DIGITAL Clusters for Windows NT

Configuration and Installation Guide

Part Number: AA–QVUSB–TE

February 1997

This guide describes how to configure and install the hardware and software for the DIGITAL Clusters for Windows NT™ environment. The guide covers the following DIGITAL Clusters for Windows NT software versions:

- Version 1.1 on Windows NT 4.0

- Version 1.0 with Clusters Service Pack 2 on Windows NT 3.51

The guide covers new installations and upgrades from Version 1.0.

February 1997

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About This Guide

This guide describes how to set up and configure the hardware and software for the DIGITAL Clusters for Windows NT environment. The guide covers the following DIGITAL Clusters for Windows NT software versions:

DIGITAL Clusters Version	Windows NT Version
1.1	4.0 with NT Service Pack 2
1.0 with Clusters Service Pack 2	3.51 with NT Service Pack 5

The guide covers new installations and upgrades to Version 1.1 or Clusters Service Pack 2.

_____Upgrades _____

If you are upgading to Version 1.1 or to Version 1.0, Clusters Service Pack 2 , see Chapter 7.

_____

Audience

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

Organization

This guide consists of seven chapters and two appendices:

Chapter 1	Describes cluster hardware configurations and concepts, supported hardware, and restrictions on 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 hardware components and 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.
Chapter 7	Describes how to upgrade from Version 1.0 to Version 1.1 of DIGITAL Clusters for Windows NT software.
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.

Convention	Meaning
SCSI and SCSI–2	Both refer to the SCSI–2 implementation as specifed in the ANSI Standard SCSI–2 document X3T9.2, Rev. 10L.
DIGITAL Clusters 1.1	Refers to DIGITAL Clusters for Windows NT Version 1.1.
1.1	Indicates a feature or step that applies to DIGITAL Clusters for Windows NT Version 1.1.
1.0 SP2	Indicates a feature or step that applies to DIGITAL Clusters for Windows NT Version 1.0, Clusters Service Pack 2.
1.0	Indicates a feature or step that applies to DIGITAL Clusters for Windows NT Version 1.0.

Related Documents

For more information about managing and using DIGITAL Clusters for Windows NT, see the *DIGITAL Clusters for Windows NT Administrator's Guide*.

You also need the hardware documentation for the systems, SCSI bus adapters, disk storage enclosures, and other hardware you plan to use in your cluster.

StorageWorks™ RAID Subsystems

If you are using a StorageWorks™ RAID subsystem, refer to the following documents:

Document	DIGITAL Part Number
StorageWorks RAID Arrays with DIGITAL Clusters for Winbdows NT Installation Guide	EK–SMRAF–IG
RAID Manager for RAID Arrays 310 and 410 for Windows NT Alpha/Intel User's Guide	AA–QU63C–TE
Command Console Version 1.1 User's Guide	AA–R24LA–TE

1
Planning Your Cluster

This chapter provides information to help you plan your DIGITAL Clusters for
Windows NT configuration. The chapter covers networking and hardware considerations,
including a list of supported hardware. Read this chapter before starting to set up your
cluster (Chapter 2).

Cluster Concepts

DIGITAL Clusters for Windows NT software provides a scaleable solution for making
shared applications and resources highly available to users in a PC local area network
(LAN). With DIGITAL Clusters 1.1, you can also make IP socket-based applications such
as web servers highly available across a wide area network (WAN). The DIGITAL Clusters
software runs as a layered product on the standard Windows NT operating system and uses
industry-standard hardware components.

The cluster. DIGITAL Clusters server software lets you combine two Windows NT Server
systems into a single cluster system within a LAN. The two servers are connected by a
SCSI bus that lets them access shared disk drives. You can use as many shared SCSI buses
as your servers will support, allowing the cluster to grow with your needs. Both cluster
servers are active at the same time—you do not need to use one server as an idle backup for
the other.

Clients. Windows based clients can access the cluster and its shared resources by using a
cluster name you assign. They do not need to know the names of the two server systems. To
enable this feature, you install DIGITAL Clusters client software on each client system.

Other clients such as Macintosh systems can also access the cluster, by using the individual
names of the two servers.

| 1.1 | With DIGITAL Clusters 1.1, all clients can access IP socket-based applications on the cluster by specifying a cluster IP address or its associated name. In this case, client software is not required. A *cluster IP address* can fail over from one server to the other. |

Shared resources and balanced workloads. After setting up the cluster, you use the Cluster Administrator to identify shared resources and place them in logical groups. A *shared resource* is one that can fail over from one cluster server to the other. Both servers cannot access the same shared resource concurrently.

Shared resources can include disk drives, file shares, cluster IP addresses, and applications. This gives you great flexibility in balancing loads between systems.

You assign each group to a primary server. Either cluster server can act as the primary server for a group. Normally, clients access a group's resources through its primary server. If the primary server fails, the group can fail over to the other cluster server.

High availability. If one cluster server fails, the second server can immediately assume the first server's workload, reconnect clients, and provide access to the shared resources.

Supported services and applications. DIGITAL Clusters software provides failover support for the following services and applications:

1.0
- NTFS file services and network file shares (over NetBEUI, TCP/IP, or IPX/SPX)
- Microsoft SQL Server Version 6.5
- Oracle7 Server Versions 7.1, 7.2, and 7.3
- Any application that you can start and shut down in a script
- Lotus Notes 4.11 server

1.0 SP2 Includes all 1.0 features, plus:
- Multiple SQL databases

1.1 Includes all 1.0 SP2 features, plus:
- One or more cluster IP addresses
  This feature lets you fail over IP socket-based applications such as the Microsoft Internet Information Server (IIS) and Netscape Enterprise Server.
- Lotus Domino 4.5 server using IP failover
- Oracle7 Server Version 7.3 using IP failover

The following sections describe the cluster hardware environment and networking issues.

Understanding Cluster Hardware Configurations

A DIGITAL Clusters hardware environment consists of four components:

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

A cluster consists of two Windows NT Server systems networked together using FDDI or Ethernet and running the DIGITAL Clusters server software. The cluster exports services to clients over standard communications interconnects and protocols. Clients view the cluster 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 that are separate from the system bus.

Both servers can access disks on the same shared bus, but only one server can access each disk 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 through 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 LAN failure.

The following figure shows a typical DIGITAL Clusters hardware configuration, with two servers sharing a SCSI bus that connects to a storage enclosure containing disk devices.

Typical DIGITAL Clusters Configuration

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Minimum Cluster Configuration

The minimum configuration for DIGITAL Clusters is as follows:

- Two Windows NT Servers connected over a LAN.
  Version 1.1 requires Windows NT Server 4.0 systems with NT Service Pack 2.
  Version 1.0 requires Windows NT Server 3.51 systems with NT Service Pack 5.

  In addition, DIGITAL strongly recommends a dedicated secondary Ethernet connection between the servers.

- A SCSI adapter in each cluster server, to provide a shared external bus between the systems.

- At least one disk drive in a storage enclosure on the shared bus.

- SCSI cables and terminators.

The two cluster servers must be members of the same Windows NT domain. The servers cannot be members of other clusters; however, a domain can contain multiple clusters.

Each server must also have its own system disk on a local unshared bus.

SCSI Concepts and Terminology

Setting up a shared SCSI bus is a critical part of the cluster configuration. Before you set up a bus, you must understand the following SCSI concepts. They affect the viability of the bus and how the devices connected to it operate.

SCSI Transmission Methods

Devices on a SCSI bus 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 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 that use different transmission methods by installing a signal converter between them. See Chapter 3 for details.

_____**Caution**_____

Do not connect single-ended and differential devices 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 following figure shows the possible SCSI bus connections between single-ended and differential devices.

Possible SCSI Bus Connections
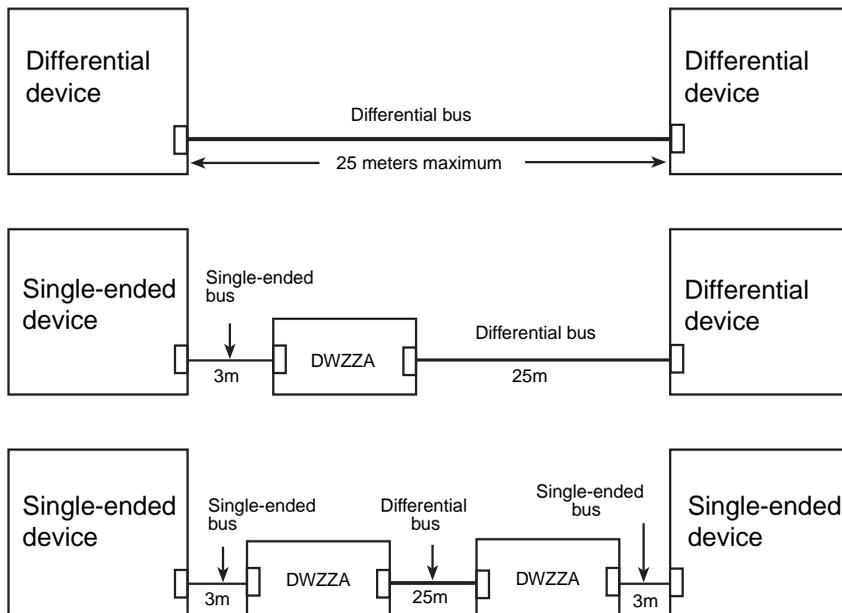
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In this guide, the term *shared SCSI bus* refers to the total interconnect between the server systems and the shared storage. In practice, however, the shared bus typically consists of multiple *bus segments*, with each segment itself being an electrically 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 following sections describe rules for bus termination and cable length. These rules 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 you must remove if the device is not at the end of the bus. DIGITAL recommends removing all internal bus termination and using Y-cables or trilink 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.

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 are 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 three speeds: slow, fast, and ultra (or Fast 20).

Device	Maximum Transfer Rate	Comments
Slow	5 MB/sec	—
Fast	10 MB/ sec	Used by all devices supported for DIGITAL Clusters.
Ultra	20 MB/sec	Currently not supported for DIGITAL Clusters.

Wide SCSI devices can operate at up to two times the data rate for narrow devices.

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. For more information, see the next section, 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 50 or 68 pins.

- 50-pin connectors always have a narrow data path, and most are single-ended.

- 68-pin connectors are 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 trilink connectors are either high- or low-density, narrow or wide. You can connect them only to cables with the same type of connector. Terminators also differ for single-ended or narrow buses.

SCSI Cable Length

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

The following table lists 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
Single-ended	Ultra	1.5 meters
Differential	Fast or Slow	25 meters

The total cable length for a bus segment is calculated from one terminated end to the other. The total length must include the internal cables inside each system and storage enclosure. Internal cable lengths vary, depending on the device. For example, the length of the internal SCSI bus in a BA350 storage enclosure is 1.0 meter. See 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 are 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 have to be in use, 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. See your system documentation for 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. You should disable this feature for adapters on the shared bus.

Number of SCSI Devices

A SCSI bus can have a limited number of devices.

- An 8-bit SCSI bus can have up to eight devices. 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 on a bus must have a unique SCSI ID, including bus adapters and disks. Signal converters are not considered devices and are not assigned SCSI IDs.

- 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. Narrow devices cannot address any device with an ID higher than 7.

SCSI bus adapters usually have an initial SCSI ID of 7. On a shared bus, this means you must reassign the ID for at least one of the adapters. IDs 7 and 6 always have the highest priority, so you should use them for the adapters on the shared bus. The full priority list is 7-6-5-4-3-2-1-0-15-14-13-12-11-10-9-8.

Network Considerations

DIGITAL Clusters is a LAN server-based cluster solution. A cluster consists of two cluster servers. Clients that access the cluster are not members of the cluster itself.

Clients must be running in an Ethernet or FDDI network using the IPX/SPX, NetBEUI, or TCP/IP protocol. The amount of network traffic created by clusters is minimal, so low-cost Ethernet is adequate—especially for the private or secondary Ethernet connections between the two cluster servers.

Configuring Servers

Consider the following rules when configuring servers for use in a cluster.

Supported Platforms

You can use DIGITAL Prioris or AlphaServer systems for cluster servers. You cannot mix Intel and Alpha based servers in the same cluster. See the Supported Server Systems section (page 1–16) for supported Prioris and AlphaServer models.

Windows NT Configuration Rules

The following rules apply when setting up cluster servers:

- Cluster servers must be in the same Windows NT domain.

  However, there is no limit to the number of clusters in a domain.

- Both cluster servers and the domain controller must be running Windows NT Server:

  1.1
  - Windows NT Server 4.0 with NT Service Pack 2

  1.0 SP2
  - Windows NT Server 3.51 with NT Service Pack 5

- Cluster servers can act as primary or backup Windows NT domain controllers, but DIGITAL does not recommend this configuration. Some applications such as the SQL server may also recommend against installation on a domain controller.

- Cluster servers can belong to only one cluster.

- To install and manage a cluster, you need a domain administrator account with advanced privileges to log on as a service. DIGITAL recommends setting up a unique account for cluster management, as described in Chapter 4.

- Cluster software supports the NTFS file system, not the FAT system. If needed, plan time to convert your servers from FAT to NTFS.

Balancing Workloads and Resources

The cluster can provide access to a shared resource through either server, but only one server can access the resource at a time. When you set up failover groups in the Cluster Administrator, you designate the primary and secondary server for each group. Clients access a group's resources through its primary server, until a failover occurs. When setting up failover groups, consider the types of clients you support, the network protocols you plan to use, and the impact of network-intensive applications.

Configuring Clients

DIGITAL Clusters provides client software to let Windows clients access the cluster by using the cluster name.

1.1 If a client needs to access only IP socket-based applications on the cluster, you do not need to install the client software. For example, if the client plans to access an only IIS web server on a DIGITAL Clusters 1.1 server, you can set up the IIS server to use a cluster IP address.

Windows Clients

Windows NT, Windows 95, and Windows for Workgroups systems can access the cluster by using a common cluster name. To enable this feature, you install cluster client software on the client systems (Chapter 5). After installation, the client software requires no further setup or management. The client software is transparent to users. When a failover occurs, clients automatically reconnect to the cluster.

Other Clients

Other clients—such as Macintosh, OS/2, and MS–DOS—must use the names of the individual cluster servers to access the cluster. If a failover occurs, these clients must manually reconnect to the cluster. This restriction does not apply for connections to IP socket-based applications that use a cluster IP address.

Clients with WAN Connections

Clients that have WAN connections separated by a router from the cluster servers must reconnect manually to the cluster if a failover occurs. See Using Cluster Client Software in an Extended LAN (page 1–11). This restriction does not apply for connections to IP socket-based applications that use a cluster IP address.

IP Failover Support—All Clients

1.1 On a DIGITAL Clusters 1.1 server, you can configure IP socket-based applications to use a cluster IP address. All clients can access these IP applications by using the assigned cluster IP address. In many cases, you can configure the IP application so that a failover is virtually transparent to clients and they do not have to manually reconnect.

TCP/IP Configuration Rules

For systems using the TCP/IP protocol (NetBT), the following rules apply:

- The two cluster servers must have static IP addresses.

  When configuring the TCP/IP protocol, do not use the DHCP option for assigning network addresses. DHCP does not guarantee that IP addresses are assigned in the same subnet. Also, DHCP reassigns addresses after a failover, and clients might have difficulty locating the reassigned services.

- The IP addresses of the two cluster servers must be in the same subnet. Any cluster IP addresses should also be in the same subnet as the individual servers.

- The IP addresses of cluster clients and servers must be in the same subnet, so that clients can access the cluster by name and use browsing features. Clients in other subnets can access the individual cluster servers by their server names.

  This restriction does not apply for accessing IP socket-based applications on the cluster. You can provide WAN access by associating these applications with a cluster IP address that can fail over from one server to another.

Using Cluster Client Software in an Extended LAN

The cluster uses a LAN-based Cluster Name Server protocol to let clients access the cluster by the cluster name. If your clients are in an extended LAN, you must consider the following restrictions.

LANs Using Bridges

In an extended LAN that uses bridges, the bridges must not filter NetBIOS multicast or TCP/IP broadcast messages. Filtering these messages prevents bridged clients from communicating with the cluster services.

LANs Using Routers

In an extended LAN that uses routers, client access to the cluster might be restricted, depending on the type of LAN protocol in use.

NetBEUI Protocol

If the client is using the NetBEUI (NBF) protocol and a router is configured to bridge all NetBEUI traffic, no restrictions exist.

IPX Protocol

If the client is using the IPX protocol and the router is configured to bridge all IPX traffic, no restrictions exist.

TCP/IP Protocol

To enable a cluster naming operation in a routed environment, broadcasts travel in both directions. The client broadcasts to the cluster to resolve a cluster alias name, and the cluster broadcasts to clients its availability, which clients use when browsing.

Instead of enabling the passage of all broadcast traffic between routers, on some routers you can direct broadcasts that occur on one subnet to specific systems on another subnet.

For example, a client can resolve a cluster name if the router between the client and cluster is configured to pass broadcasts occurring on the client subnet directly to the two cluster members, only.

Using TCP/IP Address Failover *(V1.1)*

In a TCP/IP network environment, the Cluster Administrator lets you specify one or more cluster Internet Protocol (IP) addresses as failover objects. This allows your cluster to support failover capabilities for applications typically accessed by an IP address or associated name. For example, DIGITAL Clusters 1.1 can provide IP failover support for:

- Microsoft Internet Information Server (IIS)
- Netscape Enterprise Server
- Lotus Domino 4.5 server

A cluster IP address is an IP address that can migrate from one cluster server to the other server after a failover. A cluster IP address must be a unique address that is not in use elsewhere in the network. You cannot use the individual IP addresses of your cluster servers as cluster IP addresses.

If you are configuring a web server or Domino server for IP failover, DIGITAL recommends that you register a fully qualified TCP/IP domain name for the cluster IP address. This allows users to specify a name rather than an address when making connections. If you do not use a fully qualified domain name, make sure that clients can resolve the name to the cluster IP address by using DNS, a Hosts file, or similar method.

Network Adapters and IP Addresses *(V1.1)*

When you create a cluster IP failover object in the Cluster Administrator, you must specify one or more network adapters on each server that can enable the address. Most network adapters can support multiple IP addresses. DIGITAL Clusters 1.1 can support servers that have up to three network adapters with eight IP addresses each.

- Ask your network administrator for IP addresses that you plan to use as cluster IP addresses.
- Do not use your servers' individual IP addresses as cluster IP addresses.
- Do not assign cluster IP addresses to a private adapter used for a private network, such as the network between the two servers.

Grouping IP Addresses and Disks *(V1.1)*

A cluster IP failover object specifies only an address; it does not specify an application or associated files. To fail over an application that uses a cluster IP address, you need to create a failover group in the Cluster Administrator that includes the IP address and the shared disk that stores application files. For details, see the *Administrator's Guide*.

If you have a network-intensive application, you may want to dedicate a cluster IP address and shared disk to that application. You may also want to dedicate a network adapter to the cluster IP address.

Cluster IP Failover Example *(V1.1)*

For IP failover, you install your IP application programs on a local disk of each cluster server. You install the databases for those applications on shared cluster disks. You associate a cluster IP address with one or more network adapters on each cluster server. Then you create a failover group that includes the IP address object and the shared disks with your IP application databases.

The following figure shows how a cluster IP address migrates from one cluster server to the other after a failover.

Cluster IP Failover Example

Before a Failover
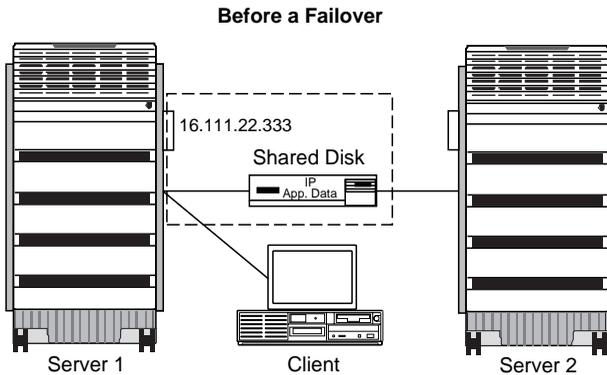
Initially, the cluster IP address is enabled on a selected adapter
on Server 1. Clients can use the address to access the IP
application databases in the same failover group.

After a Failover
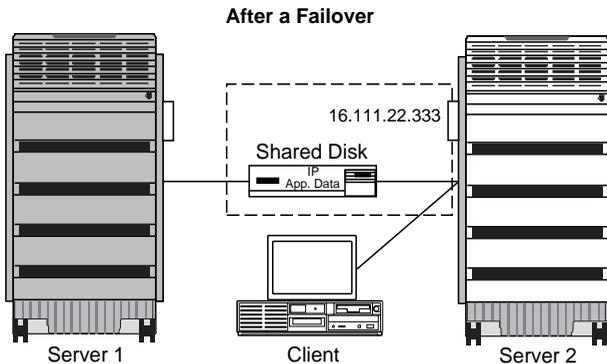
When Server 1 fails, the cluster IP address fails over to a selected
network adapter on Server 2. The IP application databases
in the same failover group are now available through Server 2.

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Applications and File Services

This section lists some things to consider in planning application support for your cluster. For details on setting up applications, see the *Administrator's Guide*.

NTFS File Services

The cluster requires that you use the NTFS file format. If your servers currently use the FAT file format, plan on time to convert them to NTFS before setting up the cluster hardware.

Microsoft SQL Server Version 6.5   (*Administrator's Guide,* Chapter 3)

For SQL support, DIGITAL strongly recommends that you install the SQL Server software before the cluster server software. You install the SQL Server on a local disk of both cluster servers.

For DIGITAL Clusters 1.0, you may need to run a script provided on the DIGITAL Clusters CD–ROM that corrects potential problems with failback support.

`1.0 SP2` You can run SQL servers on each cluster at the same time and provide failover support for multiple SQL databases.

Oracle 7 Workgroup Server 7.1 and 7.2   (*Administrator's Guide*, Chapter 3)

Oracle 7 Workgroup Server allows multiple instances to run on a cluster server. Cluster software provides failover support for Oracle instances. You install the Oracle 7 Workgroup Server software on a local disk of both cluster servers.

`1.1` ### Lotus Domino 4.5 / Notes 4.5   (*Administrator's Guide,* Chapter 4)

You can provide failover support for a Lotus Domino server by giving the server a fully qualified TCP/IP domain name associated with a cluster IP address. If you do not use cluster IP addresses, you can create a failover script . You install the Lotus Domino server on a local disk of both cluster servers

Lotus Notes 4.11   (*Administrator's Guide,* Chapter 4)

You can provide failover support for Lotus Notes by creating a failover script. The Clusters CD–ROM provides sample scripts.

`1.1` ### Microsoft IIS and Netscape Enterprise Server   (*Administrator's Guide,* Chapter 5)

You can provide failover support for the Microsoft Internet Information Server (IIS) or Netscape web server by using cluster IP addresses.

Supported Hardware

This section describes the hardware supported in a DIGITAL Clusters environment. The section lists supported devices and their use, as well as restrictions for particular devices. The section also lists web sites that provide more information on specific components.

Some hardware components require specific hardware and firmware revision levels. You must ensure that your hardware meets these requirements, or it will not work properly in your cluster environment.

Supported Server Systems

The DIGITAL Clusters environment requires two servers based on the same hardware architecture. You can use two DIGITAL AlphaServer™ systems or two DIGITAL Prioris™ systems. Mixed architecture systems are not supported. The following two tables list supported AlphaServer and Prioris systems.

Supported AlphaServer Systems

System	I/O Bus	I/O Slots	ECU (Min)*	ARC Firmware (Min)
AlphaServer 2100 4/xxx AlphaServer 2000 4/xxx	EISA/PCI	8/3	V1.81	V4.36
AlphaServer 2100 5/xxx AlphaServer 2000 5/xxx	EISA/PCI	8/3	V1.81	V4.34
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	—	V5.5
AlphaServer 4000	EISA/PCI	3/8	V1.9	V4.44.0
AlphaServer 4100	EISA/PCI	3/8	V1.9	V4.44.0

* An ECU configuration file that includes a call to an overlay file will not execute on an AlphaServer system.

† If you use an AlphaServer 1000A system with KZPSA SCSI adapter cards, the KZPCA cards can be installed only in PCI slots 0, 1, or 2. A software interaction prevents the KZPSA controller from working correctly in a bridged PCI slot (3, 4, or 5).

Web Site

For more information on AlphaServers, visit the following site:

AlphaServer InfoCenter   http://www.digital.com/info/alphaservers

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

The following cluster-ready kits provide the necessary hardware and software to set your cluster configuration. Kits include a storage enclosure, SCSI hardware, network cards, cables, and cluster software. See also the StorageWorks kits (page 1–19).

Prioris Cluster Kits

DIGITAL Part Number	Kit Contents
FR–BA356–NT	**BA356 Cluster Kit** • BA356 storage enclosure • Adaptec AHA–2944W SCSI adapters • DWZZB–VW signal converter • Trilink connector • SCSI cables and Y-cables • Network cards • Terminators • DIGITAL Clusters software kit (QB–53V9A–SA)
FR–BA356–N2	**BA356 Expansion Kit** (prerequisite is FR–BA356–NT) • BA356 storage enclosure • DWZZB–VW signal converters • Y-cables • Trilink connectors
FR–CK310–RF	**Prioris RA310 Cluster Kit** • StorageWorks RAID Array 310 with controller, firmware, and software and firmware for cluster environment • Two Adaptec AHA–2944W SCSI controllers • Two DE450 Ethernet cards • SCSI and Ethernet cabling for the cluster environment • DIGITAL Clusters software and licenses • ServerWorks Manager Version 2.0
FR–CK310–RU	**Prioris RA310 Cluster Upgrade Kit**, for BA356 Cluster Kit customers (prerequisite is FR–BA356–NT): • StorageWorks RAID Array 310 with controller, firmware, and software and firmware for the cluster environment

Web Site

For more information on Prioris Servers, visit the following site:

Windows Enterprise Computing InfoCenter   http://www.windows.digital.com

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 lists supported SCSI adapters.

Supported SCSI Adapters (Fast Wide Differential)

Adapter	Bus	BIOS Version (Min)	Driver	Comments
DIGITAL KZPSA–BB	PCI	A10	deckzpsx.sys NT driver V1.3 required	Alpha only
Adaptec AHA–2944W	PCI	1.12*	aic78xx.sys supplied with cluster software	Prioris and Alpha*

* **Adaptec AHA–2944W SCSI adapter restrictions**:

- The adapter is supported on all AlphaServer systems except 4000/4100 models. However, it must be configured on a Prioris system.

- The 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 trilink connectors to implement external termination.

- BIOS versions 1.2x for the adapter are not compatible with DIGITAL Clusters, because these versions of the BIOS provide no way of disabling bus reset.

  BIOS versions 1.12 to 1.16 are supported.

Web Sites

For more information on the DIGITAL KZPSA adapter, visit the following sites:

AlphaServer InfoCenter   http://www.digital.com/info/alphaserver
StorageWorks InfoCenter   http://www.storage.digital.com/swrks

For more information on Adaptec adapters, visit the following site:

Adaptec home page   http://www.adaptec.com

Supported Storage Enclosures

The following table lists the supported disk storage expansion enclosures. Single-ended storage enclosures require a SCSI signal converter to connect to the supported adapters.

Supported Storage Enclosures

Storage Enclosure	Connector	Transmission Method	Data Path Size
BA346–KB pedestal	68-pin	Single-ended	Wide
BA350–KB pedestal	50-pin high density	Single-ended	Narrow
BA356–KC expansion unit	68-pin	Single-ended	Wide

Web Site

For more information on DIGITAL's BA*nnn* deskside storage enclosures, visit the following site:

StorageWorks InfoCenter   http://www.storage.digital.com/swrks

Supported RAID Controllers and Subsystems

The following table lists supported RAID controllers and subsystems. 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) (used on RAID SW–410)	V3.0Z–2
DIGITAL RAID SW–450 (S)	V5.0Z–2
DIGITAL RAID SW–410 (S)	V3.0Z–2
DIGITAL RAID SW–310 (S)	V3.0Z–2

DIGITAL Clusters 1.1 supports dual-redundant HSZ40 RAID controllers in the StorageWorks RAID 410 subsystem or in any HSZ40-based RAID subsystem. See Chapter 4 for installation instructions.

StorageWorks Platform Kits

The following platform kits make it easy to add RAID storage to a DIGITAL Clusters environment. You need a StorageWorks RAID 310, RAID 410, or RAID 450 array subsystem using HSZ20 (RAID 310) or HSZ40 (RAID 410/450) controller modules.

StorageWorks Platform Kits

Part Number	Description	Prerequisites

SWDKT–DC	**RAID Arrays with DIGITAL Clusters for Windows NT Platform Kit (Alpha):**
	
	• DIGITAL Clusters software kit (QB–53V9A–SA)
	• One KZPSA–BB SCSI adapter
	• RAID Array CD–ROM including:
	  – Command Console (SWCC)
	  – HSZDISK.SYS class driver
	  – V2.7 and V3.0 RAID Array firmware
	• Two Y-cables (BN21W–0B)
	• One 68-pin SCSI cable (BN21K–05)
	• One terminator (H879–AA)
	• Documentation
		Two AlphaServers
		
		Network cards (4 recommended)
		
		One of the following:
		
		• RAID 310 with SWDKT–DA NT/Alpha platform kit
		• RAID Array 410 with SWDKT–CA NT/Alpha platform kit
		• HSZ40 RAID controller modules and one KZPSA–BB adapter

SWIKT–DC	**RAID Arrays with DIGITAL Clusters for Windows NT Platform Kit (Intel):**
	
	• DIGITAL Clusters software kit (QB–53V9A–SA)
	• One Adaptec 2944W SCSI adapter
	• RAID Array CD–ROM including:
	• RAID Array CD–ROM including:
	  – Command Console (SWCC)
	  – HSZDISK.SYS class driver
	  – V2.7 and V3.0 RAID Array firmware
	• Two Y-cables (BN21W–0B)
	• One 68-pin SCSI cable (BN21K–05)
	• One terminator (H879–AA)
	• Documentation
		Two Prioris servers
		
		Network cards (4 recommended)
		
		One of the following:
		
		• RAID 310 with SWIKT–DA NT/Intel platform kit
		• RAID Array 410 with SWIKT–CA NT/Intel platform kit
		• HSZ40 RAID controller modules and one Adaptec 2944W adapter

SWDKT–DD	**RAID Arrays with DIGITAL Clusters for Windows NT Cable/Doc Kit:** • RAID Array CD–ROM including RAID Manager, HSZDISK.SYS driver, and RAID Array firmware • Cables and documentation for Alpha and Prioris servers	This upgrade kit includes everything you need to upgrade from basic SCSI expansion JBOD storage to RAID. The kit includes everything in the platform kit except a host adapter and DIGITAL Clusters software.

The following table shows the appropriate version of HSZDISK.SYS to use for your Windows NT version.

HSZDISK.SYS Driver Versions

Windows NT Version	HSZDISK.SYS Version
4.0	3.2
3.51	2.7

Web Site

For more information on DIGITAL's RAID controllers and subsystems, visit the following site:

StorageWorks InfoCenter   http://www.storage.digital.com/swrks

Supported Disk Devices

The following table lists supported disk devices.

Supported Disk Devices

Disk Device	Storage	Firmware (Min)	Data Path
RZ26L–VA	1.5 GB disk in SBB	440C	Narrow
RZ28B–VA	2.1 GB disk in SBB	0006	Narrow
RZ28C–VA	2.1 GB disk in SBB	0004	Narrow
RZ28D–VA	2.1 GB disk in SBB	0008	Narrow
RZ29B–VA	4.3 GB disk in SBB	0014	Narrow
RZ26L–VW	1.5 GB wide disk in SBB	442E	Wide
RZ28C–VW	2.1 GB wide disk in SBB	0004	Wide
RZ28D–VW	2.1 GB wide disk in SBB	0008	Wide
RZ29B–VW	4.3 GB wide disk in SBB	0014	Wide

Restrictions

The following restrictions apply to supported disk devices:

- BA350 and RAID Array 410 enclosures support only narrow drives.

  A RAID Array 410 backplane option supports wide drives and upgrades the system to a RAID Array 450.

- IDE disks are not supported.

  The ATDISK.SYS driver used for IDE disks in incompatible with the cluster drivers. Using ATDISK.SYS in a cluster causes the system to fail when booted.

Web Site

For more information on DIGITAL's RZ series disk drives, visit the following site:

DECdirect Interactive Catalog   http://www.systems.digital.com/DIcatalog

Supported Signal Converters

Signal converters convert single-ended SCSI signals to differential SCSI signals. Signal converters let you:

- Connect single-ended and differential bus segments to allow communication between devices with different transmission methods.

- Overcome cabling length restrictions on single-ended buses.

In addition, some signal converters can 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 lists supported signal converters.

Supported Signal Converters

Signal Converter	Minimum Hardware	Minimum Firmware	Data Path	Comments
DWZZB–AA	E01	A02	Wide/ Wide	External, independently powered unit. Includes built-in universal power supply for general-purpose SCSI bus length and signal conversion needs.
DWZZB–VW	E01	A02	Wide/ Wide	StorageWorks building block. Installs in disk slot 0 in a BA356 or BA346 enclosure.
DWZZA–AA	E02	n/a	Narrow/ Wide	External, independently powered unit for use with BA350–KB enclosure.
DWZZA–VA	F02	n/a	Narrow/ Wide	StorageWorks building block. Installs in disk slot 0 in a BA350 enclosure.

Supported SCSI Cables

The type of cables you need for your cluster depends on the hardware configuration. The following table lists supported cables and their use. Each cable comes in several lengths. Make sure the total cable length of the bus segment does not exceed the 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 need terminators and connectors for your shared SCSI bus. The following table lists supported terminators and connectors.

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 trilink connector or wide differential cables.
Connector			
H885–AA trilink	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.

2
Setting Up Your Cluster

This chapter outlines the basic tasks in setting up a new cluster. The following chapters cover each step in detail. Before you start, read Chapter 1 to become familiar with cluster hardware and networking considerations.

If you are upgrading an existing cluster, see Chapter 7.

▶ **To set up your cluster:**

1. **Prepare the cluster hardware.**

   a. Install the external SCSI bus adapters in each server system, assign appropriate SCSI IDs to each adapter, and install the adapter device drivers (Chapter 3, Setting Up the Server Systems section).

   b. Install the disks to be shared by the cluster servers in a supported storage enclosure, and assign appropriate SCSI IDs to each disk (Chapter 3, Setting Up Disks and Storage Enclosures section).

2. **Create the physical cluster.**
   Set up the shared SCSI bus and connect the shared storage to both cluster servers (Chapter 3, Creating the Physical Cluster section).

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

3. **Prepare the shared disks for use in the cluster.**
   Also verify that each server can access the disks (Chapter 3, Preparing the Disks and Verifying the Cluster Configuration section).

_____**Caution** _____

> If the disks on your shared bus contain data that you want to preserve, install the
> cluster software on both server systems *before* creating and connecting the shared
> bus. Otherwise, there is danger of disk corruption if you turn on the system
> power for both servers with the shared bus connected and the cluster software is
> not yet installed.

_____

4. **Install the DIGITAL Clusters for Windows NT server software on each server**
   (Chapter 4).

   If you plan to use Microsoft SQL databases, you should install the SQL server locally
   on each cluster server before installing the cluster software (*Administrator's Guide*).

5. **Configure your cluster's shared resources and create file shares.**
   Use the Cluster Administrator to assign the shared disks to failover groups
   (*Administrator's Guide*).

   Use Windows NT Explorer to create Windows NT file shares.

6. **Install the cluster client software.**
   Install DIGITAL Clusters for Windows NT client software on client systems that need
   to access the cluster using the cluster name (also called the cluster alias) (Chapter 5).

   Clients do not need client software to access applications that use a cluster IP address.

3

Installing the Hardware

This chapter describes how to set up the hardware for a DIGITAL Clusters for Windows NT environment. See Chapter 2 for an overview of all the steps needed to set up your cluster.

Before You Start

Before you start to set up your cluster hardware:

- Make sure your servers and hardware are supported (Chapter 1).

  Update drivers, firmware, and BIOS to supported versions, if needed.

- Convert the servers' file systems to NTFS, if needed. The cluster software does not support the FAT system.

- Make sure the drive letter for a server's Windows NT system partition is fixed.

Assigning Fixed Drive Letters to System Partitions

Before adding or removing hardware to a cluster server, make sure the drive letter assigned to the Windows NT system partition (typically C: or D:) is fixed. The drive letter assignment must remain constant, because there are hardcoded references to this drive letter recorded in the Windows NT registry. The cluster software is affected by these references.

By default, Windows NT can reassign drive letters at startup based on the order in which disks are discovered and the type of partition. Primary partitions are assigned first, followed by all secondary partitions.

The following events can cause Windows NT to change drive letter assignments at startup if the drive letters are not fixed:

- Adding disks after Windows NT is installed, such as during the cluster server software installation.

- Adding, removing, or rearranging SCSI bus adapters on systems that have more than one adapter.

- Installing a new revision of an adapter driver that changes the starting order of the drivers.

- Installing the HSZDISK.SYS class driver for a RAID 310, 410, or 450 storage device. This driver starts before the default SCSI class driver, causing the operating system to discover the storage array disks before all other devices, including the system disk.

If any of these events change your system drive letter, you may be able to correct the problem by assigning a fixed drive letter in the Windows NT Disk Administrator (Tools menu, Drive Letter option). Your drive letter changes take effect when you reboot the system.

You cannot assign a fixed drive letter to a secondary partition. If your system partition is a secondary partition (for example, D:), assign fixed drive letters to all your primary partitions, beginning with a letter high enough (perhaps F:) to leave space at the beginning of the alphabet so that your secondary partitions are always assigned to the same drive letter.

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 environment.

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

Setting Up the Server Systems

Both cluster servers need an external SCSI bus adapter for the shared bus that will connect them. If you plan to use multiple shared buses, you must install an adapter for each bus.

This procedure lists the basic steps to install an adapter. The following sections provide specific information for preparing AlphaServer™ and Prioris™ servers.

▶ **To install each SCSI bus adapter:**

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 Terminating the Bus and Isolating Devices (page 3–8).

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 needed.

7. Use the configuration utility that came with your adapter to set operational parameters. See Chapter 1 for information on SCSI IDs, bus speed, and the bus reset feature.

   - Set the SCSI ID for the adapter.

   - Disable the adapter BIOS.

   - Enable fast SCSI bus speed for the adapter.

   - Disable the SCSI bus reset on initialization feature for the adapter.

8. Install the adapter driver.

9. Shut down the system and turn off the system power.

Preparing an AlphaServer System

This section describes how to install a SCSI bus adapter on an AlphaServer system.

If You Use an Adaptec SCSI Adapter

The Adaptec AHA–2944W SCSI adapter is supported on all AlphaServer systems except 4000/4100 systems. However, you first must configure the adapter on a Prioris system (or other Intel based system) with a free PCI slot before you can install the adapter in an AlphaServer system. See Chapter 1 for other restrictions.

The DIGITAL Clusters 1.1 CD–ROM does provide a version of the SCSI Select utility that you can run from the firmware menu on an Alpha system. However, the Alpha version currently does not provide the ability to disable the SCSI reset feature, which is required for the cluster setup. If you would like to try running this utility from the firmware menu, select **Run a program** and enter the following command:

```
cd:\tools\scsisel.exe
```

▶ **To install a SCSI bus adapter in an AlphaServer system:**

1. Check that your adapter has the required hardware and firmware revision levels (Chapter 1).

2. Disable the adapter's internal termination if you are not using the adapter to terminate the shared bus. DIGITAL strongly recommends that you do *not* use the adapter to terminate the shared bus. See Terminating the Bus and Isolating Devices (page 3–8).

   Adaptec AHA–2944W bus adapter: If you use this adapter, do not perform steps 3 to 7 in this section. Instead:

   a. Install the adapter in a Prioris system and perform steps 4 to 7 in the section Preparing a Prioris System later in this chapter.

   b. After you complete the adapter configuration, 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. Make sure the PCI slot is configured correctly before installing the adapter. See your system documentation.

   AlphaServer 1000A: If you use KZPSA SCSI adapter cards, the KZPSA cards can be installed only in PCI slots 0, 1, and 2. A software interaction between the KZPSA card and the AlphaServer prevents the KZPSA controller from working correctly in bridged PCI slots (3, 4, or 5).

4. After the adapter is installed, reboot your system. At the SRM console, enter the `arc` command to load the ARC console.

5. Insert your adapter's distribution media (diskette or CD–ROM) in the appropriate drive.

   If needed, run the program to update your adapter firmware. See your adapter's documentation for instructions.

6. Run the configuration utility program for your adapter and specify the following parameters. See your adapter's documentation for instructions.

   • Disable the bus reset on initialization feature.

   • Enable or disable fast bus speed, as desired.

   • Set the SCSI ID of the adapter. If needed, you can change the SCSI ID of your adapter at a later time by using the `set pk` *n0_host_id* `#` console command.

7. Exit the configuration utility, then exit the ARC console to return 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 (page 3–5).

Preparing a Prioris System

This section describes how to install a SCSI bus adapter in a Prioris server.

▶ **To install a SCSI bus adapter in a Prioris server:**

1. Check that your adapter has the required hardware and firmware revision levels (Chapter 1).

2. Disable the adapter's internal termination if you are not using the adapter to terminate the shared bus. DIGITAL strongly recommends that you do *not* use the adapter to terminate the shared bus. See Terminating the Bus and Isolating Devices (page 3–8).

3. Install the adapter in an I/O slot of your server system. You must properly configure the I/O slot before installing the adapter. See your system documentation.

4. After the adapter is installed, reboot your system. Then follow the screen prompts to enter the Setup program for your adapter.

5. When the Setup program starts, check the adapter's firmware level to verify it meets the required revision level (Chapter 1). If not, update the firmware. See your adapter's documentation for instructions.

6. Specify the following parameters. See your adapter's documentation for instructions.

   • 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 restarts the boot process and posts messages for each device it finds, starting with the first I/O slot.

8. When Windows NT is up and running, install the adapter device driver.

Installing the Adapter Device Driver

To complete the installation of your SCSI bus adapter, you must install the adapter device driver.

▶ **To install the Adapter device driver:**

1. Display the Windows NT Control Panel and click the SCSI Adapters icon.

2. In the SCSI Adapters dialog box, click the Drivers tab and choose Add.

3. The Install Driver dialog box displays a list of device drivers available on the Windows NT distribution CD–ROM. If your adapter is in the list, select the device and choose OK. Load the Windows NT distribution disc when prompted by the Setup program.

4. If your adapter is not in the list, choose Have Disk. Insert the adapter's distribution media (diskette or CD–ROM) in the appropriate drive, specify the drive letter, and choose OK. Confirm the device when prompted by the Setup program.

5. Exit the Setup program and restart Windows NT.

Setting Up Storage Enclosures

Before you connect storage enclosures to the shared bus and create the physical cluster, you must install supported disk devices in the enclosures. See the documentation supplied with your storage enclosure and disks for detailed instructions.

Assigning SCSI IDs

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

BA350 storage unit. 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 a disk in slot 0 has an ID of 0. On the shared bus in a cluster, the bus adapters installed in the server systems use IDs 6 and 7. Therefore, you can install disks only in slots 0 to 5 in the BA350.

If you connect two BA350 disk storage units to the same shared bus, you must install the disks in different slots in each unit so that each disk has a unique SCSI ID on the bus. For example, if one BA350 has disks in slots 0 and 1, the other BA350 can have disks only in slots 2 to 5.

BA356 storage unit. 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, install the converter in slot 0.
_____

You can configure an HSZ40–AX RAID subsystem with up to four different SCSI IDs. See your hardware documentation for details.

Internal Termination

Some disk drives and storage enclosures have internal termination. For some configurations, you must remove this termination. For example, if the storage enclosure is in the middle of the shared bus, you must remove the internal termination. DIGITAL strongly recommends that you remove this termination from *all* devices and use external termination. See Terminating the Bus and Isolating Devices (page 3–8) for more information.

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

Configuring a Dual HSZ40 RAID Controller

DIGITAL Clusters 1.1 includes support for dual-redundant HSZ40 RAID controllers in the StorageWorks RAID 410 subsystem or any HSZ40-based RAID subsystem. You must configure RAID 410 controllers to work with clusters.

▶ **To configure a RAID 410 controller:**

For DIGITAL Clusters 1.1, use HSZ40 firmware V3.0Z–2.

1. Install the RAID Manager with the serial cable.

    For details on installing the serial cable, see the installation instructions supplied in the application notes on the RAID CD–ROM.

2. Set the Host Functionality to D.

3. Set the Cache flush time to 10.

4. Create your storage sets.

5. Install the HSZDISK.SYS class driver on both cluster servers. This driver enables and supports fault-tolerant capabilities.

Windows NT Version	HSZDISK.SYS Version
4.0	3.01
3.51	2.51

6. Use the Disk Administrator to partition and format the storage sets (NTFS).

7. Use the Disk Administrator to assign drive letters.

    HSZDISK reorders the existing drive letters.

8. Upgrade the HSZ40 controller to Version 3.0, then install the Version 3.02 patch.

Creating the Physical Cluster

After you prepare the individual hardware components, you can connect them as a cluster. Typically, you set up the cluster configuration before installing the cluster software.

_____**Caution** _____

If the disks on your shared bus contain data that you want to preserve, install the cluster software on both cluster servers *before* creating and connecting the shared bus. Otherwise, there is danger of disk corruption if you turn on system power for both servers while the shared bus is connected.

_____

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

Before you 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 cluster server and configured with unique SCSI IDs.

- The SCSI adapter firmware must meet the cluster software requirements. Update the firmware, if needed.

- Disks must be installed in the appropriate storage enclosure slots and configured with unique SCSI IDs.

Refer to the section Preparing the Hardware 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 environment. For the cluster to operate properly, you must follow strict guidelines when terminating the shared bus and connecting cables.

Terminating the Bus and Isolating Devices

You must terminate the shared SCSI bus as described here for it to operate properly in the DIGITAL Clusters 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.** Although SCSI adapters have internal termination you could use to terminate the bus, DIGITAL does not recommend this method. If the server becomes disconnected from the shared bus, the bus will not be terminated properly and will be inoperable.

- **Storage enclosures.** You can use the internal termination of a storage enclosure to terminate the bus if the enclosure is at the end of the bus.

- **Y-cables.** You can connect Y-cables to certain devices. If the device is 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.

- **Trilink connectors.** You can connect trilink connectors to certain devices. If the device is at the end of the bus, you can attach a terminator to one of the trilink 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 at the end of the shared bus, you must disable its internal termination.

_____

DIGITAL strongly recommends that you use Y-cables or trilink connectors to terminate the bus. In addition to providing termination, Y-cables and trilink connectors provide a way to isolate systems and storage enclosures from the shared bus without affecting the bus termination. This allows your shared bus to remain operating while you perform maintenance on a device or change the configuration.

Example 1

The configuration shown in the following figure has a system 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
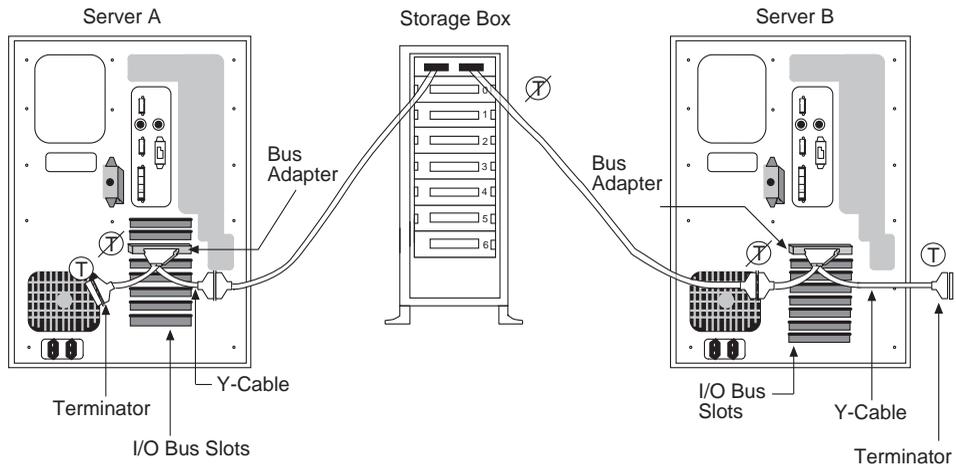
ZK-8691A-FH5

In this configuration, if you disconnect one of the Y-cables from the adapter port (figure on following page), the shared bus is still properly terminated. Although the disconnected server is no longer available, the cluster can still operate with the remaining server.

Note, however, that there is no Y-cable at the storage enclosure in this configuration. If the shared storage is disconnected, the bus becomes inoperable. If you have more than one storage enclosure on the bus, use a Y-cable or a trilink connector to connect each enclosure to the bus. This allows the bus to remain operable if one of the enclosures is disconnected.

Disconnecting a Y-Cable
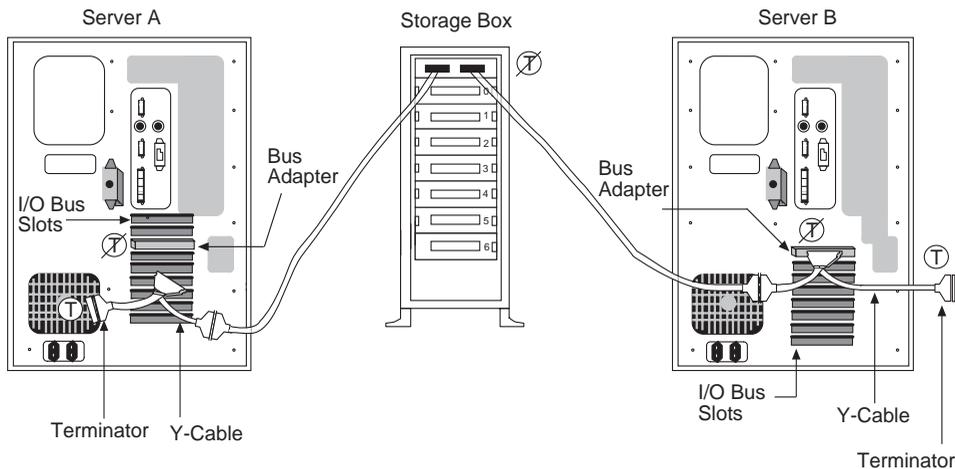
ZK-8692A-FH5

Example 2

The configuration shown in the figure on the following page includes the same hardware components as Example 1. In this example, however, one of the cluster servers is in the middle of the shared bus. The storage enclosure is 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 at the end of the shared bus) rather than mid-bus configurations (where the storage enclosure is configured between the server systems).

_____

As in Example 1, you can isolate either server from the cluster by disconnecting the appropriate Y-cable, without affecting the termination of the shared bus. If you disconnect the storage enclosure, however, the shared bus becomes inoperable because the bus is no longer properly terminated.

Shared Bus with the Storage Enclosure at the End
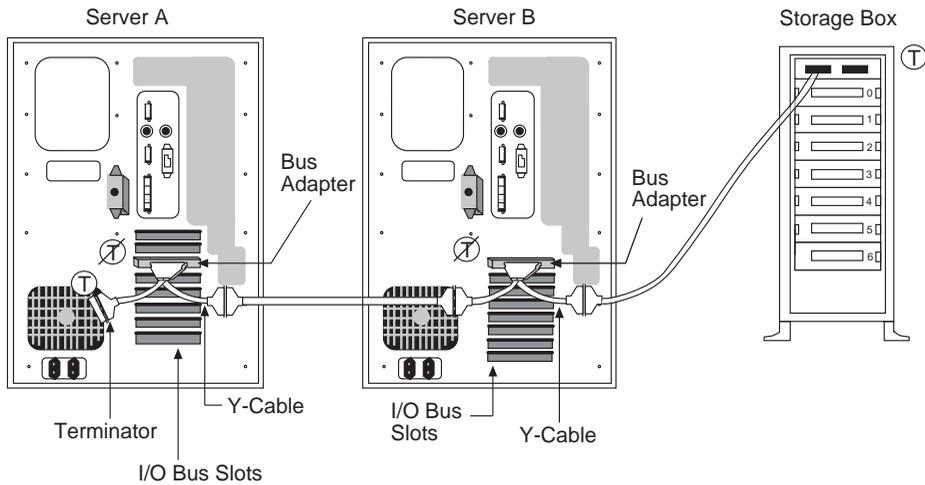
ZK-8693A-FH5

Configuring Adaptec SCSI Adapters

Adaptec AHA–2944W SCSI adapters can be manufactured using either passive or active SCSI termination. Currently, there are no AHA–2944W adapters with active termination.

Adapters with Passive Termination

To disable termination, remove resistor SIP packs RN1 through RN12. Jumper locations J4 and J5 have no effect and should be left open.

The SCSI Select function for enabling or disabling termination does not work.

If you use on-card termination on the shared SCSI bus instead of external termination with Y-cables, the terminator SIPs are powered from TERMPWR bus line when power to the board is turned off.

Adapters with Active Termination

Use the SCSI Select function to enable or disable termination.

If you use on-card termination on the shared SCSI bus instead of external termination with Y-cables, make sure jumper J4 is installed so that active termination ICs can receive power from TERMPWR bus line when power to the board is turned off.

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. Configure both bus adapters to supply termination power, so the bus remains properly terminated even when one server goes off line.

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 serve 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 connect narrow, single-ended devices to wide differential buses.

Do 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 trilink 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**
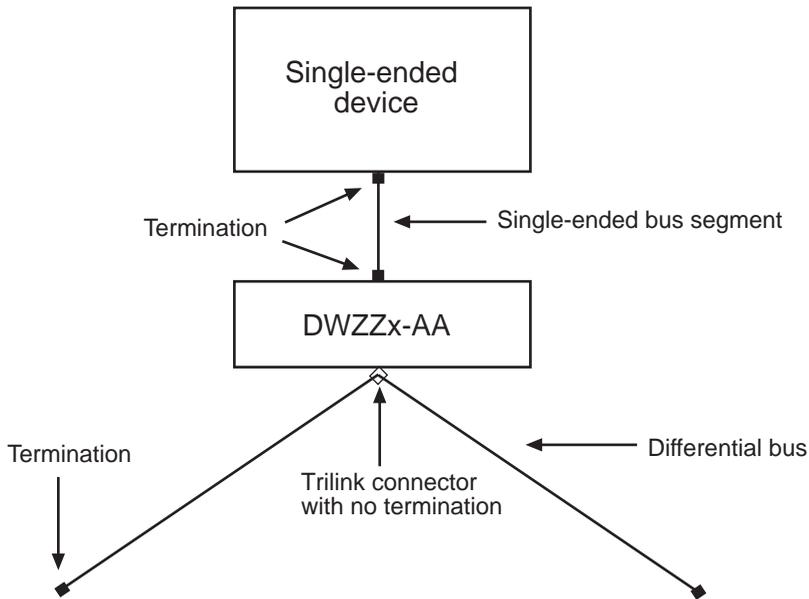
ZK-8694A-FH5

Sample Configurations

This section describes cluster configurations for specific DIGITAL Clusters hardware environments.

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 merely give you some guidelines for the most commonly used configurations.

Configuring a Differential Bus with Differential Storage

The figure on the following page 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
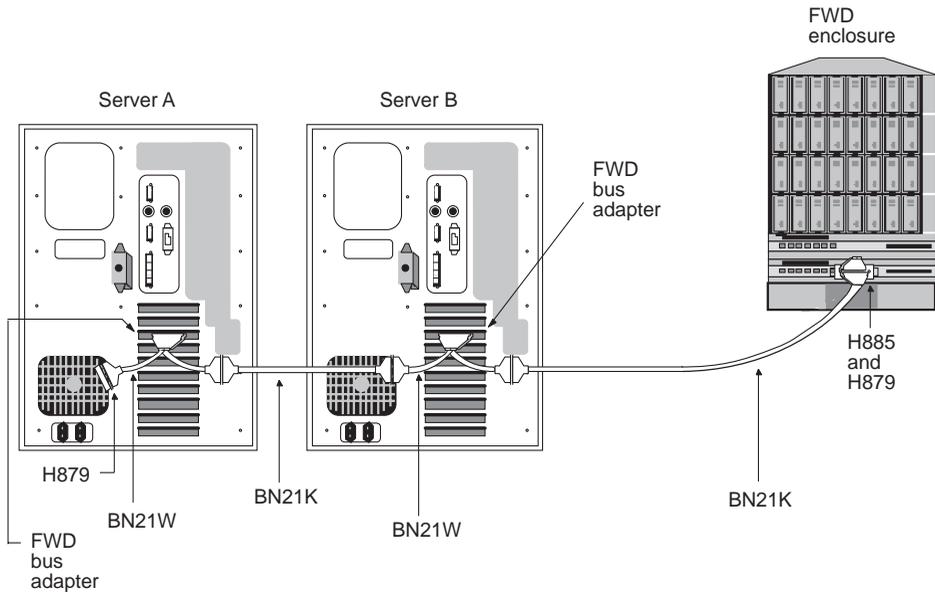
ZK-8695A-FH5

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

- Two fast wide differential (FWD) bus adapters

- Two BN21W–0B Y-cables

- One H885–AA trilink 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.

Although DIGITAL strongly recommends that you implement external termination in all cases, external termination is not strictly required at the signal converter in this example. See Terminating the Bus and Isolating Devices (page 3–8). If you choose not to use this external termination, you do not need the trilink connector and one of the H879–AA terminators. Retain the internal termination of the signal converter.

Configuring a Differential Bus with Single-Ended Storage

To configure a differential bus using a single-ended storage device, you need the components listed in the previous section, as well as a StorageWorks signal converter installed in slot 0 of the storage enclosure.

- For a single-ended narrow storage enclosure such as the BA350, use the DWZZA–VA.

- For 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 following figure shows a differential bus with single-ended storage.

Configuring a Differential Bus with Single-Ended Storage
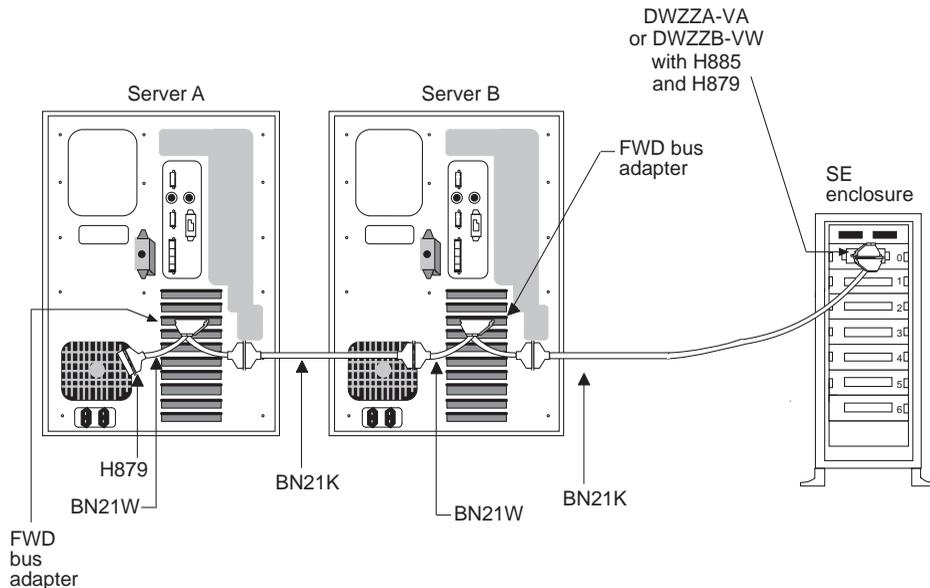
ZK-8696A-FH5

Although DIGITAL strongly recommends that you implement external termination in all cases, external termination is not strictly required at the signal converter in this example. See Terminating the Bus and Isolating Devices (page 3–8). If you choose not to use this external termination, you do not need the trilink connector and one of the H879–AA terminators. Retain the internal termination of the signal converter.

Extending the Bus Using Signal Converters

If your cluster servers and shared storage must be farther apart than permitted by standard cabling, you can extend the length of the shared SCSI bus by 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
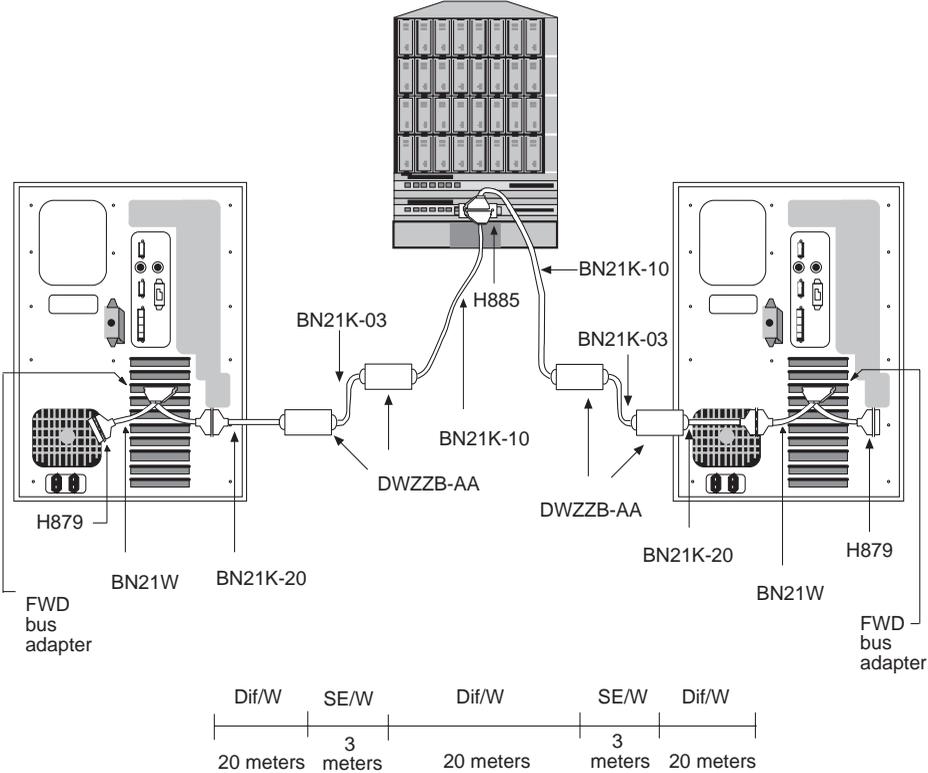
ZK-8701A-FH5

To use this configuration, you need the following:

- Two fast wide differential (FWD) bus adapters

- Two BN21W–0B Y-cables

- Four DWZZB–AA desktop signal converters

- Two 3-meter BN21K–03 cables

- Two 20-meter BN21K–20 cables and two 10-meter BN21K–10 cables

- One H885–AA trilink connector

- Two H879–AA terminators

You must remove or disable the internal termination for both bus adapters and the storage enclosure. 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.

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 (such as a BA356), 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. To add disks to an existing cluster, see the section Adding a Disk in Chapter 6.

_____

▶ **To prepare disks for your cluster:**

1. Turn on the system power for *one* of your cluster servers while leaving the second server turned off.

2. Turn on the power for the shared storage.

_____**Caution**_____

Be sure you turn on power for only *one* cluster server at this time. Otherwise, there is danger of disk corruption if both server systems are turned on while the shared bus is connected and the cluster software is not yet installed.

_____

3. Run the Windows NT Disk Administrator.

4. If the 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. Choose OK so the Disk Administrator will write the signatures.

_____**Caution** _____

Writing a signature can corrupt certain types of disks. In particular, writing a signature to a disk 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.

   Fault-tolerant storage sets—such as those created with Windows NT FTDISK—are not supported for shared disks.

7. Assign fixed drive letters to the partitions so that each disk has a consistent set of drive letters each time the disk is brought on line. These drive letters are the drive letters of your shared disks *on this server*.

   Assign the 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 for one server, you must add up:

   • The disks (shared and local) that will be on line during normal operations

   • The additional disks that will be on line if a failover occurs from the other server

If the total exceeds 26 drives, you cannot bring all disks on line at one time.

8. DIGITAL recommends that you label your shared disks. Use 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.

After you prepare your disks for one server, verify that they also are recognized by the second server.

▶ **To verify that disks are recognized by the second server:**

1. Shut down the first 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* cluster server at this time. Otherwise, there is danger of disk corruption if both servers are turned on while the shared bus is connected and the cluster software is not yet installed.

_____

3. Run the Windows NT Disk Administrator. You should see the disks that you prepared and labeled on the first server.

4. Again, assign fixed drive letters to each partition. DIGITAL recommends that you use the same drive letters for each partition on both servers, so that the drive letters remain the same after a failover. However, this is not required.

After you verifiy that both server systems recognize your shared disks, shut down the second server and turn off the system power. Also turn off the power for the shared storage.

The next step is to install the cluster server software (Chapter 4).

4

Installing the Server Software

This chapter describes how to install DIGITAL Clusters for Windows NT Version 1.1 or Version 1.0 server software on your two cluster servers. You install the server software after you set up the cluster hardware.

For upgrades, go to Chapter 7. You can upgrade a Version 1.0 cluster to Clusters Service Pack 2 or to Version 1.1. For Version 1.1, you first must upgrade your servers to Windows NT Server 4.0 as described.

For an overview of the full cluster setup procedure, see Chapter 2.

To install cluster client software, see Chapter 5.

System Requirements for Server Software

The following table lists the software and hardware requirements for installing and running DIGITAL Clusters server software:

Operating system	Microsoft Windows NT Server
Clusters Version 1.1	Microsoft Windows NT Server 4.0 with NT Service Pack 2*
Clusters Version 1.0	Microsoft Windows NT Server 3.51 with NT Service Pack 5*
Server	Two Prioris or two AlphaServer systems
Hard disk space (approximate)	5 MB
Distribution media	CD–ROM

* The DIGITAL Clusters 1.1 CD–ROM provides a copy of the required NT Service Pack.

Other Requirements

Your cluster servers must also meet the following system and licensing requirements:

- The two cluster servers must be running in an Ethernet or FDDI network, using one of the following PC LAN protocols:

  – NetBEUI

  – TCP/IP

  – IPX/SPX

  The two servers must have at least one protocol in common.

- Both servers must belong to the same Windows NT Server domain. You can use primary and backup domain controllers (PDCs and BDCs) as cluster servers.

- Your Windows NT Server licensing for a server should cover the total number of clients that may connect to that server if a failover occurs from the other server.

Before You Start

Before installing the cluster server software, complete the following checklist:

☐ **Ensure that your hardware is properly installed (Chapter 3).**

_____**Caution**_____

If the disks on your shared bus contain data you want to preserve, install the server software on both servers *before* creating and connecting the shared bus. Otherwise, there is danger of disk corruption if the system power for both servers is turned on while the shared bus is connected and the cluster software is not yet installed.

_____

☐ **For upgrades from Version 1.0, follow the procedures in Chapter 7.**

☐ **For DIGITAL Clusters 1.1, install Windows NT 4.0 Service Pack 2.**
The DIGITAL Clusters 1.1 CD–ROM provides a copy.

☐ **For DIGITAL Clusters 1.0, install Windows NT 3.51 Service Pack 5.**
The DIGITAL Clusters 1.1 CD–ROM provides a copy.

☐ **For Microsoft SQL, install the SQL 6.5 Server with Service Pack 1.**
Install the SQL server locally on each cluster server if you plan to use SQL databases. The DIGITAL Clusters 1.1 CD–ROM provides a copy of the SQL Service Pack 1 in the \SQL65sp1 directory. See the *Administrator's Guide* for details on using SQL in a cluster.

☐ **Create a cluster administrator account.**

When you install the server software, the Setup program prompts you for the user name, domain name, and password of an 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 the cluster administrator account:**

1. Start Windows NT and log in to an account with Domain Administrator privileges.

2. Start the User Manager for Domains and create an account with the 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.

☐ **Identify your shared buses.**

During the installation, 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 start the installation process.

▶ **To identify your shared buses on a Window NT 4.0 server system:**

1. Open the Windows NT Control Panel, SCSI Adapters applet.

2. Expand the list under each device.

3. Select a device, then choose Properties to see the information for that device.

4. Look for the port and bus that match the configuration of your shared bus, with the correct adapter type and combination of disk types and SCSI IDs.

5. Note the port and bus numbers of all your shared buses.

▶ **To identify your shared buses on a Window NT 3.51 server system:**

1. Run the Registry Editor (\winnt40\system32\regedt32.exe) and click on the following, in order:

   • HKEY_LOCAL_MACHINE window

   • HARDWARE

   • DEVICEMAP

   • Scsi

   2. Double-click on all the Scsi Port keys to expand them. For each bus on each port the system displays 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 that match the configuration of your shared bus, with the correct adapter type and combination of disk types and SCSI IDs.

   4. Note the port and bus numbers of all your shared buses.

Software Installation Overview

This section lists the basic installation steps. The following sections describe each step in detail.

▶ **To install the server software:**

   1. Turn off the power for the shared storage and turn on the power for both cluster servers.

   2. Install the server software on the first server (page 4–5). After the installation, leave the server turned on but do not reboot it.

   3. Install the server software on the second server (page 4–16). After the installation, leave the server turned on but do not reboot it.

   4. Turn on power for the shared storage, then reboot the servers *one at a time* (page 4–5).

   5. With the power on for the entire cluster, verify that the software is installed properly and that you can see all your shared disks (page 4–18).

   6. Use the Cluster Administrator to assign shared disks to failover groups and Windows NT Explorer to create file shares.

Rebooting Your Server Systems

After you install the cluster server software on each server, the system displays instructions to reboot your servers, *one at a time*. It is critical that you understand the proper way to reboot your servers.

_____**Caution**_____

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

▶ **To safely reboot your servers:**

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 start the installation, make sure the power for the shared storage is off. Unsynchronized access to the shared disks can corrupt the disks.
_____

▶ **To install the DIGITAL Clusters server software on the first server:**

1. Start Windows NT and log in to the cluster administrator account. Close all open applications. To create the administrator account, see Before You Start (page 4–2).

2. Insert the DIGITAL Clusters 1.1 CD–ROM in the CD–ROM drive.

3. Run the set up program for the version of clusters software you are installing. For example, if the CD–ROM is in drive E:

   `1.1`
   - In the Windows NT Start menu, choose Run and enter:
     `e:\Clu1-1.nt40\V1.1\setup`

   `1.0`
   - In the Windows NT Program Manager, choose Run from the File menu and enter:
     `e:\Clu1-1.nt351\V1.0\setup`

4. Choose OK, then follow the screen instructions. 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 them and then return to the Setup program.

5. Type your name and the name of the company you work for.

   Confirm the information, then choose Next to proceed to the next screen.

   If needed, you can return to a previous screen by choosing Back and change the information you entered.
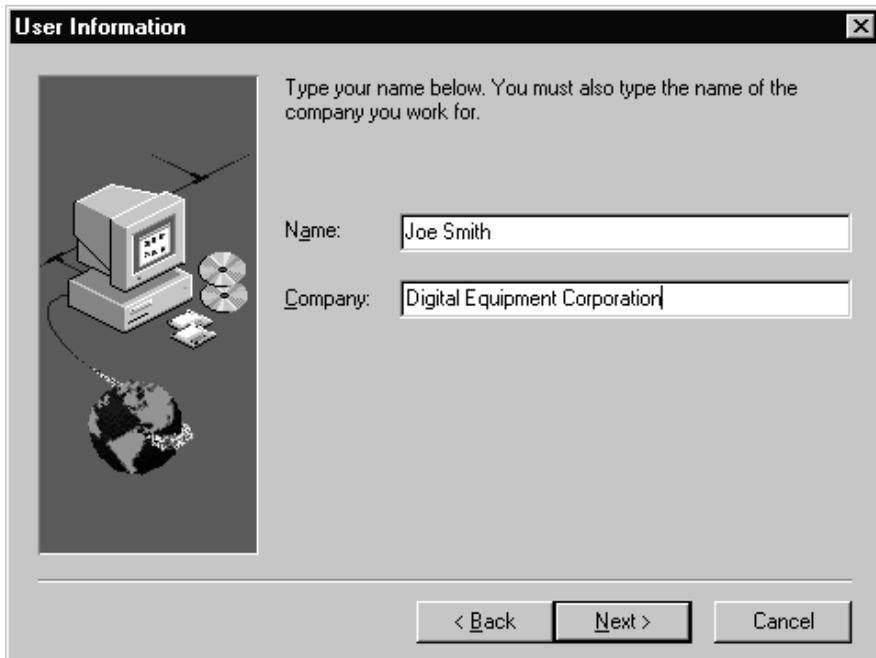
6. To install the server software, select Install NT Cluster Server.
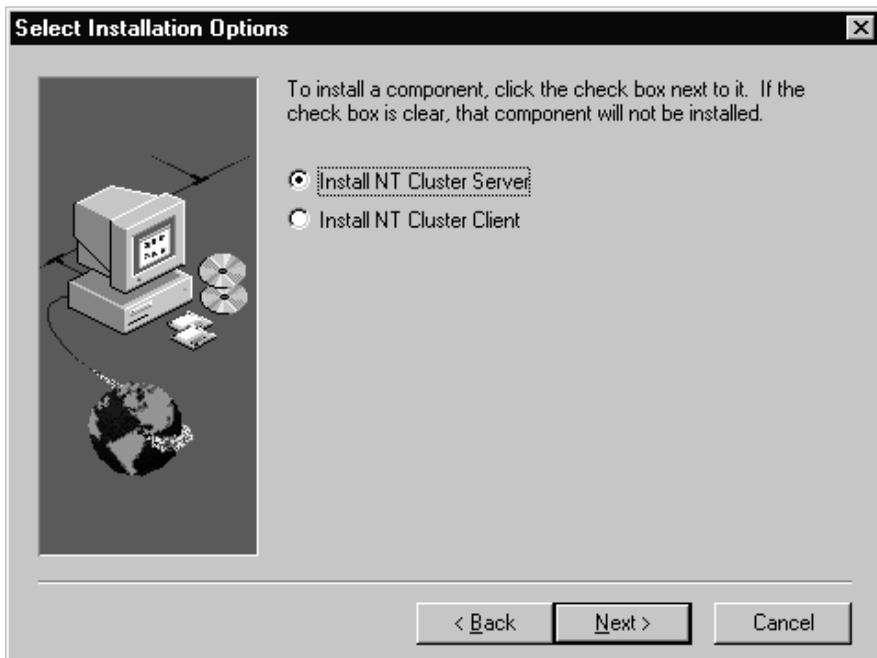
7. Confirm the directory path for the installed files.

To change the directory path, choose Browse and select a new directory. If the specified destination directory does not exist, the Setup program asks you if you want to create it.

8. 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.
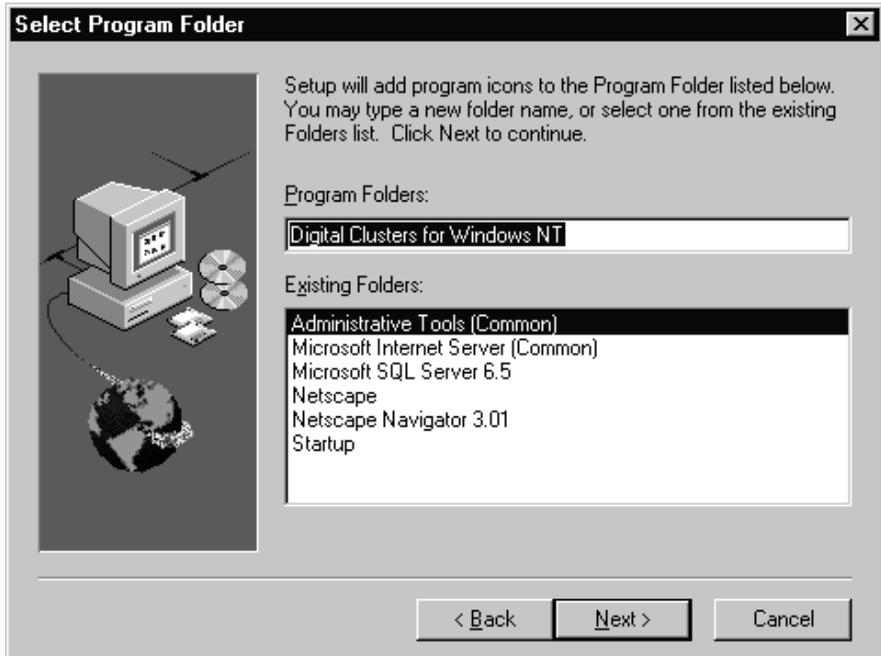
9. Verify the information you have supplied to the Setup program. If you want to change any of the supplied information, choose Back repeatedly until you return to the window containing the information you want to change.
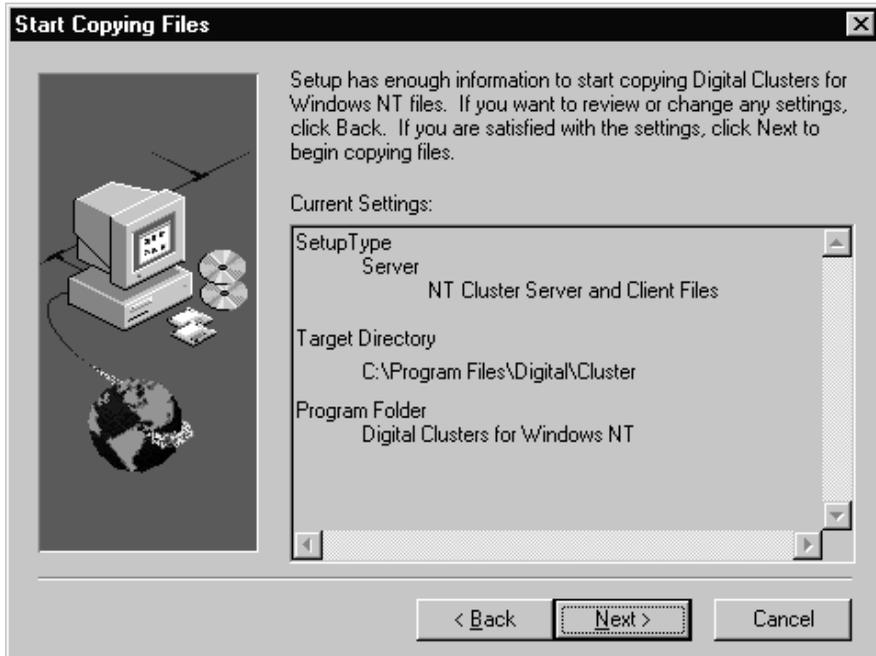
If the information displayed is correct, choose Next. The Setup program copies files to the destination directory. While Setup is copying files, the program displays a status meter to mark its progress.

10. 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. Enter the name you want to give your cluster. Cluster names can contain up to 15 characters.
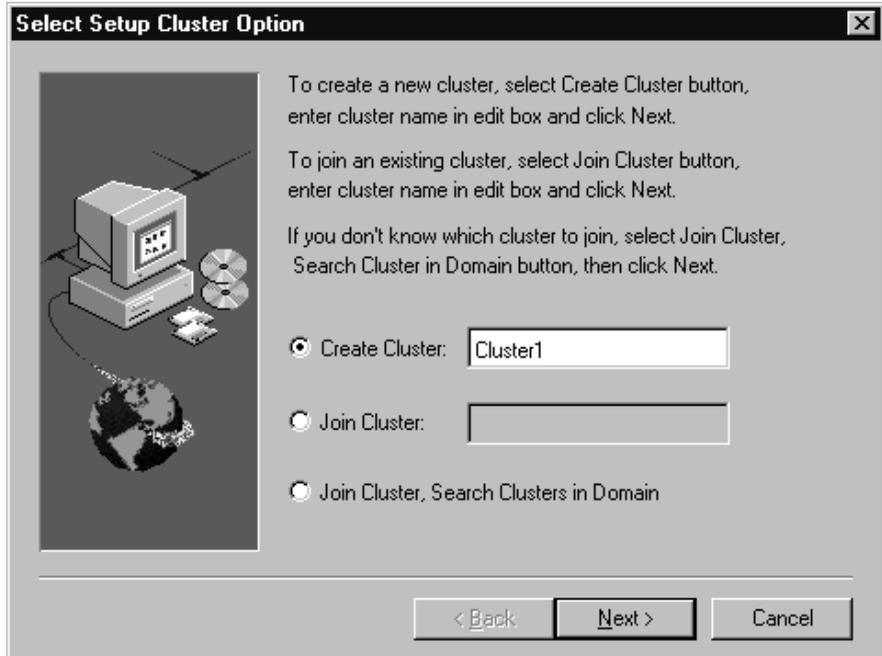
Multiple Clusters in a LAN

If you have more than one cluster in your LAN, make sure the first eight characters of cluster names are unique. Otherwise, it is possible for one cluster to see resources owned by another cluster.

Examples

Valid: CLUSTER1 and CLUSTER2
Invalid: CLUSTER1A and CLUSTER1B

11. 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 Before You Start (page 4–2).
_____

The system does not display your password on the screen. You must enter the password again to confirm it and guard against typing errors.

12. 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.

    For details on identifying your shared bus, see Before You Start (page 4–2).
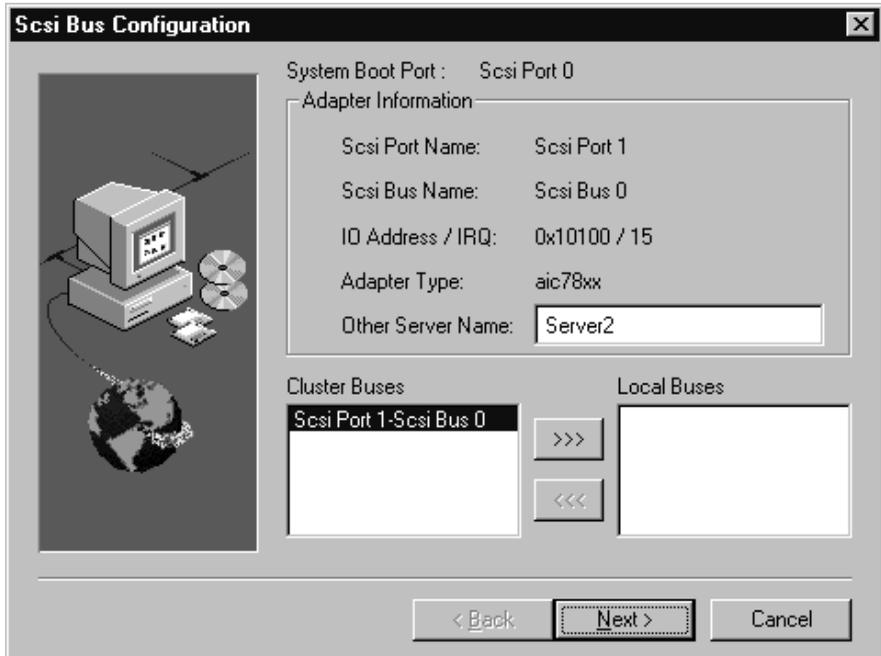
13. Review and verify the bus adapter information you have supplied. To change any information, choose Back and reenter the bus information.
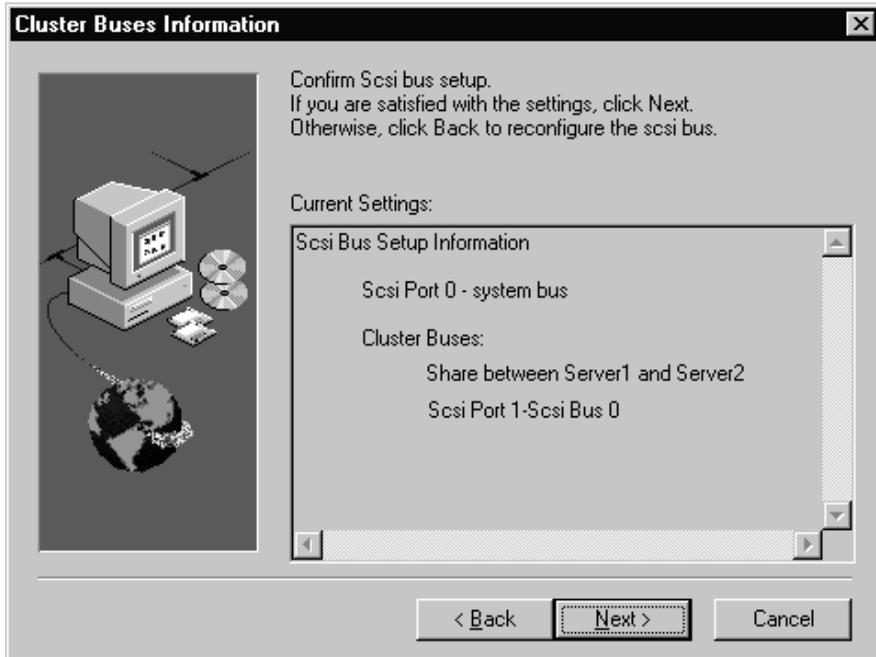
14. The Setup program creates the Cluster program folder, then displays the Setup Complete dialog box. Choose Finish to complete Setup. DIGITAL strongly recommends that you read the ReadMe file at this time.

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

Installing the Software on the Second Server

_____Caution_____

Before you start the installation, make 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:**

1. Perform steps 1 to 9 of the first server software installation (page 4–5).

2. Select Join Cluster and enter the name of the cluster.

   If you forgot the name of the cluster, select Join Cluster, Search Clusters in Domain to have Setup search for existing clusters.

   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.
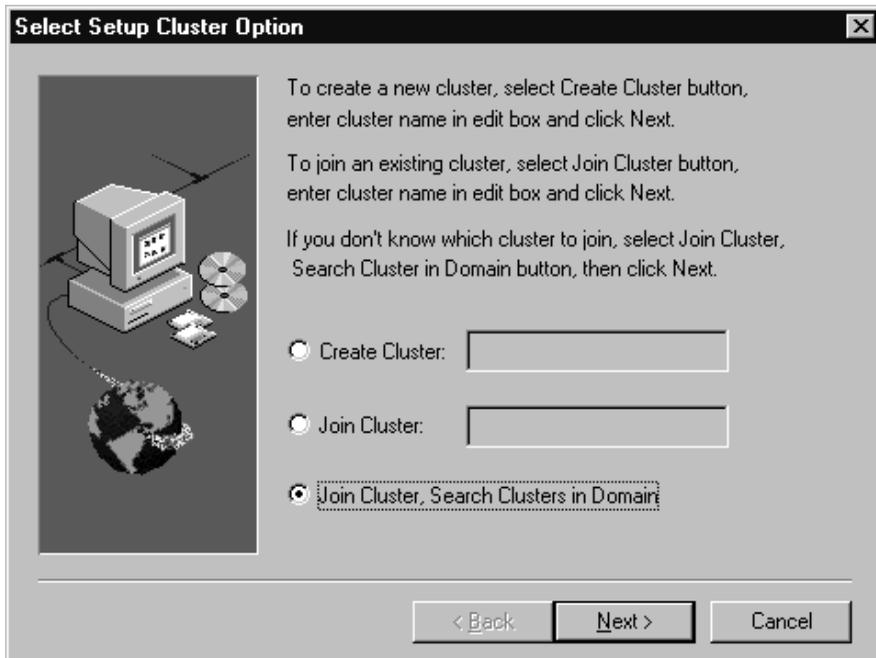
3. If you selected the Search Clusters in Domain option from the previous dialog box and Setup found existing clusters, select the cluster name from the list provided.

    If Setup did not find any existing clusters, Setup will prompt you to type the cluster name.
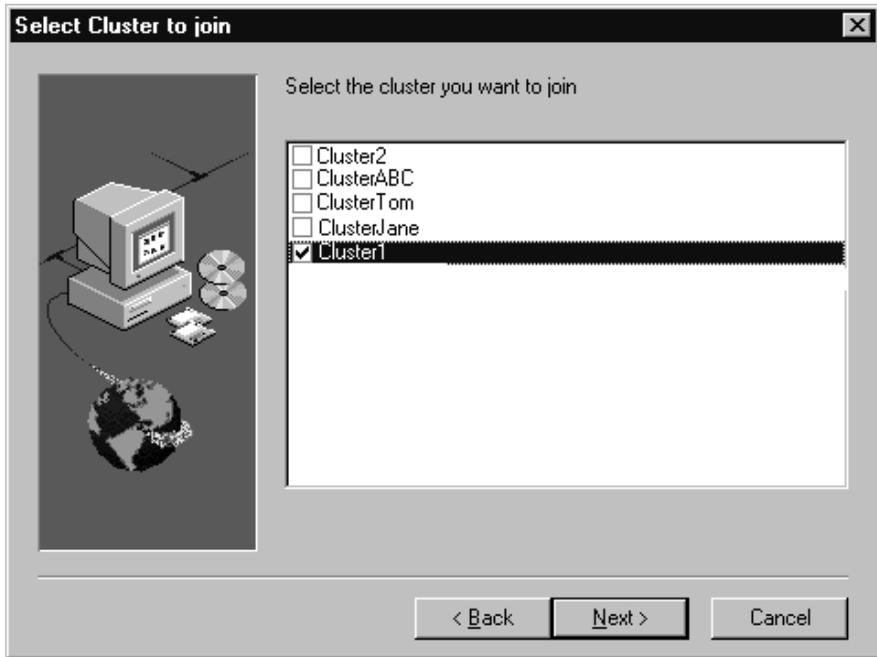
4. Complete steps 11 to 15 in the section Installing the Software on the First Server.

Completing and Verifying the Installation

After installing the cluster server software on the second cluster server, use the following procedure to start the servers and verify the software installation.

▶ **To complete the installation of the server software on both servers:**

1. Turn on the power for the shared storage.

2. Reboot the servers, *one at a time* (page 4–5).

After you reboot both servers, verify that the software was installed properly.

▶ **To verify that the software was installed properly:**

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

   You cannot view the 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 in the Control Panel to verify that the following services started on both servers:

   - Cfmd Server

   - Cluster Failover Manager

   - Cluster Name Service

Problems?

Some problems require reinstalling the cluster software:

- **The cluster services are not running.** This indicates the cluster software is not installed properly. 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 Before You Start (page 4–2) for information on creating the cluster administrator account. To correct this problem, you must reinstall the cluster software.

- **The cluster services are running but you cannot see your shared disks.** You may have specified the bus adapter for your shared SCSI bus incorrectly. If so, you must reinstall the software. Otherwise, see the Troubleshooting chapter of the *Administrator's Guide* for more information on possible causes of disk problems.

▶ **To reinstall the cluster software:**

1. Turn off the power for the shared storage.

2. Uninstall the server software on the affected server (Appendix A). Then reboot the server.

3. Log in to the server by using a properly configured cluster administrator account and reinstall the server software as described in the section Installing the Software on the Second Server (page 4–16). Make sure you follow the instructions exactly.

Configuring the Cluster Software

After installing the server software, you must run the Cluster Administrator to place your shared disks in failover groups and Windows NT Explorer to create file shares. See your *Administrator's Guide* for details.

5

Installing the Client Software

This chapter describes how to install DIGITAL Clusters for Windows NT Version 1.1 or Version 1.0 client software on Windows systems that need to access the cluster using the common cluster alias name. The chapter also lists tips and restrictions for using clients.

You can install the client software on systems running the following operating systems: Windows NT (Server or Workstation), Windows for Workgroups, or Windows 95®.

Other systems, such as Macintosh® systems, can access the cluster by using the individual names of the cluster servers rather than the cluster alias. However, these systems must manually reconnect to the cluster if a failover occurs.

For upgrades, go to Chapter 7. You can upgrade a Version 1.0 cluster to Clusters Service Pack 2 or to Version 1.1.

Client Software Not Required for IP Failover

With DIGITAL Clusters 1.1, you can set up IP socket-based applications such as web servers to use a cluster IP address. Any client can access these applications by using the specified cluster IP address or associated IP name. If clients are going to access only those applications configured for IP failover, they do not need the client software.

System Requirements for Client Software

The following table lists the software and hardware requirements for installing and running DIGITAL Clusters client software:

Operating system	Windows 95 Windows NT Server 3.51 or 4.0 Windows NT Workstation 3.51 or 4.0 Windows for Workgroups 3.11
System CPU	Intel® (any supported operating system) DIGITAL Alpha (Windows NT only)
Hard disk space (approximate)	2 MB

Other Requirements

Cluster clients must also meet the following system requirements:

- The client system must be running in an Ethernet or FDDI network, using one of the following PC–LAN protocols:

  – NetBEUI

  – TCP/IP

  – IPX/SPX

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

- The DIGITAL Clusters 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 from the CD–ROM to a diskette. The following table lists the required files, where e is the CD–ROM drive letter:

If your client is running . . .	Copy these files . . .
Version 1.1	
Windows 95	`e:\Clu1-1.nt40\V1.1\Client\W95\*.*`
Windows for Workgroups	`e:\Clu1-1.nt40\V1.1\Client\WFWG\*.*`
Windows NT (Alpha)	`e:\Clu1-1.nt40\V1.1\Server\NT\Alpha\*.*`
Windows NT (Intel)	`e:\Clu1-1.nt40\V1.1\Server\NT\Intel\*.*`
Version 1.0	
Windows 95	`e:\Clu1-0.nt351\V1.0\Client\W95\*.*`
Windows for Workgroups	`e:\Clu1-0.nt351\V1.0\Client\WFWG\*.*`
Windows NT (Alpha)	`e:\Clu1-0.nt351\V1.0\Client\NT\Alpha\*.*`
Windows NT (Intel)	`e:\Clu1-0.nt351\V1.0\Client\NT\Intel\*.*`

Note that the Version 1.1 client for Windows NT uses files from the `\Server` directory. In this case, the client installation is built into the server setup procedure.

Installing the Software on Your Computer

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

▶ **To install the DIGITAL Clusters client software on your system:**

1. Log in to the system under an account that has 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 1.1 CD–ROM or a diskette copy of the setup files into the appropriate drive. Or access the CD–ROM over the network.

4. Run the set up program for the version of clusters software you are installing. For example, if the CD–ROM is in drive E:

   1.1
   - In the Windows NT Start menu, choose Run and enter:
     `e:\Clu1-1.nt40\V1.1\setup`

   1.0
   - In the Windows NT Program Manager, choose Run from the File menu and enter:
     `e:\Clu1-1.nt351\V1.0\setup`

5. Choose OK, then follow the setup 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 make sure that all other Windows applications are closed. If applications are open, close them and then return to the Setup program.

6. Enter your name and the name of the company you work for.

   Each setup screen has Next and Back buttons. When you complete a screen, choose Next to move to the next screen. Choose Back to return to a previous screen and make changes.

7. **Windows NT only:** If you are installing the client software on a Windows NT client system, Setup prompts you to select the type of installation you want to do. Select Install NT Cluster Client.
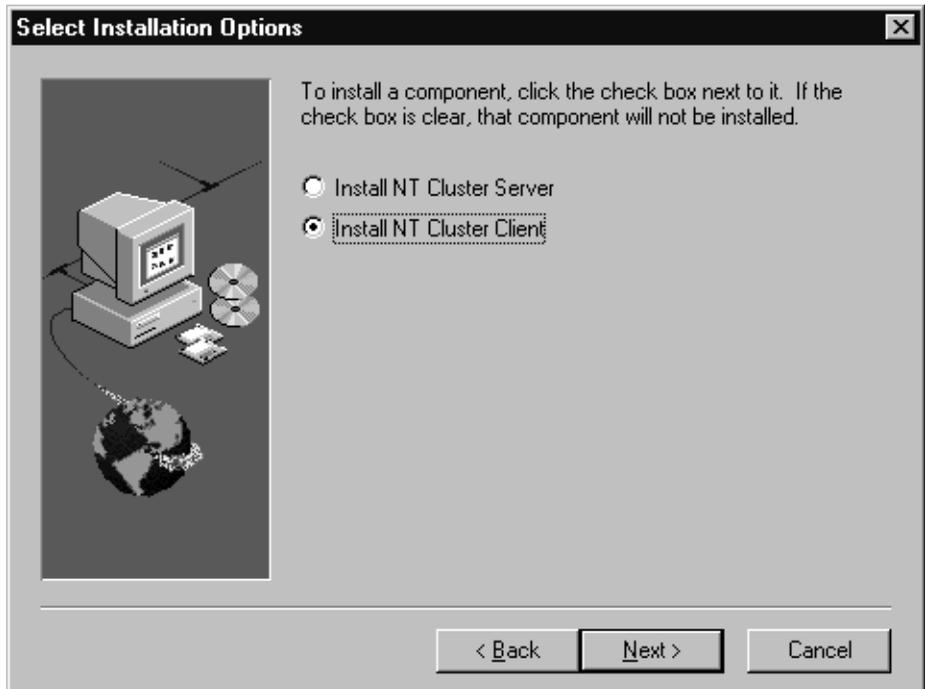
8. **Windows NT only:** Select the directory path for the installed files. You can use the default path or choose Browse and select a new directory. If you specify a directory that does not exist, the Setup program asks if you want to create it.

| Ask User Destination Path	☒
Setup will install Digital Clusters for Windows NT in the following directory. To install to this directory, choose Next. To install to a different directory, choose Browse You can choose not to install Digital Clusters for Windows NT or change destination directory again later. ┌ Destination Directory ───────────── D:\Program Files\Digital\Cluster [Browse...]	
[< Back] [Next >] [Cancel]	

9. **Windows NT only:** 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 entering the new folder name in the Program Folders box.
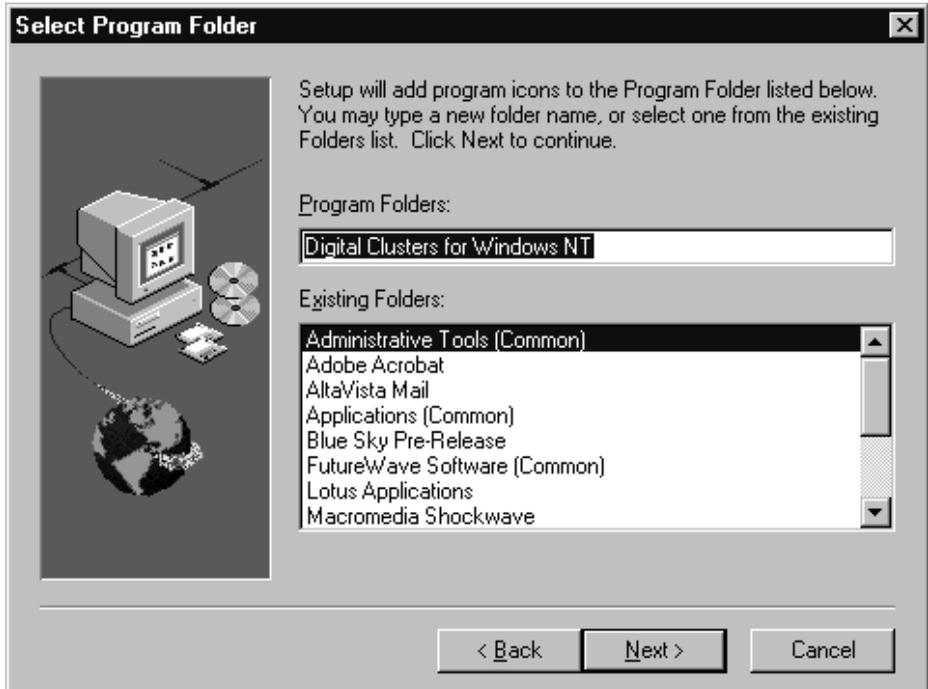
10. Review and verify the information you have supplied to the Setup program. If you want to change any of the supplied information, choose Back repeatedly until you return to the window containing the information you want to change.
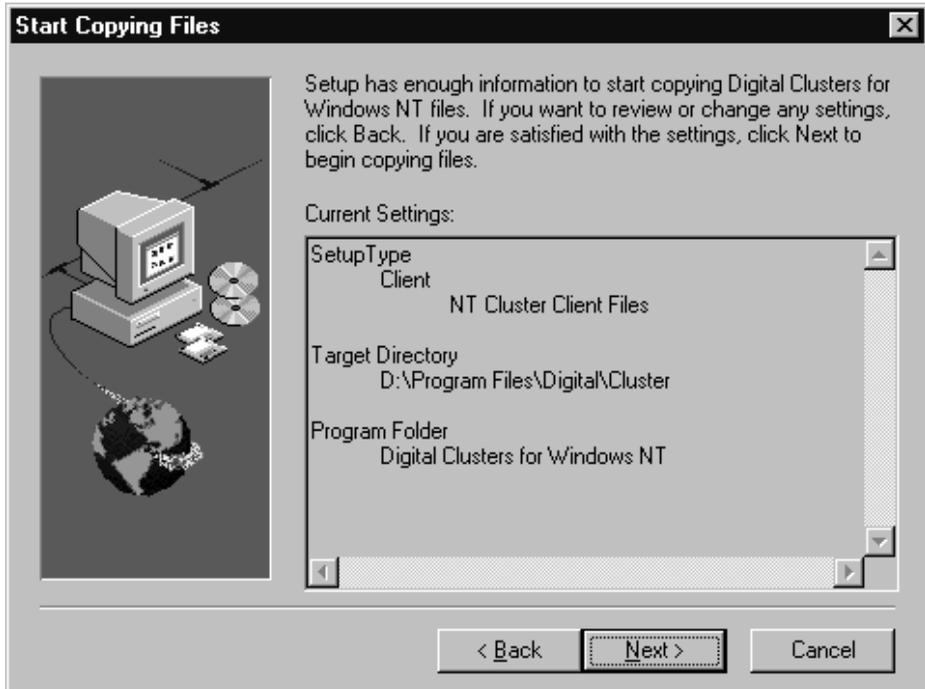
If you are satisfied with the information as specified, choose Next. The Setup program copies files to the destination directory. While it is copying files, the program displays a status meter to mark its progress.

11. **Windows NT only**: After copying all files, the Setup program displays the Copying Complete window. Choose Finish to optionally read the ReadMe file and complete Setup. DIGITAL strongly recommends that you read the ReadMe file at this time. You must close the ReadMe file to continue to the final Setup window.

12. To complete the installation, the Setup program prompts you to restart your system.
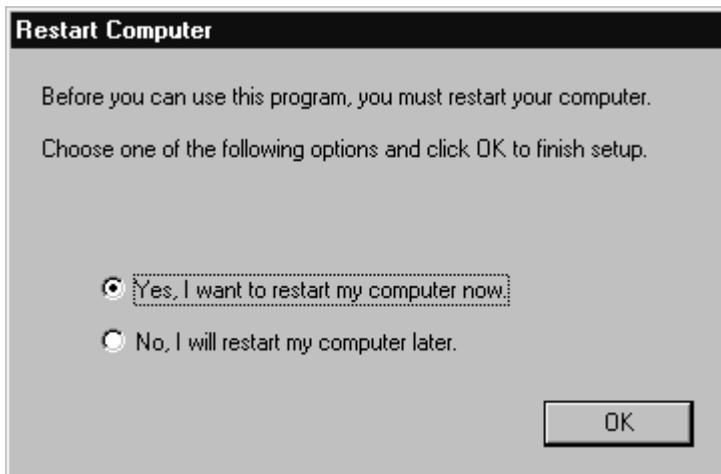
Notes on Using Clients

This section provides tips and restrictions for systems that have the cluster client software installed.

Windows NT Clients

The following notes apply to Windows NT clients running the cluster client software.

Network Drives May Not Connect Automatically

The DIGITAL Clusters client software affects the startup timing of some network-related services. This can affect automatic reconnections to network drives at login time, if the drives are connected to cluster shares. If you log in to the system soon after it restarts, network drives connected to cluster shares may be visible but not fully connected. In this case, you can disconnect and then reconnect these network drives.

To avoid this situation, wait about 2 or 3 minutes after the system reboots before logging in. The exact length of time you must wait depends on system speed, network traffic, and other factors.

Alternatively, before you restart and log in to your system, make sure you have no network drives connected to cluster shares that are marked to automatically reconnect.

Determining Time from the Network

The `net time \\clustername` command is not supported because this is not a failover resource supported by clusters. However, you can issue the `net time \\servername` command to either cluster server.

Windows 95 Clients

The following notes apply to Windows 95 clients running the cluster client software.

Adjusting the Time for Trying Network Connections *(V1.1, V1.0 SP2)*

Requests for network connections, such as network drive or browsing requests, can take up to 15 seconds to fail. You can adjust the default timeout period (5 seconds) and retry count (3 times) by changing settings in the Windows 95 registry. See the DIGITAL Clusters Client Tuning Parameters section in Appendix A of the *Administrator's Guide*.

Remote users may want to increase the timeout period to allow for a slow network link. LAN users may want to decrease the retry count, because the need for retries is low unless the name server is unavailable.

Using Quick Logon on Mobile Systems

If you have a number of permanent network drive connections, you may want to use the Quick Logon option in the Windows 95 Control Panel, Network applet. When you use Quick Logon, the system does not reconnect to drives until you use them. This setting is especially recommended for laptop and mobile systems.

▶ **To select the Quick Logon option:**

1. In the Network applet, select the Client for Microsoft Networks and choose Properties.

2. On the General tab, choose **Quick logon**.

Updated dclnamc.vxd File to Fix a Problem with Find Files or Folders *(V1.0 SP2)*

If you select Find Files or Folders from the Start menu, the window can freeze and prevent further network browsing. To fix this problem, you can install the following updated driver provided on the DIGITAL Clusters CD–ROM:

```
Clu1-0nt.351\CluSP2\Client\W95\dclnamc.vxd
```

The CD–ROM provides a `CLW95SP2.BAT` batch file for copying the new driver to your system.

▶ **To install the new driver:**

1. Open an MS–DOS® command window from the Start menu by selecting Programs/Main/MS–DOS Prompt.

2. Change to the CD–ROM drive. For example, if your CD–ROM drive is drive D:

   ```
   > D:
   ```

3. Change the directory to `Clu1-0nt.351\CluSP2\Client\W95`:

   ```
   > cd Clu1-0nt.351\CluSP2\Client\W95
   ```

4. Run the batch file, specifying the location of your Windows 95 root directory. For example:

   ```
   > CLW95SP2 C:\WIN95
   ```

Determining Time from the Network

The `net time \\clustername` command is not supported on clients because this is not a failover resource supported by clusters. However, you can issue the `net time \\servername` command to either cluster server.

Windows for Workgroups Clients

The following notes apply to Windows for Workgroups clients running the cluster client software.

Adjusting the Time for Trying Network Drive Connections *(V1.1, V1.0 SP2)*

Requests for network drive connections can take up to 15 seconds to fail. You can adjust the default timeout period (5 seconds) and retry count (3 times) by changing settings in the `system.ini` file. See the DIGITAL Clusters Client Tuning Parameters section in Appendix A of the *Administrator's Guide*.

Remote users may want to increase the timeout period to allow for a slow network link. LAN users may want to decrease the retry count, because the need for retries is low unless the name server is unavailable.

Viewing Cluster Objects

To view the list of known clusters, use the browser provided with File Manager. The name `DigitalClusters` appears as a domain name. Double-click on this name to display the list of known clusters.

To list the objects on a particular cluster, double-click on the cluster's icon.

All Supported Clients

The following notes apply to all supported Windows clients.

Order of Network Bindings

For the cluster software to detect system failures quickly, the network bindings under the NetBIOS interface (Control Panel, Network applet) must be listed in the same order on both servers. This requirement applies to bindings under NetBIOS only.

The clusters software uses the bindings for its heartbeat traffic in the order you specify. You can choose the best order for your system. For example, if you use multiple LAN adapters, you might list your private or least loaded LAN first so the cluster software will use it first.

LANman Connections May Take Longer

With the cluster software installed, connections to LANman servers may take longer than normal. Because LANman server names and cluster server names are indistinguishable, the cluster software first tries to establish a requested connection by locating a cluster server of the specified name. It is only after the attempted cluster connection times out that the software passes the request to the LANman redirector.

Windows NT Macintosh Clients

Do not create Macintosh volumes on cluster shares, for the following reason:

If Macintosh services are installed under Windows NT, a menu is added to File Manager providing management of Macintosh volumes. This allows the user to create a Macintosh volume on a cluster share that would be available to Macintosh clients through the server that owns the share. If a failover occurs, however, the client connection to this volume is lost and clients cannot reconnect to this volume on the failover server.

6

Maintaining the Hardware

This chapter describes how to maintain your cluster hardware, change SCSI and network adapter configurations, and add and remove disk devices.

Disconnecting Devices

Before you disconnect a device from an active cluster, you must make sure that the shared SCSI bus will remain terminated properly. Otherwise, you must stop cluster activity first.

If the cluster has trilink connectors and Y-cables to isolate devices and implement external termination, you can disconnect a device and maintain proper termination on the shared bus. See Chapter 3 for information about termination, trilink connectors, and Y-cables.

If you cannot 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. See the *Administrator's Guide* for instructions on how to stop cluster activity.

Performing Maintenance on Cluster Servers

Occasionally, you may need to disconnect a cluster server to fix hardware problems or install new hardware.

If you can isolate the system from the shared bus without affecting the bus termination, the cluster can remain active while you perform the maintenance. If not, 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.

▶ **To disconnect a cluster server and perform maintenance:**

1. If you can, isolate the server from the shared bus.

2. Using the Cluster Administrator, perform a manual failover for all groups currently serviced by the server system.

3. Shut down the system and turn off the system power.

4. Disconnect the system from the shared bus, making sure the bus is still properly terminated.

5. Perform the necessary maintenance.

6. Reconnect the system to the shared bus, turn on the system power, and reboot the system.

7. Using the Cluster Administrator, perform a manual failover on all groups to be serviced by the server system.

Changing the Network Adapter Configuration *(V1.1)*

Changing network adapters on cluster servers can affect the cluster's IP address failover capability, if used. The effect of adding or removing a network adapter depends on how you configured cluster IP addresses in the Cluster Administrator. When you set up a cluster IP address, the Cluster Administrator lets you specify which installed adapters can enable the address: a single adapter, a selected set of adapters, or any installed adapter.

If you enabled an IP address…	And you…	Then…
On any adapter or a set of adapters	Remove one or more adapters	No action is required if at least one of the originally assigned adapters remains in the server.
On a specific adapter	Remove the adapter	Use the Cluster Administrator to associate the IP address with another installed adapter.

Changing the SCSI Adapter Configuration

If you make changes to SCSI bus adapters on cluster servers, you must update the adapter configuration in the Cluster Administrator promptly. Changes include moving a SCSI bus adapter to another I/O slot, adding or removing SCSI bus adapters, or installing a new version of the bus adapter driver.

After you make changes, reboot the system and restart the Cluster Administrator. The cluster software detects if you have added or moved a shared SCSI bus adapter. The software then guides you through a SCSI bus configuration procedure similar to the one performed when you first installed the cluster server software. You use the Manage SCSI Adapter Configuration dialog box in Cluster Administrator to update adapter settings. Then reboot your server again immediately. See the *Administrator's Guide* for details.

Until you update the dialog box settings, the cluster software cannot access your shared disks. Under this condition, the shared disks are accessible simultaneously from both servers. Be careful not to access the file system through both servers.

The software issues the following warnings:

- The cluster driver displays the message `Adapter configuration has changed` on the blue screen while the system is rebooting.

- A message is written to the event log indicating the cluster software is unable to control the disks because there is no shared bus selected.

- The Cluster Administrator displays a warning that it cannot obtain information on the shared disks.

Adding and Removing Shared Storage Enclosures

Use the following procedures to add or remove a shared storage enclosure.

▶ **To add a new storage enclosure to your shared SCSI bus:**

Before you begin, you must shut down all cluster activity unless you planned for this addition by including appropriate trilink connectors or Y-cables in the original bus path. Otherwise, the bus will be terminated improperly while you disconnect and reconfigure the bus cabling.

See the *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 you can isolate the enclosure from the shared bus without affecting the bus termination. However, make sure that no services are using the disks in the enclosure before you turn off the power and disconnect it from the bus.

Adding Shared SCSI Buses

You can install additional SCSI buses to expand the storage capacity of your cluster. The number of SCSI buses is limited only by the number of I/O slots available on your cluster servers.

▶ **To add a shared SCSI bus to your cluster:**

1. Perform an orderly shutdown of both cluster servers.

2. Set up the hardware for the new bus, following the same procedures used to set up the first bus.

    a. Install a SCSI bus adapter on each server for the new bus (Chapter 3).

    b. Set up the cabling for the new bus (Chapter 3).

3. Restart both cluster servers. The cluster software displays a message that the SCSI adapter configuration has changed.

4. In the Cluster Administrator, choose Manage SCSI Adapter Configuration from the Manage menu. Assign the new SCSI bus adapter on each server as a cluster bus. For details on using Cluster Administrator, see the online help or *Administrator's Guide*.

5. Restart both cluster servers. The Cluster Administrator detects the shared disks on the new SCSI bus.

6. In Cluster Administrator, add the new disks to a failover group. This brings the disks on line.

7. Prepare the new disks and verify the hardware configuration (Chapter 3). This step includes repartitioning and formatting the disks, then assigning fixed drive letters.

8. Restart both cluster servers.

Maintaining Disks

Basically, system management tasks for shared cluster disks are the same as those in a noncluster environment. However, there are a few considerations 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 probably need to turn off the power to the storage enclosure. Turning off power sets all disks in the enclosure off line and may disrupt the termination of the shared SCSI bus, depending on your hardware configuration.

If you have more than one enclosure on the shared bus, try to configure the bus cabling so 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

Physically removing a shared disk involves removing the disk from its failover group.

▶ **To permanently remove a shared disk from the cluster:**

1. Make sure that no application is using the disk. Because Windows NT provides no way to determine which applications are using the disk, 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. Otherwise, physically removing a disk that is still part of a failover group will set the entire group off line. See the *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 so the remaining disks can come back on line.

To replace the disk after it has been removed, see Replacing a Disk (page 6–6).

Adding a Disk

Adding a shared disk to a cluster involves installing the disk, adding the disk to a failover group, formatting the disk into NTFS partitions, and assigning fixed disk letters.

▶ **To add a disk to a cluster:**

1. Install the disk in the enclosure as described in your hardware documentation. The disk must have a unique SCSI ID.

   The installation may require you to turn off the power in the storage enclosure. Turning off power sets all disks in the enclosure off line. See Turning Off Power in the Storage Enclosure, page 6–4.

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 cluster servers or run Windows NT Disk Administrator. If the disk has no disk signature, the software writes 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 is detected by the cluster software, run the Cluster Administrator to assign the disk to a failover group and bring the disk on line.

5. After 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. Although the cluster software does not enforce the use of NTFS, it 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 uses 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 cluster servers.

8. Assign fixed drive letters to the partitions so they have the same drive letter each time the disk is brought on line.

   Begin in the middle of the alphabet (for example, with G or higher) to ensure that the fixed assignments do not interfere with the Windows NT dynamic assignment of secondary partitions.

   The drive letters you assign are used by the current system on which you are running Disk Administrator. To use the same drive letters on the second server, 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 assign drive letters for partitions, you must reboot that server to force the cluster software to recognize the new drive letters.
   _____

Replacing a Disk

Use this procedure to remove and replace a shared disk.

▶ **To replace a shared disk in your cluster:**

1. Remove the disk from its storage enclosure by following steps 1 to 3 of the section Removing a Disk 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.

7
Upgrading a Cluster

This chapter describes how to upgrade your cluster from DIGITAL Clusters for Windows NT Version 1.0 software. The chapter covers two upgrade paths:

- Version 1.0 to Version 1.1

- Version 1.0 to Version 1.0, Clusters Service Pack 2

The upgrade procedures preserve your existing cluster configuration.

Upgrading to Version 1.1

To upgrade to DIGITAL Clusters 1.1, you do the following:

- Upgrade one cluster server at time, while leaving the other server running.

- For each server: uninstall the Version 1.0 cluster software, upgrade the operating system to Windows NT 4.0, then install the Version 1.1 cluster software.

- Use the same computer names for the cluster servers as used in the original cluster configuration.

Do Not Use Mixed Cluster Versions for an Extended Period

The Version 1.1 upgrade procedure lets you upgrade one cluster server at a time, while the other cluster server remains running. This means that after upgrading the first server, you have one server running Version 1.1 software and one server running Version 1.0 software. Support for this mixed environment is provided only for upgrade purposes. DIGITAL strongly recommends that you upgrade the second server immediately and do not run mixed cluster versions for an extended period.

Requirements

You need the following software to perform the upgrade:

- DIGITAL Clusters 1.1 CD–ROM

- Windows NT 4.0 Upgrade/Installation CD–ROM or network distribution

Upgrading Your Cluster Servers

Use the following procedure to upgrade your two cluster servers, referred to here as servers A and B. Assume that you are upgrading server B first.

▶ **To upgrade your two cluster servers to Version 1.1:**

1. Manually fail over any groups on the server you are upgrading (B) to the other server (A):

   a. Start the Cluster Administrator.

   b. From the Manage menu, choose Manual Failover.

   c. In the Failover Groups list box, select groups assigned to server B and choose Failover.

   For details on managing manual failovers, see the *Administrator's Guide*.

2. With server A still running, uninstall the current DIGITAL Clusters software from server B.

   To do this, double-click on the uninstall icon in the DIGITAL Clusters for Windows NT program folder.

3. Reboot server B.

4. Install Windows NT Server 4.0 on server B by running the Windows NT 4.0 Upgrade program. Follow the instructions for upgrading from Windows NT 3.51.

   DIGITAL strongly recommends that you perform an upgrade from Windows NT 3.51 to Windows NT 4.0 rather than a completely new installation of Windows NT 4.0. An upgrade preserves your cluster setup, registry settings, and any SQL configuration.

5. Reboot server B again before installing DIGITAL Clusters 1.1.

   You may be able to see the cluster's shared drives from the server, but DIGITAL recommends that you do not access them.

6. Install the Version 1.1 cluster server software on server B (Chapter 4).

   When prompted to create or join a cluster, choose one of the following:

   • If you know the cluster name and name of the other server, choose Join Cluster.

   • If you want to search the list of clusters in your domain, choose Join Cluster, Search Clusters in Domain.

   _____**Caution**_____

   You must use the same computer name as used in the original cluster. Otherwise the upgrade will fail.

   _____

7. Reboot server B.

   At this point, you have a working cluster that contains a mixture of cluster versions. DIGITAL strongly recommends that you do not run mixed cluster versions for an extended period.

8. Repeat steps 1 to 7 for server A.

   After you upgrade server A, your cluster is completely upgraded to Version 1.1.

Upgrading Your Cluster Clients

Version 1.0 clients can work with Version 1.1 cluster servers. However, DIGITAL recommends that you upgrade your clients to Version 1.1 at a convenient time, to take advantage of software fixes and improvements.

To upgrade a cluster client, you first must uninstall the Version 1.0 software and reboot the client system.

▶ **To upgrade your cluster clients from Version 1.0 to Version 1.1:**

1. Uninstall the Version 1.0 client software (Appendix A).

2. Reboot the client system.

3. Install the Version 1.1 client software (Chapter 5).

Upgrading to Version 1.0, Clusters Service Pack 2

If you are not ready to upgrade your cluster servers to Version 1.1 and Windows NT 4.0, you can upgrade to Clusters Service Pack 2. Clusters Service Pack 2 provides:

- Most new features and fixes in DIGITAL Clusters 1.1, except IP address failover capabilities

- All Clusters Service Pack 1 features and fixes

Requirements

Upgrading to Clusters Service Pack 2 requires the following:

- DIGITAL Clusters 1.1 CD–ROM

- Cluster servers running:

    - Windows NT 3.51 with Service Pack 5

    - DIGITAL Clusters 1.0 *with or without* Clusters Service Pack 1

Upgrading Your Cluster Servers

Do not upgrade while running applications such as the Cluster Administrator or SQL Server. If you try to install the Clusters Service Pack 2 while running an application, the upgrade will not complete.

▶ **To upgrade to Clusters Service Pack 2:**

If you have not installed Windows NT Service Pack 5 yet, perform steps 1 and 2. If you have installed Service Pack 5, go to step 3.

1. Stop all clusters services by using the Services applet in the Windows NT Control Panel. The services are:

    - Cfmd Server

    - Cluster Failover Manager

    - Cluster Log Service

    - Cluster Name Service

2. Install Windows NT Version 3.51 Service Pack 5.

    NT Service Pack 5 is provided on DIGITAL Clusters CD–ROM at:

    `\Clu1-0nt.351\nt351sp5`

    Read the NT Service Pack 5 release notes (`readme.txt`) before installing.

You must install NT Service Pack 5 before Clusters Service Pack 2, because NT Service Pack 5 deletes some files used by your cluster software. These files will be replaced when you install the Clusters Service Pack 2 in the next step.

3. Install DIGITAL Clusters 1.0 Service Pack 2. To start the installation, go to the `\Clu1-0nt.351\CluSP2` directory on the CD–ROM and run the setup program:

   `\Clu1-0nt.351\CluSP2\Setup`

Server Files Updated by Service Pack 2

Service Pack 2 updates the following files on the cluster server:

- In the user's target directory (typically `C:\Program Files\Digital\Clusters`):

```
cfmdsrv.exe              logwatch.exe
cluivp.exe               ntcluster.cnt
clustat.exe              ntcluster.hlp
cluxfer.exe              ntcluster.exe
cns.exe                  sp_dec_find_cluster_dbs.sql
fmcore.exe               sp_dec_find_cluster_fb_dbs.sql
fmdisk.dll               sp_DEC_list_db_devs.sql
fmoracle.dll             sp_DEC_list_db_fb_devs.sql
fmscript.dll             sp_fallback_DEC_clean.sql
fmsql.dll                sp_fallback_DEC_perm_srv_db.sql
fmstat.exe
```

- In the user's Windows NT 3.51 `System32` directory:

```
cfmd.dll                 clumgmt.dll
cfms.dll                 clunsapi.dll
clucis.dll               fmlib.dll
```

- In the user's Windows NT 3.51 `System32\drivers` directory:

```
aic78xx.sys
cfs.sys
cluport.sys
```

Upgrading Your Cluster Clients

After upgrading your cluster servers, upgrade clients at the earliest convenient time.

▶ **To upgrade Version 1.0 cluster clients to Clusters Service Pack 2:**

Follow the steps in Chapter 5 for installing cluster client software. When you reach the step to start the installation, specify the appropriate setup program or batch command file for your client:

For this client…	Specify this file on the Version 1.1 CD–ROM…
Windows 95	`Clu1-0.nt351\CluSP2\Client\W95\Clw95sp2.bat`
Windows for Workgroups	`Clu1-0.nt351\CluSP2\Client\Wfwg\Clwfwsp2.bat`
Windows NT	`Clu1-0.nt351\CluSP2\setup.exe`

No CD–ROM Drive?

If the client does not have a CD–ROM drive or network access to a CD–ROM drive, you can copy the required installation files from the CD–ROM to a diskette. You need the following files for the installation:

For this client…	Copy these files from the Version 1.1 CD–ROM…
Windows 95	`Clu1-0.nt351\CluSP2\Client\W95\ *.*`
	Run the `Clw95sp2.bat` command file.
Windows for Workgroups	`Clu1-0.nt351\CluSP2\Client\Wfwg\*.*`
	Run the `Clwfwsp2.bat` command file.
Windows NT (Alpha)	`Clu1-0.nt351\CluSP2\Server\Alpha\*.*`
Windows NT (Intel)	`Clu1-0.nt351\CluSP2\Server\Intel\*.*`
	Run the `setup.exe` program.

Note that the Windows NT client installation uses the \Server directory files. This is because the Windows NT client installation is built into the server setup procedure.

A
Uninstalling the Software

This appendix describes when and how to uninstall DIGITAL Clusters for Windows NT software.

When Do I Need to Uninstall the Software?

You must uninstall DIGITAL Clusters software before upgrading to a new base version or reinstalling the current base version. For example, you must uninstall Version 1.0 before upgrading to Version 1.1.

Do not uninstall the DIGITAL Clusters software before upgrading to a Clusters Service Pack release. A Clusters Service Pack provides a subset of new and revised files for the given software version.

_____ **Note**_____

When uninstalling DIGITAL Clusters software, you must use an administrator account with sufficient privileges to delete the necessary files.
_____

Uninstalling the Server Software

The uninstall procedure also removes the cluster client, if installed.

▶ **To uninstall the cluster server software:**

- On a Windows NT 4.0 server, go to the Start menu and choose DIGITAL Clusters for Windows NT→ Uninstall.

- On a Windows NT 3.51 server, 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.

Uninstalling the Client Software

The method you use to uninstall the DIGITAL Clusters client software depends on the operating system running on the client system.

Windows NT Clients

_____**Caution** _____

If the client is also a cluster server, the following procedure will uninstall the cluster server software as well as the client software.

_____

▶ **To uninstall the client software from a Windows NT client:**

- On a Windows NT 3.51 client, double-click on the Uninstall icon in the DIGITAL Clusters for Windows NT program folder.

- On a Windows NT 4.0 client, go to the Start menu and choose DIGITAL Clusters for Windows NT → Uninstall.

Windows 95 Client

To uninstall a Windows 95 cluster client, you use the Control Panel.

▶ **To uninstall the client software from a Windows 95 client:**

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 a Windows for Workgroups cluster client, you manually delete cluster files.

▶ **To uninstall the client software from a Windows for Workgroups client:**

1. Run File Manager.

2. Open the Windows system directory, usually `windows\system`. Note that this directory may be a subdirectory of another root-level directory, such as `WFW311`.

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.

Effects of Canceling a Clusters Installation

If you exit prematurely from the Setup program when installing either the cluster server or cluster client software, application files and Registry entries can be left on your system. You must manually delete these files and Registry entries and reboot your system before reinstalling the cluster software.

This section describes the files and subdirectories that should be deleted, including:

- Server Files and Registry Entries

- Windows NT Client Files and Registry Entries

- Windows 95 Client Files and Registry Entries

- Windows for Workgroups Client Files

Server Files and Registry Entries

Delete the following server files and registry entries:

- All files and subdirectories under the target directory. The target directory is typically:

  `C:\Program Files\Digital\Cluster`

- Files copied to your Windows NT `System32` directories, including the following:

  - The top level of the System32 directory, including:

    ```
    clumgt.dll
    cfms.dll
    fmlib.dll
    clucis.dll
    cfmd.dll
    ```

  - The `System32\drivers` subdirectory, including:

    ```
    cludisk.sys
    cluport.sys
    ```

- The following keys, where:

  root = HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services

  Use the regedt32 tool to delete:

  ```
  root\ClusterFailoverManager
  root\Cfmd
  root\CluPort
  root\CluDisk
  root\ClusterNameServer
  root\Logwatch
  root\EventLog\System\CFS
  root\EventLog\System\CluPort
  root\EventLog\System\CluDisk
  root\EventLog\Application\Cluster Event Log
  ```

  Also delete the following key:

  HKEY_LOCAL_MACHINE\SOFTWARE\DigitalEquipmentCorporation

  \DigitalClustersforWindowsNT

Windows NT Client Files and Registry Entries

Delete the following client files and registry entries:

- All files and subdirectories under the target directory. The target directory is typically:

  `C:\Program Files\Digital\Cluster`

- Files copied to your Windows NT System32 directories, including those files located in:

  - The top level of the `System32` directory:

    `clunsapi.dll`

  - The `System32\drivers` subdirectory:

    `cfs.sys`

- The following keys, using the regedt32 tool:

  HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\CFS

  HKEY_LOCAL_MACHINE\SOFTWARE\DigitalEquipmentCorporation
  \DigitalClustersforWindowsNT

Windows 95 Client Files and Registry Entries

Delete the following Windows 95 client files and registry entries:

- Files copied to the top level of your Windows 95 `System32` directory, including:

  ```
  clunsapi.dll
  clusprop.dll
  dclnamc.vxd
  dclnamc.sym
  dclnamc.map
  dclnamc.exp
  ```

- The following keys, using the regedit tool:

  HKEY_CLASSES_ROOT\CLSID\
  95F0CC20-8342-11CF-8F47-08002B2A957A

  HKEY_CLASSES_ROOT\Digital_Cluster

  HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\
  Services\DigitalCluster
  Services\VxD\DCLNAMC

- The data value "DigitalCluster" from the following key:

  HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\
      NetworkProvider\Order

Windows for Workgroups Client Files

Delete the following Windows for Workgroup client files:

- Files copied to the top level of your Windows `System` directory, including:

```
clunsapi.dll
clunsapi.pbd
dclnamc.386
dclnamc.sym
dclnamc.map
dclnamc.exp
```

- The following entry in the 386 Enhanced section of the `system.ini` file:

```
device = dclnamc.386
```

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 differs from that on RISC platforms such as AlphaServer systems. This incompatibility is at the operating system level—DIGITAL does not control this feature.

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 cluster servers if the enterprise LAN fails. For example, a manual failover operation may not be properly negotiated using the rudimentary communication mechanisms provided by the shared SCSI bus.

The secondary network connection should be dedicated to 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 exactly, but you must follow the rules for configuring the shared SCSI bus and all its segments. The following table summarizes the rules.

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: 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 be connected with 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 Prioris 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?

If a device does not reside at the end of a bus segment, you *must* remove or disable the internal termination of the device. If the device is 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 setup problems for shared SCSI buses are caused by one or more of the following conditions:

- **The total cable length of a bus segment is too long for the speed and transmission type**. Make 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 add the length of any internal bus within each device. See your hardware documentation 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. Make sure you have disabled or removed the internal termination of each device, as appropriate. See the device's documentation for instructions.

- **The terminators are not at the ends of a bus segment**. If you have installed a trilink 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. See the device's documentation for instuctions.

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