

Windows* 2003 Cluster Implementation Guide for the Intel RAID controller SRCU42X

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1.0 Installing and Configuring Clusters

This chapter explains how clusters work and how to install and configure them.

Note: The Intel SRCU42X adapters support clustering, minimum firmware level: **413E or Later**.

1.1 Overview

This document described storage failover clustering as implemented in Windows* 2000 or later. For the purposes of this document, a cluster is a grouping of two independent servers that can access the same shared data storage and provide services to a common set of clients (as verified by a domain controller). Logically, a cluster is a single management unit. Any server can provide any available service to any authorized client. The servers must have access to the same shared data and must share a common security model. This generally means that the servers in a cluster have the same architecture and run the same version of the operating system.

1.2 Benefits of Clusters

Clusters provide three basic benefits:

- Improved application and data availability.
- Scalability of hardware resources.
- Simplified management of large or rapidly growing systems.

1.3 Installing SCSI Drives

This information is provided as a generic instruction set for SCSI drive installations. If the SCSI hard disk vendor's instructions conflict with the instructions in this section, always use the instructions supplied by the vendor. The SCSI bus listed in the hardware requirements must be configured prior to installation of Cluster Services. This includes:

- Configuring the SCSI devices.
- Configuring the SCSI storage adapters and hard disks to work properly on a shared SCSI bus.
- Properly terminating the bus. The shared SCSI bus must have a terminator at each end of the bus. It is possible to have multiple shared SCSI buses between the nodes of a cluster. In addition to the information on the next page, refer to the documentation from the SCSI device manufacturer or the SCSI specifications, which can be ordered from the American National Standards Institute (ANSI). The ANSI web site contains a catalog that you can search for the SCSI specifications.

1.3.1 Configuring the SCSI Devices

Each device on the shared SCSI bus must have a unique SCSI ID. Since most SCSI storage adapters default to SCSI ID 7, part of configuring the shared SCSI bus is to change the SCSI ID on one storage adapter to a different SCSI ID, such as SCSI ID 6. If more than one disk is to be on the shared SCSI bus, each disk must also have a unique SCSI ID. Some SCSI storage adapters reset the SCSI bus

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when they initialize at boot time. If this occurs, the bus reset can interrupt any data transfers between the other node and disks on the shared SCSI bus; therefore, disable SCSI bus resets, if possible.

1.3.2 Terminating the Shared SCSI Bus

You can connect *Y* cables to devices if the device is at the end of the SCSI bus. You can then attach a terminator to one branch of the *Y* cable to terminate the SCSI bus. This method of termination requires either disabling or removing any internal terminators the device has. Note: Any devices that are not at the end of the shared bus must have their internal termination disabled.

1.4 SCSI Cabling Guide

1.4.1 Introduction

For purposes of this document the configuration of a cluster using a JBOD with 8 SCSI disks will be described. In this example, there are 2 SCSI buses in the box with each bus supporting 4 drives. Therefore total 4 SCSI ports are provided, SCSI BUS A IN/OUT, SCSI BUS B IN/OUT. Cabling selected for use must meet the minimum cabling and connector specifications for the SCSI bus speed that will be used.

1.4.2 Cabling Guide

There are 2 configurations that are described for this JBOD configuration using two clustered servers. These configurations are described below.

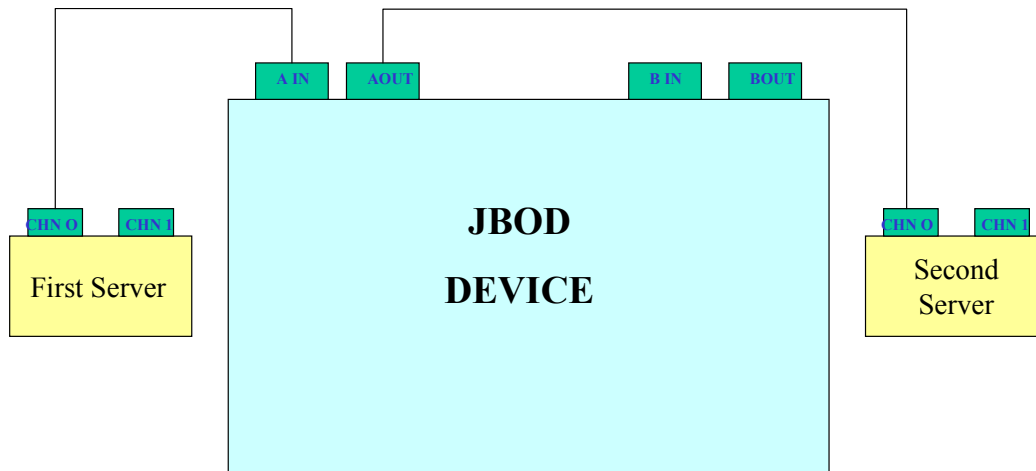
1.4.2.1 Four Disks Environment

In this configuration two SCSI cables would be used. Depending on the JBOD being used, cable ends will vary. Cables must be selected that match the RAID controller on one end and the JBOD connector on the other.

Connect a cable end connector to the SCSI BUS A IN port on the JBOD and attach the other cable end connector to the channel 0 port on the RAID controller of the first server.

Connect a cable end connector to the SCSI BUS A OUT port on the JBOD and attach the other cable end connector to channel 0 port on the RAID controller of the second server.

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Cabling for Single SCSI Bus Connection

1.4.2.2 Eight Disks Environment

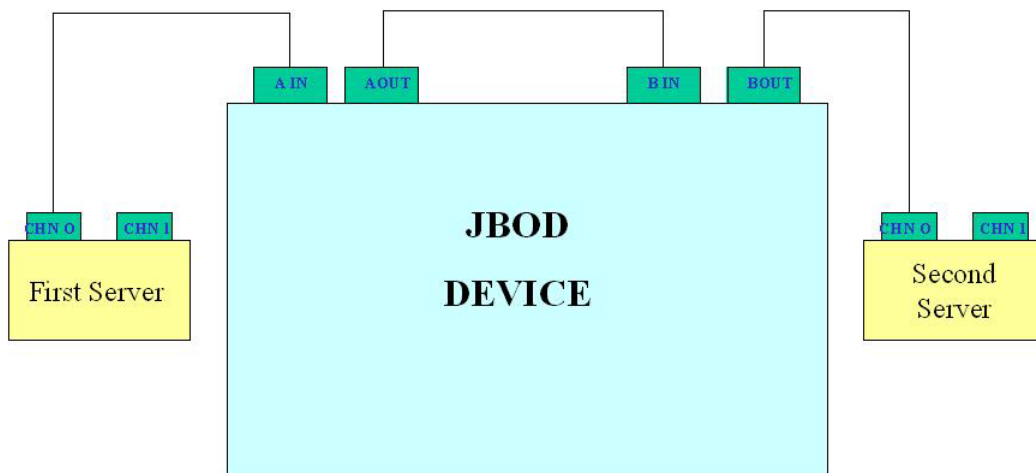
In this configuration, you should have 3 SCSI cables, 2 cables will be used to connect the RAID Controllers to the JBOD and one cable will be used to connect the in and out ports on the JBOD, cable ends must be matched to mate with their target connectors.

Connect one end of a SCSI cable to the SCSI BUS A IN port on the JBOD and the other end of the SCSI cable to the connector on channel 0 port on the SRCU42X of the first server.

Connect one end of a SCSI cable to SCSI BUS B OUT port on the JBOD and other end of the SCSI cable to the connector on channel 0 port on the SRCU42X of the second server.

Connect SCSI BUS A OUT and SCSI BUS B IN with standard SCSI cable.

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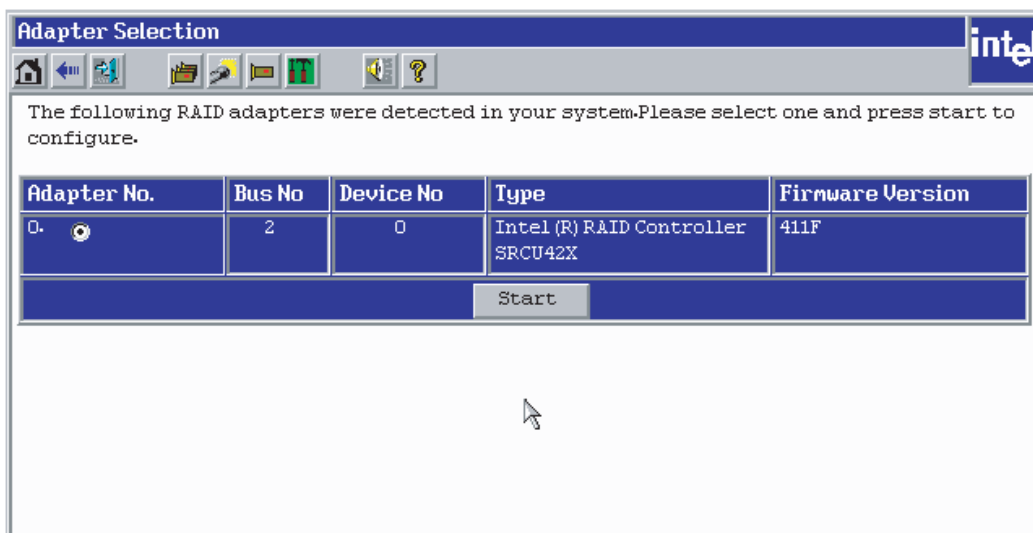


Cabling for Dual SCSI Bus Connection

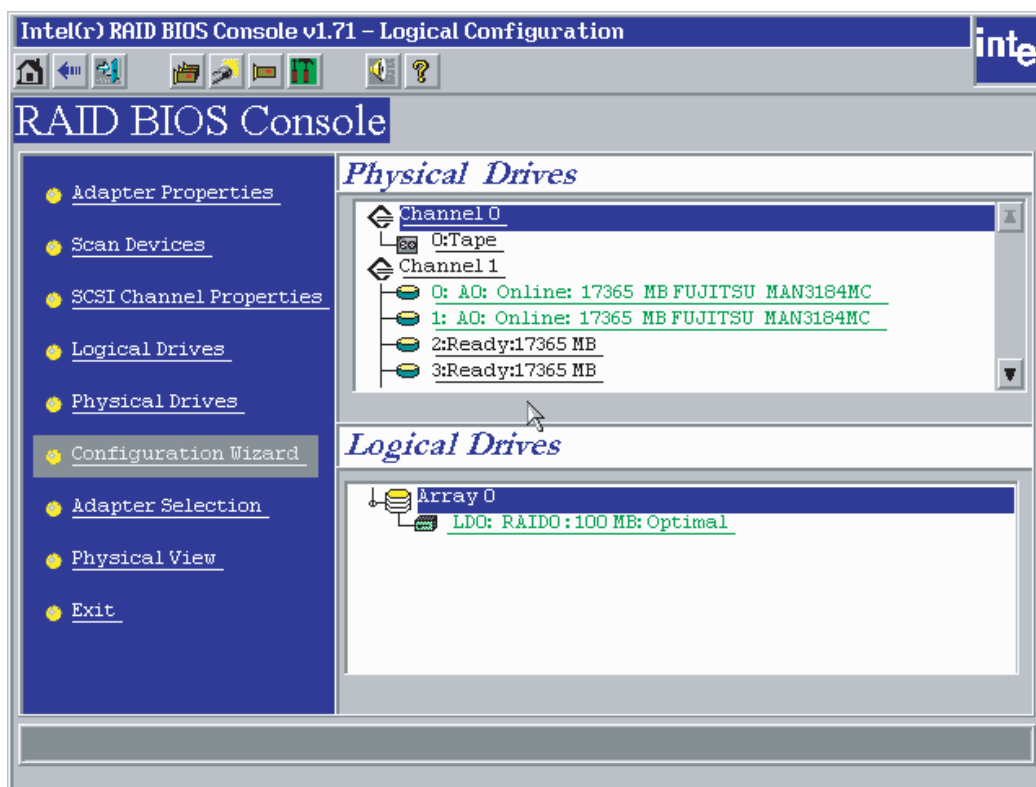
1.3 Installation and Configuration

To install and configure your system as part of a cluster:

1. Unpack the storage adapter and install the SRCU42X into the first server by following the instructions of hardware installation guide.
2. To configure the adapter, boot the server and press <Ctrl> + <G> at BIOS prompt screen. **Do not attach the disks array in this phase!!!** You will be presented with the following screen.

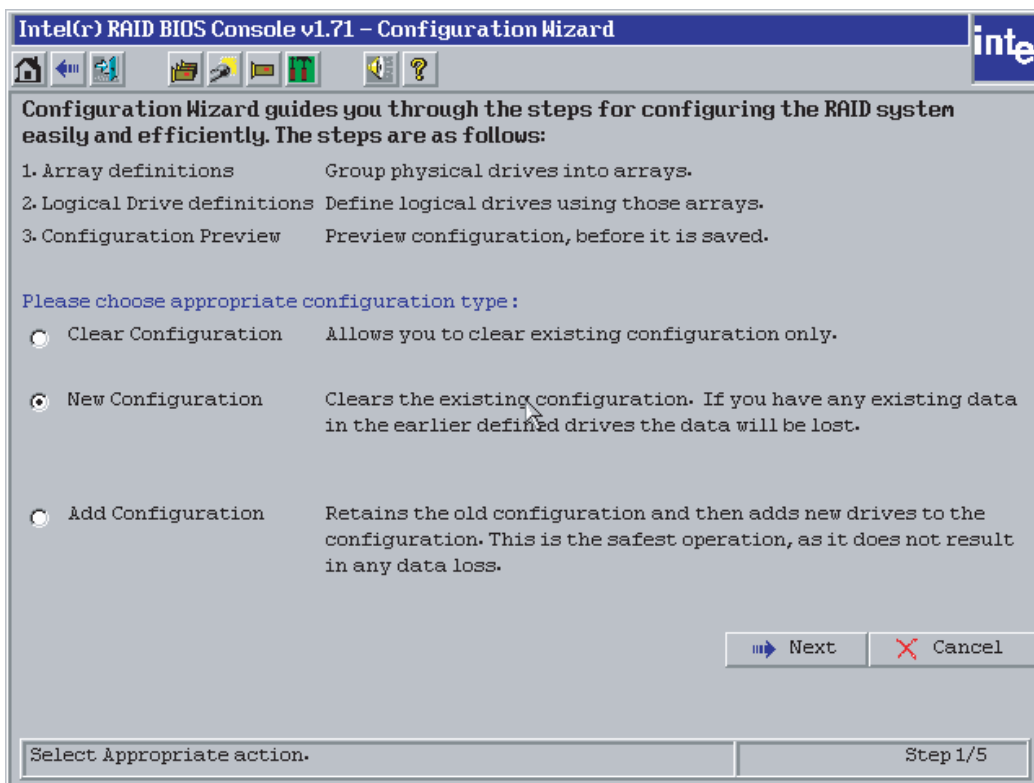


3. Choose the adapter that will be used for Clustering (if there is more than one), click start.
4. Choose Adapter properties from the screen below and set the storage adapter to Cluster Mode in the Adapter Properties > cluster> **enable**



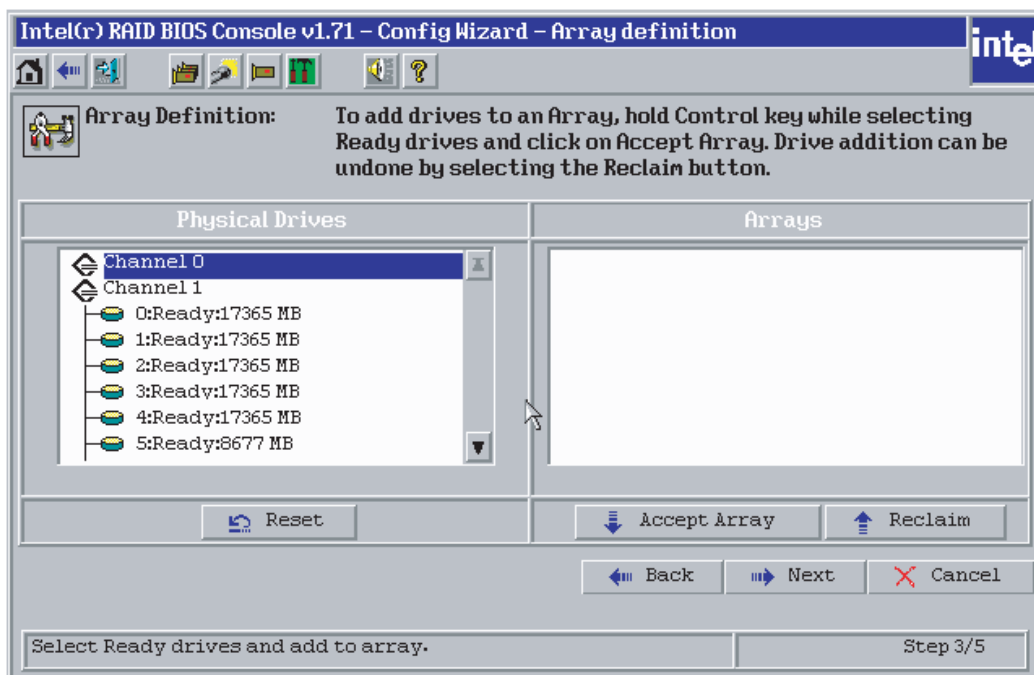
5. Disable the BIOS in the Adapter Properties> BIOS menu> **disabled.**
 6. Because each RAID adapter in same cluster must has unique SCSI ID, you must manually modify the default value to “8” for first server (Server 1) , and leave it at “7” in the second server (Server 2). To perform this operation, change the initiator ID to 8 in the Adapter Properties > Initiator ID> **8.**
 7. Power down the first server.
 8. Attach the SRCU42X controller to the shared array and power on the first server.
 9. Enter Bios Console during POST by pressing <cnrl> = <g> when prompted.
 10. From the main menu, configure the logical drives for the first storage adapter using the configuration wizard - Configure > New.
- Configuration menu.

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11. Chose to create a new configuration.

Note: Use the entire array size of any created array.



12. Follow the on-screen instructions to create arrays, and save the configuration.

13. When the logical drives have completed initialization, power down the first server.

14. Repeat steps 2 through 5 for the second server; remember to set the ID of the second controller to a

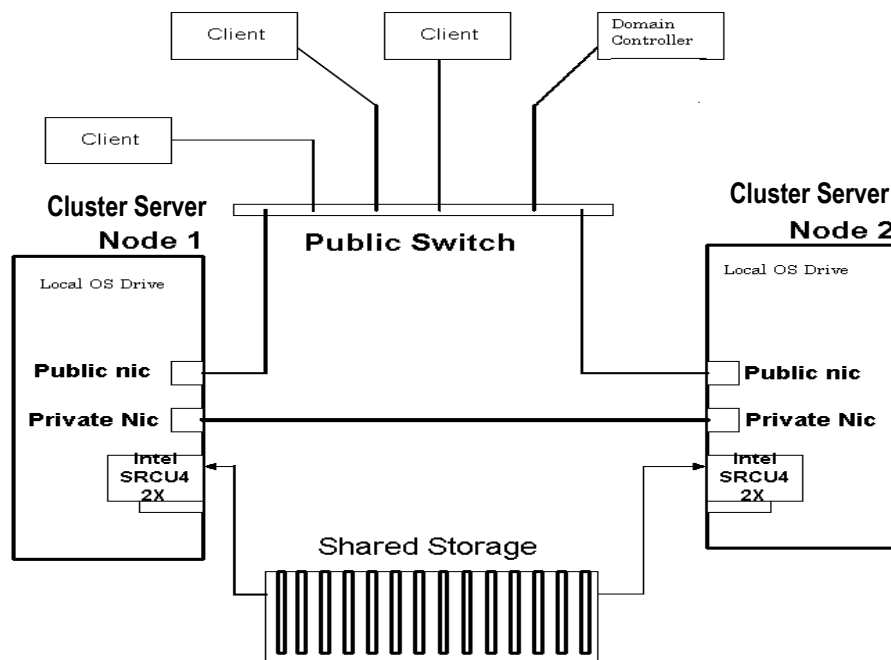
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- different ID from the controller in the first server (ID 7 is recommended for the second server).
15. Power down the second server.
 16. Power on the second server.
 12. If a configuration mismatch occurs, enter the <Ctrl> <G> utility, > View disk menu and use the configuration on disk.
 13. Save the configuration. Power down second server.

1.3.1 Driver Installation Instructions under Microsoft Windows 2003

Enterprise Server

It is recommended that three server be used in a Windows 2003 cluster configuration, two as failover cluster servers, and the third as a domain controller. In addition, it is recommended that the hard drive containing the operating system on each Cluster Failover server be installed on a separate bus than the storage drives being shared as cluster devices. The operating system could be installed on an IDE drive(s) or on a SCSI drive(s) controlled by a local SCSI controller or attached to the unused channel on the RAID controller. A good solution would be to mirror a set of drives in each cluster server that will hold the operating system.



1.3.1.1 Install Windows 2003 on the system to be used as a domain controller and configure it as a domain controller.

1.3.1.1 Install Windows 2003 to the two servers designated as cluster servers. After the operating system is install, perform the following procedure to

configure the driver under Microsoft* Windows 2003 Enterprise Server.

Note you can either install the SRCU42X driver when you install Windows 2003 or you can add the driver for the SRCU42X after the installation of Windows 2003.

1.3.1.1 Install SRCU42X when installation of Microsoft* Windows 2003

- ✧ Insert the installation CD for Microsoft* Windows 2003 into the CD-ROM, and boot the system from it.
- ✧ Press <F6> to install when the screen displays:
Press F6 if you need to install...
- ✧ Choose <S> to specify an additional device when the screen displays:
Setup could not determine the type...
- ✧ The system prompts for the manufacturer supplied driver disk.
Insert the driver diskette and press <Enter>.
Select the appropriate driver from the menu by highlighting it. Press <Enter> to proceed.
- ✧ Follow the normal Windows installation procedure.

1.3.1.2 Install SRCU42X on existing Windows 2003

- ✧ Power down the server
- ✧ Insert the SRCU42X as described above.
- ✧ Power on the server
- ✧ When the Found New Hardware Wizard screen displays the detected hardware device, click on **Next**
- ✧ When the next screen appears, select **Search for a suitable driver**, and click on **Next**. The **Locate Driver Files** screen appears.
- ✧ Insert the floppy diskette with the appropriate driver disk for Windows 2003, then select **Floppy disk drives** on the screen and click on **Next**. The Wizard detects the device driver on the diskette; the “Completing the upgrade device driver” wizard displays the name of the device.
- ✧ Click on **Finish** to complete the installation.

1.3.2 Network Requirements

The network requirements for clustering are:

- A unique NetBIOS cluster name
- Five unique, static IP addresses:
 - Two addresses are for the network adapters on the internal (private) network.(one for each server)
 - Two addresses are for the network adapters on the external (public) network.(one for each server)
 - One address for the cluster itself.
- A domain user account for Cluster Service (all nodes must be part of the same domain)
- Two network adapters for each cluster server node: one for connection to the external network, the other for the node-to-node internal cluster network. If you do not use two network adapters for each node, your configuration is unsupported. HCL certification requires a separate private network adapter.

1.3.3 Shared Disk Requirements

Disks can be shared by the nodes. The requirements for sharing disks are:

- All shared disks, including the quorum disk, must be physically attached to the shared bus.
- All disks attached to the shared bus must be visible from all nodes. You can check this at the setup level in the BIOS Configuration utility, which is accessed by pressing <Ctrl><G>.
- Each SCSI device must have a unique SCSI identification number assigned to it, and each device must be terminated properly. See the storage enclosure manual for information about installing and terminating SCSI devices.
- Configure all shared disks as basic (not dynamic).
- Format all partitions on the disks as NTFS.

It is best to use fault-tolerant RAID configurations for all disks. This includes RAID levels 1, 5, 10, and 50.

1.4 Cluster Installation

During installation, some nodes are shut down, and other nodes are rebooted. This ensures uncorrupted data on disks attached to the shared storage bus. Data corruption can occur when multiple nodes try to write simultaneously to the same disk that is not yet protected by the cluster software.

[Table 1.1](#) shows which nodes and storage devices must be powered on during each step.

Table 1.1 Nodes and Storage Devices

Step	Node 1	Node 2	Storage	Comments
Set Up Networks	On	On	Off	Ensure that power to all storage devices on the shared bus is turned off. Power on all nodes.
Set up Shared Disks	On	Off	On	Power down all nodes. Next, power on the shared storage, then power on the first node.
Verify Disk Configuration	Off	On	On	Shut down the first node. Power on the second node.
Configure the First Node	On	Off	On	Shut down all nodes. Power on the first node.
Configure the Second Node	On	On	On	Power on the second node after the first node was successfully configured.
Post-installation	On	On	On	All nodes must be active.

Before configuring the Cluster Service software follow these steps:

1. Install Windows 2003 Enterprise Server on each node.
2. Set up networks.

Note: These steps must be completed on every cluster node before proceeding with the configuration of Cluster Service on the first node. To configure the Cluster Service on a Windows 2003 Enterprise

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Server, you must be able to log on as administrator or have administrative permissions on each node. Each node must be a member server, or must be a domain controller inside the same domain. A mix of domain controllers and member servers in a cluster is not acceptable.

1.4.1 Installing Microsoft Windows 2003 Enterprise Server

Install Microsoft Windows 2003 on each node. See your Windows 2003 install manual for information. Log on as administrator before you configure the Cluster Services.

1.4.2 Setting Up Networks

Note: Do not allow both nodes to access the shared storage device before the Cluster Service is correctly configured. To prevent this, power down any shared storage devices, then power up nodes one at a time.

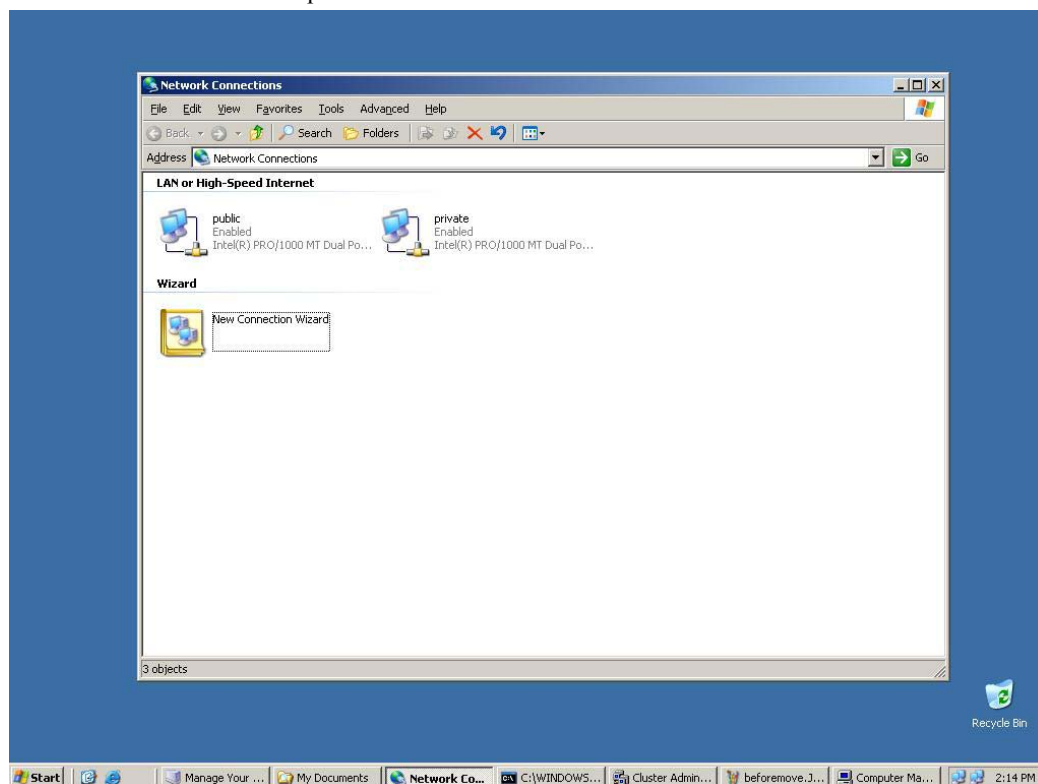
Install at least two network card adapters for each cluster node. One network card adapter card is used to access the public network. The second network card adapter is used to access the cluster nodes.

The network card adapter used to access the cluster nodes establishes the following:

- Node-to-node communications
- Cluster status signals
- Cluster Management

Ensure that all the network connections are correct. Network cards that access the public network must be connected to the public network. Network cards that access the cluster nodes must connect to each other. Verify that all network connections are correct, with private network adapters connected only to other private network adapters, and public network adapters connected only to the public network.

View the Network and Dial-up Connections screen to check the connections.



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Note: Use **crossover** cables for the internal network connection or connect to a separate hub/switch. If you do not use the crossover cables properly, the system does not detect the network card adapter that accesses the cluster nodes.

1.4.3 Configuring the Cluster Node Network Adapter

Note: The wiring determines which network adapter is private and which is public. For this chapter, the first network adapter (Local Area Connection) is connected to the public network; the second network adapter (Local Area Connection 2) is connected to the private cluster network. This might not be the case in your network.

1.4.3.1 Renaming the Local Area Connections

To clarify the network connection, you can change the name of the Local Area Connection (2). Renaming helps you identify the connection and correctly assign it. Follow these steps to change the name:

1. Right-click on the **Local Area Connection 2** icon.
2. Click on **Rename**.
3. In the text box, type "Private" and press **Enter**.
4. Repeat steps 1 through 3 to change the name of the **Local Area Connection 1** adapter to "Public".
5. The renamed icons look like those in the picture above. Close the Networking and Dial-up Connections window. The new connection names automatically replicate to other cluster servers as the servers are brought online.

1.4.4 Configuring the Private Network Adapter

Windows 2003 Enterprise Server installs the cluster service as default, so it needs to be configured and started. To setup the first node in your cluster:

1. Left-click on **Network Connections**, select **Private Connection**.
2. Right-click the **Private Connection** icon.
3. Right-click **Private Connection** again
4. Click on **Properties**.
5. Click on **Transmission Control Protocol/Internet Protocol (TCP/IP)**.
6. Click on **Properties**.
7. Click on the radio-button for **Use the following IP address**.
8. Enter the IP addresses you want to use for the private network.
9. Type in the subnet mask for the network.
10. Click the Advanced radio button, then select the WINS tab.
11. Select **Disable NetBIOS over TCP/IP**.
12. Click **OK** to return to the previous menu.

1.4.5 Configuring the Public Network Adapter

It is strongly recommended that you use static IP addresses for all network adapters in the cluster. This includes both the network adapter used to access the cluster nodes and the network adapter used to

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access the LAN (Local Area Network). If you must use a dynamic IP address through DHCP, access to the cluster could be terminated and become unavailable if the DHCP server goes down or goes offline.

1.4.6 Verifying Connectivity and Name Resolution

Perform the following steps to verify that the network adapters are working properly:

Note: Before proceeding, you must know the IP address for each network card adapter in the cluster.

You can view the IP configuration by using the IPCONFIG command on each node.

1. Click on **Start**.
2. Click on **Run**.
3. Type *cmd* in the text box.
4. Click on **OK**.
5. Type *ipconfig /all*, and press **Enter**. IP information is displayed for all network adapters in the machine.
6. If you do not already have the command prompt on your screen, click on **Start**.
7. Click on **Run**.
8. In the text box, type: "cmd"
9. Click on **OK**.
10. Type "ping ipaddress"
where *ipaddress* is the IP address for the corresponding network adapter in the other node. For example, you could set the IP addresses as follows:

Node	Network Name	Network Adapter IP Address
1	Public Cluster Connection	172.16.221.177
1	Private Cluster Connection	10.1.1.1
2	Public Cluster Connection	172.16.221.166
2	Private Cluster Connection	10.1.1.2

In this example, you would type:

Ping 172.16.221.177 and Ping 10.1.1.1 from Node 1.

Then you would type:

Ping 172.16.221.166 and 10.1.1.2 from Node 2.

To confirm name resolution, ping each node from a client using the node's machine name instead of its IP number.

1.4.7 Verifying Domain Membership

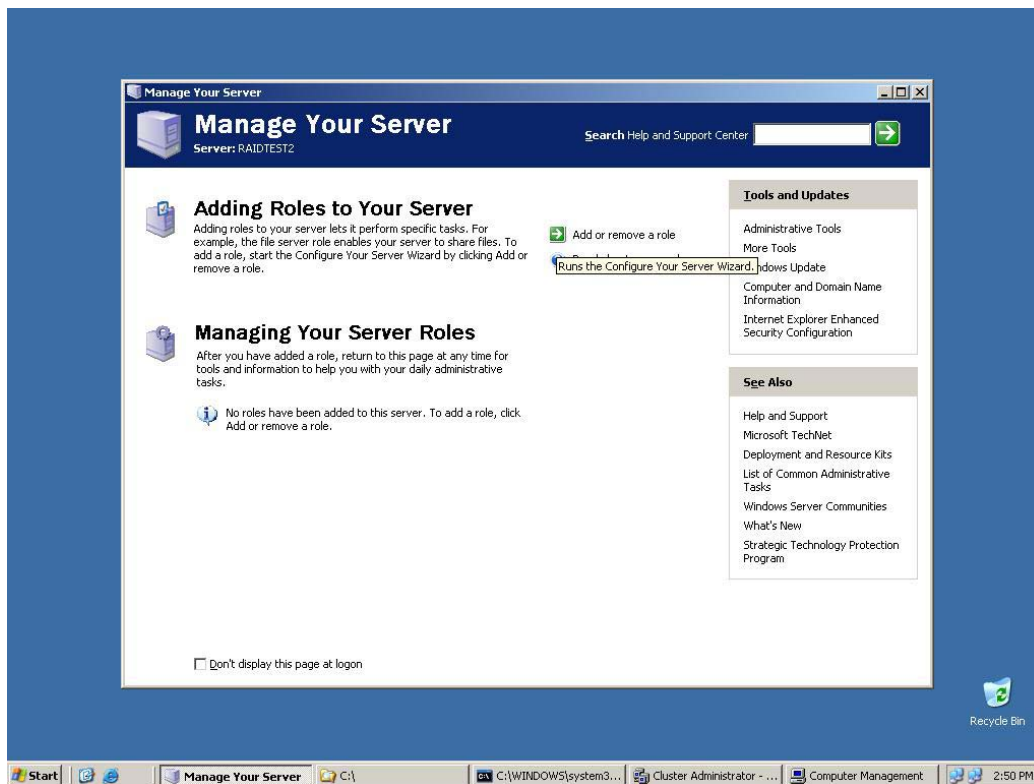
All nodes in the cluster must be members of the same domain and must be capable of accessing a domain controller and a DNS Server.

For example, a server is set up as a domain server with the domain name as "test.local". This can be accomplished with the following steps:

1. At the Start menu go to Administrative tools>Manage your server

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2. Add/remove roles to the server



3. Follow the screen instruction to key in the DOMAIN name, it needs to copy files from Windows 2003 installation disc. Server will be reboot automatically after installation.

1.4.8 Setting Up a Cluster User Account

The Cluster Service requires a domain user account under which the Cluster Service can run. Create the user account before configuring the Cluster Service. Setup requires a user name and password. This user account should not belong to a user on the domain.

To set up a cluster user account.

1. Administrative> **Active Directory Users and Computers**
2. Click the plus sign (+) to expand the domain name (if it is not already expanded.)
5. Click on **Users**.
6. Right-click on **Users**.
7. Point to New and click on **User**.
8. Type in the cluster name such as: **Cluster** and click on **Next**.
9. Set the password settings to User Cannot Change Password and Password Never Expires.
10. Click on **Next**, then click on **Finish to create this user**.

Note: If your company's security policy does not allow the use of passwords that never expire, you must renew the password on each node before password expiration. You must also update the Cluster Service configuration.

11. Right-click on **Cluster** in the right pane of the Active Directory Users and Computers snap-in.

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12. Select **Properties** from the context menu.
13. Click on **Add Members to a Group**.
14. Click on **Administrators** and click on **OK**. This gives the new user account administrative privileges on this computer.
15. Close the Active Directory Users and Computers snap-in.

1.4.9 Setting Up Shared Disks

1.4.9.1 Quorum Disk

The quorum disk stores cluster configuration database checkpoints and log files that help manage the cluster. Windows 2003 makes the following quorum disk recommendations:

- Create a small partition. Use a minimum of 50 Mbytes as a quorum disk. Windows 2003 generally recommends a quorum disk to be 500 Mbytes.
- Dedicate a separate disk for a quorum resource. The failure of the quorum disk would cause the entire cluster to fail; During the Cluster Service configuration, you must provide the drive letter for the quorum disk. For purposes of example, the letter **E** was used.

1.4.10 Configuring Shared Disks

To configure the shared disks:

1. Right-click on **My Computer**.
2. Click on **Manage**, then click on **Storage**.
3. Double-click on **Disk Management**.
4. Ensure that all shared disks are formatted as NTFS and are designated as Basic. If you connect a new drive, the Write Signature and Upgrade Disk Wizard starts automatically. If this occurs, click on **Next** to go through the wizard. The wizard sets the disk to dynamic, but you can uncheck it at this point to set it to basic. To reset the disk to Basic, right-click on **Disk #** (where # identifies the disk that you are working with) and click on **Revert to Basic Disk**.
5. Right-click on unallocated disk space.
6. Click on **Create Partition...** . The Create Partition Wizard begins.
7. Click on **Next** twice.
8. Enter the desired partition size in Mbytes, and click on **Next**.
9. Accept the default drive letter assignment by clicking on **Next**.
10. Click on **Next** to format and create a partition.

1.4.11 Assigning Drive Letters

After you have configured the bus, disks, and partitions, you must assign drive letters to each partition on each clustered disk. Follow these steps to assign drive letters.

Note: Mountpoints is a feature of the file system that lets you mount a file system using an existing directory without assigning a drive letter. Mountpoints are **NOT** supported on clusters. Any external disk that is used as a cluster resource must be partitioned using NTFS partitions and must have a drive letter assigned to it.

1. Right-click on the desired partition and select **Change Drive Letter and Path**.
2. Select a new drive letter.

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3. Repeat steps 1 and 2 for each shared disk.
4. Close the Computer Management window.

1.4.12 Verifying Disk Access and Functionality

To verify disk access and functionality:

1. Click on **Start**.
 2. Click on **Programs**. Click on **Accessories**, then click on **Notepad**.
 3. Type some words into Notepad and use the File/Save As command to save it as a test file called test.txt. Close Notepad.
 4. Double-click on the **My Documents** icon.
 5. Right-click on test.txt and click on **Copy**.
 6. Close the window.
 7. Double-click on **My Computer**.
 8. Double-click on a shared drive partition.
 9. Click on **Edit** and click on **Paste**.
 10. A copy of the file should now exist on the shared disk.
 11. Double-click on **test.txt** to open it on the shared disk.
 12. Close the file.
 13. Highlight the file, and press the **Del** key to delete it from the clustered disk.
 14. Repeat the process for all clustered disks to ensure they can be accessed from the first node.
- After you complete the procedure, shut down the first node, power on the second node, and repeat the procedure above. Repeat again for any additional nodes. After you have verified that all nodes can read and write from the disks, turn off all nodes except the first, and continue with this guide.

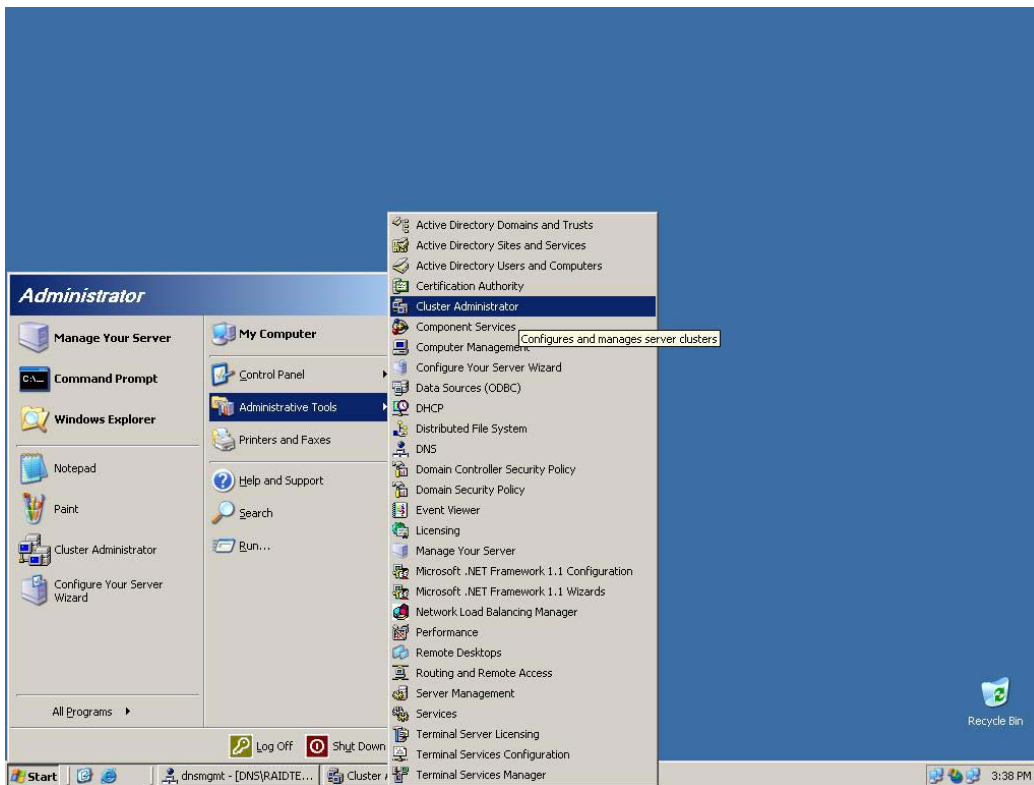
1.4.13 Configure Cluster Service

Before you begin the Cluster Service Software configuration on the first node, ensure that all other nodes are either powered down or stopped and that all shared storage devices are powered on.

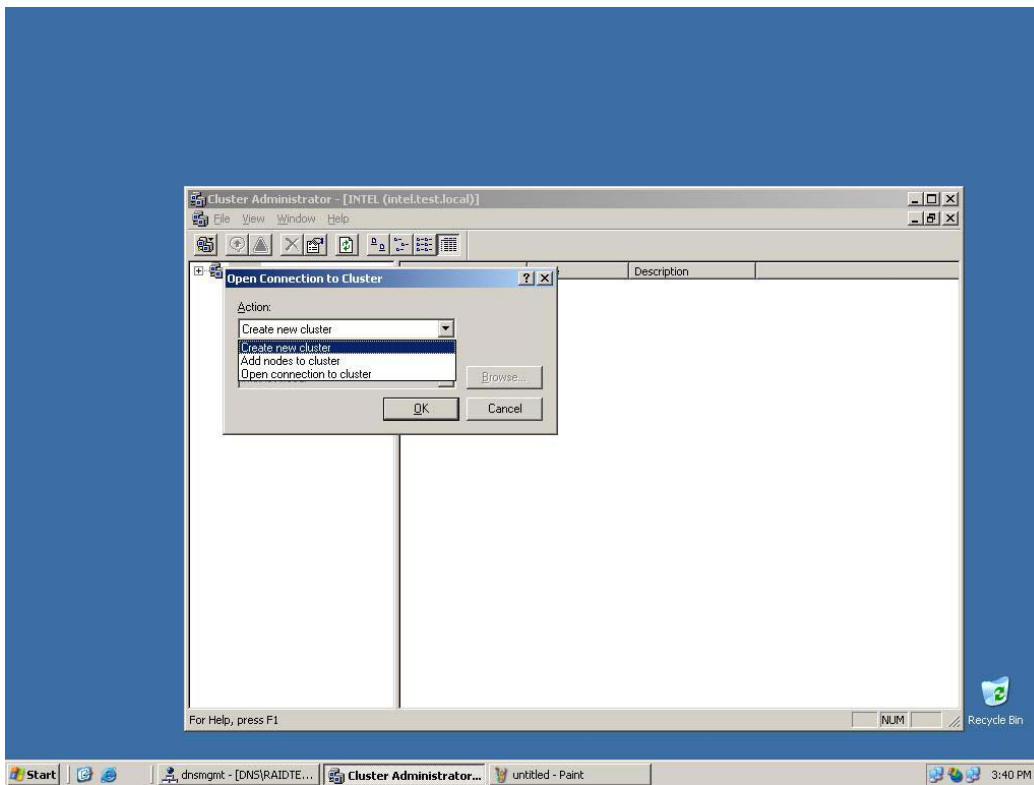
To create the cluster, you must provide the cluster information.

1. Administrative tools> Cluster Administrator

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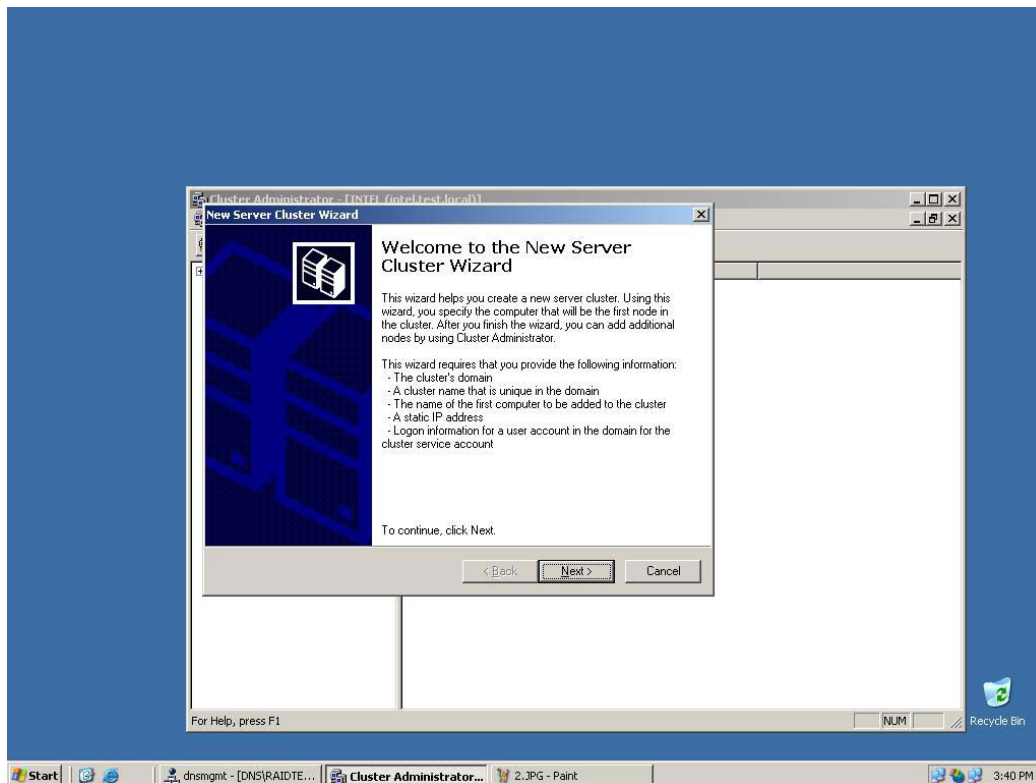


2. Select “Create new cluster”

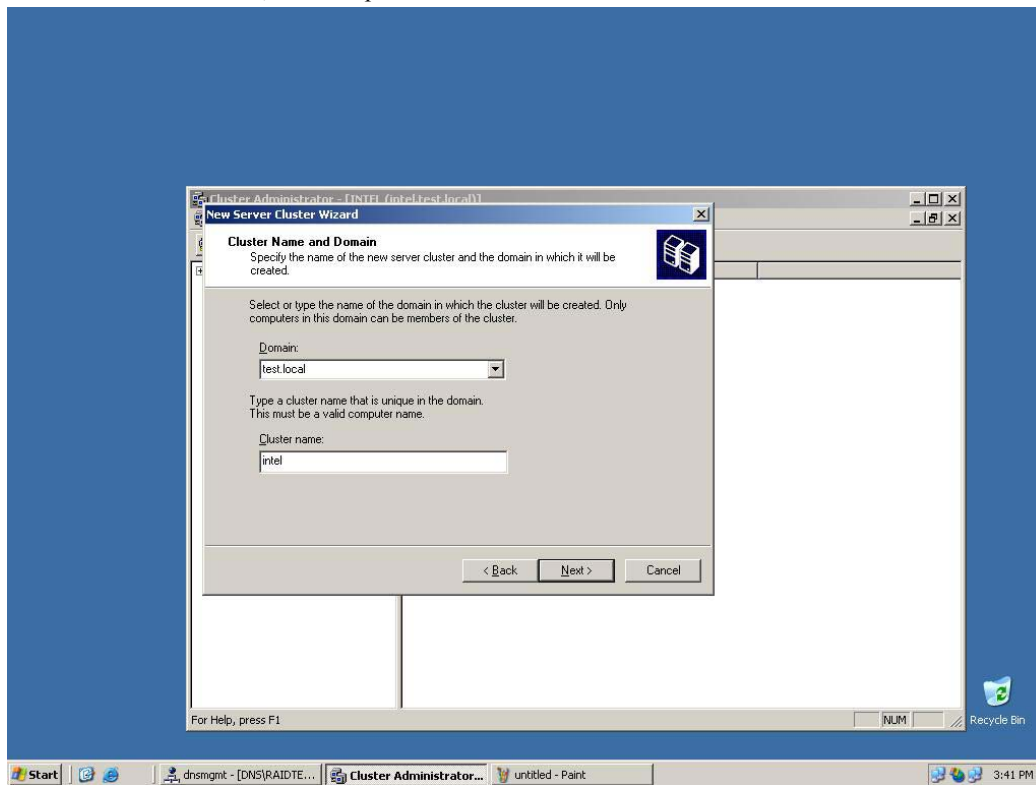


3. Click “Next”

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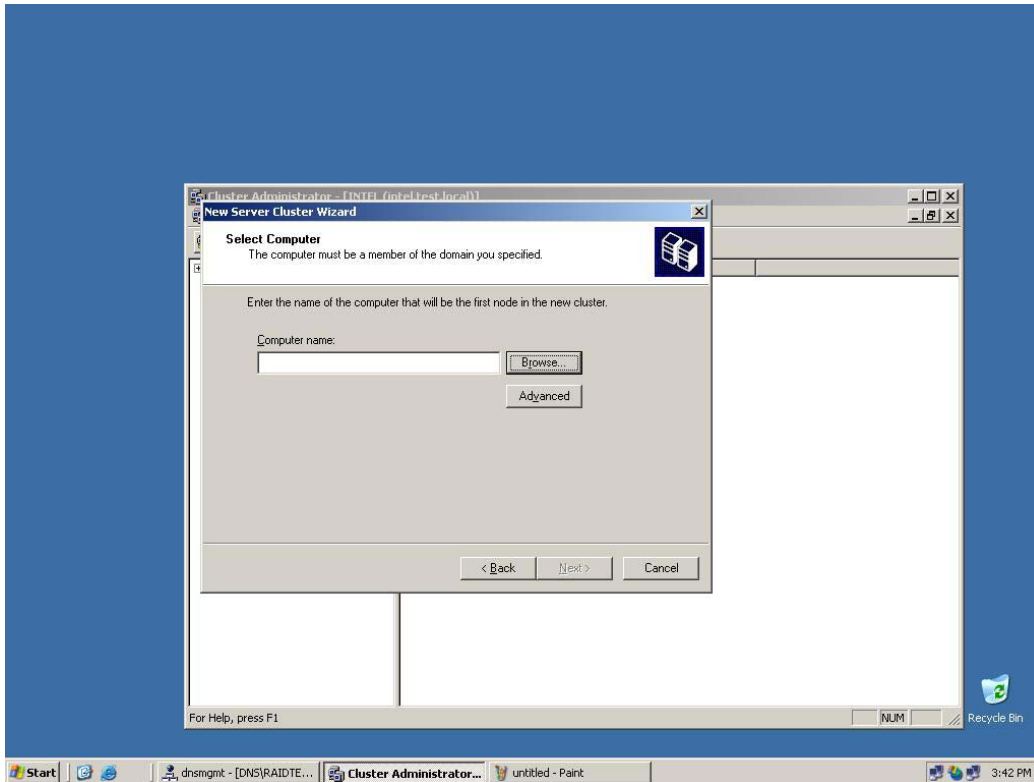


4. Enter the Cluster name, for example “intel”.

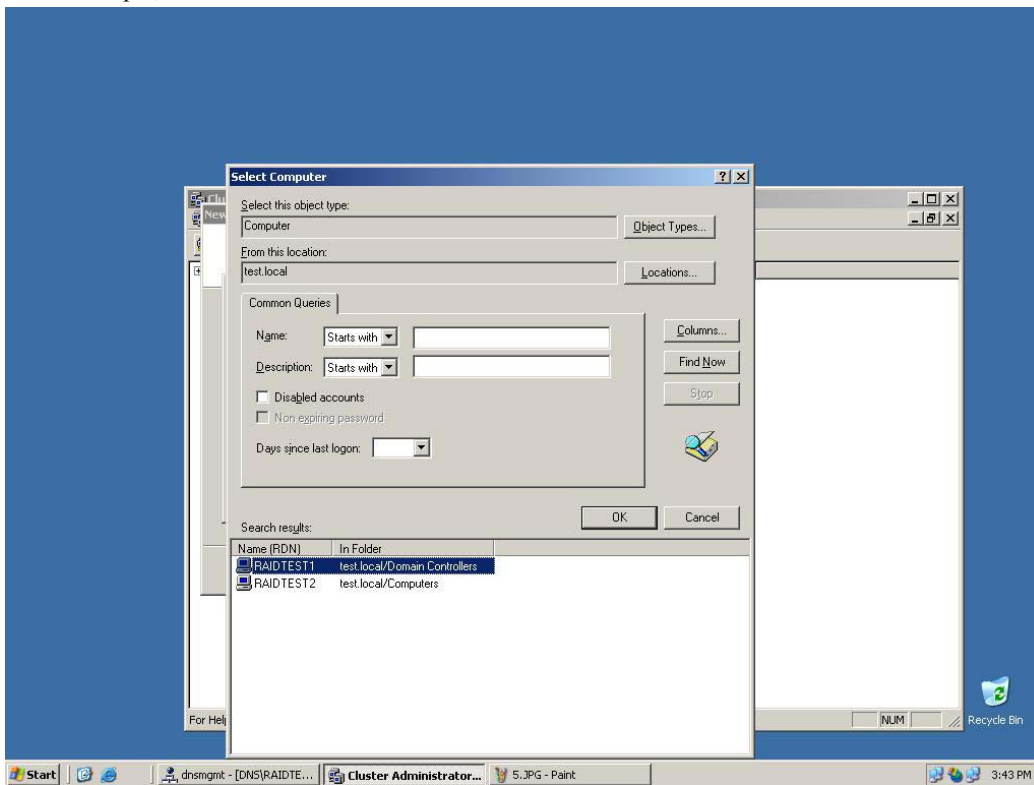


4. Select the server name you want to add into the cluster

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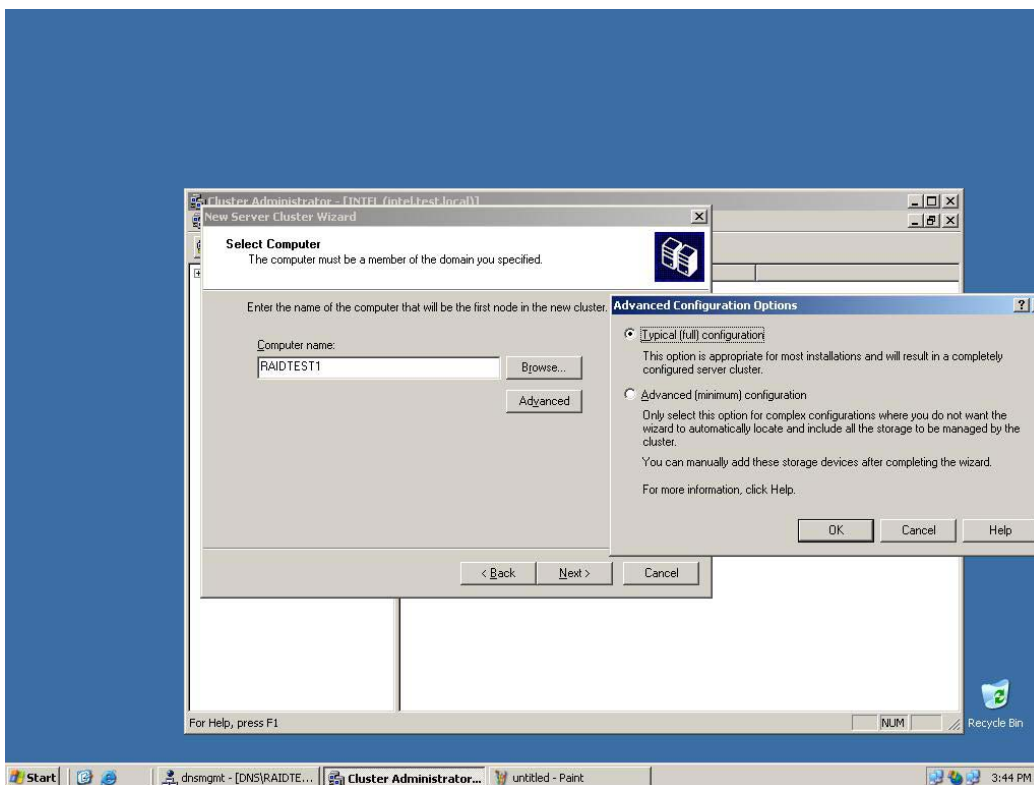


In the example, the two nodes “RAIDTEST1” & “RAIDTEST2” are used.

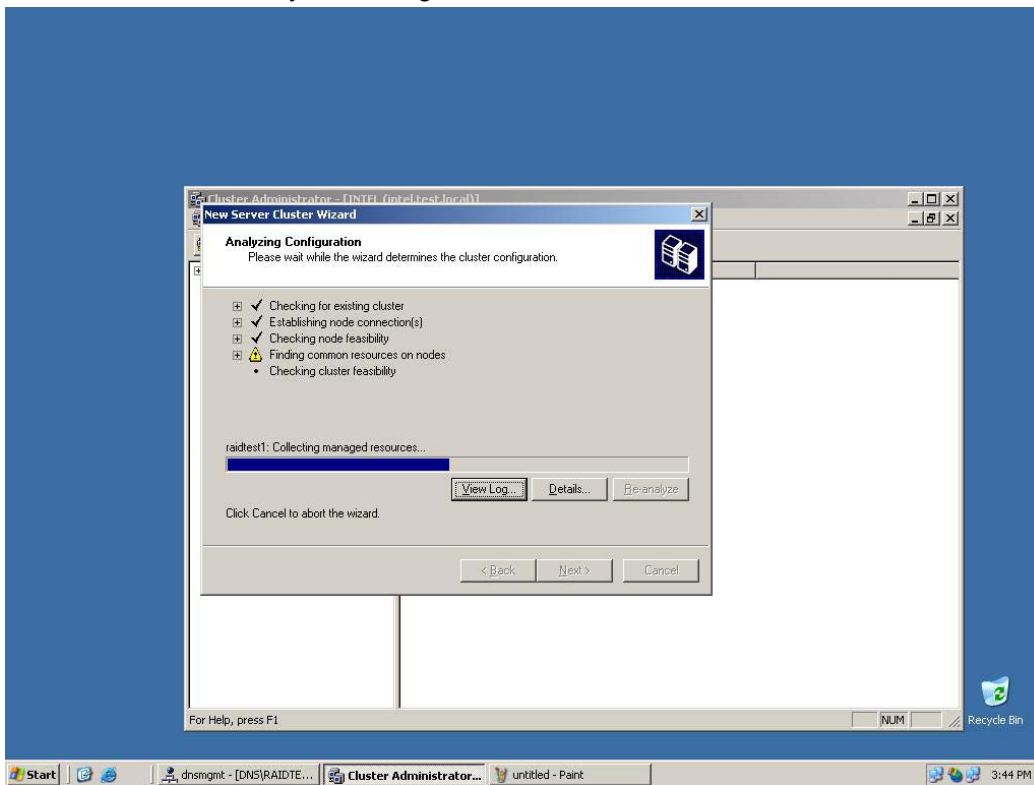


5. Select RAIDTEST1, you can choose either “Full configuration” or “Minimum configuration”

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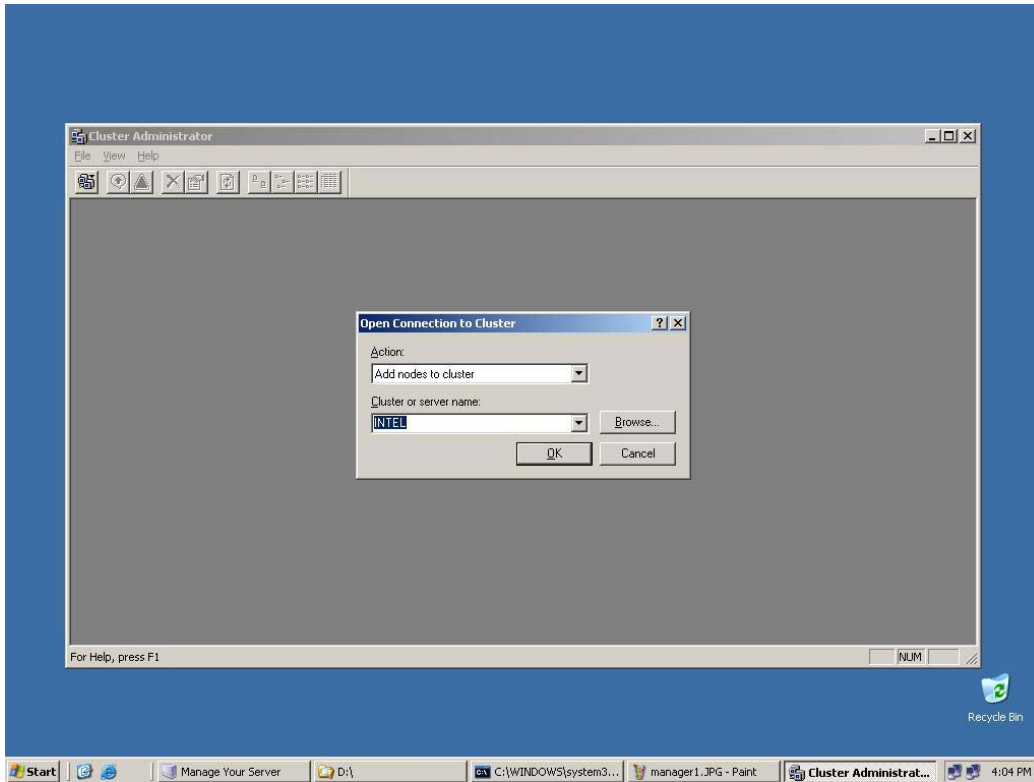
7. Cluster wizard will analyze the configuration.



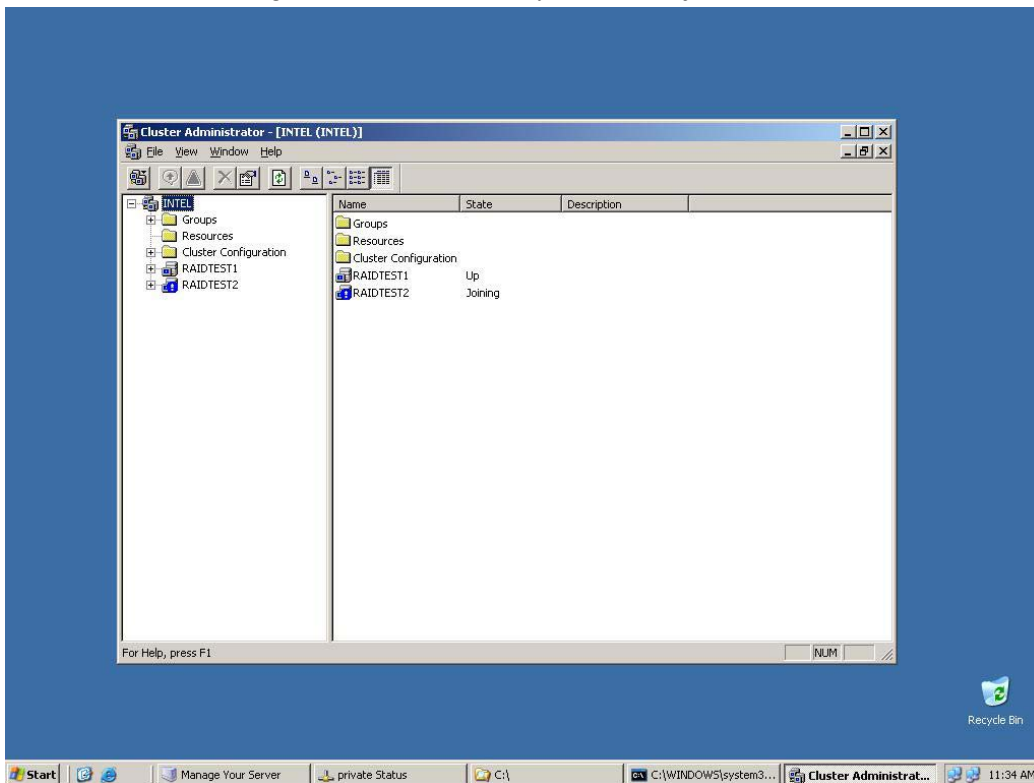
8. After successfully analyzing the configuration, you will be prompted to enter one user for cluster service configuration. Enter the user name and password that you created above.
9. To configure the Cluster for second server, just choose " Add nodes to cluster". Repeat steps 5

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through 8.

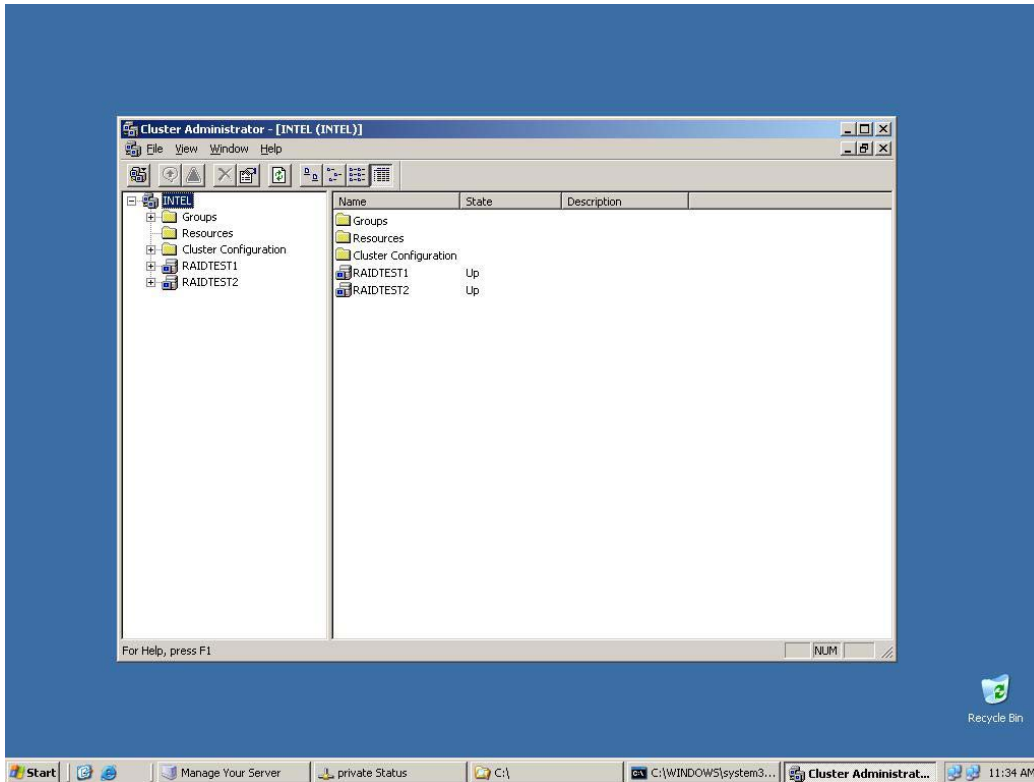


10. After successful configuration of second server, you will see it join into the cluster.



11. The cluster configuration is complete.

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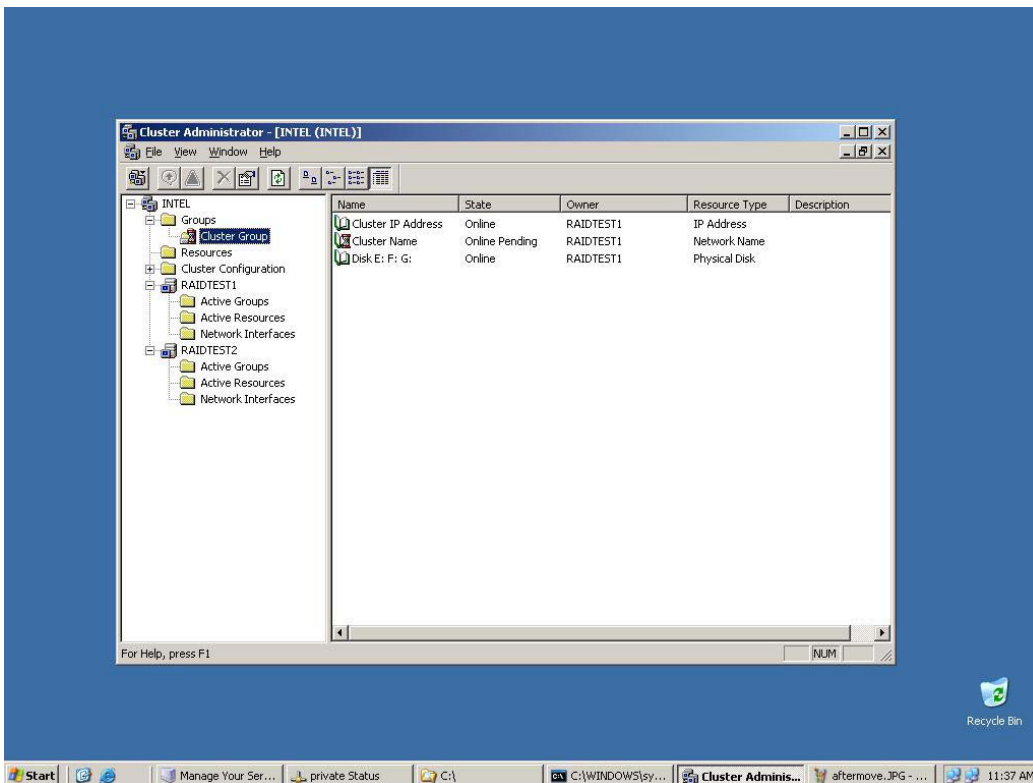
1.4.17 Verifying Installation

There are several ways to verify that Cluster Service was successfully installed. Here one example:

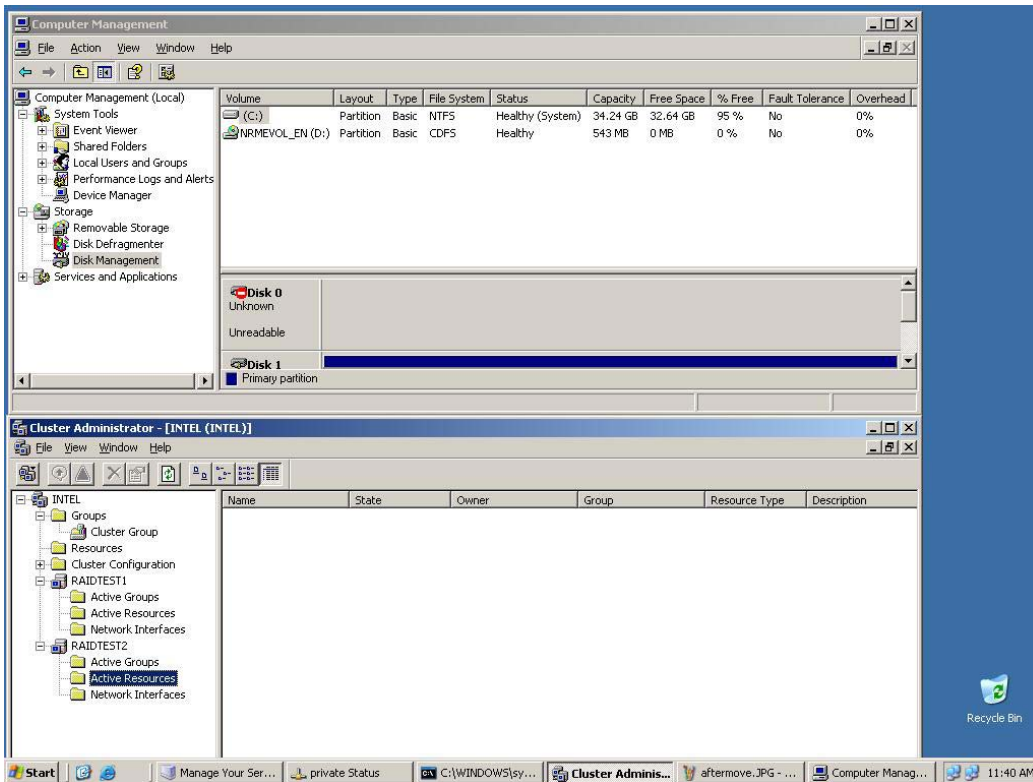
1. Click **Start**, click **Programs**, click **Administrative Tools**, then click **Cluster Administrator**.

The presence of two nodes (pictured below) shows that a cluster exists and is in operation.

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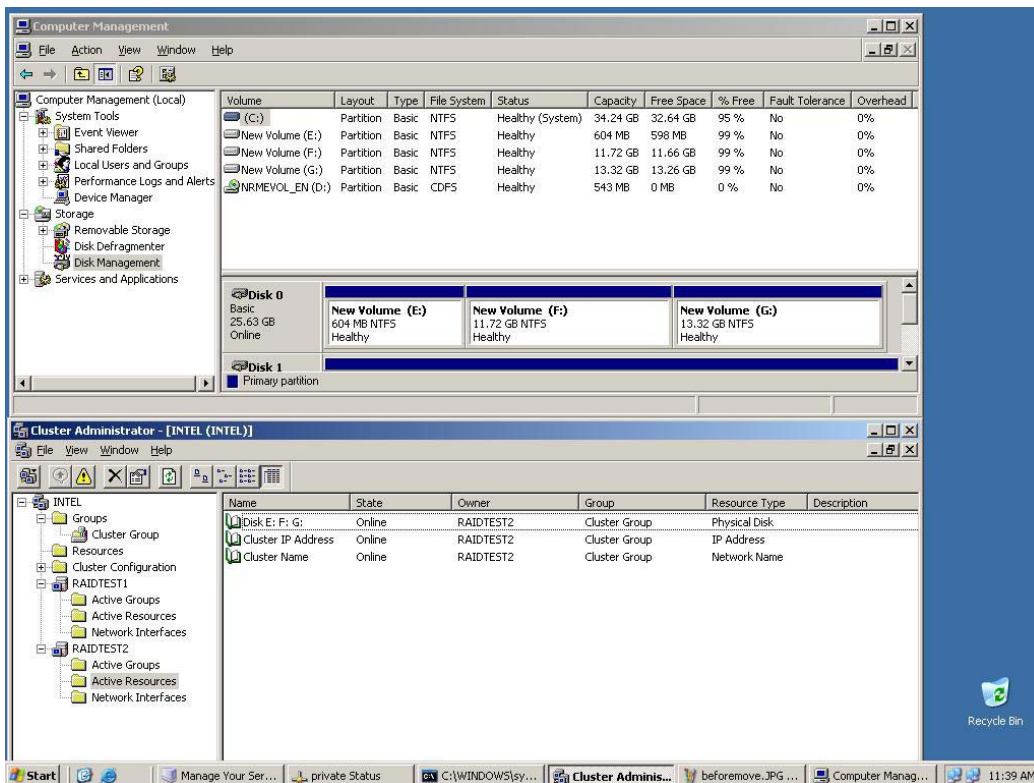


2. Right-click the group Cluster Group 1, and select the option **Move**. This option moves the group and all its resources to another node. Disks E: F:and G: are brought online on the second node. Watch the screen to see this shift. Close the Cluster Administrator snap-in. Before the move:



After Move:

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You can see the disks E: F: G: become available after you move the resource from node “RAIDTEST1” to node “RAIDTEST2”.

This completes installing Cluster Service on all nodes. The server cluster is fully operational. Now you can install cluster resources, such as file shares, printer spoolers, cluster aware services like IIS, Message Queuing, Distributed Transaction Coordinator, DHCP, WINS, or cluster aware applications like Exchange or SQL Server. Please refer Microsoft document for more detailed support on how to add resources into the cluster.