



xSeries 230 HA Cluster

Installation Guide

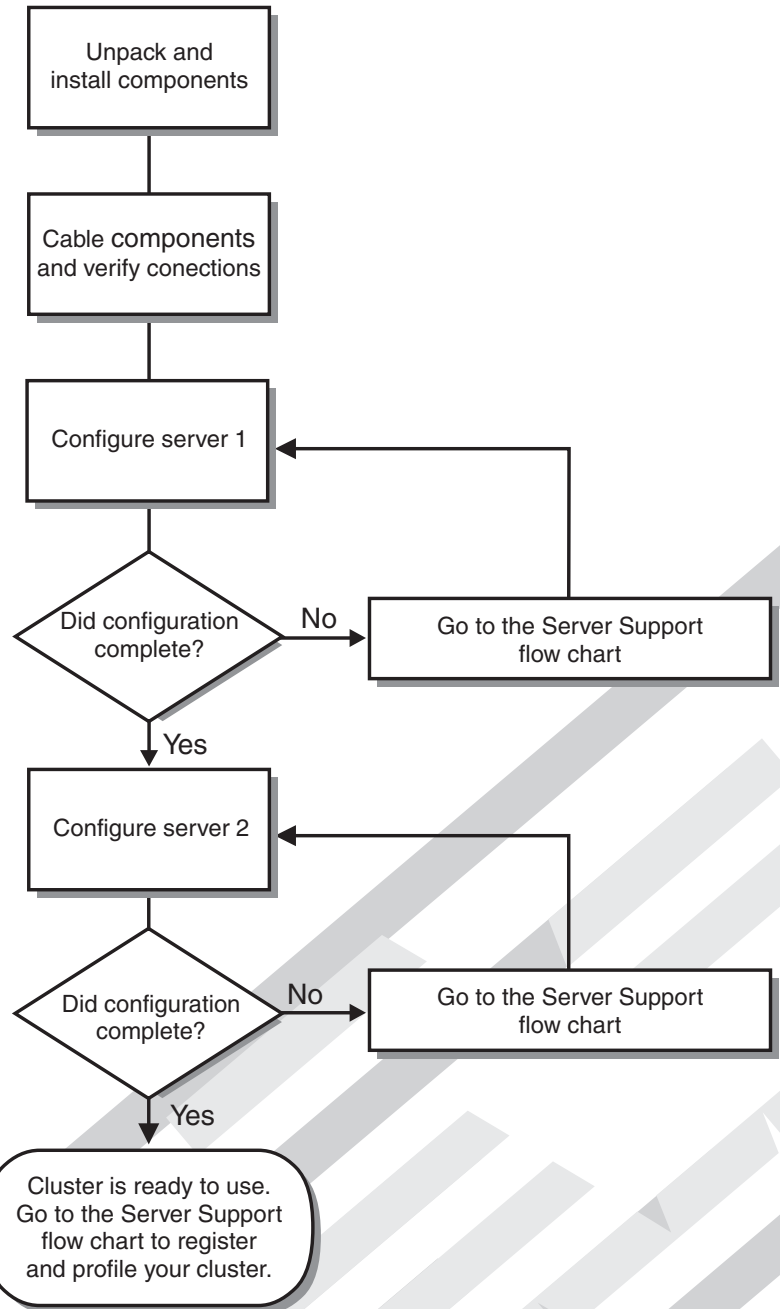
Welcome...

Thank you for buying an IBM xSeries high-availability cluster.

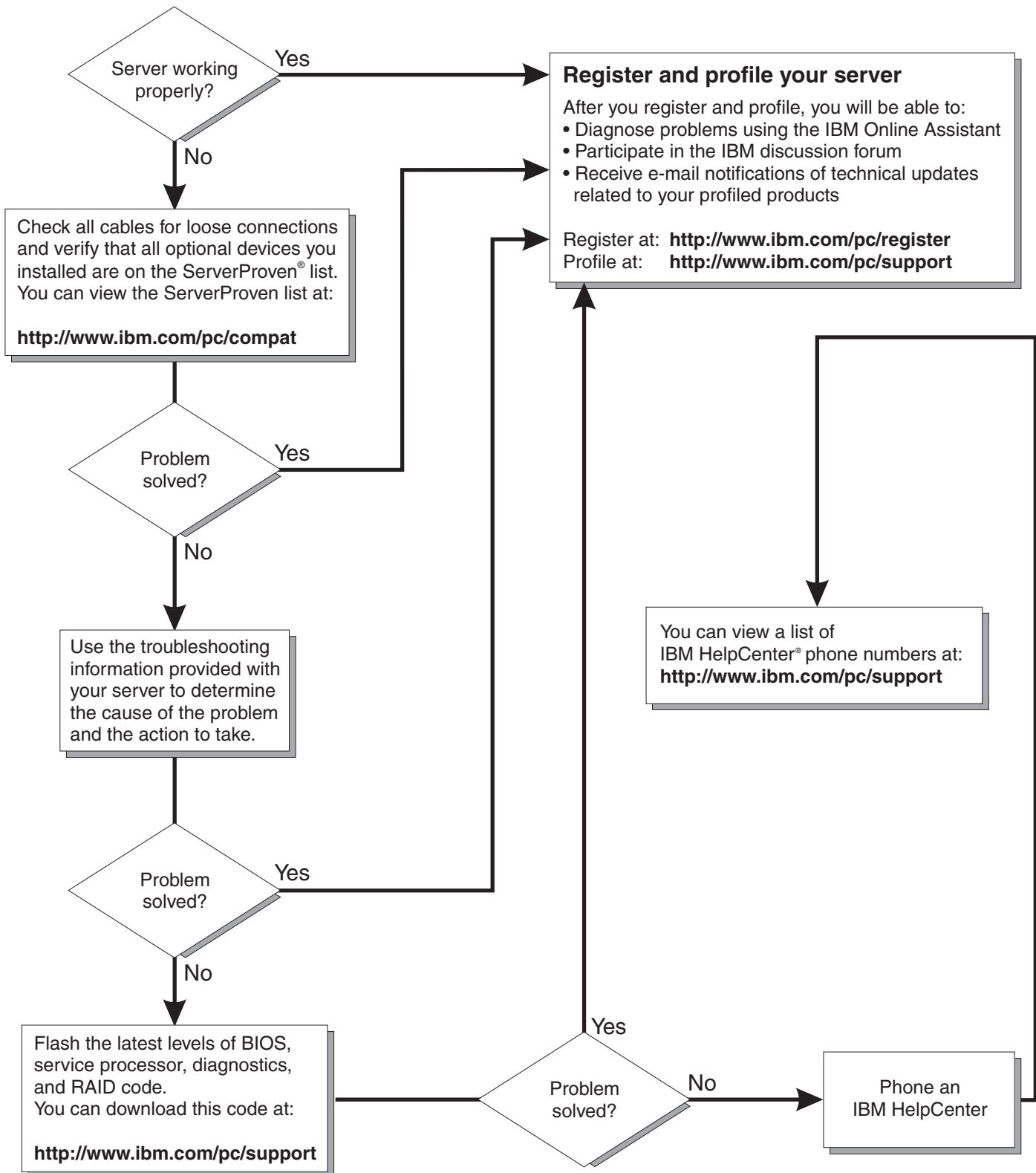
This *Installation Guide* contains information for setting up and configuring your cluster.

For detailed information about your cluster components, view the product documentation on the Documentation CD.

You can also find the most current information about your cluster on the IBM Web site at: <http://www.ibm.com/pc/support>



Server Support



IBM® xSeries 230 HA Cluster



Installation Guide

NOTE

Before using this information and the product it supports, be sure to read the general information in Appendix B, "Product warranties and notices," on page 43.

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Safety

Before installing this product, read the Safety Information book.

مج، يجب قراءة دات السلامة

Antes de instalar este produto, leia o Manual de Informações sobre Segurança.

安裝本产品前请先阅读《安全信息》手册。

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs hæftet med sikkerhedsforskrifter, før du installerer dette produkt.

Lue Safety Information -kirjanen, ennen kuin asennat tämän tuotteen.

Avant de procéder à l'installation de ce produit, lisez le manuel Safety Information.

Vor Beginn der Installation die Broschüre mit Sicherheitshinweisen lesen.

Πριν εγκαταστήσετε αυτό το προϊόν, διαβάστε το εγχειρίδιο Safety Information.

Prije instalacije ovog proizvoda pročitajte priručnik sa sigurnosnim uputama.

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

Przed zainstalowaniem tego produktu należy przeczytać broszurę Informacje Dotyczące Bezpieczeństwa.

Prima di installare questo prodotto, leggere l'opuscolo contenente le informazioni sulla sicurezza.

本製品を導入する前に、安全情報資料を御読みください。

이 제품을 설치하기 전에, 안전 정보 책자를 읽어보십시오.

Пред да го инсталирате овој производ прочитајте ја книгата со безбедносни информации.

Lees voordat u dit product installeert eerst het boekje met veiligheidsvoorschriften.

Les heftet om sikkerhetsinformasjon (Safety Information) før du installerer dette produktet.

Antes de instalar este produto, leia o folheto Informações sobre Segurança.

Перед установкой продукта прочтите брошюру по технике безопасности (Safety Information).

Pred inštaláciou tohto produktu si prečítajte Informačnú brožúrku o bezpečosti.

Preden namestite ta izdelek, preberite knjižico Varnostne informacije.

Antes de instalar este producto, lea la Información de Seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

在安裝本產品之前，也請先閱讀「安全性資訊」小冊子。

Installálás el tt olvassa el a Biztonsági el írások kézikönyvét !

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Chapter 1. Introduction

The IBM® eServer xSeries 230 HA Cluster consists of interconnected hardware and software that is configured to provide uninterrupted access to applications and services. The cluster uses two xSeries 230 servers with 1 GHz Intel® Pentium® III microprocessors. Each server supports up to 4 GB (4 000 000 000 bytes) of SDRAM memory.

Both servers connect to an EXP300 Storage Expansion Unit that contains shared data for the cluster. The EXP300 comes with five 18.2 GB hot-swappable hard drives, and supports up to 13 total hot-swappable hard drives.

Note: If you add new hard drives to the EXP300, leave Bay 7 empty. Bay 7 uses the SCSI initiator identifier 6. This conflicts with the cluster ServeRAID configuration.

Either Microsoft® Windows® 2000 Advanced Server or Windows NT® 4.0 Enterprise Edition is preinstalled as the operating system on each server within the cluster. Each server comes with clustering software that you must install and configure before initial use of the cluster.

Inventory checklist

Examine items as you unpack them and verify that you have all of the cluster components. This section contains a list of items that come with all xSeries 230 clusters. If any items are missing or damaged, contact your place of purchase.

- Two xSeries 230 servers
- One EXP300 Storage Expansion Unit
- One EXP300 Rack-to-Tower Conversion Kit (for installing the EXP300)
- One NetBAY 1x4 Console Switch
- Two NetBAY Console Cable Sets
- One keyboard
- One mouse
- One E54 15-in. monitor
- Six 120 V ac power cables (for connecting power to the monitor, console switch, EXP300, and both servers)
- One Ethernet crossover cable (for connecting the 10/100 Ethernet adapters to each other)
- Two external LVD SCSI cables (for connecting the servers to the EXP300)
- Cable straps (for securing cables)
- User and Installation Guides for all cluster components
- *IBM xSeries 230 and xSeries 340 HA Cluster Documentation CD*
- This documentation

Your cluster might also include an optional APC uninterruptible power supply (UPS).

Tool requirements

To install the xSeries 230 cluster, you will need the following tools:

- A medium flat-blade screwdriver
- A medium Phillips screwdriver
- A large Phillips screwdriver

Service and support

For additional information on how to use this and certain other IBM products, see one of the following Web sites:

<http://www.ibm.com/pc/support>

<http://www.pc.ibm.com/support/qtechinfo/MIGR-4RSSCC.html>

Chapter 2. Unpacking and installing the hardware

This chapter contains instructions for unpacking and installing the cluster. During the installation and setup of the cluster, you might need to see one of the additional publications that come with the cluster.

Handling static-sensitive devices

Static electricity can damage electronic devices and your system. To avoid damage, keep static-sensitive devices in their static-protective packages until you are ready to install them. To reduce the possibility of electrostatic discharge, observe the following precautions:

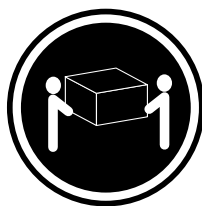
- Limit your movement. Movement can cause static electricity to build up around you.
- Handle the device carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed printed circuitry.
- Do not leave the device where others can handle and possibly damage the device.
- While the device is still in its static-protective package, touch it to an unpainted metal part of the unit for at least two seconds. (This drains static electricity from the package and from your body.)
- Remove the device from its package and install it directly into your system unit without setting it down. If it is necessary to set the device down, place it on its static-protective packaging. (If your device is an adapter, place it component side up.) Do not place the device on your system unit cover or on a metal table.
- Take additional care when handling devices during cold weather, because heating reduces indoor humidity and increases static electricity.

Unpacking the cluster components

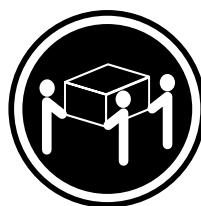
Before you unpack the cluster components, ensure that your site is ready for installing the components. Use the following steps to unpack your cluster:

1. See the information that is attached to the outside of the box that contains Server 1 for a list of the components that come with the cluster. You can also see the “Inventory checklist” on page 1.

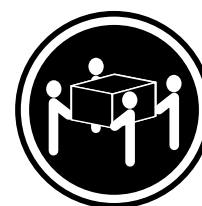
Statement 4



≥18 kg (39.7 lbs)



≥32 kg (70.5 lbs)



≥55 kg (121.2 lbs)

CAUTION:

Use safe practices when lifting.

2. Carefully unpack the components from the packages and compare the components with the inventory checklist. See “Handling static-sensitive devices” on page 3 for handling guidelines as you unpack some static-sensitive devices.

After you unpack all of the cluster components, proceed to “Installing and cabling the xSeries 230 cluster” for information on how to install and cable the cluster hardware.

Installing and cabling the xSeries 230 cluster

As you install and cable your xSeries 230 cluster, use the following general guidelines:

- Review the documentation that comes with your cluster.
- Maintain clearance around your devices for air circulation.
- Ensure that the room air temperature is below 35°C (95°F).
- Connect all power cords to properly wired and grounded electrical outlets.
- Take caution to prevent overloading the power outlets when you install multiple devices.
- Do not run cables in front of or behind other devices that will prevent service access to those devices.
- Label all cables so that they are clearly distinguishable from each other.

- When cabling the servers, do the following:
 - Run the cables neatly through the cable-restraint bracket on the server and secure the cables as necessary using the cable straps provided.
 - Leave enough extra cable so that you can move or service the device without straining the cables.

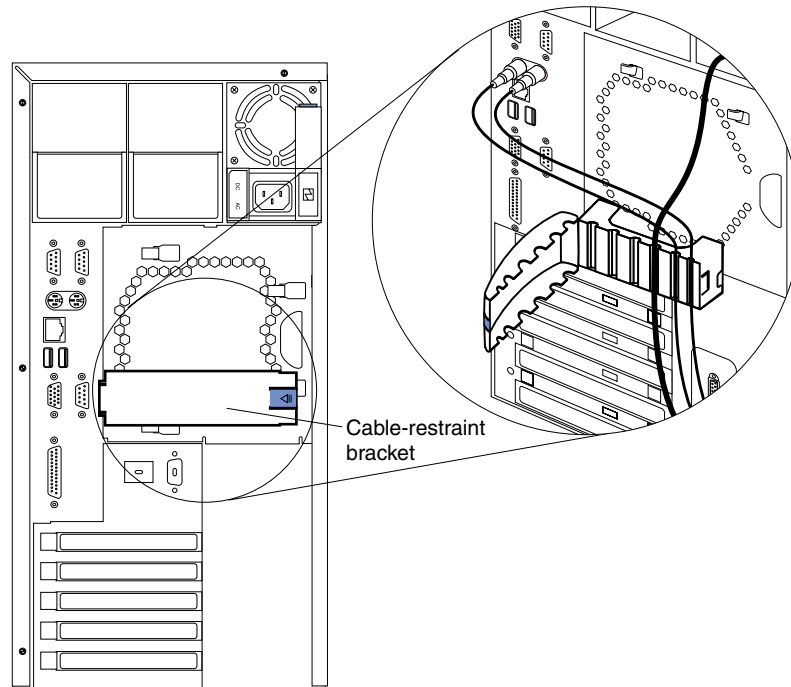


Figure 1. Routing the server cables

- When cabling the other devices, do the following:
 - Run the cables neatly along the wall or floor.
 - Use the cable straps provided to secure the cables as necessary.
 - Make sure that the cables cannot be pinched or cut by other devices.

Make sure that the power switches on all devices are off; then, use the following procedure to install and cable the cluster components:

Attention: Some devices might automatically turn on when you plug them into a power source. If this happens, turn each device off by pressing the power button.

1. Before you install any devices, make sure that you are in a location where you can connect your cluster to your public network.

Attention: Before you turn on the servers and configure the software, you must connect servers in your cluster to active ports on your public network. Make sure that the location you choose for your cluster installation provides access to these network connections.

2. If a UPS came as part of your cluster, you must place it in a central location where power cables from all of your cluster components can reach.

Note: The batteries inside of the UPS are disconnected before shipping. See the documentation that comes with the UPS for instructions on how to connect the batteries before you turn on your UPS or any devices that are connected to it.

3. The EXP300 installs in the tower enclosure that comes with your cluster. Slide the EXP300 fully into the enclosure; then, secure the front of the EXP300 to the enclosure with two M6 screws. Secure the rear of the EXP300 with the two provided M5 screws.

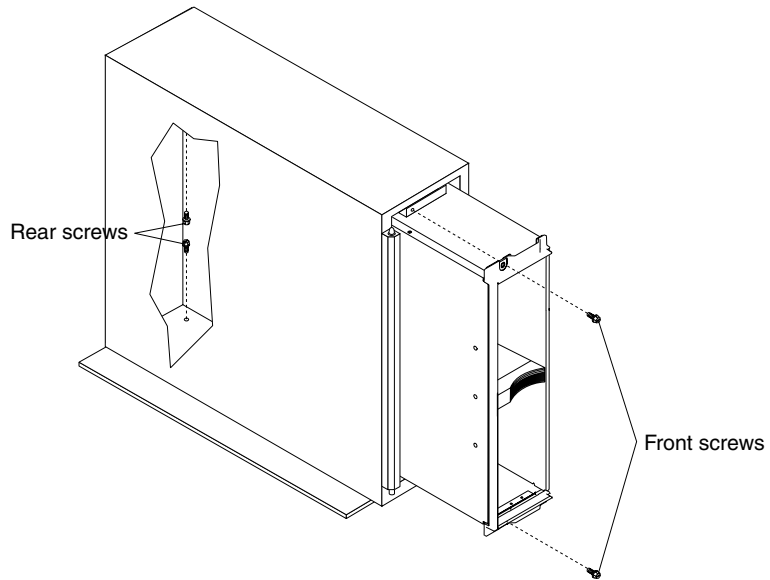


Figure 2. Installing the EXP300 in the tower enclosure

Notes:

- a. Figure 2 shows an EXP300 with hard drives and power supplies removed. If you need to reduce the weight of the EXP300 for easier installation into the enclosure, see the EXP300 documentation that comes with your cluster for instructions on how to temporarily remove these items during installation.
- b. After you install the EXP300 in the tower enclosure, verify that all hard drives are properly seated.

- Unlock the enclosure door and hold it at a 90-degree angle to the front of the enclosure; then, lower the top of the door over the tab on the top of the enclosure. Gently push the bottom of the door until it snaps into place over the tab on the bottom of the enclosure.

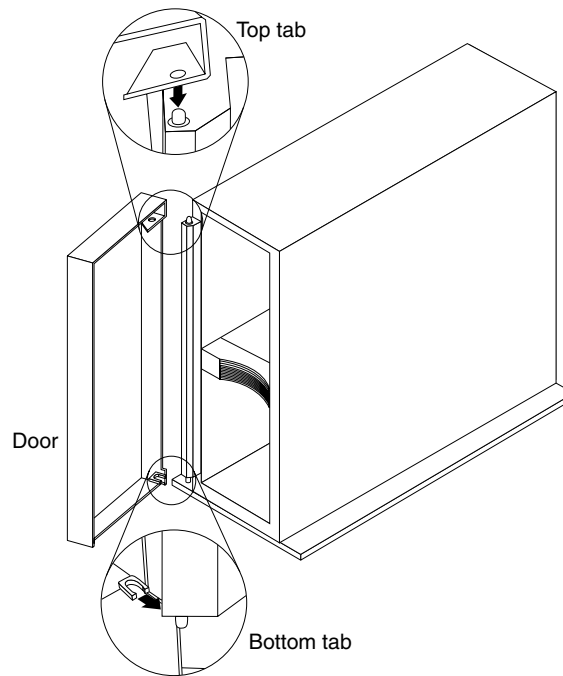


Figure 3. Attaching the enclosure door

- Set Server 1, Server 2, and the EXP300 tower enclosure in a location where you can access the rear of the devices for cabling; then, set the monitor, keyboard, and mouse in a location that enables you to operate them conveniently and comfortably.
- Connect the monitor power cable to the UPS or to a properly wired and grounded electrical outlet; then, connect the monitor, keyboard, and mouse to the appropriate ports on the console switch.

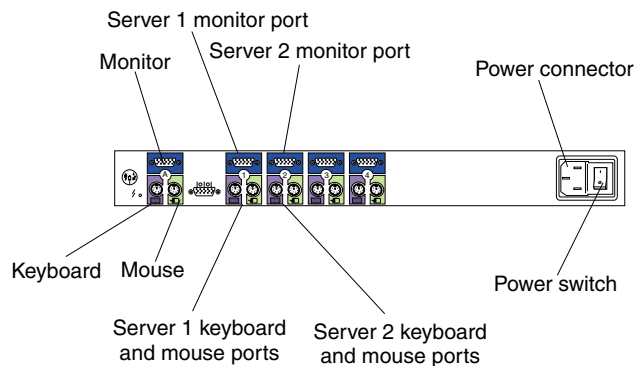


Figure 4. Locating console switch connectors

- Set the console switch in a convenient location; then, connect the power cable for the console switch to the UPS or to a properly wired and grounded electrical outlet.

8. Connect the monitor, keyboard, and mouse cable (1A) from the Server 1 ports on the console switch to the appropriate ports on Server 1; then, connect the monitor, keyboard, and mouse cable (2A) from the Server 2 ports on the console switch to the appropriate ports on Server 2.

Note: Make sure that you properly route all cables that you connect to a server through the cable-restraint bracket for that server.

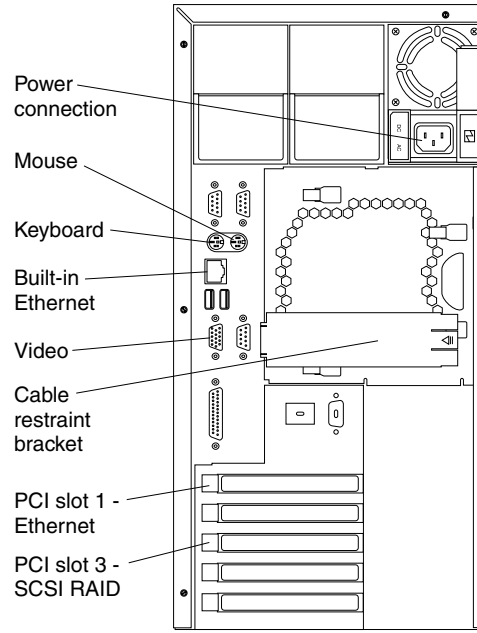


Figure 5. Locating server connectors

9. Connect a power cable to each server; then, connect the server power cables to the UPS or to a properly wired and grounded electrical outlet.

Note: To provide redundant power protection against power failures for clusters without a UPS, connect each server to a different power source.

10. Connect two power cables to the EXP300; then, connect both power cables to the UPS or to properly wired and grounded electrical outlets.

Note: To provide redundant power protection against power failures for clusters without a UPS, connect each power cable to a different power source.

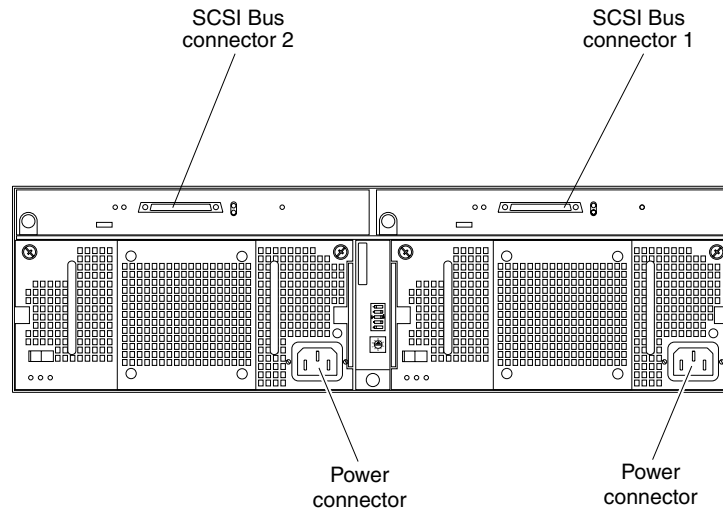


Figure 6. Locating EXP300 connectors

11. Connect the SCSI bus connector 1 on the EXP300 to the top connector of the Server 1 ServeRAID[®] adapter in PCI slot 3 using the LVD SCSI cable (3A); then, connect the SCSI Bus connector 2 on the EXP300 to the top connector of the Server 2 ServeRAID adapter in PCI slot 3 using the cable (3B).

Attention: Do not change the position of the option switches on the EXP300. A loss of data can occur if you change the position of the option switches.

12. Connect the Server 1 built-in Ethernet controller to an active port on a hub that is part of your public network; then, connect the Server 2 built-in Ethernet controller to another active port on a hub that is part of your public network.

Note: You do not have to connect both servers to the same hub, as long as they are connected to hubs on the same public network.

13. Connect the provided Ethernet crossover cable between the Server 1 Ethernet 10/100 adapter in PCI slot 1 and the Server 2 Ethernet adapter in PCI slot 1 to interconnect the cluster.

Attention: Before you turn on the servers and configure the software, you must connect the servers in your cluster to active ports on your public network, and connect the servers to each other. Failure to do this will cause your software configuration to fail.

14. If you have a UPS, plug the UPS into a properly wired and grounded electrical outlet.

Attention: Some devices might automatically turn on when you plug them into a power source. If this happens, turn those devices off by pressing the power button.

Proceed to Chapter 3, “Configuring Windows 2000 Advanced Server,” on page 11 or Chapter 4, “Configuring Windows NT 4.0 Enterprise Edition,” on page 23 to begin configuring your cluster software.

Chapter 3. Configuring Windows 2000 Advanced Server

Additional configuration is necessary before you can use your cluster. This chapter describes how to configure your Windows 2000 Advanced Server cluster. If you have a Windows NT 4.0 Enterprise Edition cluster, see Chapter 4, “Configuring Windows NT 4.0 Enterprise Edition,” on page 23 for instructions on how to configure your cluster software.

Attention: The synchronizing shared disk process might take up to three hours. The complete cluster configuration process might take up to five hours.

Use the following general guidelines as you configure your cluster:

- Ensure that all cables and power cords are properly connected to all cluster components.
- Ensure that both servers are connected to each other and to a working public network.
- Retrieve the 25-character product key from the Certificate of Authenticity (COA). The COA is a label on the side of Server 1. This information is required for configuring both servers.
- Turn on cluster components in the following order:
 1. Uninterruptible power supply (UPS)
 2. EXP300 storage expansion unit
 3. Console switch
 4. Monitor
 5. Server 1
 6. Server 2

The following is an overview of the procedures you must perform in order to configure your cluster:

Note: Some of the window information in the following steps might appear in English only.

1. Collect information about your public network and cluster configuration according to “Collecting network information” on page 12.
2. Initialize both servers according to “Initializing the servers” on page 13.
3. Configure the network settings for both servers according to “Configuring server network settings” on page 14.
4. Assign the permanent drive letters for the shared storage on both servers according to “Assigning permanent drive letters to shared disks” on page 15.
5. Configure the clustering service on both servers according to “Installing and configuring Microsoft Clustering Services” on page 19.

Collecting network information

To begin configuring your cluster, gather information for Table 1 so that you have all of the necessary information available during the configuration process.

Table 1. Collecting network information.

Cluster	Description	Default Values
For Computer Domain Controller (CDC)	Domain administrator user ID	
	Domain administrator password	
For Server 1	Computer name (host name) for Server 1	NFCBS001
	Administrator password for Server 1	password
	TCP/IP address for public/client network	192.168.0.1
	Subnet mask for public/client network	255.255.255.0
	Default gateway for public/client network	
	DNS Server for public/client network	
	WINS Server for public/client network	
	TCP/IP Address for private/cluster interconnect network	10.0.0.10
	Subnet mask for private/cluster interconnect network	255.0.0.0
For Server 2	Computer name (host name) for Server 2	NFCBS002
	Administrator password for Server 2	password
	TCP/IP address for public/client network	192.168.0.2
	Subnet mask for public/client network	255.255.255.0
	Default gateway for public/client network	
	DNS Server for public/client network	
	WINS Server for public/client network	
	TCP/IP address for private/cluster interconnect network	10.0.0.20
Subnet mask for private/cluster interconnect network	255.0.0.0	
For Cluster Virtual Server (Microsoft Cluster Service)	Domain name	
	Domain cluster service account name	
	Domain cluster service account password	
	Network name for primary virtual server (cluster name)	
	TCP/IP address of primary virtual server (cluster TCP/IP address)	
	Subnet mask for primary virtual server (cluster TCP/IP subnet mask)	
For ServeRAID Manager	Password for default admin account	

Initializing the servers

The first time that you turn on a server after unpacking the cluster components, or after using the Recovery CDs, use the following procedure to initialize the servers.

1. Turn on Server 1; then, use the console switch to select Server 1.

Note: If necessary, see the documentation that comes with the console switch for information on how to select servers.

2. When the Windows 2000 Server Setup window opens, click **Next**.
3. Read and accept the information on the License Agreement window; then, click **Next** and wait for the Personalize Your Software window to open.

Attention: If you do not have a US English keyboard, see Figure 7 for the default keyboard layout to complete this procedure.

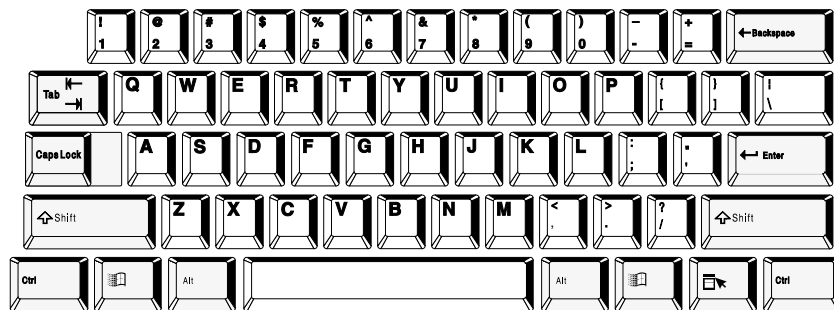


Figure 7. Using the keyboard in Windows 2000

4. Enter your full name and organization name in the corresponding fields; then, click **Next** and wait for the Your Product Key window to open.
5. In the **Product Key** field, type the 25-character product key from the COA; then, click **Next** and wait for the Windows 2000 Setup Wizard to complete the process.
6. Click **Finish** to restart your server.
7. Turn on Server 2; then, use the console switch to select Server 2.
8. Repeat step 2 through step 6 to initialize Server 2.

To operate your cluster in a language other than English and configure your keyboard, proceed to “Configuring the regional settings and keyboard”. Otherwise, proceed to “Configuring server network settings” on page 14 to continue configuring your cluster.

Configuring the regional settings and keyboard

To configure the regional settings and keyboard for a language other than English, use the following procedure.

1. Login to Server 1 using the Administrator account; then, close the Windows 2000 Configuring Your Server window.
2. Open the Control Panel; then, double-click **Regional Options**, and wait for the Regional Settings Properties window to open.
3. In the **Your Locale** field, select the language that you want for your cluster. The selection you make here changes the settings on the number, currency, time and data tables to correspond with the locale that you select.
4. In the **Menus and dialogs** field, select the language that you want; then, click **OK** to save the changes. The selection you make here changes the language for the interface items such as the menus, buttons, and messages.

5. Double-click **Keyboard**.
6. Select the **Input Locales** tab; then, select **Properties**.
7. Select the language that you want and click **OK**; then, click **Apply**.
8. Shut down, and restart your server for the changes to take effect.
9. Login to Server 2 using the Administrator account; then, close the Windows 2000 Configuring Your Server window.
10. Repeat step 2 on page 13 through step 8 for Server 2.

Proceed to “Configuring server network settings” to continue configuring your cluster.

Configuring server network settings

You must have a domain controller in your network for this cluster to function. You must also have a DNS server in your network.

Note: Refer to your Microsoft documentation for information on DNS servers.

The servers within your cluster are configured with network settings that might not be compatible with your network environment. If you are not sure if your network is compatible, contact your network administrator.

The default network settings for your cluster are located in “Collecting network information” on page 12. To modify the network settings for your cluster, use the following procedure.

Note: You must configure Server 1 before you configure Server 2.

1. Login to Server 1 using the Administrator account; then, close the Windows 2000 Configuring Your Server window.
2. Right-click the **My Network Places** icon; then, select **Properties** from the menu.
3. Right-click the **Local Area Connection** icon; then, select **Properties** from the menu. Verify that you have the IBM Netfinity Fault Tolerance PCI Adapter, and select **Internet Protocol (TCP/IP)**; then, click **Properties**.

Note: See “Collecting network information” on page 12 for the necessary information to fill in the fields.

4. After you configure your network settings, click **OK**; then, close the configuration window.
5. Right-click **My Computer**, and then select **Properties** from the menu.
6. Select the **Network Identification** tab; then, click **Properties**.
7. If you want to change the computer name, in the **Computer Name** field, type the new name. Click **OK** to save the changes; then, when asked to restart your server, click **Yes**.
 - a. After the server restarts, login using the Administrator account; then, close the Windows 2000 Configuring Your Server window.
 - b. Right-click **My Computer**, and then select **Properties** from the menu.
 - c. Select the **Network Identification** tab; then, click **Properties**.
8. Select **Domain** and type the name of the existing domain in the corresponding text field; then, click **OK**.
9. If you are prompted to enter a username and password, type the name and password of the domain administrator account; then, click **OK**.

10. When the domain controller responds with a welcome message, click **OK**; then, click **OK** again to acknowledge the message informing you that your server must restart for these changes to take effect.

Note: If an error message opens informing you that the domain controller could not be contacted, contact your network administrator.

11. Click **OK** to save the changes made and close the System Properties window; then, when asked to restart your server, click **Yes**.
12. Login to Server 2 using the Administrator account; then, close the Windows 2000 Configuring Your Server window.
13. Repeat step 2 through step 11 for Server 2.

Proceed to “Assigning permanent drive letters to shared disks” to continue configuring your cluster.

Assigning permanent drive letters to shared disks

Drive letters for the EXP300 shared storage and server CD-ROM drive are subject to change until you explicitly assign them. After you assign permanent drive letters on both servers, you will always access the shared storage through the same drive letters. Use the following procedure to assign permanent drive letters.

Note: You must configure Server 1 before you configure Server 2.

Attention: If you are restoring your cluster and have important data on the shared storage, proceed to “Assigning permanent drive letters after restoring the cluster” on page 17.

Assigning permanent drive letters for Server 1

Use the following procedure to assign permanent drive letters for Server 1.

1. From the Logon to Windows window on Server 1, click **Options**.
2. In the **Logon to** field, select your domain. Type your password, and click **OK**.
3. Close the Windows 2000 Configuring Your Server window.
4. On Server 1, open a command prompt and then type
cd\IBM\cluster\support
and press **Enter**; then, type
ipshahto synchoff
and press **Enter**. This ensures that Server 1 has control of the shared disks.
5. Click **Start**→ **Settings**→ **Control Panel**; then, double-click **Administrative Tools**, and double-click **Computer Management**. Click **Storage** and double-click **Disk Management**.

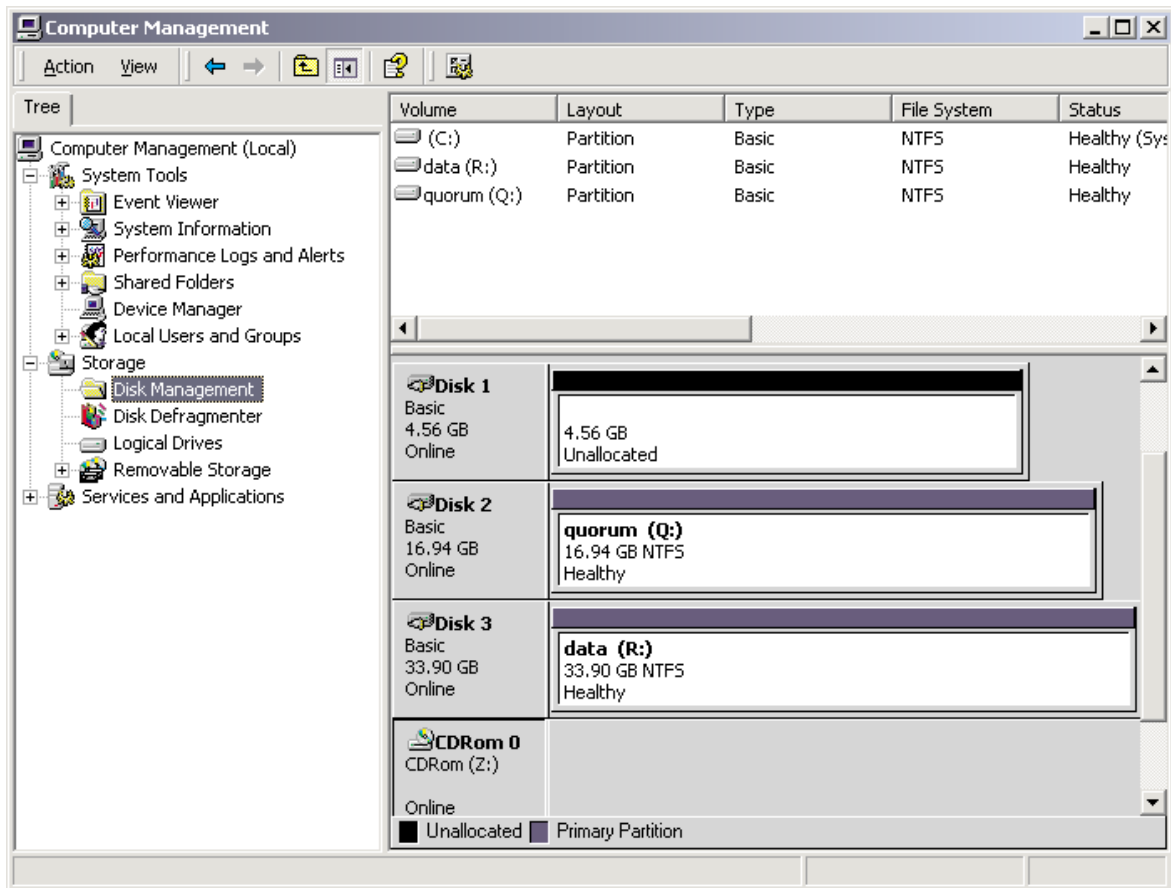


Figure 8. Assigning permanent drive letters

6. The Write Signature and Upgrade window opens. Click **Next**, and select the disks to which you want to write signatures.
7. Click **Finish**.
8. Right-click the box labelled **DISK 2 Basic**, and then click **Create Partition**. The Create Partition wizard starts. On the following three windows, click **Next**.
9. From the Assign drive letter on path window, select the letter **Q**. Click **Next**. A Format option window opens.
10. In the **Volume Label** field, type *Quorum*; then click **Next**. Do not change the name of the NTFS file system.
11. Click **Finish**.
12. Repeat step 8 through step 11 for the DISK 3 partition and for other disk partitions. When creating the partition for DISK 3, use drive letter R and use *Data* as the volume label. For additional shared disks, assign sequential drive letters starting with S and assign each volume a unique label.
13. Right-click the **CD-ROM** entry, and then select **Change Drive Letter and Path**.
14. Select **Edit**, and then select **Z**. Click **OK** to set the drive letter. When the **Confirm** window opens, click **Yes**.
15. When you finish assigning permanent drive letters to shared disks, close the Computer Management window.

Proceed to “Assigning permanent drive letters for Server 2” on page 17 to continue configuring your cluster.

Assigning permanent drive letters for Server 2

Use the following procedure to assign permanent drive letters for Server 2.

1. From the Logon to Windows window on Server 2, click **Options**.
2. In the **Logon to** field, select your domain. Type your password, and click **OK**.
3. On Server 2, open a command prompt and then type
`cd\IBM\cluster\support`
and press **Enter**; then, type
`ipshahto synchoff`
and press **Enter**. This ensures that Server 2 has control of the shared disks.
4. Click **Start**→ **Settings**→ **Control Panel**; then, double-click **Administrative Tools**, and double-click **Computer Management**. Click **Storage** and double-click **Disk Management**.
5. To assign and change the drive letters, right-click the box beside the drive to change. Select **Change Drive Letter and Path**. The Change Drive Letter and Path window opens.
6. Select **Edit**, and then mark **Assign a drive letter**. Select the same drive letter as you did for Server 1.
7. Click **OK** to set the drive letter. When the **Confirm** window opens, click **Yes**.
8. Repeat step 5 through step 7 for all drives, including the CD-ROM drive.
9. Close the Computer Management window.

Proceed to “ServeRAID security configuration” on page 18 to continue configuring your cluster.

Assigning permanent drive letters after restoring the cluster

Use the following procedure to assign permanent drive letters to your cluster after restoring it from the Recovery CDs.

Attention: Only use this procedure after you restore your cluster from the Recovery CDs.

1. From the Logon to Windows window on Server 1, click **Options**.
2. In the **Logon to** field, select your domain. Type your password, and click **OK**.
3. On Server 1, open a command prompt and then type
`cd\IBM\cluster\support`
and press **Enter**; then, type
`ipshahto synchoff`
and press **Enter**. This ensures that Server 1 has control of the shared disks.
4. Click **Start**→ **Settings**→ **Control Panel**; then, double-click **Administrative Tools**, and double-click **Computer Management**. Click **Storage** and double-click **Disk Management**.
5. To assign and change the drive letters, right-click the box beside the drive to change. Select **Change Drive Letter and Path**. The Change Drive Letter and Path window opens.
6. Select **Edit**, and then mark **Assign a drive letter**. When assigning the drives, use drive letter Q for Disk 2. For additional drives, assign sequential drive letters starting with R for Disk 3 and assign a different letter for each drive. For the CD-ROM drive, select the letter Z.

7. Click **OK** to set the drive letter. When the **Confirm** window opens, click **Yes**.
8. Repeat step 5 through step 7 for all drives, including the CD-ROM drives.
9. Close the Computer Management window on Server 1.
10. From the Logon to Windows window on Server 2, click **Options**.
11. In the **Logon to** field, select your domain. Type your password, and click **OK**.
12. On Server 2, open a command prompt and then type


```
cd\IBM\cluster\support
```

 and press **Enter**; then, type


```
ipshahto synchoff
```

 and press **Enter**. This ensures that Server 2 has control of the shared disks.
13. Click **Start**→ **Settings**→ **Control Panel**; then, double-click **Administrative Tools**, and double-click **Computer Management**. Click **Storage** and double-click **Disk Management**.
14. To assign and change the drive letters, right-click the box beside the drive to change. Select **Change Drive Letter and Path**. The Change Drive Letter and Path window opens.
15. Select **Edit**, and then mark **Assign a drive letter**. Select the same drive letter as you did for Server 1.
16. Click **OK** to set the drive letter. When the **Confirm** window opens, click **Yes**.
17. Repeat step 14 through step 16 for all drives, including the CD-ROM drive.
18. Close the Computer Management window on Server 2.

Proceed to “ServeRAID security configuration” to continue configuring your cluster.

ServeRAID security configuration

Complete the security configuration on both servers before you attempt to complete and validate the ServeRAID configuration.

1. On Server 1, click **Start**→ **Programs**→ **ServeRAID Manager**.
2. When ServeRAID Manager opens, from the Managed Systems tree, click the name of your Server 1. Select **Actions**→ **Configure ServeRAID Agent**→ **Security**.
3. In the **Password** and **Confirm Password** fields, type a ServeRAID administrator password. Click **Add** to create the default security administrator password. Close the ServeRAID Agent Security window.
4. On Server 2, click **Start**→ **Programs**→ **ServeRAID Manager**.
5. When ServeRAID Manager opens, from the Manage Systems tree, click the name of your Server 2. Select **Actions**→ **Configure ServeRAID Agent**→ **Security**.
6. In the **Password** and **Confirm Password** fields, type the same ServeRAID administrator password as you did for Server 1. Click **Add** to create the default security administrator password. Close the ServeRAID Agent Security window.

Proceed to “Completing and validating the ServeRAID configuration” to continue configuring your cluster.

Completing and validating the ServeRAID configuration

Use the following procedure to complete and validate the ServeRAID configuration on both servers.

1. On Server 2, click **Start**→ **Programs**→ **ServeRAID Manager**.
2. On Server 1, click **Start**→ **Programs**→ **ServeRAID Manager**. When ServeRAID Manager opens, on the Managed Systems tree, click Server 1. Select **Actions**→**Validate Cluster**. The ServeRAID Cluster Validation window opens.
3. In the **Node B** field, type the name of Server 2. Click **Start** to validate the ServeRAID cluster settings. The Connecting to Remote System window opens. In the **Username** and **Password** fields, type `admin` and the password that you created in “ServeRAID security configuration” on page 18.
4. Click **Connect** to close the window and start the validation process.
5. After the validation process is complete, click **Cancel**.

Proceed to “Synchronizing shared disks between the servers” to continue configuring your cluster.

Synchronizing shared disks between the servers

You must synchronize shared disks between both servers before you install and configure Microsoft Clustering Services.

Attention: This process might take up to three hours.

1. Open a command prompt on Server 1 and then type
`cd\IBM\Cluster\support`
and press **Enter**; then, type
`ipshahto synchon`
and press **Enter**. The bottom pane in the ServeRAID Manager window shows the synchronizing logical drive status.
2. After synchronizing completes, close the ServeRAID Manager window on both servers.

Proceed to “Installing and configuring Microsoft Clustering Services” to continue configuring your cluster.

Installing and configuring Microsoft Clustering Services

You must install and configure Microsoft Clustering Services on both servers in the cluster.

Note: You must configure Server 1 before you configure Server 2.

Configuring Server 1

Use this procedure to configure Server 1.

1. Open a command prompt on Server 1, and then type
`cd\ibm\cluster`
and press **Enter**; then, type
`setup`
and press **Enter**.
2. When the IBM ServeRAID Cluster Solution window opens, click **OK**; then, from the Welcome window, click **Next** to start the ServeRAID Cluster Configuration Wizard.

3. Read the next three windows that open, and click **Next**; then, from the Cluster Service Configuration Wizard window, read the agreement, select **I Understand** and then click **Next**. The Cluster Service Configuration Wizard Create or Join Cluster window opens.
4. Select **The first node in the cluster**; then, click **Next**.
5. In the **Cluster Name** field, type a unique name for the cluster; then, click **Next**.
6. When the select an account screen opens, enter a username and password, type the name and password of the domain administrator account; then, click **Next**.
7. When the Cluster Service Configuration Wizard Configure Cluster Networks window opens, read the information and click **Next**.
8. Several Cluster Service Configuration Wizard Network Connections windows open, when the window opens containing the IBM 10/100 Ethernet Server Adapter in the **device** field, change the network name to **private**.
9. Mark the **Enable this network for cluster use** checkbox; then, for the Local Area Connection 2, select **internal use only** and click **Next**.
10. When the window opens containing the IBM Netfinity Fault Tolerance PCI Adapter in the **device** field, change the network name to **public**.
11. Mark the **Enable this network for cluster use** checkbox; then, for the Local Area Connection 2, select **all communications (mixed network)** and click **Next**. The Cluster Service Configuration Wizard Internal Cluster Communication window opens.
12. Ensure that the private network is at the top of the network list; then, click **Next**. The Cluster Service Configuration Wizard Cluster IP Address window opens.
13. Type the IP address of the cluster (see “Collecting network information” on page 12); then, click **Next**.
14. Click **Finish** to complete the cluster service configuration; then, click **OK** when the cluster service starts. The IBM ServeRAID Cluster Configuration Wizard window opens.
15. Click **Next**. In the next window, select **ipsha disk Q drive** as the quorum drive; then, click **Next**.
16. Click **Finish** to complete the ServeRAID configuration; then, click **Finish** to complete the cluster configuration.

Proceed to “Configuring Server 2” to continue configuring your cluster.

Configuring Server 2

Use this procedure to configure Server 2.

1. Open a command prompt on Server 2 and then type


```
cd\ibm\cluster
```

 and press **Enter**; then, type


```
setup
```

 and press **Enter**.
2. When the IBM ServeRAID Cluster Solution window opens, click **OK**; then, from the Welcome window, click **Next** to start the ServeRAID Cluster Configuration Wizard.
3. Click **Next** until the Cluster Service Configuration Wizard window opens. Read the agreement, select **I Understand**, and then click **Next**. The Cluster Service Configuration Wizard Create or Join Cluster window opens.
4. Select **The second node in the cluster**; then, click **Next**.

5. In the **Cluster Name** field, type the same name for the cluster as you did for Server 1; then, click **Next**.
Note: Make sure that you use the same password and administrator account as you did for Server 1.
6. The Select an account window opens, type the domain administrator account password. The username and domain fields are not available.
7. Click **Finish** to complete the ServeRAID configuration; then, click **OK**.
8. From the IBM ServeRAID cluster wizard, click **Finish** to complete the cluster configuration.
9. Click **Finish**.
10. Verify that the cluster is running and that the resources are Online. Click **Start**→ **Programs**→ **Administrative Tools**→ **Cluster Administrator**.
11. Open the Resources folder. The resources display an Online status for two servers in the cluster.
12. Ensure that all resource groups can be brought online in either cluster node by right-clicking the resource group and selecting **Move Group**. When the group is Online in the other cluster node, move the group back to the previous node.

If you want to create additional cluster resources such as IP Addresses, Network Names, or Generic Applications, see the documentation for that specific application to review instructions for installation in a Microsoft Cluster Services environment.

Note: Anytime you are prompted to insert your Windows operating system CD, type `c:\Microsoft\i386\` and then press **Enter**.

Attention: The drivers that are part of your initial cluster configuration have been tested and certified for clustering. Do not update drivers on your servers without contacting IBM support for assistance.

Chapter 4. Configuring Windows NT 4.0 Enterprise Edition

Additional configuration is necessary before you can use your cluster. This chapter describes how to configure your Windows NT 4.0 Enterprise Edition cluster. If you have a Windows 2000 Advanced Server cluster, see Chapter 3, “Configuring Windows 2000 Advanced Server,” on page 11 for instructions on how to configure your cluster software.

Attention: The synchronizing shared disk process might take up to three hours. The complete cluster configuration process might take up to five hours.

Use the following general guidelines as you configure the cluster:

- Ensure that all cables and power cords are properly connected to all cluster components.
- Ensure that both servers are connected to each other and to a working public network.
- Retrieve the 25-character product key from the Certificate of Authenticity (COA). The COA is a label that comes with your cluster documentation. This information is required for configuring both servers.
- Turn on cluster components in the following order:
 1. Uninterruptible power supply (UPS)
 2. EXP300 storage expansion unit
 3. Console switch
 4. Monitor
 5. Server 1
 6. Server 2

The following is an overview of the procedures you must perform in order to configure your cluster:

Note: The window information in the following steps might appear in English only.

1. Collect information about your public network and cluster configuration according to “Collecting network information” on page 24.
2. Initialize both servers according to “Initializing the servers” on page 25.
3. Configure the network settings for both servers according to “Configuring server network settings” on page 26.
4. Assign the permanent drive letters for the shared storage to both servers according to “Assigning permanent drive letters to shared disks” on page 30.
5. Install and configure the Microsoft Cluster Services on both servers according to “Installing and configuring Microsoft Clustering Services” on page 34.

Collecting network information

To begin configuring your cluster, gather information for Table 2 so that you have all the necessary information available during the configuration process.

Table 2. Collecting network information.

Cluster	Description	Default Values
For Computer Domain Controller (CDC)	Domain administrator user ID	
	Domain administrator password	
For Server 1	Computer name (host name) for Server 1	NFCBS001
	Administrator password for Server 1	password
	TCP/IP address for public/client network	192.168.0.1
	Subnet mask for public/client network	255.255.255.0
	Default gateway for public/client network	
	DNS Server for public/client network	
	WINS Server for public/client network	
	TCP/IP Address for private/cluster interconnect network	10.0.0.10
	Subnet mask for private/cluster interconnect network	255.0.0.0
For Server 2	Computer name (host name) for Server 2	NFCBS002
	Administrator password for Server 2	password
	TCP/IP address for public/client network	192.168.0.2
	Subnet mask for public/client network	255.255.255.0
	Default gateway for public/client network	
	DNS Server for public/client network	
	WINS Server for public/client network	
	TCP/IP address for private/cluster interconnect network	10.0.0.20
Subnet mask for private/cluster interconnect network	255.0.0.0	
For Cluster Virtual Server (Microsoft Cluster Service)	Domain name	
	Domain cluster service account name	
	Domain cluster service account password	
	Network name for primary virtual server (cluster name)	
	TCP/IP address of primary virtual server (cluster TCP/IP address)	
	Subnet mask for primary virtual server (cluster TCP/IP subnet mask)	
For ServeRAID Manager	Password for default admin account	

Initializing the servers

The first time that you turn on a server after unpacking the cluster components or after using the Recovery CDs, use the following procedure to initialize the servers.

1. Turn on Server 1; then, use the console switch to select Server 1.

Note: If necessary, see the documentation that comes with the console switch for information on how to select servers.

2. When the Windows NT Setup Wizard window opens, click **Next**.
3. Read and accept the information on the License Agreement window; then, click **Next** and wait for the Name and Organization window to open.

Attention: If you do not have a US English keyboard, see Figure 9 for the default keyboard layout to complete this procedure.

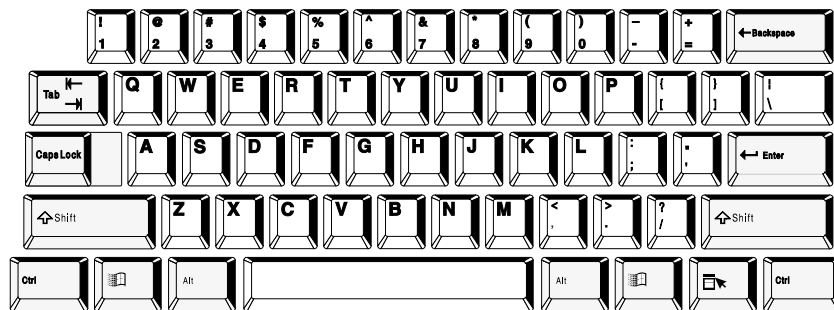


Figure 9. Using the keyboard in Windows NT

4. Enter your full name and organization name in the corresponding fields; then, click **Next** and wait for the Registration window to open.
5. In the **Product Key** field, type the 25-character product key from the COA; then, click **Next** and wait for the Administrator Account window to open.
6. Set the Administrator account password. Type the same password in the **Password** and **Confirm Password** fields; then, click **Next**.
7. Click **Finish** to restart your server.
8. Turn on Server 2; then, use the console switch to select Server 2.
9. Repeat step 2 through step 7 to initialize Server 2.

To configure your keyboard for a language other than English, proceed to “Configuring the keyboard”. Otherwise, proceed to “Configuring server network settings” on page 26 to continue configuring your cluster.

Configuring the keyboard

To configure the keyboard for a language other than English, use the following procedure.

1. Login to Server 1 using the Administrator account and password that you defined during server initialization; then, close the Welcome window.
2. Open the Control panel; then, double-click **keyboard**.
3. Select the **Input locales** tab; then, select **Properties**.

4. Select the language that you want to use for your keyboard and click **OK**; then, click **Apply**. If you are prompted to insert a disk, type
c:\Microsoft\i386
and then press **Enter**. Wait for the process to finish.
5. Restart the server.
6. Login to Server 2 and repeat step 2 through step 5 for Server 2.

Proceed to “Configuring server network settings” to continue configuring your cluster.

Configuring server network settings

You must have a domain controller in your network for this cluster to function. You must also have a WINS server in your network, and you might also have a DNS server.

Note: Refer to your Microsoft documentation for information on WINS servers.

The servers within your cluster are configured with network settings that might not be compatible with your network environment. If you are not sure if your network is compatible, contact your network administrator.

The default network settings for your cluster are located in “Collecting network information” on page 24. To modify the network settings for your cluster, use the following procedure.

Note: You must configure Server 1 before you configure Server 2.

1. Login to Server 1 using the Administrator account and password that you defined during server initialization; then, close the Welcome window.
2. Right-click the **Network Neighborhood** icon; then, select **Properties** from the menu.
3. If you need to change the server name, click **Change**.
4. In the **Computer Name** field, type the new name. Click **OK** to save the changes made. When the Warning window opens, click **Yes**.
5. Click the **Protocols** tab; then, select the TCP/IP protocol and click **Properties**.

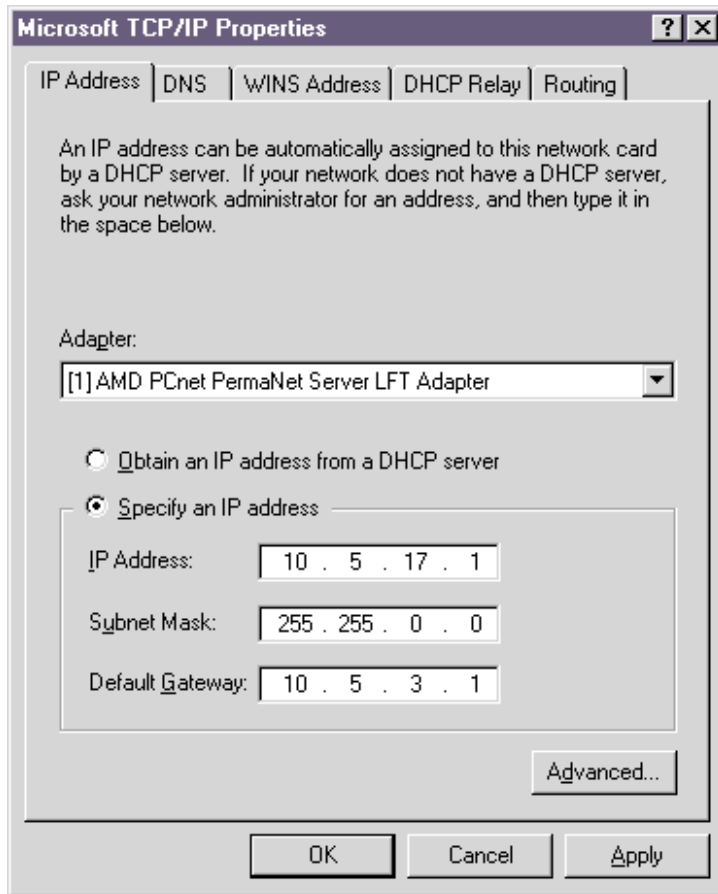


Figure 10. Configuring IP address information

6. Enter the **IP Address**, **Subnet Mask**, and **Default Gateway** fields for the AMD PCnet PermaNet Server LFT Adapter.
7. If you have a DNS server on your network:
 - a. Click the **DNS** tab; then, in the **Host Name** field, enter the computer name of this server.
 - b. In the **Domain** field, enter the name of the DNS server.
 - c. Click **Add** to add a DNS server to the search list; then, enter the IP address of the DNS server and click **Add** on the **TCP/IP DNS Server** window.

Note: You can add up to three DNS servers in this list. Select an IP address and click **Up** or **Down** to change the search order within the list.

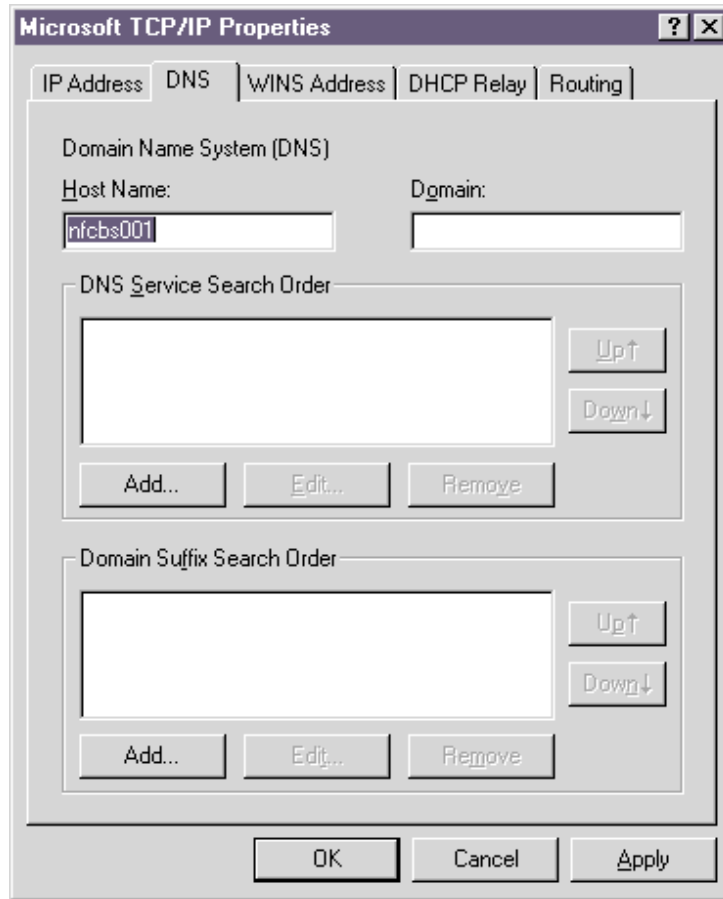


Figure 11. Configuring the DNS settings

8. For the WINS server:
 - a. Click the **WINS Address** tab; then, from the **Adapter** drop-down list, select the AMD PCnet PermaNet Server LFT Adapter.
 - b. In the **Primary WINS Server** field, type the IP address for the primary WINS server on your network; then, click **OK**.

Note: When you are asked to continue even though one of the network adapters has an empty WINS server IP address, click **Yes**.
9. Click the **Bindings** tab; then, from the **Show bindings for** drop-down list select all protocols.

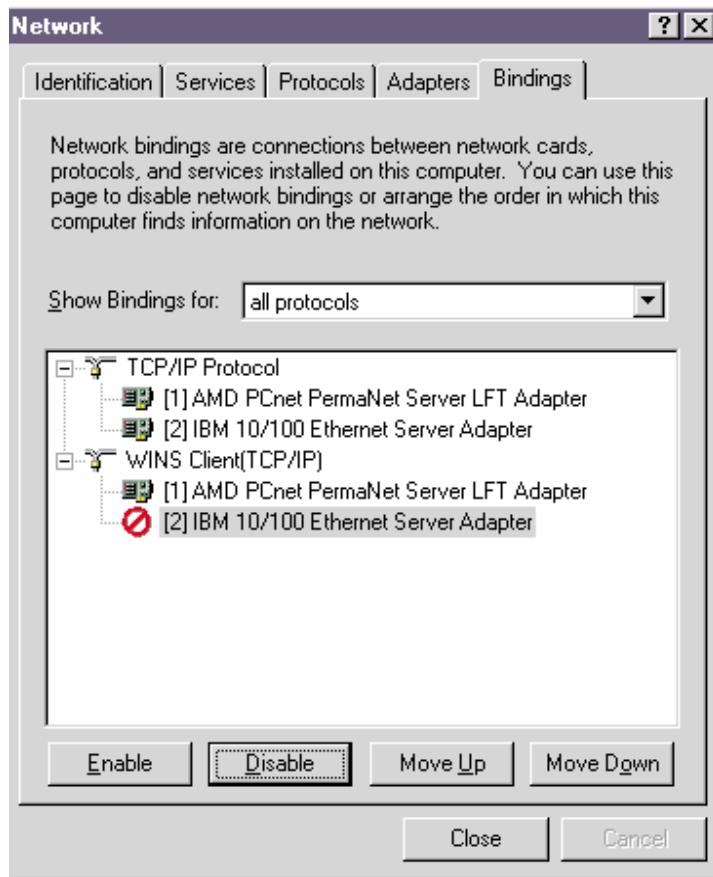


Figure 12. Configuring the protocol bindings

10. Click the **TCP/IP Protocol** entry to display a list of all installed network adapters; then, right-click the **AMD PCnet PermaNet Server LFT Adapter** and move it to the first position in the list.
11. Click the **WINS Client (TCP/IP)** entry to display a list of all installed network adapters; then, select the **IBM 10/100 Ethernet Server Adapter** and click **Disable**.
12. Click **Close** to save the network configuration settings; then, when asked if you want to restart, click **Yes**.
13. After the server restarts, login to the server using the Administrator account and password that you defined during server initialization.
14. Right-click the **Network Neighborhood** icon; then, select **Properties**.
15. On the Identification tab, click **Change**; then, select **Domain**. Enter the name of the network domain controller.
16. Mark the **Create a Computer Account in the domain** checkbox.
17. In the **User Name** and **Password** fields, enter the name and password of the user account; then, click **OK**.
18. Click **OK**; then, click **Close**.
19. Click **OK**. When you are asked to restart your server, click **No**.

20. Open a command prompt and then type

```
cd\ibm\firmware_bios\ethernet\  
and press Enter; then, type  
makeamdfirst.reg  
and press Enter.
```

21. After the registry entries import, shut down and restart the server.

22. Repeat step 2 on page 26 through step 21 for Server 2.

Proceed to “Assigning permanent drive letters to shared disks” to continue configuring your cluster.

Assigning permanent drive letters to shared disks

Drive letters for the EXP300 shared storage and server CD-ROM drive are subject to change until you explicitly assign them. After you assign permanent drive letters on both servers, you will always access the shared storage through the same drive letters. Use the following procedure to assign permanent drive letters.

Note: You must configure Server 1 before you configure Server 2.

Attention: If you are restoring your cluster and have important data on the shared storage, proceed to “Assigning permanent drive letters after restoring the cluster” on page 32.

Assigning permanent drive letters for Server 1

Use the following procedure to assign permanent drive letters for Server 1.

1. Verify that the Domain field on Server 1 contains the name of the domain; then, login to the domain.
2. On Server 1, open a command prompt and then type

```
cd\IBM\cluster\support  
and press Enter; then, type  
ipshahto synchoff  
and press Enter.
```
3. Click **Start**→ **Programs**→ **Administrative Tools**→ **Disk Administrator**.
4. On the No Signature window, click **Yes**. Continue clicking **Yes** until the Disk Administrator window opens. The shared disks are listed as Free Space with crosshatch boxes.
5. Right-click the crosshatch box next to **DISK 2**, and then select **Create** from the menu. The Create Primary Partition window opens. Click **OK** to accept the default size of the partition. A message window opens stating that the partition created might not be accessible from other operating systems and asks if you want to create the partition anyway. Click **Yes** to continue.
6. Right-click the box next to **DISK 2** and select **Commit Changes Now**. Click **Yes** to save the configuration and continue. A window opens to inform you that the disks were successfully updated. Click **OK**.
7. Right-click the box next to **DISK 2** and select **Assign Drive Letter** from the menu. The Assign Drive Letter window opens.
8. Select **Assign Drive Letter** and then select the letter **Q** from the list. Click **OK** to set the drive letter for this disk. When the Confirm window opens, click **Yes**.

9. Right-click on the box next to **DISK 2**, and then select **Format**.

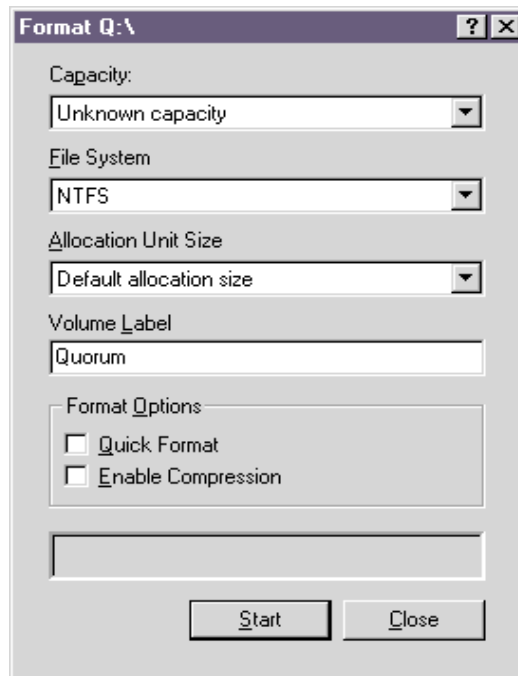


Figure 13. Formatting drives

10. On the Format window, select **NTFS** under **File System**. In the **Volume Label** field type Quorum. Do not select any options in the Format Options frame. To begin the formatting process on the disk, click **Start**. A warning window opens. Click **Start** to continue the disk formatting process. After the formatting completes, click **OK**; then, close the Format window.
11. Repeat step 5 on page 30 through step 10 for the DISK 3 partition and for other shared disk partitions. When creating the partition for DISK 3, use drive letter R and use *Data* as the volume label. For additional shared disks, assign sequential drive letters starting with S and assign each volume a unique label.
12. Right-click the **CD-ROM** entry, and select **Assign Drive Letter**. The Assign Drive Letter window opens. Select **Assign Drive Letter**, and then from the Assign Drive Letter drop-box, select **Z**. Click **OK** to set the drive letter. When the Confirm window opens, click **Yes**.
13. When you finish assigning permanent drive letters to shared disks, close Disk Administrator by selecting **Exit** from the Partition menu.
Proceed to “Assigning permanent drive letters for Server 2” to continue configuring your cluster.

Assigning permanent drive letters for Server 2

Use the following procedure to assign drive letters for Server 2.

1. Verify that the Domain field on Server 2 contains the name of the domain; then, login to the domain.

2. On Server 2, open a command prompt and then type
`cd\IBM\cluster\support`
 and press **Enter**; then, type
`ipshahto synchoff`
 and press **Enter**. This ensures that Server 2 has control of the shared disks.
3. Click **Start**→ **Programs**→ **Administrative Tools**→ **Disk Administrator**.
4. When the Disk Administrator window opens, right-click the white box next to a drive.
5. Click **Assign Drive Letter**. In the Assign Drive Letter window, select the drive letters that match those you assigned to Server 1. Assign drive letters to all drives and the CD-ROM to match those you assigned in Server 1.
6. Click **OK**. When the confirmation window opens, click **Yes**.
7. Close the Disk Administrator window.

Proceed to “ServeRAID security configuration” on page 33 to continue configuring your cluster.

Assigning permanent drive letters after restoring the cluster

Use the following procedure to assign permanent drive letters to your cluster after restoring it from the Recovery CDs.

Attention: Only use this procedure after you restore your cluster from the Recovery CDs.

1. Login to Server 1 using the domain administrator account.
2. On Server 1, open a command prompt and then type
`cd\IBM\cluster\support`
 and press **Enter**; then, type
`ipshahto synchoff`
 and press **Enter**. This ensures that Server 1 has control of the shared disks.
3. Click **Start**→ **Programs**→ **Administrative Tools**→ **Disk Administrator**.
4. When the Disk Administrator window opens, right-click the white drive box next to a drive.
5. Click **Assign Drive Letter**. When assigning the drives, use drive letter Q for Disk 2. For additional drives, assign sequential drive letters starting with R for Disk 3 and assign a different letter for each drive. For the CD-ROM drive, select the letter Z.
6. Click **OK**. When the confirmation window opens, click **Yes**.
7. Close the Disk Administrator window on Server 1.
8. Login to Server 2 using the domain administrator account.
9. On Server 2, open a command prompt and then type
`cd\IBM\cluster\support`
 and press **Enter**; then, type
`ipshahto synchoff`
 and press **Enter**. This ensures that Server 2 has control of the shared disks.
10. Click **Start**→ **Programs**→ **Administrative Tools**→ **Disk Administrator**.

11. When the Disk Administrator window opens, right-click the white drive box next to a drive.
12. Click **Assign Drive Letter**. In the Assign Drive Letter window, select the drive letters that match those you assigned to Server 1. Assign drive letters to all drives and the CD-ROM to match those you assigned in Server 1.
13. Click **OK**. When the confirmation window opens, click **Yes**.
14. Close the Disk Administrator window.

Proceed to “ServeRAID security configuration” to continue configuring your cluster.

ServeRAID security configuration

Complete the security configuration on both servers before you attempt to complete and validate the ServeRAID configuration.

1. On Server 1, click **Start**→ **Programs**→ **ServeRAID Manager**.
2. When ServeRAID Manager opens, from the Managed Systems tree, click the name of your Server 1. Select **Actions**→ **Configure ServeRAID Agent**→ **Security**.
3. In the **Password** and **Confirm Password** fields, type a ServeRAID administrator password. Click **Add** to create the default security administrator password. Close the ServeRAID Agent Security window.
4. On Server 2, click **Start**→ **Programs**→ **ServeRAID Manager**.
5. When ServeRAID Manager opens, from the Manage Systems tree, click the name of your Server 2. Select **Actions**→ **Configure ServeRAID Agent**→ **Security**.
6. In the **Password** and **Confirm Password** fields, type the same password as you did for Server 1. Click **Add** to create the default security administrator password. Close the ServeRAID Agent Security window.

Proceed to “Completing and validating ServeRAID configuration” to continue configuring your cluster.

Completing and validating ServeRAID configuration

Use the following procedure to complete and validate the ServeRAID configuration on both servers.

1. On Server 2, click **Start**→ **Programs**→ **ServeRAID Manager**.
2. On Server 1, click **Start**→ **Programs**→ **ServeRAID Manager**. On the Managed Systems tree click Server 1. Select **Actions**→**Validate Cluster**. The ServeRAID Cluster Validation window opens.
3. In the **Node B** field, type the name of Server 2. Click **Start** to validate the ServeRAID cluster settings. The Connecting to Remote System window opens. In the **Username** and **Password** fields, type admin and the password that you created in “ServeRAID security configuration”.
4. Click **Connect** to close the window and start the validation process.
5. After the validation process is complete, click **Cancel**.

Proceed to “Synchronizing shared disks between the servers” on page 34 to continue configuring your cluster.

Synchronizing shared disks between the servers

You must synchronize shared disks between both servers before you install and configure Microsoft Clustering Services (MSCS).

Attention: This process might take up to three hours.

1. Open a command prompt on Server 1 and type
`cd\IBM\Cluster\support`
and press **Enter**; then, type
`ipshahto synchon`
and press **Enter**. The bottom pane in the ServeRAID Manager window shows the synchronizing logical drive status.
2. After synchronizing completes, close the ServeRAID Manager window on both servers.

Proceed to “Installing and configuring Microsoft Clustering Services” to continue configuring your cluster.

Installing and configuring Microsoft Clustering Services

You must install and configure MSCS on both servers.

Note: You must configure Server 1 before you configure Server 2.

Configuring Server 1

Use this procedure to configure Server 1.

1. Open a command prompt on Server 1, and then type
`cd\microsoft\MSCS\cluster\i386\`
and press **Enter**; then type
`setup /localquorum`
and press **Enter**.
Note: The parameter `/localquorum` is case sensitive.
2. The Microsoft Cluster Server Setup window opens. Click **Next**. Then review the Microsoft conditions that the clustering software is supported only if it is installed on a hardware configuration that was tested for compatibility with this software. Click **I Agree**. Then, click **Next** to continue.
3. From the Select Operation to Perform group, select **Form a New Cluster**, and then click **Next**.
4. In the **Enter the Name of the Cluster to Form or Join** field, type the name of the MSCS cluster you want to form, and then click **Next**.
Note: The name of the MSCS cluster must be unique in the public/client network. If you choose a name that already exists in the network, a warning opens and you need to specify another MSCS cluster name.
5. Click **Next** to accept the default directory for cluster software installation. The default directory displays in the **Setup will place files in this folder** field.
Attention: Do not change this directory unless you thoroughly understand the effects that this can have on your installation
6. In the **User Name** and **Password** fields, type the domain cluster service account name and domain cluster service Account Password. Do not change the Domain selection. Click **Next** to continue.

7. Click **Next** to scan for all available adapters that are installed in the server.
8. In the Network Adapter window in which E100B2 is displayed in the **Adapter Name** field, in the **Network Name** field, type
private
Mark the **Enable for Cluster Use** checkbox, select the **Use only for internal cluster communications** option, and then click **Next** to continue.
9. In the Network Adapter window in which PCNTN4M1 is displayed in the **Adapter Name** field in the **Network Name** field, type
public
Mark **Enable for Cluster Use**, select **Use for all communications**, and then click **Next** to continue.
When you finish specifying the names and roles for the network adapters in your system, a window opens that enables you to prioritize the available networks that you can use for Internal Cluster Communications.
10. Select the **Private** entry and then move it to the top of the list; then, click **Next**. If Private is at the top of the list, click **Next** to continue.
11. In the **TCP/IP Address** and **Subnet Mask** fields, type the TCP/IP address and the Subnet mask of the MSCS cluster. In the **Network** field select **public**. Click **Next**. You can now install the clustering software.
12. Click **Finish**.
When the Microsoft Clustering Service successfully installs, a Microsoft Cluster Server Setup window opens stating that the cluster software is successfully installed and advises you that you must restart the server for all changes to take effect. Click **OK** to restart the server.
13. After Server 1 restarts, login to Server 1, and open the Control Panel.
14. Open the Services window. In the **Services** list, find the Cluster Server entry and ensure that the word "Started" is listed in the Status column. Click **Close** to close the Services window and then the Control Panel window.
Attention: Wait ten minutes before configuring Server 2.
Proceed to "Configuring Server 2" on page 36 to continue configuring your cluster.

Configuring Server 2

Use this procedure to configure Server 2.

1. Open a command prompt and type
`cd\Microsoft\MSCS\Cluster\I386\`
and then press **Enter**; then type
`setup`
and press **Enter**.

Attention: Do not specify the parameter `/localquorum`. Only use the local quorum parameter when installing MSCS to form a cluster on the first node or server of an MSCS cluster.

2. The Microsoft Cluster Server Setup window opens. Click **Next**. Then, review the conditions under which MSCS is supported. Click **I Agree**. Then, click **Next** to continue.
3. In the **Select the Operation to Perform** box, click **Join an Existing Cluster**, and click **Next**.
4. In the **Enter the name of the cluster to form or join** field, type the name of the cluster that you specified for Server 1. If you do not enter the same name, an error window opens and you need to enter the MSCS cluster name. Click **Next** to continue.
5. To accept the default directory for cluster software installation, click **Next**. The default directory opens in the **Setup will place files in this folder** field.
Attention: Do not change this directory unless you have a strong technical understanding of the effects this can have on your MSCS installation.
6. In the next window, in the **Password** field, type the domain cluster service account password. The **User Name** and **Domain** fields are not available. Click **Next**. The MSCS setup program completes collecting all necessary information and is now ready to install the cluster software.
7. Click **Finish** to start copying files and to start the clustering service.

When the Microsoft Cluster Service successfully installs, a Microsoft Cluster Server Setup window opens stating that the cluster software is successfully installed and advises you that you must restart the server for all changes to take effect. Click **OK** to restart the server.

Proceed to “Installing the ServeRAID Windows NT cluster solution” to continue configuring your cluster.

Installing the ServeRAID Windows NT cluster solution

After Server 2 restarts and the clustering service starts, install the ServeRAID Windows NT Cluster Solution utility, first on Server 1 and then on Server 2.

1. Open a command prompt on Server 1 and then type
`cd\ibm\cluster`
and press **Enter**; then, type
`setup`
and press **Enter** to start the installation program.
2. The setup program opens a reminder that you must assign permanent drive letters before running this program. Click **OK** to continue. The **Welcome** window opens.

3. Click **Next** to install the software. Click **OK** to continue to the next window, and then click **Finish**, to complete the installation.
4. Login to Server 2; then repeat step 1 on page 36 through step 3 on Server 2.
5. On Server 1, click **Start**→ **Programs**→ **Administrative Tools**→ **Cluster Administrator**. The Open Connection to Windows window opens. In the **Cluster or Server Name** field, type the name of the newly formed MSCS cluster, and then click **Open**. A window that shows the status of the MSCS cluster opens.
6. Verify that the IPSHA Disk Group x groups can be brought online. Right-click on the group that you want, and then select **Move Group**. If an IPSHA Disk Group x group cannot be brought online, it either shows as **Failed** in the "moving to" node or as **Online** in the "starting from" node. If this occurs, shutdown both servers and restart Server 1. After Server 1 restarts, start Server 2 and repeat step 5 on Server 2.

Note: If this procedure is not successful, you need to move the resource to a different node. The first time you perform this procedure, it might take five minutes for the resource to appear online. To recover this, do the following:

- a. Right-click on each failed resource, and then click **Move**. This moves the resource over to the node and it appears in an Online state. If you try to move it back, it appears as failed.
- b. When all of the resources are moved to the other node and all resources are online, restart the server that failed.
- c. After the server restarts and the cluster starts, move the resources back to the original node so that they appear in an online status.

If you are still unable to bring IPSHA Disk Group x groups online in either server node, call IBM support.

7. Right-click the cluster name and then from the menu, select **Properties**.
8. Click the **Quorum** tab and click the **Quorum Resource** selection list. Change the quorum disk resource from Local Quorum to IPSHA Disk Q. Click **OK**.
9. Move the local quorum and the IPSHA Disk Q resources to the Cluster Group by right-clicking on the resource and then selecting **Change Group**→ **Cluster Group**.

Attention: Do not install service packs on both servers at the same time.

10. Use the following procedure to install Windows NT Service Pack 5 (located in the C:\Microsoft\SP5 directory) or Windows NT Service Pack 6a (located in the C:\Microsoft\SP6a directory) first on Server 1 and then on Server 2:
 - a. Login to Server 1 using the domain administrator account.
 - b. On Server 1, use the Cluster Administrator program to move all cluster resources to the other cluster server node (Server 2); then, stop the cluster service on Server 1.
 - c. Open a command prompt on Server 1 and change to the directory that corresponds with the level of service pack you need to install; then, type setup and press **Enter** to install the service pack.
 - d. Wait for Server 1 to restart after the service pack installs; then, login to Server 1.
 - e. Login to Server 2 using the domain administrator account. On Server 2, use the Cluster Administrator program to move all cluster resources to the other cluster server node (Server 1); then, stop the cluster service on Server 2.
 - f. Open a command prompt on Server 2 and change to the directory that corresponds with the level of service pack you need to install; then, type setup and press **Enter** to install the service pack.

- g. Wait for Server 2 to restart after the service pack installs; then, login to Server 2.
11. Ensure that all resource groups can be brought online in either cluster node by right-clicking the resource group and selecting **Move Group**. When the group is Online in the other cluster node, move the group back to the previous node.

If you want to create additional cluster resources such as IP Addresses, Network Names, or Generic Applications, refer to the documentation for that specific application to review instructions for installation in a Microsoft Cluster Services environment.

Note: Anytime you are prompted to insert your Windows operating system CD, type `c:\Microsoft\i386\` and then press **Enter**.

Attention: The drivers that are part of your initial cluster configuration have been tested and certified for clustering. Do not update drivers on your servers without contacting IBM support for assistance.

Chapter 5. Restoring your cluster to the default configuration

The Recovery CDs that come with your cluster restore the servers to their default configuration. Any applications installed or configuration changes made after the initial cluster configuration will be lost. You must backup all data and configuration information if you want to preserve these settings. Shared storage (the EXP300) might be temporarily unavailable until you completely restore Server 1.

Note: The tape drive option available for the cluster enables you to make frequent system backups of your servers and preserve this information. If you have this option within your cluster, attempt to recover from a tape backup before using the Recovery CDs.

Refer to “Restoring a Windows 2000 Advanced Server Cluster” for the Windows 2000 Advanced Server operating system, or “Restoring a Windows NT 4.0 Enterprise Edition cluster” on page 40 for the Windows NT 4.0 Enterprise Edition operating system.

Restoring a Windows 2000 Advanced Server Cluster

There are two Recovery CDs for each server. When you restore the servers, you return them to the condition they were in before you started the configuration process. The recovery process might take up to fifteen minutes.

Attention: Contact IBM support before you use the Recovery CDs on your cluster. The Recovery CDs return your servers to the original default settings. All applications and configuration changes made to your cluster are lost after using these CDs.

1. If you have not already done so and you still can, backup any data stored on the hard disk drives in the servers.
2. Insert the first Recovery CD into each server; then restart the servers. The first Recovery CD automatically starts the restoration process.

Note: Each Recovery CD has a label that indicates whether it is for Server 1 or Server 2, and whether it is the first or second Recovery CD for that server.

3. Use the console switch to select between the servers so that you can restore both servers at the same time. If necessary, refer to the documentation that comes with the console switch for detailed instructions on how to select servers.
4. From the main menu of the IBM Product Recovery window, press **Enter**.
5. In the Terms and Conditions window, press **Y**.
6. In the next window, press **Y**.

Attention: Press **N** to cancel if you do not want to restore the servers to their default configuration.

7. When the next window opens, press **Y**.
8. When you are prompted, insert the second Recovery CD for the appropriate server; then, click **OK** to continue restoring that server.
9. When the process is finished, remove the CD and press **Enter**.

After both servers are restored, remove the CDs from the servers; then, turn off both servers and refer to Chapter 3, “Configuring Windows 2000 Advanced Server,” on page 11 for information on how to configure your cluster.

Restoring a Windows NT 4.0 Enterprise Edition cluster

There is one Recovery CD for each server. When you restore the servers, you return them to the condition they were in before you started the configuration process. The recovery process might take up to fifteen minutes.

Attention: Contact IBM support before you use the Recovery CDs on your cluster. The Recovery CDs return your servers to the original default settings. All applications and configuration changes made to your cluster are lost after using these CDs.

1. If you have not already done so and you still can, backup any data stored on the hard disk drives in the servers.
2. Insert the Recovery CD into each server; then restart the servers. The Recovery CD automatically starts the restoration process.

Note: Each Recovery CD has a label that indicates whether it is for Server 1 or for Server 2.

3. Use the console switch to select between the servers so that you can restore both servers at the same time. If necessary, see the documentation that comes with the console switch for detailed instructions on how to select servers.
4. From the main menu of the IBM Product Recovery window, press **Enter**.
5. In the Terms and Conditions window, press **Y**.
6. In the next window, press **Y**.

Attention: Press **N** to cancel if you do not want to restore the servers to their default configuration.

7. In the next window, press **Y** to continue the recovery process.
8. When the process is finished, remove the CD and press **Enter**.

After both servers are restored, remove the CDs from the servers; then, turn off both servers and refer to Chapter 4, "Configuring Windows NT 4.0 Enterprise Edition," on page 23 for information on how to configure your cluster.

Appendix A. Getting help, service, and information

If you need help, service, technical assistance, or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you.

With the original purchase of an IBM hardware product, you have access to extensive support coverage. During the IBM hardware product warranty period, you may call the IBM Personal Computer HelpCenter (1-800-772-2227 in the U.S.) for hardware product assistance covered under the terms of the IBM Statement of Limited Warranty.

The following services are available during the warranty period:

- Problem Determination - Trained personnel are available to assist you with determining if you have a hardware problem and deciding what action is necessary to fix the problem.
- IBM Hardware Repair - If the problem is determined to be caused by IBM hardware under warranty, trained service personnel are available to provide the applicable level of service.
- Engineering Change Management - Occasionally, there might be changes that are required after a product has been sold. IBM or your reseller, if authorized by IBM, will make Engineering Changes (ECs) available that apply to your hardware.

Be sure to retain your proof of purchase to obtain warranty service. Refer to the IBM hardware warranty for a full explanation of IBM's warranty terms.

Please have the following information ready when you call:

- Machine type and model
- Serial numbers of your IBM hardware products
- Description of the problem
- Exact wording of any error messages
- Hardware and software configuration information

On the World Wide Web, the IBM Personal Computing Web site has up-to-date information about IBM Personal Computer products and support.

Some helpful addresses are:

Table 1. IBM Personal Computing Web sites.

World Wide Web site URL	Description
http://www.ibm.com	Main IBM home page
http://www.ibm.com/pc	IBM Personal Computing
http://www.ibm.com/pc/support	IBM Personal Computing Support
http://www.ibm.com/pc/us/accessories	Options by IBM (U.S.)
http://www.ibm.com/pc/us/eserver/xseries	IBM xSeries Servers (U.S.)
http://www.ibm.com/pc/techconnect	IBM TechConnect

You can select a country-specific Web site from these pages.

If you select Profile from the support page, you can create a customized support page that is specific to your hardware, complete with Frequently Asked Questions, Parts Information, Technical Hints and Tips, and Downloadable Files. You will have the information you need, all in one place. In addition, you can choose to receive e-mail notifications whenever new information becomes available about your registered products. You can also access online support forums, which are community sites monitored by IBM support staff.

Appendix B. Product warranties and notices

This chapter contains warranty and emission notices. It also contains trademarks and general-information notices.

Warranty Statement

Warranty Period

The warranty period varies by machine type and country or region.

Notes:

- Contact your place of purchase for warranty service information. Some IBM Machines are eligible for on-site warranty service depending on the country or region where service is performed.
- A warranty period of 3 years on parts and 1 year on labor means that IBM will provide warranty service without charge for:
 1. parts and labor during the first year of the warranty period
 2. parts only, on an exchange basis, in the second and third years of the warranty period.

IBM will charge you for any labor it provides in performance of the repair or replacement.

Machine - IBM xSeries 230 HA Cluster

Warranty Period* - Three Years

** Contact your place of purchase for warranty service information. Some IBM Machines are eligible for On-site warranty service depending on the country where service is performed.*

IBM Statement of Limited Warranty

Part 1 - General Terms

This Statement of Limited Warranty includes Part 1 - General Terms and Part 2 - Country-unique Terms. The terms of Part 2 replace or modify those of Part 1. The warranties provided by IBM in this Statement of Limited Warranty apply only to Machines you purchase for your use, and not for resale, from IBM or your reseller. The term "Machine" means an IBM machine, its features, conversions, upgrades, elements, or accessories, or any combination of them. The term "Machine" does not include any software programs, whether pre-loaded with the Machine, installed subsequently or otherwise. Unless IBM specifies otherwise, the following warranties apply only in the country where you acquire the Machine. Nothing in this Statement of Limited Warranty affects any statutory rights of consumers that cannot be waived or limited by contract. If you have any questions, contact IBM or your reseller.

The IBM Warranty for Machines

IBM warrants that each Machine 1) is free from defects in materials and workmanship and 2) conforms to IBM's Official Published Specifications ("Specifications"). The warranty period for a Machine is a specified, fixed period commencing on its Date of Installation. The date on your sales receipt is the Date of Installation unless IBM or your reseller informs you otherwise.

If a Machine does not function as warranted during the warranty period, and IBM or your reseller are unable to either 1) make it do so or 2) replace it with one that is at least functionally equivalent, you may return it to your place of purchase and your money will be refunded.

Extent of Warranty

The warranty does not cover the repair or exchange of a Machine resulting from misuse, accident, modification, unsuitable physical or operating environment, improper maintenance by you, or failure caused by a product for which IBM is not responsible. The warranty is voided by removal or alteration of Machine or parts identification labels.

THESE WARRANTIES ARE YOUR EXCLUSIVE WARRANTIES AND REPLACE ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THESE WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF EXPRESS OR IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU. IN THAT EVENT, SUCH WARRANTIES ARE LIMITED IN DURATION TO THE WARRANTY PERIOD. NO WARRANTIES APPLY AFTER THAT PERIOD.

Items Not Covered by Warranty

IBM does not warrant uninterrupted or error-free operation of a Machine.

Any technical or other support provided for a Machine under warranty, such as assistance via telephone with "how-to" questions and those regarding Machine set-up and installation, will be provided **WITHOUT WARRANTIES OF ANY KIND**.

Warranty Service

To obtain warranty service for a Machine, contact IBM or your reseller. If you do not register your Machine with IBM, you may be required to present proof of purchase.

During the warranty period, IBM or your reseller, if approved by IBM to provide warranty service, provides without charge certain types of repair and exchange service to keep Machines in, or restore them to, conformance with their Specifications. IBM or your reseller will inform you of the available types of service for a Machine based on its country of installation. At its discretion, IBM or your reseller will 1) either repair or exchange the failing Machine and 2) provide the service either at your location or a service center. IBM or your reseller will also manage and install selected engineering changes that apply to the Machine.

Some parts of IBM Machines are designated as Customer Replaceable Units (called "CRUs"), e.g., keyboards, memory, or hard disk drives. IBM ships CRUs to you for replacement by you. You must return all defective CRUs to IBM within 30 days of your receipt of the replacement CRU. You are responsible for downloading designated Machine Code and Licensed Internal Code updates from an IBM Internet Web site or from other electronic media, and following the instructions that IBM provides.

When warranty service involves the exchange of a Machine or part, the item IBM or your reseller replaces becomes its property and the replacement becomes yours. You represent that all removed items are genuine and unaltered. The replacement may not be new, but will be in good working order and at least functionally equivalent to the item replaced. The replacement assumes the warranty service status of the replaced

item. Many features, conversions, or upgrades involve the removal of parts and their return to IBM. A part that replaces a removed part will assume the warranty service status of the removed part.

Before IBM or your reseller exchanges a Machine or part, you agree to remove all features, parts, options, alterations, and attachments not under warranty service.

You also agree to

1. ensure that the Machine is free of any legal obligations or restrictions that prevent its exchange;
2. obtain authorization from the owner to have IBM or your reseller service a Machine that you do not own; and
3. where applicable, before service is provided:
 - a. follow the problem determination, problem analysis, and service request procedures that IBM or your reseller provides;
 - b. secure all programs, data, and funds contained in a Machine;
 - c. provide IBM or your reseller with sufficient, free, and safe access to your facilities to permit them to fulfill their obligations; and
 - d. inform IBM or your reseller of changes in a Machine's location.

IBM is responsible for loss of, or damage to, your Machine while it is 1) in IBM's possession or 2) in transit in those cases where IBM is responsible for the transportation charges.

Neither IBM nor your reseller is responsible for any of your confidential, proprietary or personal information contained in a Machine which you return to IBM or your reseller for any reason. You should remove all such information from the Machine prior to its return.

Limitation of Liability

Circumstances may arise where, because of a default on IBM's part or other liability, you are entitled to recover damages from IBM. In each such instance, regardless of the basis on which you are entitled to claim damages from IBM (including fundamental breach, negligence, misrepresentation, or other contract or tort claim), except for any liability that cannot be waived or limited by applicable laws, IBM is liable for no more than

1. damages for bodily injury (including death) and damage to real property and tangible personal property; and
2. the amount of any other actual direct damages, up to the charges (if recurring, 12 months' charges apply) for the Machine that is subject of the claim. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code.

This limit also applies to IBM's suppliers and your reseller. It is the maximum for which IBM, its suppliers, and your reseller are collectively responsible.

UNDER NO CIRCUMSTANCES IS IBM LIABLE FOR ANY OF THE FOLLOWING: 1) THIRD-PARTY CLAIMS AGAINST YOU FOR DAMAGES (OTHER THAN THOSE UNDER THE FIRST ITEM LISTED ABOVE); 2) LOSS OF, OR DAMAGE TO, YOUR RECORDS OR DATA; OR 3) SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES, LOST PROFITS OR LOST SAVINGS, EVEN IF IBM, ITS SUPPLIERS OR YOUR RESELLER IS INFORMED OF THEIR POSSIBILITY. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

Governing Law

Both you and IBM consent to the application of the laws of the country in which you acquired the Machine to govern, interpret, and enforce all of your and IBM's rights, duties, and obligations arising from, or relating in any manner to, the subject matter of this Agreement, without regard to conflict of law principles.

Part 2 - Country-unique Terms

AMERICAS

BRAZIL

Governing Law: *The following is added after the first sentence:*

Any litigation arising from this Agreement will be settled exclusively by the court of Rio de Janeiro.

NORTH AMERICA

Warranty Service: *The following is added to this Section:*

To obtain warranty service from IBM in Canada or the United States, call 1-800-IBM-SERV (426-7378).

CANADA

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:*

laws in the Province of Ontario.

UNITED STATES

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:*

laws of the State of New York.

ASIA PACIFIC

AUSTRALIA

The IBM Warranty for Machines: *The following paragraph is added to this Section:*

The warranties specified in this Section are in addition to any rights you may have under the Trade Practices Act 1974 or other similar legislation and are only limited to the extent permitted by the applicable legislation.

Limitation of Liability: *The following is added to this Section:*

Where IBM is in breach of a condition or warranty implied by the Trade Practices Act 1974 or other similar legislation, IBM's liability is limited to the repair or replacement of the goods or the supply of equivalent goods. Where that condition or warranty relates to right to sell, quiet possession or clear title, or the goods are of a kind ordinarily acquired for personal, domestic or household use or consumption, then none of the limitations in this paragraph apply.

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:*

laws of the State or Territory.

CAMBODIA, LAOS, AND VIETNAM

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:*

laws of the State of New York.

The following is added to this Section:

Disputes and differences arising out of or in connection with this Agreement shall be finally settled by arbitration which shall be held in Singapore in accordance with the rules of the International Chamber of Commerce (ICC). The arbitrator or arbitrators designated in conformity with those rules shall have the power to rule on their own competence and on the validity of the Agreement to submit to arbitration. The arbitration award shall be final and binding for the parties without appeal and the arbitral award shall be in writing and set forth the findings of fact and the conclusions of law.

All proceedings shall be conducted, including all documents presented in such proceedings, in the English language. The number of arbitrators shall be three, with each side to the dispute being entitled to appoint one arbitrator.

The two arbitrators appointed by the parties shall appoint a third arbitrator before proceeding upon the reference. The third arbitrator shall act as chairman of the proceedings. Vacancies in the post of chairman shall be filled by the president of the ICC. Other vacancies shall be filled by the respective nominating party. Proceedings shall continue from the stage they were at when the vacancy occurred.

If one of the parties refuses or otherwise fails to appoint an arbitrator within 30 days of the date the other party appoints its, the first appointed arbitrator shall be the sole arbitrator, provided that the arbitrator was validly and properly appointed.

The English language version of this Agreement prevails over any other language version.

HONG KONG AND MACAU

Governing Law: *The following replaces "laws of the country in which you acquired the Machine" in the first sentence:*

laws of Hong Kong Special Administrative Region.

INDIA

Limitation of Liability: *The following replaces items 1 and 2 of this Section:*

1. liability for bodily injury (including death) or damage to real property and tangible personal property will be limited to that caused by IBM's negligence;
2. as to any other actual damage arising in any situation involving nonperformance by IBM pursuant to, or in any way related to the subject of this Statement of Limited Warranty, IBM's liability will be limited to the charge paid by you for the individual Machine that is the subject of the claim.

JAPAN

Governing Law: *The following sentence is added to this Section:*

Any doubts concerning this Agreement will be initially resolved between us in good faith and in accordance with the principle of mutual trust.

NEW ZEALAND

The IBM Warranty for Machines: *The following paragraph is added to this Section:*

The warranties specified in this Section are in addition to any rights you may have under the Consumer Guarantees Act 1993 or other legislation which cannot be

excluded or limited. The Consumer Guarantees Act 1993 will not apply in respect of any goods which IBM provides, if you require the goods for the purposes of a business as defined in that Act.

Limitation of Liability: *The following is added to this Section:*

Where Machines are not acquired for the purposes of a business as defined in the Consumer Guarantees Act 1993, the limitations in this Section are subject to the limitations in that Act.

PEOPLE'S REPUBLIC OF CHINA (PRC)

Governing Law: *The following replaces this Section:*

Both you and IBM consent to the application of the laws of the State of New York (except when local law requires otherwise) to govern, interpret, and enforce all your and IBM's rights, duties, and obligations arising from, or relating in any manner to, the subject matter of this Agreement, without regard to conflict of law principles.

Any disputes arising from or in connection with this Agreement will first be resolved by friendly negotiations, failing which either of us has the right to submit the dispute to the China International Economic and Trade Arbitration Commission in Beijing, the PRC, for arbitration in accordance with its arbitration rules in force at the time. The arbitration tribunal will consist of three arbitrators. The language to be used therein will be English and Chinese. An arbitral award will be final and binding on all the parties, and will be enforceable under the Convention on the Recognition and Enforcement of Foreign Arbitral Awards (1958).

The arbitration fee will be borne by the losing party unless otherwise determined by the arbitral award.

During the course of arbitration, this Agreement will continue to be performed except for the part which the parties are disputing and which is undergoing arbitration.

EUROPE, MIDDLE EAST, AFRICA (EMEA)

THE FOLLOWING TERMS APPLY TO ALL EMEA COUNTRIES:

The terms of this Statement of Limited Warranty apply to Machines purchased from IBM or an IBM reseller.

Warranty Service:

If you purchase an IBM Machine in Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland or United Kingdom, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM. If you purchase an IBM Personal Computer Machine in Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Georgia, Hungary, Kazakhstan, Kirghizia, Federal Republic of Yugoslavia, Former Yugoslav Republic of Macedonia (FYROM), Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, or Ukraine, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM.

If you purchase an IBM Machine in a Middle Eastern or African country, you may obtain warranty service for that Machine from the IBM entity within the country of purchase, if that IBM entity provides warranty service in that country, or from an IBM reseller, approved by IBM to perform warranty service on that Machine in that country. Warranty service in Africa is available within 50 kilometers of an IBM authorized

service provider. You are responsible for transportation costs for Machines located outside 50 kilometers of an IBM authorized service provider.

Governing Law:

The applicable laws that govern, interpret and enforce rights, duties, and obligations of each of us arising from, or relating in any manner to, the subject matter of this Statement, without regard to conflict of laws principles, as well as Country-unique terms and competent court for this Statement are those of the country in which the warranty service is being provided, except that in 1) Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Hungary, Former Yugoslav Republic of Macedonia, Romania, Slovakia, Slovenia, Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan, the laws of Austria apply; 2) Estonia, Latvia, and Lithuania, the laws of Finland apply; 3) Algeria, Benin, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Congo, Djibouti, Democratic Republic of Congo, Equatorial Guinea, France, Gabon, Gambia, Guinea, Guinea-Bissau, Ivory Coast, Lebanon, Mali, Mauritania, Morocco, Niger, Senegal, Togo, and Tunisia, this Agreement will be construed and the legal relations between the parties will be determined in accordance with the French laws and all disputes arising out of this Agreement or related to its violation or execution, including summary proceedings, will be settled exclusively by the Commercial Court of Paris; 4) Angola, Bahrain, Botswana, Burundi, Egypt, Eritrea, Ethiopia, Ghana, Jordan, Kenya, Kuwait, Liberia, Malawi, Malta, Mozambique, Nigeria, Oman, Pakistan, Qatar, Rwanda, Sao Tome, Saudi Arabia, Sierra Leone, Somalia, Tanzania, Uganda, United Arab Emirates, United Kingdom, West Bank/Gaza, Yemen, Zambia, and Zimbabwe, this Agreement will be governed by English Law and disputes relating to it will be submitted to the exclusive jurisdiction of the English courts; and 5) in Greece, Israel, Italy, Portugal, and Spain any legal claim arising out of this Statement will be brought before, and finally settled by, the competent court of Athens, Tel Aviv, Milan, Lisbon, and Madrid, respectively.

THE FOLLOWING TERMS APPLY TO THE COUNTRY SPECIFIED:

AUSTRIA AND GERMANY

The IBM Warranty for Machines: *The following replaces the first sentence of the first paragraph of this Section:*

The warranty for an IBM Machine covers the functionality of the Machine for its normal use and the Machine's conformity to its Specifications.

The following paragraphs are added to this Section:

The minimum warranty period for Machines is six months. In case IBM or your reseller is unable to repair an IBM Machine, you can alternatively ask for a partial refund as far as justified by the reduced value of the unrepaired Machine or ask for a cancellation of the respective agreement for such Machine and get your money refunded.

Extent of Warranty: *The second paragraph does not apply.*

Warranty Service: *The following is added to this Section:*

During the warranty period, transportation for delivery of the failing Machine to IBM will be at IBM's expense.

Limitation of Liability: *The following paragraph is added to this Section:*

The limitations and exclusions specified in the Statement of Limited Warranty will not apply to damages caused by IBM with fraud or gross negligence and for express warranty.

The following sentence is added to the end of item 2:

IBM's liability under this item is limited to the violation of essential contractual terms in cases of ordinary negligence.

EGYPT

Limitation of Liability: *The following replaces item 2 in this Section:*

as to any other actual direct damages, IBM's liability will be limited to the total amount you paid for the Machine that is the subject of the claim. For purposes of this item, the term "Machine" includes Machine Code and Licensed Internal Code.

Applicability of suppliers and resellers (unchanged).

FRANCE

Limitation of Liability: *The following replaces the second sentence of the first paragraph of this Section:*

In such instances, regardless of the basis on which you are entitled to claim damages from IBM, IBM is liable for no more than: *(items 1 and 2 unchanged).*

IRELAND

Extent of Warranty: *The following is added to this Section:*

Except as expressly provided in these terms and conditions, all statutory conditions, including all warranties implied, but without prejudice to the generality of the foregoing all warranties implied by the Sale of Goods Act 1893 or the Sale of Goods and Supply of Services Act 1980 are hereby excluded.

Limitation of Liability: *The following replaces items one and two of the first paragraph of this Section:*

1. death or personal injury or physical damage to your real property solely caused by IBM's negligence; and
2. the amount of any other actual direct damages, up to 125 percent of the charges (if recurring, the 12 months' charges apply) for the Machine that is the subject of the claim or which otherwise gives rise to the claim.

Applicability of suppliers and resellers (unchanged).

The following paragraph is added at the end of this Section:

IBM's entire liability and your sole remedy, whether in contract or in tort, in respect of any default shall be limited to damages.

ITALY

Limitation of Liability: *The following replaces the second sentence in the first paragraph:*

In each such instance unless otherwise provided by mandatory law, IBM is liable for no more than:

1. *(unchanged)*
2. as to any other actual damage arising in all situations involving nonperformance by IBM pursuant to, or in any way related to the subject matter of this Statement of Warranty, IBM's liability, will be limited to the total amount you paid for the Machine that is the subject of the claim.

Applicability of suppliers and resellers (unchanged).

The following replaces the third paragraph of this Section:

Unless otherwise provided by mandatory law, IBM and your reseller are not liable for any of the following: *(items 1 and 2 unchanged)* 3) indirect damages, even if IBM or your reseller is informed of their possibility.

SOUTH AFRICA, NAMIBIA, BOTSWANA, LESOTHO AND SWAZILAND

Limitation of Liability: *The following is added to this Section:*

IBM's entire liability to you for actual damages arising in all situations involving nonperformance by IBM in respect of the subject matter of this Statement of Warranty will be limited to the charge paid by you for the individual Machine that is the subject of your claim from IBM.

UNITED KINGDOM

Limitation of Liability: *The following replaces items 1 and 2 of the first paragraph of this Section:*

1. death or personal injury or physical damage to your real property solely caused by IBM's negligence;
2. the amount of any other actual direct damages or loss, up to 125 percent of the charges (if recurring, the 12 months' charges apply) for the Machine that is the subject of the claim or which otherwise gives rise to the claim;

The following item is added to this paragraph:

3. breach of IBM's obligations implied by Section 12 of the Sale of Goods Act 1979 or Section 2 of the Supply of Goods and Services Act 1982.

Applicability of suppliers and resellers (unchanged).

The following is added to the end of this Section:

IBM's entire liability and your sole remedy, whether in contract or in tort, in respect of any default shall be limited to damages.

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Processor speeds indicate the internal clock speed of the microprocessor; other factors also affect application performance.

When referring to hard disk drive capacity, MB stands for 1 000 000 bytes and GB stands for 1 000 000 000 bytes. Total user-accessible capacity may vary depending on operating environments.

Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and population of all hard disk drive bays with the largest currently supported drives available from IBM.

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Federal Communications Commission (FCC) Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference

caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada Class A emission compliance statement

This Class A digital apparatus complies with Canadian ICES-003.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de classe A est conforme à la norme NMB-003 du Canada.

Australia and New Zealand Class A statement

Attention: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

United Kingdom telecommunications safety requirement

Notice to Customers

This apparatus is approved under approval number NS/G/1234/J/100003 for indirect connection to public telecommunication systems in the United Kingdom.

European Union EMC Directive conformance statement

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a nonrecommended modification of the product, including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to CISPR 22/European Standard EN 55022. The Limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

Attention: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Taiwan electrical emission statement

警告使用者：
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Japanese Voluntary Control Council for Interference (VCCI) statement

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Power cords

For your safety, IBM provides a power cord with a grounded attachment plug to use with this IBM product. To avoid electrical shock, always use the power cord and plug with a properly grounded outlet.

IBM power cords used in the United States and Canada are listed by Underwriter's Laboratories (UL) and certified by the Canadian Standards Association (CSA).

For units intended to be operated at 115 volts: Use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a parallel blade, grounding-type attachment plug rated 15 amperes, 125 volts.

For units intended to be operated at 230 volts (U.S. use): Use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a tandem blade, grounding-type attachment plug rated 15 amperes, 250 volts.

For units intended to be operated at 230 volts (outside the U.S.): Use a cord set with a grounding-type attachment plug. The cord set should have the appropriate safety approvals for the country in which the equipment will be installed.

IBM power cords for a specific country or region are usually available only in that country or region.

IBM power cord part number	Used in these countries and regions
13F9940	Argentina, Australia, China (PRC), New Zealand, Papua New Guinea, Paraguay, Uruguay, Western Samoa
13F9979	Afghanistan, Algeria, Andorra, Angola, Austria, Belgium, Benin, Bulgaria, Burkina Faso, Burundi, Cameroon, Central African Rep., Chad, China (Macau S.A.R.), Czech Republic, Egypt, Finland, France, French Guiana, Germany, Greece, Guinea, Hungary, Iceland, Indonesia, Iran, Ivory Coast, Jordan, Lebanon, Luxembourg, Malagasy, Mali, Martinique, Mauritania, Mauritius, Monaco, Morocco, Mozambique, Netherlands, New Caledonia, Niger, Norway, Poland, Portugal, Romania, Senegal, Slovakia, Spain, Sudan, Sweden, Syria, Togo, Tunisia, Turkey, former USSR, Vietnam, former Yugoslavia, Zaire, Zimbabwe
13F9997	Denmark
14F0015	Bangladesh, Burma, Pakistan, South Africa, Sri Lanka
14F0033	Antigua, Bahrain, Brunei, Channel Islands, China (Hong Kong S.A.R.), Cyprus, Dubai, Fiji, Ghana, India, Iraq, Ireland, Kenya, Kuwait, Malawi, Malaysia, Malta, Nepal, Nigeria, Polynesia, Qatar, Sierra Leone, Singapore, Tanzania, Uganda, United Kingdom, Yemen, Zambia
14F0051	Liechtenstein, Switzerland
14F0069	Chile, Ethiopia, Italy, Libya, Somalia
14F0087	Israel
1838574	Thailand
6952301	Bahamas, Barbados, Bermuda, Bolivia, Brazil, Canada, Cayman Islands, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Japan, Korea (South), Liberia, Mexico, Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Saudi Arabia, Suriname, Taiwan, Trinidad (West Indies), United States of America, Venezuela

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