructions to “reboot your servers, *one at a time*.” It is vitally important that you understand the proper way to reboot your servers.

Unsynchronized access to the shared bus can corrupt data on your shared disks.

To safely reboot your servers, do the following:

1. Reboot one server.
2. Wait until the logon prompt appears on that server.
3. Reboot the second server.

Installing the Software on the First Server

Caution

Before you begin the installation, be sure the power for the shared storage is off. Unsynchronized access to the shared disks can corrupt the disks.

To install the Digital Clusters for Windows NT server software on the first server, do the following:

1. Start Windows NT and log into the cluster administrator account. (See the section *Before You Begin*, earlier in this chapter, for instructions on creating this account.) Close all open applications.
2. Insert the Digital Clusters for Windows NT distribution disc into the CD-ROM reader.
3. In the Windows NT Program Manager, choose Run from the File menu.
4. In the Command Line box, type the letter of the drive assigned to the CD-ROM reader, followed by a colon and the word `setup`. For example, type `e:\setup`.
5. Choose the OK button and then follow the instructions on the screen. Setup does the following:
 - Displays a status meter while it initializes the setup process.
 - Displays a Welcome window prompting you to be sure that all other Windows applications have been closed. If applications are open, close the applications and then return to the Setup program.

6. Type your name and the name of the company you work for. (Note that once you have supplied all the required information requested on a particular Setup screen, you confirm the information and move to the next screen by choosing the Next button. You can return to a previous screen by choosing the Back button.)



The image shows a Windows-style dialog box titled "User Information". On the left side, there is a vertical panel containing an illustration of a computer monitor, a tower PC case, two CD-ROMs, and a globe. To the right of this panel, the text reads: "Type your name below. You must also type the name of the company you work for." Below this text are two text input fields. The first field is labeled "Name:" and contains the text "Donna Goodman". The second field is labeled "Company:" and contains the text "Digital Equipment Corporation". At the bottom of the dialog box, there are three buttons: "< Back", "Next >", and "Cancel".

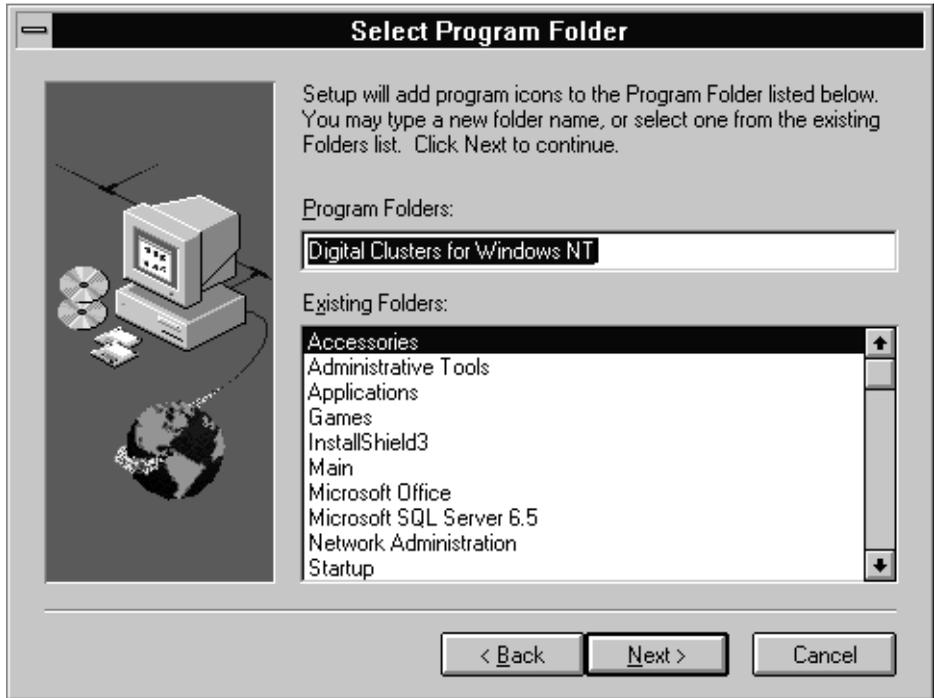
7. Select the type of installation you want to do. To install the server software, select Install NT Cluster Server.



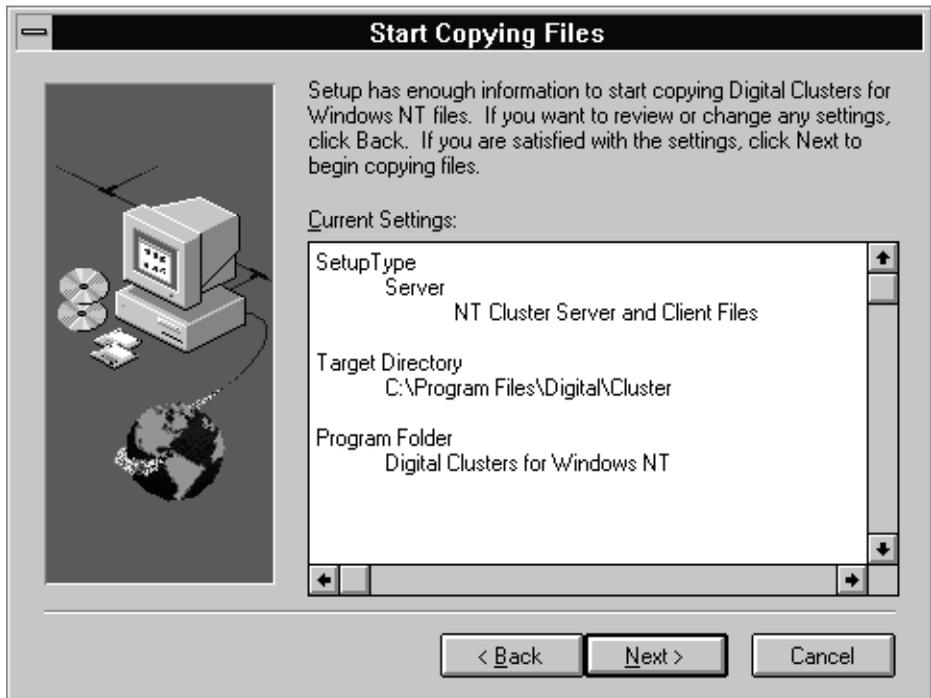
8. Confirm the directory path for the installed files. To change the directory path, choose Browse and select a new directory. If the specified destination directory does not exist, the Setup program will ask if you wish to create it.



9. Select the program folder for the program icons. You can specify an existing folder from the Existing Folders list or create a new folder by typing the new folder name in the Program Folders box.

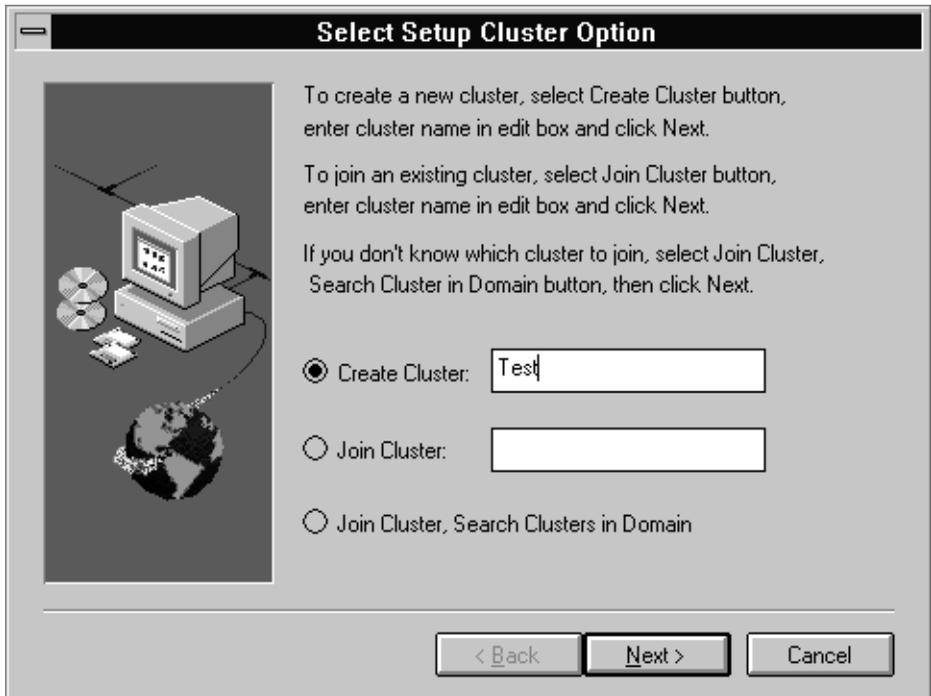


10. Review and verify the information you have supplied to the Setup program. If you want to change any of the supplied information, choose Back repeatedly until you return to the window containing the information you want to change.



If the information displayed is correct, choose the Next button. The Setup program copies files to the destination directory. While it is copying files, the program displays a status meter to mark its progress.

11. The Setup program prompts you to select whether you want to create a new cluster or join an existing cluster. Because you are installing the software on the first server of your cluster, select Create Cluster, and enter the name you want to give your cluster. Cluster names can be a maximum of 15 characters long.



12. Enter the user name, domain name, and password of an account in the Domain Administrators group that has the advanced user right to log on as a service.

Note

Digital recommends that you create such an account specifically to serve as the cluster administrator account and suggests using "ClusterAdmin" as the user name. (See the section Before You Begin, earlier in this chapter for more information about this account.)

Note that the password does not echo on the screen as you type it. You must enter the password twice to confirm it and guard against errors in typing.

Cluster Administrator Information

Enter username and password for
Cluster Administrator account

User Name:

From:

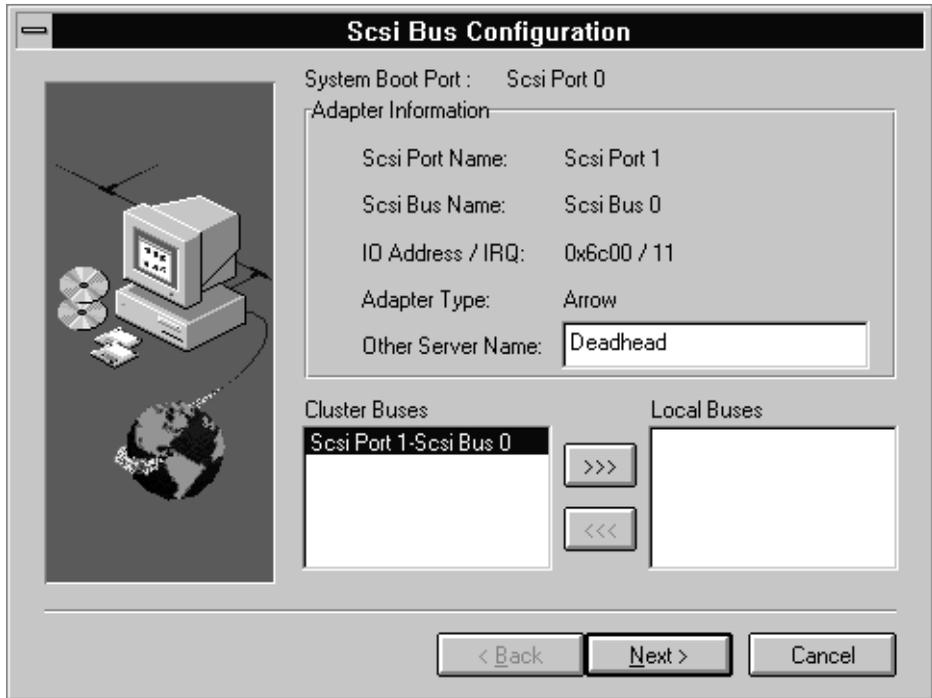
Password:

Confirm Password:

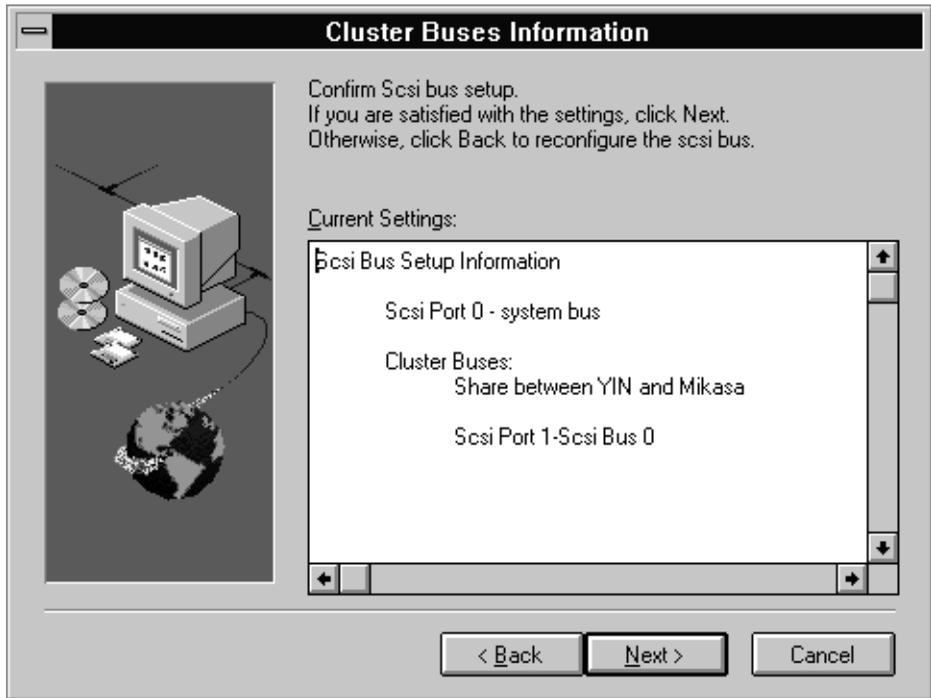
< Back Next > Cancel

13. The Setup program scans the system hardware, looking for SCSI bus adapter cards. For each adapter port, select whether the bus is a local bus or a bus shared with another server. If it is a shared bus, enter the name of the other server.

(See the section Before You Begin, earlier in this chapter, for instructions on how to determine which SCSI port and bus is your shared bus.)



14. Review and verify the bus adapter information you have supplied. If you want to change any of the information, choose Back and reenter the bus information.



15. The Setup program creates the Cluster program folder and then displays the Setup Complete window. Choose Finish to exit the program. Digital strongly recommends that you select the option to read the ReadMe file at this time.



16. Leave the power to the system turned on, but *do not* reboot the system at this time.

Installing the Software on the Second Server

Caution

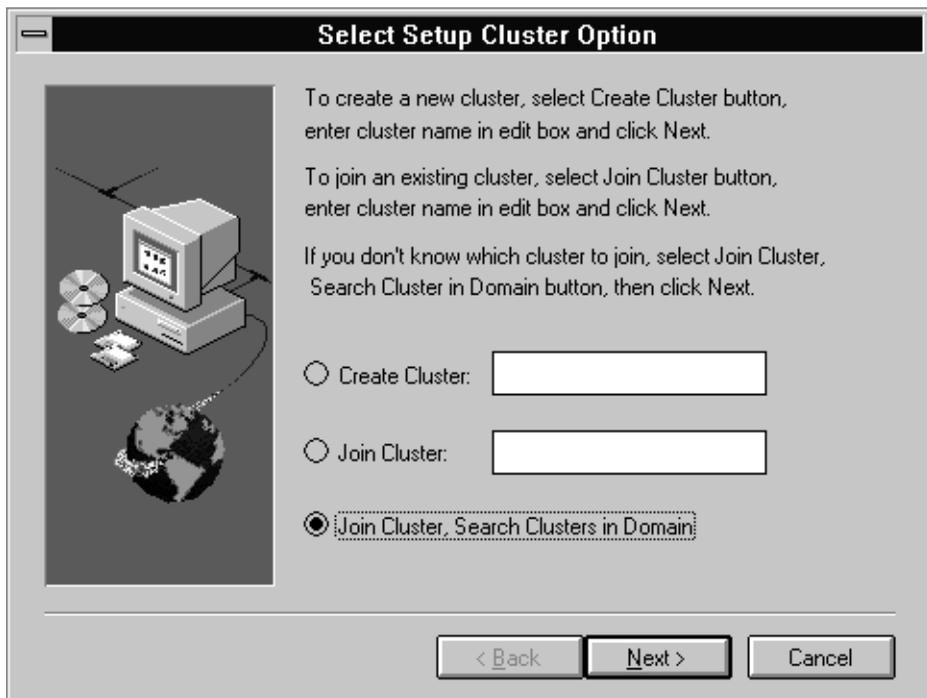
Before you begin the installation, be sure the power for the shared storage is off. Unsynchronized access to the shared disks can corrupt the disks.

To install the server software on the second server, do the following:

1. Perform steps 1 to 10, as described in the section *Installing the Software on the First Server*, earlier in this chapter.
2. If you already know the name of the cluster you want to join, select *Join Cluster* and enter the name of the cluster. Otherwise, select *Join Cluster, Search Clusters in Domain* to have Setup search for existing clusters.

Note

Searching for existing clusters in a domain can take *several* minutes. Digital strongly recommends that you do *not* select *Search Cluster in Domain* unless you absolutely have to.



3. If you selected the Search Clusters in Domain option from the previous dialog box and Setup found existing clusters, select the cluster name from the list provided. (If Setup did not find any existing clusters, Setup will prompt you to type the cluster name.)



4. Complete the installation, following steps 12 to 16, as described in the section Installing the Software on the First Server, earlier in this chapter.

Completing and Verifying the Installation

To complete the installation of the server software on both your server systems, do the following:

1. Turn on the power for the shared storage.
2. Reboot the servers, *one at a time*. (See the section Rebooting Your Server Systems, earlier in this chapter, for instructions on safely rebooting your servers.)

Once you have rebooted both your servers, you should verify that the software was installed properly by doing the following:

1. Wait approximately one minute for the registries on both systems to be updated with the cluster configuration. Then run the Cluster Administrator on both your servers. Select Class View from the drop-down list and click on Disk. You should see a list of your shared disks.

Note

You will not be able to view shared cluster resources on *either* server until the cluster software is installed on *both* systems. At that point, you can view the shared resources from both systems.

2. If you do not see your shared disks, use the Services applet from Control Panel to verify that the following services have been started on both your servers:
 - Cfmnd Server
 - Cluster Failover Manager
 - Cluster Name Service

If these cluster services are not running, the software has not been properly installed. The most likely reason is that the software was not installed from the proper user account — that is, an account in the Domain Administrators group with the advanced user right to log on as a service. (See the section *Before You Begin*, earlier in this chapter, for information on the cluster administrator account.) To correct this problem, you must reinstall the software by doing the following:

1. Turn off the power for the shared storage.
2. Uninstall the server software on the affected system. (See Appendix A, *Uninstalling the Software*, for instructions.) Reboot the system.
3. Log on to the system in a properly configured cluster administrator account and reinstall the server software as described in the section *Installing the Software on the Second Server*, earlier in this chapter. Be sure you follow the instructions exactly as they are listed in that section.

If the cluster services are running but you cannot see your shared disks, it is possible that you did not correctly specify the bus adapter for your shared SCSI bus. If this is the case, you will need to reinstall the software, as described above. Otherwise, refer to the *Troubleshooting* chapter of the *Digital Clusters for Windows NT Administrator's Guide* for more information on possible causes of disk problems.

Configuring the Cluster Software

After the Setup program exits, you must run the Cluster Administrator and Windows NT File Manager to complete the configuration of your cluster by creating disk groups and cluster shares. See the *Digital Clusters for Windows NT Administrator's Guide* for details.

Running with Microsoft SQL Server 6.5

To use Microsoft SQL Server™ 6.5 with Digital Clusters for Windows NT, you may need to run script `fallbac3.sql` after starting the MSSQLServer service on your system. This script, a patch from Microsoft to correct potential SQL Server failback problems, is provided on the Digital Clusters for Windows NT distribution CD-ROM.

If you are not running Microsoft SQL Server 6.5 with Service Pack 1, you will need to run this script after starting the MSSQLServer service under either of the following circumstances:

- You have MS SQL Server installed on your server but it was not running at the time that you installed the cluster server software.
- You installed MS SQL Server after installing the cluster software.

If you had Microsoft SQL Server installed and the MSSQLServer service was running when you installed the cluster server software, Setup will have run the script automatically for you and you need to do nothing further.

To install the patch script, do the following:

1. Using the Services applet of Windows NT Control Panel, ensure that the MSSQLServer service is running.
2. Return to Program Manager and open an MS-DOS window.
3. At the MS-DOS command prompt, type the following:

```
isql -Usa -P -S -n -i "cluster-directory\fallbac3.sql"
```

where *cluster-directory* is the drive and path name of the destination directory that you specified during the cluster server software installation. If you used the default directory, this drive and path will be as follows:

```
c:\Program Files\Digital\Cluster
```

Note that the quotes in the command string are required.

Chapter 5

Installing the Client Software

The Digital Clusters for Windows NT client software can be installed on client systems running the following operating systems: Windows NT (Server or Workstation), Windows for Workgroups, or Windows 95®.

System Requirements for Client Software

The following table shows the software and hardware requirements for installing and running the Digital Clusters for Windows NT client software:

Operating system	One of the following: Windows 95 Windows NT Server Version 3.51 Windows NT Workstation Version 3.51 Windows for Workgroups Version 3.11
Microprocessor	Prioris (all operating systems), Digital Alpha (Windows NT only)
Hard disk space (approximate)	2 MB

You also should consider the following when installing the Digital Clusters for Windows NT client software:

- The client system must be running in an ethernet or FDDI network, using one of the following PC-LAN protocols:
 - IPX/SPX
 - NetBEUI
 - TCP/IP

Note

The client system must have at least one protocol in common with each of the cluster servers.

- The Digital Clusters for Windows NT software is distributed on a CD-ROM. If your client system does not have a local CD-ROM reader, there are two methods you can use to access the software installation files.
 - Make a remote CD-ROM reader shareable across the network.
 - Copy the required files onto a floppy diskette. The required files are shown in the following table, where “e” is the CD-ROM drive letter:

If your client is running . . .	Copy these files . . .
Windows 95	e:\client\W95*.*
Windows for Workgroups	e:\client\WFWG*.*
Windows NT on an Alpha processor	e:\client\NT\Alpha*.*
Windows NT on a Prioris processor	e:\client\NT\Intel*.*

Installing the Software on Your Computer

Note

The screens shown in the following steps are for a Windows NT installation. The actual screens you see on your client system may differ slightly from those shown. However, except where noted, the steps you execute and the information you supply are the same for all client software installations.

To install the Digital Clusters for Windows NT client software on your computer, do the following:

1. Be sure you are logged into the system under an account with sufficient administrative privileges to copy files to the system directories. (Failure to do so may result in a General File Transfer Error.)
2. Close all open applications.
3. Insert the Digital Clusters for Windows NT distribution disc or a floppy-disk copy of the setup files into the appropriate drive. Or access the distribution disc over the network.
4. In the Program Manager, choose Run from the File menu.
5. In the Command Line box, type the letter of the drive that contains the Setup disc or copy, followed by a colon and the word `setup`. For example, type `e:\setup`.
6. Choose the OK button and then follow the instructions on the screen. Setup does the following:
 - Displays a status meter while it initializes the setup process.
 - Displays a Welcome window prompting you to be sure that all other Windows applications have been closed. If applications are open, close the applications, and then return to the Setup program.

7. Type your name and the name of the company you work for. (Note that once you have supplied all the required information requested on a particular Setup screen, you confirm the information and move to the next screen by choosing the Next button. You can return to a previous screen by choosing the Back button.)



8. If you are installing the client software on a system running the Windows NT operating system, Setup will ask you to select the type of installation you want to do. Select Install NT Cluster Client.

Note

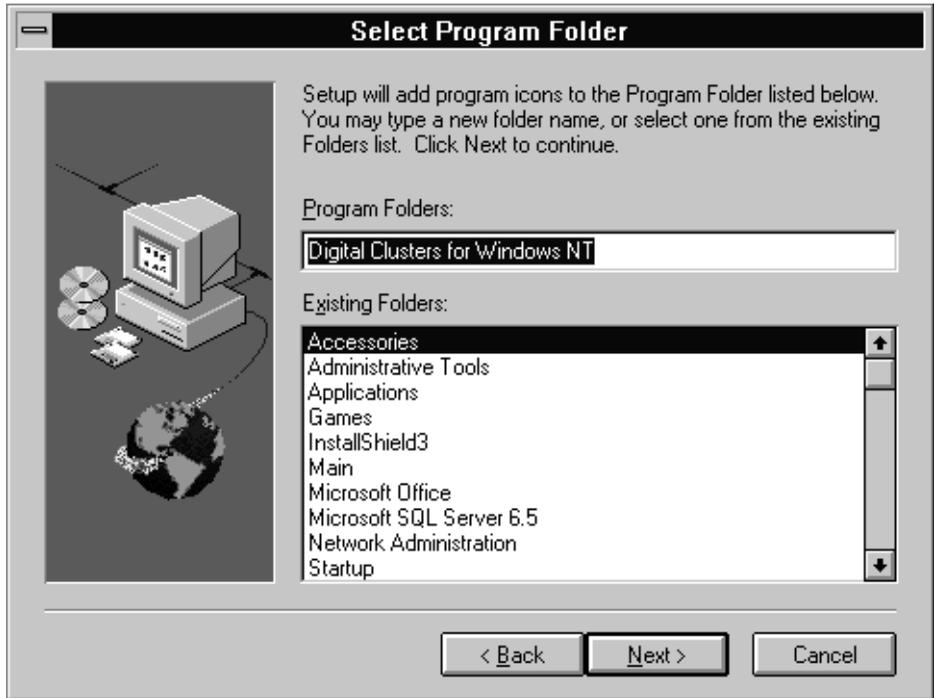
You will see this screen only if you are installing on a Windows NT system.



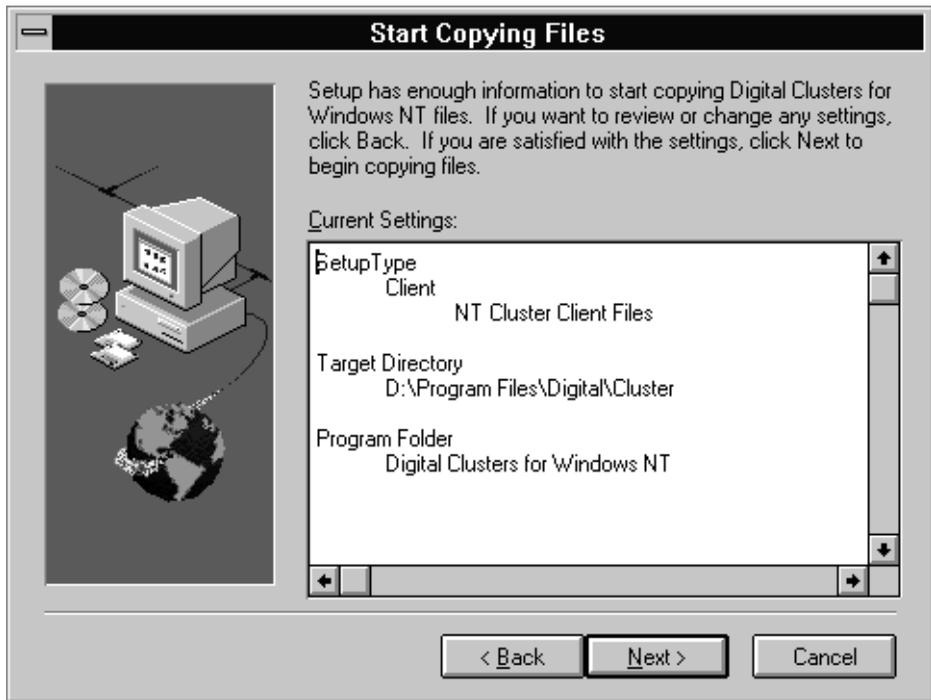
9. Confirm the directory path for the installed files. To change the directory path, choose Browse and select a new directory. If the specified destination directory does not exist, the Setup program will ask if you wish to create it.



10. Select the program folder for the program icons. You can specify an existing folder from the Existing Folders list or create a new folder by typing the new folder name in the Program Folders box.



11. Review and verify the information you have supplied to the Setup program. If you want to change any of the supplied information, choose Back repeatedly until you return to the window containing the information you want to change.



If you are satisfied with the information as specified, choose Next. The Setup program copies files to the destination directory. While it is copying files, the program displays a status meter to mark its progress.

- When all files have been copied, the Setup program displays the Setup Complete window. Choose Finish to exit the program. Digital strongly recommends that you select the option to read the ReadMe file at this time.



- Reboot your system to complete the installation.

Chapter 6

Maintaining the Hardware

This chapter describes how to maintain your Digital Clusters for Windows NT hardware environment.

Disconnecting Devices

To perform hardware maintenance functions in an active cluster and continue cluster operations, you must ensure that the shared SCSI bus is always terminated properly.

If you have used tri-link connectors and Y cables to isolate your devices and implement external termination, you should have no problem disconnecting a device and maintaining proper termination. (See Chapter 3 for information about termination and the use of tri-link connectors and Y cables.)

If you are unable to maintain proper termination on the shared bus, you must stop all cluster activity before you turn off and disconnect the device providing the termination point. Refer to the *Digital Clusters for Windows NT Administrator's Guide* for instructions on how to stop cluster activity.

Performing Maintenance on Server Systems

You occasionally will need to disconnect a server system to fix hardware problems or install new hardware.

If you can isolate the system from the shared bus without affecting the bus termination, you can perform the maintenance without interrupting the availability of cluster services. However, if disconnecting the system will disrupt the termination of the shared bus, you

must shut down all cluster activity before disconnecting the system. Cluster services will be unavailable until you complete the system maintenance and reconnect the shared bus.

If you can isolate the server system from the shared bus, do the following to disconnect the system and perform the necessary maintenance:

1. Using the Cluster Administrator, perform a manual failover for all groups currently serviced by the server system.
2. Shut down the system and turn off the system power.
3. Disconnect the system from the shared bus, making sure the bus is still properly terminated.
4. Perform the necessary maintenance.
5. Reconnect the system to the shared bus, turn on the system power and reboot the system.
6. Using the Cluster Administrator, perform a manual failover on all groups to be serviced by the server system.

When you reboot the system and restart the Cluster Administrator, the cluster software will detect if you have added another shared bus adapter or moved an existing shared bus adapter. The software will guide you through a SCSI bus configuration procedure similar to the procedure executed during the server software installation.

Adding and Removing Shared Storage Enclosures

To add a new storage enclosure to your shared SCSI bus, you will probably need to shut down all cluster activity before you begin. Unless you have planned for this addition and included appropriate tri-link connectors or Y cables in the bus path, the bus will be terminated improperly while you disconnect and reconfigure the bus cabling.

(Refer to the *Digital Clusters for Windows NT Administrator's Guide* for instructions on how to shut down cluster activity.)

To remove a shared storage enclosure, you do not need to shut down cluster activity if the enclosure can be isolated from the shared bus without affecting the bus termination. However, be sure that no services are using any of the disks within the enclosure before you turn off the power and disconnect it from the bus.

Maintaining Disks

Most of the basic system management tasks on the shared disks in a cluster are the same as those in a noncluster environment. However, there are a few considerations you should take into account when performing maintenance on shared disks.

Turning Off Power in the Storage Enclosure

You do not necessarily need to shut down your cluster to physically add or remove a disk. However, you will probably need to turn off the power to the storage enclosure. Note that doing so will result in all disks in the enclosure being set off line. Depending on your hardware configuration, it may also disrupt the termination of the shared SCSI bus.

If you have more than one enclosure on the shared bus, you should attempt to configure the bus cabling such that each enclosure can be isolated from the bus without disrupting bus termination. You can then add or remove a disk in one enclosure while permitting disks in the other enclosures to remain on line and functioning. (See Chapter 3 for more information about terminating the shared SCSI bus.)

Removing a Disk

To permanently remove a shared disk from the cluster, do the following:

1. Be sure that no application is using the disk. Because Windows NT provides no way to determine which applications are currently using which disks, you should broadcast a message to all users indicating that you want to take the disk out of service.
2. Use the Cluster Administrator to remove the disk from its group. Note that physically removing a disk that is still part of a failover group will result in the entire group being set off line. (See the *Digital Clusters for Windows NT Administrator's Guide* for instructions on removing a disk from a group.)
3. Remove the disk from its storage enclosure, following the instructions that came with your hardware.
4. Turn the power back on in the storage enclosure. The remaining disks will come back on line.

To replace the disk after it has been removed, see the section Replacing a Disk later in this chapter.

Adding a Disk

To add a disk to the cluster configuration, do the following:

1. Install the disk in the enclosure as described by the documentation that came with your hardware. Note that this may require you to turn off the power in the storage enclosure. If so, all existing disks in the enclosure will be set off line. (See the section Turning Off Power in the Storage Enclosure earlier in this chapter.) The disk must have a unique SCSI ID.
2. Turn the power back on in the storage enclosure.
3. To force the software to detect the new disk, you must either reboot one of the server systems or run Windows NT Disk Administrator. If the disk has no disk signature, the software will write a signature on the disk. A disk signature is a 32-bit value that uniquely identifies the disk. A signature is required for all disks used in the cluster.

Caution

Writing a signature can corrupt certain types of disks. In particular, writing a signature to a disk that has been formatted for use with the UNIX operating system will damage the UNIX boot block.

4. After the disk has been detected by the cluster software, run the Cluster Administrator to assign the disk to a group and bring it on line.
5. Once the disk is on line, run Windows NT Disk Administrator to partition the disk, if needed.
6. Format the partitions using the NTFS file system. Note that the use of this file system is not enforced by the cluster software, but is required to prevent possible data loss during failover. NTFS uses logging techniques that minimize the potential for such data loss.

Note that fault tolerant storage sets — such as those created with Windows NT FTDISK — are *not* supported for shared disks.

7. Digital recommends that you label each disk. You should choose a meaningful label because the Cluster Administrator will use the label, if provided, as the default name of the disk. A unique label also helps you determine that the disk is recognized by both server systems.

8. You also should assign fixed drive letters to the partitions so they will have the same drive letter each time the disk is brought on line.

Assign these drive letters beginning in the middle of the alphabet (for example, with “G” or higher) to ensure that they do not interfere with the Windows NT dynamic assignment of secondary partitions.

Note that the drive letter you assign is the drive letter that will be used by the system on which you are currently running Disk Administrator. To use the same drive letters on the second server, you should run Disk Administrator on that server and assign the same letters. Digital recommends that you use the same drive letters for each partition on both server systems so that the drive letters will remain the same after a failover. Note, however, that this is *not* required.

Windows NT permits a maximum of 26 drive letters. When assigning drive letters to your shared storage, you must consider not only the total number of disks (both shared and local) that will be on line during normal operations, but also the number that will be on line in the event of a failover from the other server. If this number exceeds the 26-drive maximum, you will not be able to bring all disks on line at one time.

Note

After using Disk Administrator to change the drive letter of a partiiton, you must reboot that server to force the cluster software to recognize the new drive letter.

Replacing a Disk

To replace a shared disk in your cluster, do the following:

1. Remove the disk from its storage enclosure by following steps 1 to 3 of the section Removing a Disk, earlier in this chapter. Leave the storage enclosure power turned off.
2. Replace the disk you just removed or install a new disk by following the instructions in the previous section, Adding a Disk.

Appendix A

Uninstalling the Software

If you need to install the Digital Clusters for Windows NT software on a system that has already had the cluster software installed, you must first uninstall the software.

Note

When uninstalling the cluster software, be sure you are logged into the system under an account with sufficient administrative privileges to permit deletion of the necessary files.

Uninstalling the Server Software

To uninstall the Digital Clusters for Windows NT server software, double-click on the uninstall icon in the Digital Clusters for Windows NT program folder. You must reboot your system before reinstalling the server software.

Saving the Cluster Configuration

Note that when you uninstall the server software, your cluster configuration information — group and share definitions — will be deleted. To retain your cluster configuration information, do the following:

1. Run Registry Edit, found at `\winnt35\system32\regedt32.exe`. Select the following:
 - HKEY_LOCAL_MACHINE
 - SYSTEM
 - CurrentControlSet

- Services
 - Cfmnd
2. Select Registry→Save Key and supply a file name when you are prompted to do so.
 3. Exit Registry Edit.

To restore your cluster configuration information after reinstalling the cluster software, do the following:

1. In Registry Edit, select the following:
 - HKEY_LOCAL_MACHINE
 - SYSTEM
 - CurrentControlSet
 - Services
 - Cfmnd
2. Select Registry→Restore and supply a file name when you are prompted to do so.
3. Exit Registry Edit.

Uninstalling the Client Software

The method you use to uninstall the Digital Clusters for Windows NT client software depends on the operating system running on the client system.

Windows NT Clients

To uninstall the client software running under the Windows NT operating system, double-click on the uninstall icon in the Digital Clusters for Windows NT program folder.

Note

If your system is running as a cluster server, as well as a cluster client, double-clicking on the uninstall icon will uninstall the *server* software, as well as the client software.

Windows 95 Client

To uninstall the client software running under the Windows 95 operating system, do the following:

1. Click on the Start button and select Settings→Control Panel.
2. Select Add/Remove Programs.
3. Select Digital Clusters from the list box. Click on Add/Remove.
4. Control Panel will prompt you to confirm the operation. Click on Yes.
5. The Uninstall Shield utility will remove the appropriate files and then display a dialog box stating that the operation was successful. Click on OK.
6. Click on OK to exit Control Panel.
7. Reboot the system.

Windows for Workgroups Client

To uninstall the client software running under the Windows for Workgroups operating system, do the following:

1. Run File Manager.
2. Find your way to the Windows system directory, `windows\system`. Note that this directory may be a subdirectory of another root-level directory, such as `WF311`.
3. Delete the following files:
 - `dlcnamc.386`
 - `dlcnamc.exp`
 - `dlcnamc.map`
 - `dlcnamc.sym`
 - `clunsapi.dll`
 - `clunsapi.pbd`
4. Using a text editor such as Notepad, delete the following line from the `[386Enh]` section of `file system.ini`:
 - `device = dclnamc.386`
5. Reboot the system.

Appendix B

Frequently Asked Questions

This appendix contains a list of questions that are frequently asked about the Digital Clusters for Windows NT hardware environment.

Do my server systems have to be identical?

Both server systems in the cluster must be of the same architecture — either AlphaServer or Prioris systems. You can, however, use different models of the same architecture.

Why can't I mix architectures?

The NTFS logfile page size on Prioris systems is different from that on RISC platforms such as AlphaServer systems. This incompatibility must be changed at the operating system level — it is out of Digital's control.

Can the server systems share a system disk?

No, system disks cannot be shared cluster resources.

Why must I have a secondary network connection?

Although there is no danger of file corruption, a second network connection allows more effective communication between the cluster servers in the event of a failure of the enterprise LAN. For example, a manual failover operation may not be properly negotiated using the rudimentary communication mechanisms provided by the shared SCSI bus.

Note that this secondary network connection should be dedicated to use by the cluster servers. The network controllers need not be expensive.

Must the secondary network connection be the same as the enterprise network connection?

No. You can have both ethernet and FDDI running in the same LAN.

Can I have more than two ethernet connections?

Yes. You can have as many as you like.

Do I have to run the same network protocol on both servers?

Yes. They must have at least one protocol in common.

Can cluster clients connect to more than one cluster?

Yes.

How much flexibility do I have to depart from the examples given for configuring the shared SCSI bus?

You need not follow the examples to the letter, but you must follow the rules for configuring the shared SCSI bus and all its segments. The following table summarizes the rules you must follow when configuring a SCSI bus.

Summary of SCSI Bus Rules

Component	Rule						
Cable length	Each bus segment must adhere to strict cable length limits, according to the transmission method and bus speed of the segment, as follows: <table><tbody><tr><td>Single-ended/fast</td><td>3 meters</td></tr><tr><td>Single-ended/slow</td><td>6 meters</td></tr><tr><td>Differential</td><td>25 meters</td></tr></tbody></table>	Single-ended/fast	3 meters	Single-ended/slow	6 meters	Differential	25 meters
Single-ended/fast	3 meters						
Single-ended/slow	6 meters						
Differential	25 meters						
Termination	Each bus segment must have exactly two points of termination, and those termination points must be at the ends of the segment.						
Transmission methods	Single-ended and differential devices must not be connected without an intervening signal converter.						
Number of signal converters	No more than two signal converters should be connected between two devices.						
SCSI IDs	All devices on the shared SCSI bus, including the two host bus adapters, must have a unique SCSI ID.						
Termination power	There should be no more than two sources of termination power on a single bus segment.						

Why must Adaptec bus adapters be configured on a Priors system?

The Adaptec SCSI Select utility currently does not run on an AlphaServer system.

Why is there a restriction on the number of signal converters I can use between devices?

The restriction is based on gate delays inside the converter. Passing signals through more than two signal converters introduces too much delay, interfering with bus arbitration.

Why can't I set a bus adapter SCSI ID to 0 or a disk ID to 7?

You can, but it is likely to degrade performance. For best performance, assign the highest priority SCSI IDs (6 and 7) to your bus adapters. Note that even for wide devices that permit IDs numbered up to 15, SCSI IDs 6 and 7 are the highest priority.

Must I always remove or disable the internal terminators on my devices?

For those devices that do not reside at the end of a bus segment, you *must* remove or disable the internal termination of the device. If the device is located at the end of a bus segment, you do not need to remove or disable the termination if you are using that termination to terminate the segment. However, Digital strongly recommends that you remove or disable internal terminators on *all* devices and use external termination for all bus segments. See the section Terminating the Bus and Isolating Devices in Chapter 3 for more information.

Why aren't there any single-ended bus adapters on the list of supported adapters?

It is not possible to configure two single-ended adapters in such a way that the configuration meets the SCSI 2 specification for maximum bus length. Although two 1-meter cables to a storage enclosure containing 1 meter of internal bus is within the guidelines, adding external termination with Y cables extends the bus beyond the required 3 meters. (Remember that bus length is measured from terminator to terminator, not from initiator to initiator.)

I think I've set up my shared SCSI bus according to the rules, but things don't work right. What's wrong?

Most of the unexplained and unusual behavior you will encounter when setting up your shared SCSI bus is a result of one or more of the following problems:

- The total cable length of a bus segment is too long for the speed and transmission type. Be sure each bus segment meets the length restrictions listed in the previous table. When calculating the length of a bus segment, don't forget to account for the length of any internal bus within each device. (Check the documentation that came with your hardware to determine this length.)
- There are too many or too few terminators on a bus segment. Each bus segment must have exactly two points of termination. Be sure you have disabled or removed the internal termination of each device, as appropriate. (Check the documentation that came with the device for instructions on how to disable or remove the internal termination.)
- The terminators are not at the ends of a bus segment. If you have installed a tri-link connector or a Y cable at the end of a bus segment, be sure you have also installed the appropriate external terminator.
- One of your cables is defective. Check all cables for broken shields, especially where the cable joins the connector.
- One of your connectors is defective. Check each connector for bent or broken pins.
- The hardware or firmware revision of a device is out of date. Check the revision level of each device against the list in Chapter 1. Where appropriate and possible, update the firmware revision of your device. (Check the documentation that came with the device for information on how to do this.)

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