



Microsoft SQL Server Service Failover Using Microsoft Cluster Server

TechNote

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Chapter 1

About This TechNote

Introduction

The purpose of this document is to provide a practical and effective way of implementing a successful Compaq ProLiant Cluster service failover for Microsoft SQL Server.

Expected Audience

This document is intended to help in the installation, configuration and administration of Microsoft Cluster Server with Microsoft SQL Server and assumes that the reader has working knowledge of the following:

- Installing and configuring Compaq Servers and Compaq ProLiant Cluster Servers
- Installing and configuring Microsoft Windows NT Server Enterprise
- Microsoft Windows NT Server interface and setting up and administering user accounts in a domain
- Installing and configuring Microsoft SQL Server
- Installing, configuring, and administering Microsoft Cluster Server

Text Conventions

This document uses the following conventions to distinguish elements of text:

Table 1-1
Text Conventions

Convention	Use
OK, CANCEL	Window command button labels appear in bold caps.
CTRL + DEL	Keyboard keys appear in bold caps.
<i>c:\dirname\filename.exe</i>	Path Names of items such as files, directories, resources, groups, and services appear in bold italics.
Select Item → Item	Items you select from a pull down menu appear in bold initial caps, separated by arrows for each submenu item
<i>USER INPUT</i>	Information to be entered by the user is shown in uppercase italics

Chapter 2

Overview of a Failover

Types of Failovers

In the first release of Microsoft Cluster Server, there are two types of failovers: service and resource. Both types of failovers allow for high levels of server and application availability.

In a service failover configuration, a service is defined to Microsoft Cluster Server as a resource. Once defined, its Failover Manager Process ensures that the service is running on only one member of the cluster at a given time. Although the service is running on only one member of the cluster at a time, the resource group where the service is defined uses a common name. Therefore, all services running on that resource group are available to all connected network client machines using the common name.

A more comprehensive model is the resource failover, which takes advantage of Independent Software Vendor's (ISV) cluster-aware resource DLLs to execute the failover. In a resource failover configuration, it is assumed that the service is running on both members of the cluster and that some resource such as a database or a website fails over, and not the service.

Since most ISV applications do not yet have resources to make them cluster-aware, service failovers are the most common forms of implementing the failover in Microsoft Cluster Server. Microsoft provides a generic service resource DLL to allow these applications to function under Microsoft Cluster Server.

What are the Advantages of a Failover?

Both service and resource failovers provide a highly available computing environment with relative simplicity and can be used for both planned and unplanned service outages. A planned outage occurs when one of the members in the cluster is taken off-line for upgrades or maintenance. An unplanned outage occurs when one of the members or the application on that member fails. During both types of outages, the services and/or resources can be moved to the other member of the cluster. Since the clients do not communicate to the server directly but through a virtual server, the failover can be transparent to the clients.

Note: This depends on the mechanism that allows the client and the clusters to re-establish a live connection to continue the services. For example, developing client software that automatically re-establishes a connection after losing them provides near transparent failover.

What are the Disadvantages of a Failover?

One of the main disadvantages of a Microsoft Cluster Server Failover is that in a failover condition, the performance of the server taking over the work load of the failed server may degrade since it is now doing the work of both servers. However, by manually balancing the load and selecting the appropriate hardware, performance degradation can be minimized.

Another major disadvantage of a failover environment is that the state information of the application is not monitored. As a result when the application fails over, an entire new instance of the application is started. Any work in progress is lost and data recovery must occur.

Chapter 3

Model Failover Environment

The model environment presented here consists of two Compaq ProLiant servers sharing a ProLiant Storage Unit and its drives, networked to each other through a LAN and a dedicated server interconnect.

To enhance availability, Compaq strongly recommends the use of at least two PCI network cards per server. One of these cards should be connected to its counterpart in the other node of the cluster via a private hub or a special crossover cable, such as the one supplied in the cluster kit. These cards should be configured for cluster communication only. The other card in each server should be configured for both client access and cluster communication. This configuration allows the client network to provide an alternative path for the heartbeat should the dedicated connection fail.

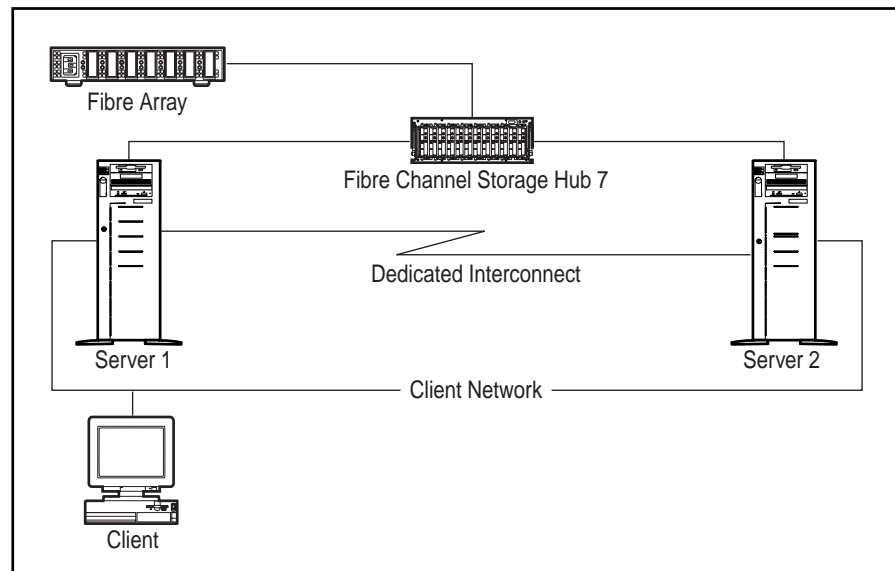


Figure 3-1. Standard ProLiant Cluster Configuration

For even higher availability, Compaq recommends the use of duplexed network cards configured for client access and cluster communication in addition to using a dedicated connection as described above.

Model Environment Naming Conventions

Table 3-1
System and Cluster Specifics

Operating System	Windows Enterprise Server 4.0 w/ Service Pack 3
Domain Name	SOLNET
Name of Server 1	SQL_NODE1
IP Address of Server 1	110.2.13.1 (subnet mask 255.255.0.0)
IP Address of Interconnect	110.2.2.1 (subnet mask 255.255.255.0)
Name of Server 2	SQL_NODE2
IP Address of Server 2	110.2.13.2 (subnet mask 255.255.0.0)
IP Address of Interconnect	110.2.2.2 (subnet mask 255.255.255.0)
Name of Cluster	SQL_CLUSTER
IP Address of Cluster	110.2.13.10 (subnet mask 255.255.0.0)
Name of Virtual Server 1	SQLNAME
IP Address of Virtual Server 1	110.2.13.15 (subnet mask 255.255.0.0)
IP Address of Interconnect	110.2.2.3 (subnet mask 255.255.255.0)

Table 3-2
Application Specifics

Service	MS SQL SERVER 6.5
Location of Executables	V:\MSSQL
Location of Log Files	V:\MSSQL\LOG
Location of Data Files	X:\MSSQL\DATA

Table 3-3
SQL Server Group

Shared Disk(s)	V:, W:, X:
IP address	110.2.13.15 (subnet mask 255.255.0.0)
Network Name	SQLNAME
Service	MSSQLServer
Service	SQLExecutive

Hardware Requirements

Server Configuration

Two Compaq ProLiant 5000 Servers, each with:

- 4P, P5/200 Processor, 512-Mb memory
- Compaq Netelligent 10/100 TX PCI UTP NIC
- Compaq Fibre Channel Host Controller /P

Compaq Fibre Channel Array with:

- Compaq Fibre Channel Array Controller
- Compaq Fibre Channel Loop

Client Configuration

Compaq ProLiant 1500 Server with:

- 2P, P5/133 Processor, 64-Mb memory

For detailed configuration information, see Appendix A.

Software Requirements

Microsoft NT Server Enterprise with:

- Microsoft Service Pack 3

Compaq Utilities:

- Compaq System Configuration Utility version 2.35 or later
- Compaq Array Configuration Utility version 1.20 or later
- Compaq NT Software Support Disk version 2.02 or later

Note: To create a cluster, a Domain environment is required using TCP/IP as the network protocol. Both servers as a cluster should be configured to be servers in the domain. It is highly recommended that you do not use either server in a cluster as a Primary or Backup domain controller.

Chapter 4

Software Installation Process

Installation of Microsoft Cluster Server

Microsoft Cluster Server must be installed on both servers before installing the application. Detailed installation instructions are not provided in this document. For detailed instructions on how to setup a cluster refer to *Introduction to Compaq ProLiant Clusters*. The following table details the necessary information to complete the installation of Microsoft Cluster Server on both servers:

Server 1

Table 4-1
Microsoft Cluster Server Installation Specifics

Domain Name	SOLNET
Cluster Name (to form)	SQL_CLUSTER
Cluster IP address	110.2.13.10 (subnet mask 255.255.0.0)
Shared Disks	V:, W:, X:
Cluster Admin User / Password	WOLFPACK / <password>
Location of Cluster Executables	Default (C:\WINNT\CLUSTER)
Quorum Disk	Disk V:

Server 2

Table 4-2
Microsoft Cluster Server Installation

Domain Name	SOLNET
Cluster Name (to join)	SQL_CLUSTER
Cluster Admin Password	<password>
Location of Cluster Executables	Default (C:\WINNT\CLUSTER)

Installation of Microsoft SQL Server

The following procedure is not an in-depth installation guide for SQL Server 6.5. It provides information to make the correct decisions regarding Microsoft Cluster Server environments. To install SQL Server 6.5 in a cluster server environment, perform the following steps:

1. User Cluster Administrator to move all three disk groups to **SQL_NODE1**.
2. Insert the MS SQL Server 6.5 CD into the CD-ROM drive. Run `z:\i386\setup.exe` (where z is the CD-ROM drive letter) to install “Microsoft SQL Server 6.5” on **SQL_NODE1**.
3. Click **CONTINUE** when the “**Welcome**” screen is displayed.
4. Enter Name and Organization information, then click **CONTINUE**.
5. Verify Name and Organization, then click **CONTINUE**.

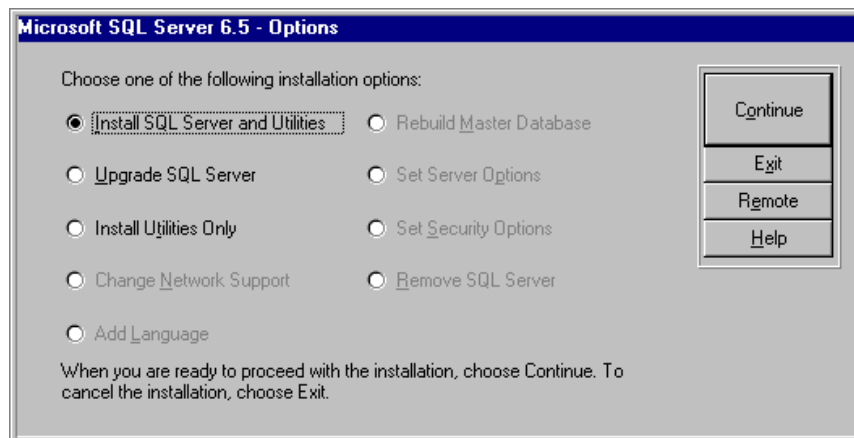


Figure 4-1. Microsoft SQL Server 6.5 Options Dialog Box

6. Select **Install SQL Server and Utilities**, then click **CONTINUE**.
7. The “**Choose Licensing Mode**” screen is displayed. If using the “Per Server” method of license management, click **ADD LICENSES**. In the “Quantity” field, enter the number of valid SQL Server Client licenses purchased from Microsoft, then click **OK**.

If you are using the “Per Seat” method of license management, select **Per Seat**.

4-4 Software Installation Process

Note: In “Per Seat” licensing, each client computer must be configured with a SQL Server license before it can access the SQL Server Database. Refer to SQL Server 6.5 documentation for details.

8. Click **CONTINUE**. Licensing information is displayed. Click the **I agree that** check box, then click **OK**.

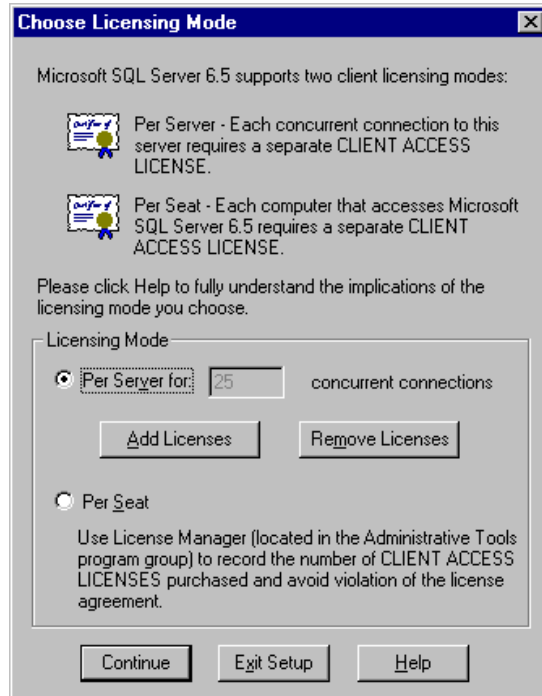


Figure 4-2. Choose Licensing Node Dialog Box

9. The “**SQL Server Installation Path**” screen is displayed. In the “Drive” field, select the shared drive created in the previous section **Initial Cluster Server Setup**. Then enter the directory to install SQL Server 6.5. This directory is where SQL Server installs its utilities and support files. Click **CONTINUE**.

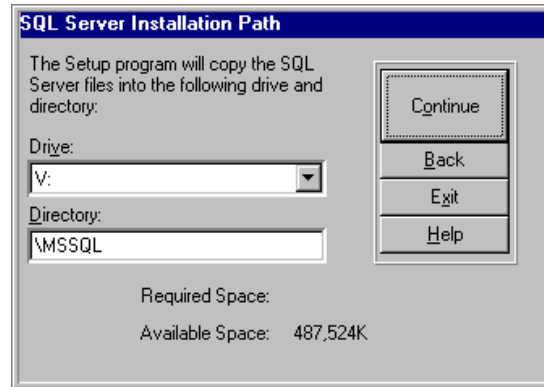


Figure 4-3. SQL Server Installation Path Dialog Box

4-6 Software Installation Process

10. The “**MASTER Device Creation**” screen is displayed. SQL Server needs to know the location of the Master database device. In the “Drive” list box, enter the name of the shared drive created earlier. In the “Directory” field, enter the directory and filename for the Master database device location. In the “MASTER device Size (MB)” field, enter the size for the Master database device. Click **CONTINUE**.



Figure 4-4. SQL Server Installation Path Dialog Box

11. The **SQL Server Books Online** screen is displayed. Select the desired option, then click **CONTINUE**.

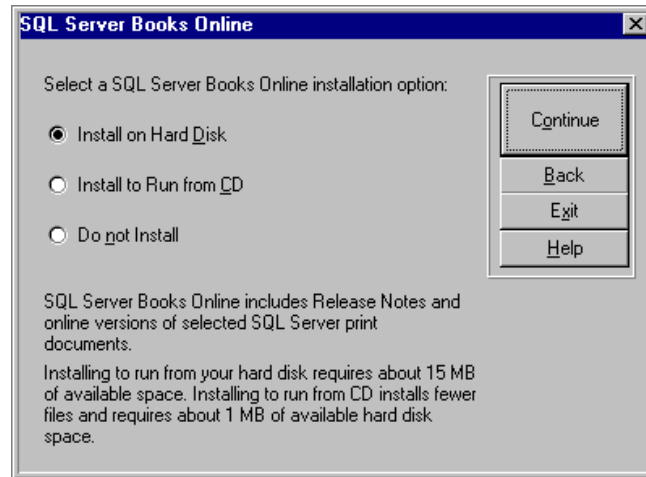


Figure 4-5. SQL Server Books Online Dialog Box

4-8 Software Installation Process

12. The “**Installation Options**” screen is displayed. Select any desired Character Sets, and Sort Orders now by clicking on “**Sets...**” or “**Orders...**” respectively. After each change, the “**Installation Options**” screen is again displayed.

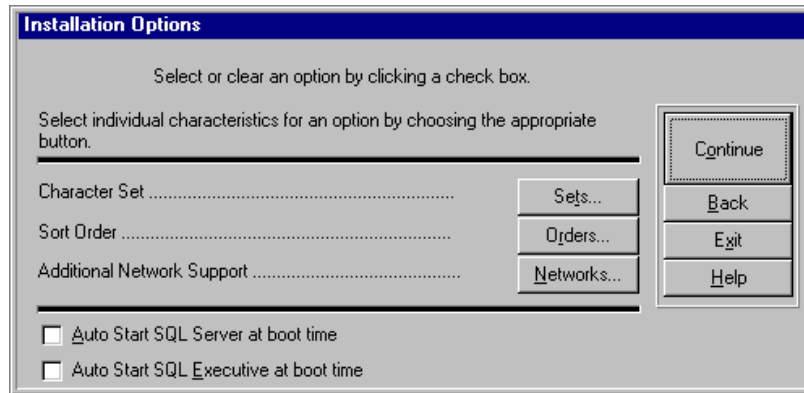


Figure 4-6. Installation Options Dialog Box

Note: Do not activate the two Auto Start options at the bottom of the dialog box. SQL Server automatically starting in this Cluster scenario could cause errors during Windows NT Server bootup.

13. Click on **Networks...**. The “**Select Network Protocols**” screen is displayed. **Named Pipes** is already selected. Select **TCP/IP Sockets** by clicking on the associated check box, then click **OK** to return to the **Installation Options** screen. Click **CONTINUE**.

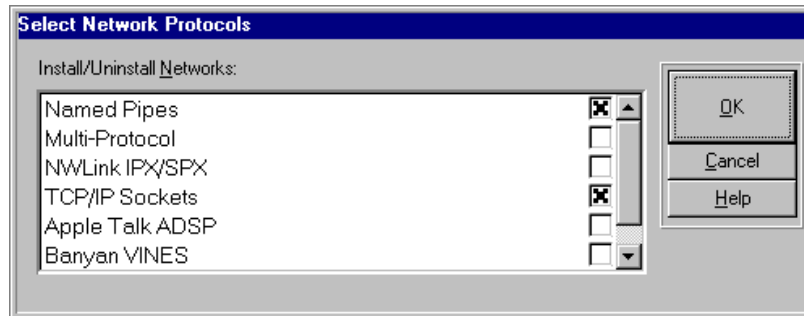


Figure 4-7. Select Network Protocol Dialog Box

14. The “**SQL Executive Log On Account**” screen is displayed. Enter the appropriate information, then click **CONTINUE**. If needed, consult the SQL Server 6.5 documentation for more information.

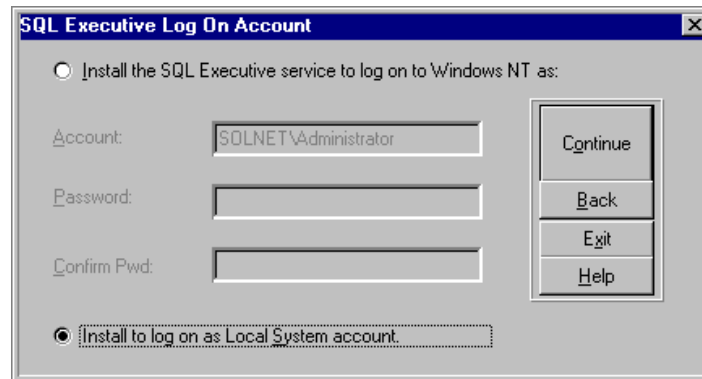


Figure 4-8. SQL Executive Log On Account Dialog Box

15. The “**TCP/IP Socket Number**” screen is displayed. Socket **1433** is the officially assigned socket number for Microsoft SQL Server, and should not be changed for interoperability reasons. Click **CONTINUE** to accept the default value and Microsoft SQL Server completes the installation without further interaction.

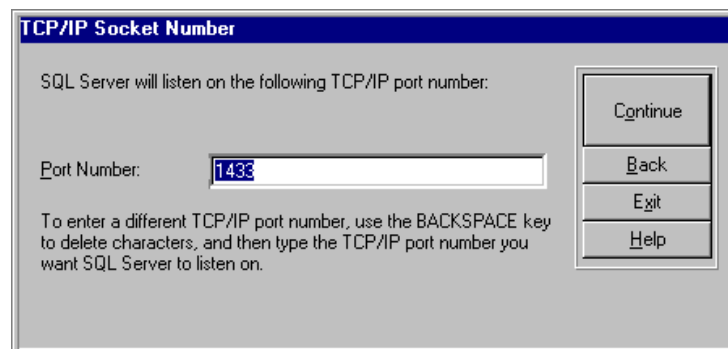


Figure 4-9. TCP/IP Socket Number Dialog Box

Installation of Microsoft SQL Server on SQL_NODE2

Once Microsoft SQL Server has been installed on **SQL_NODE1**, use Cluster Administrator to move all three disk groups from **SQL_NODE1** to **SQL_NODE2**.

1. From **SQL_NODE2**, open a DOS Prompt and go to the directory:
V:\MSSQL\BINN
2. Run the command: *SETUP /T RegistryRebuild = ON*. This runs the Microsoft SQL setup program and sets up all the registry values and services needed without copying files.

Note: You must enter this exactly as it is shown. Otherwise the installation of SQL Server on **SQL_NODE2** will fail.

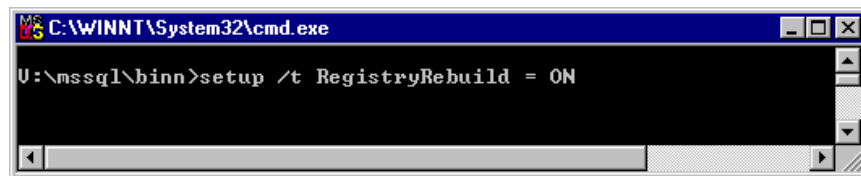


Figure 4-10. SQL_Node2 Setup Command Prompt

3. During the installation of SQL Server on **SQL_NODE2**, use the same values that were used to install **SQL_NODE1**.

Note: Once Microsoft SQL Server is installed on both servers, make sure that the Microsoft SQLServer and SQLExecutive services are setup for Manual start on both nodes of the cluster.

Chapter 5

Configuring Microsoft Cluster Server

Creating Microsoft SQL Server Resource Group

The Microsoft SQL Server Resource Group must be created before creating the resources.

1. Start the Cluster Administrator.
2. Select **Disk Group 1**, then right-click to display the floating menu.
3. Select **Rename** then change the name of the resource group from **Disk Group 1** to **SQL Server**.

Once the resource group SQL Server has been created, the necessary resources can be created for the group.

Table 5-1
SQL Server Group

Resource Group Name	SQL Server
Preferred Nodes	SQL_NODE1, SQL_NODE2
Failover Option	Default
Failback Option	Default

Creating the SQL Server Resources

Use the following table to create the following resources for this group.

**Table 5-2
Resource Group (SQL Server)**

Physical Disk(s)	X:, Y:, Z:	X: , Y:, Z:,
IP Address	ip_MSSQL	110.2.30.15
Network Name	nm_MSSQL	SQLNAME
Generic Service	srv_MSSQLServer	MSSQLServer
Generic Service	srv_SQLExecutive	SQLExecutive

The following sections detail the configuration of each resource.

Physical Disk

Use the following information to setup your Shared Disk resource.

**Table 5-3
SQL Server Group (Physical Disk)**

Resource Name	Disk(s) V:, W:, X:
Resource Type	Physical Disk(s)
Shared Disk	Disk(s) V:, W:, X:
Dependencies	None

Normally, the **Shared Disk Resource** already exists in your cluster and does not have to be created. Copy this resource to the resource group(s) you create or rename the group where this resource is located.

Creating IP Address Resource

Use the following information to setup your IP Address Resource.

Table 5-4
SQL Server Group (IP Address)

Resource Name	ip_MSSQL
Resource Type	IP Address
IP address	110.2.13.15 (subnet mask 255.255.0.0)
Dependencies	None

1. To create the **IP Address Resource**, select the **SQL Server** resource group then click the right mouse button. Select **New**→**Resource** from the floating menu and the **New Resource** dialog box is displayed.

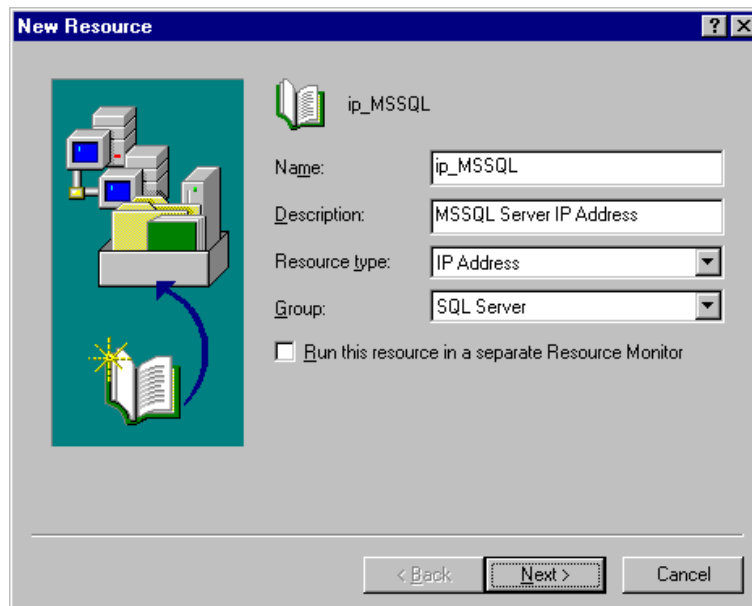


Figure 5-1. New Resource Dialog Box

5-4 Configuring Microsoft Cluster Server

2. Enter a name, **ip_ MSSQL**, for the IP Address Resource.
3. Enter desired text for the **Description**.
4. Select **IP Address** for the **Resource Type** from the drop down box.
5. Select **SQL Server** for the **Group** from the drop down box.
6. Click **Next** to continue.
7. At the **Possible Owners** dialog box, both servers should be in the **Possible Owners** list box. Accept this default by clicking **Next**.

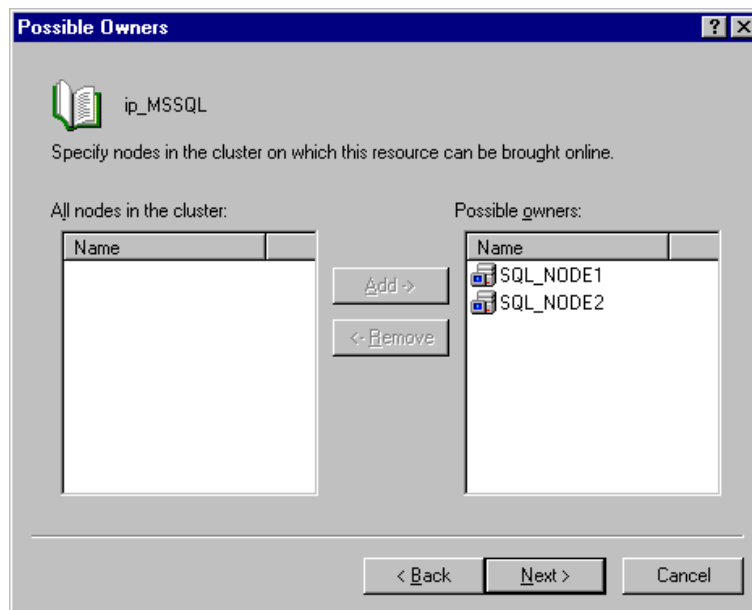


Figure 5-2. Possible Owners Dialog Box

- There are no dependencies, so accept the defaults in the **Dependencies** dialog box and click **Next**.

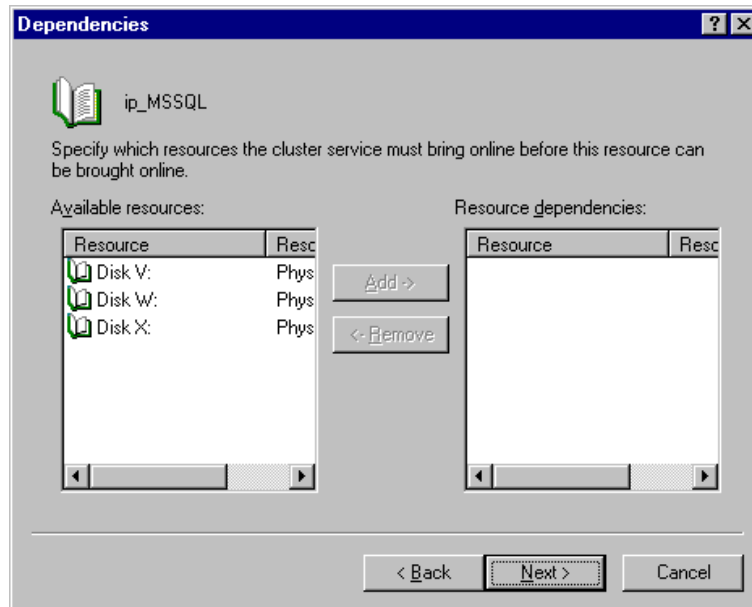


Figure 5-3. Dependencies Dialog Box

5-6 *Configuring Microsoft Cluster Server*

9. From the **TCP/IP Address Parameters** dialog box, select the client network as the **Network to use**.

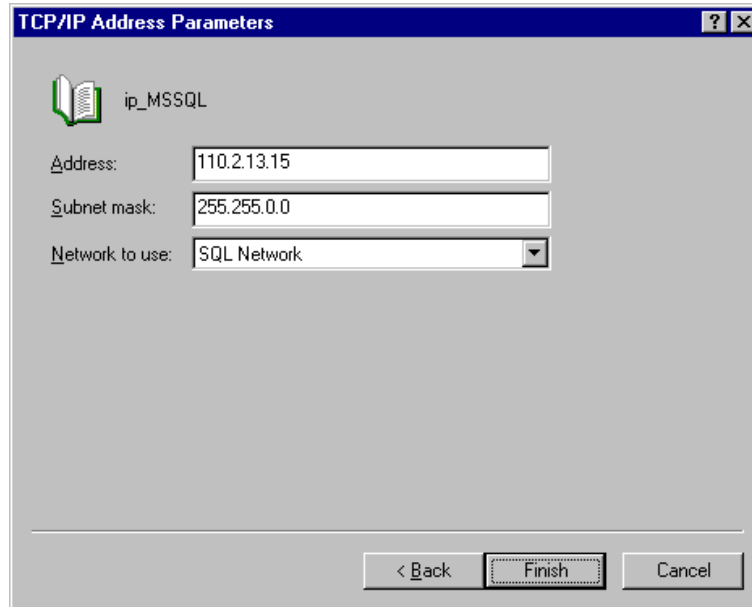


Figure 5-4. TCP/IP Address Parameters Dialog Box

10. Enter the **IP Address** of the cluster.
 11. Enter the correct **Subnet Mask**.
 12. Click **Finish** to complete creating the **IP Address Resource**.
-

Creating Network Name Resource

Use the following information to setup your Network Name Resource.

Table 5-5
SQL Server Group (Network Name)

Resource Name	nm_MSSQL
Resource Type	Network Name
Network Name	SQLNAME
Dependencies	ip_MSSQL

1. To create the **Network Name Resource**, select the **SQL Server** resource group and then click the right mouse button. Select **New→Resource** from the floating menu and the **New Resource** dialog box is displayed.

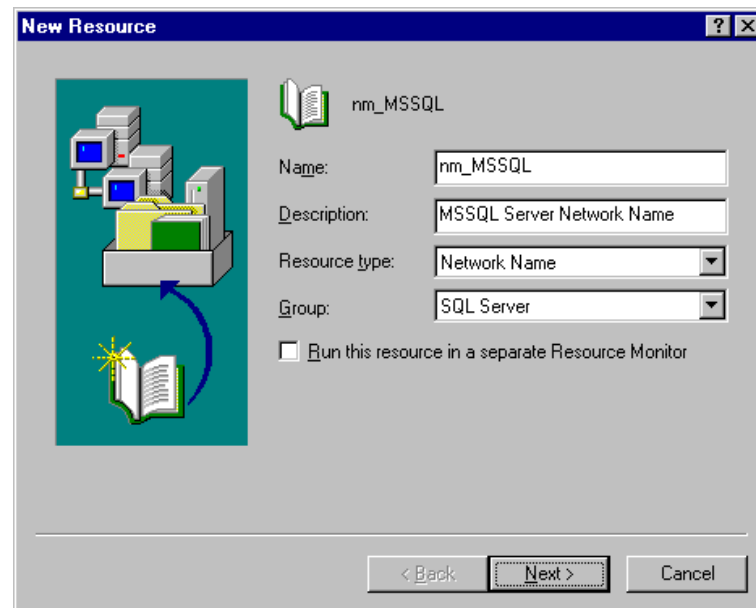


Figure 5-5. New Resource Dialog Box

5-8 *Configuring Microsoft Cluster Server*

2. Enter a name, **nm_MSSQL**, for the Network Name Resource.
3. Enter desired text for the **Description**.
4. Select **Network Name** for the **Resource Type** from the drop down box.
5. Select **MSSQL** for the **Group** from the drop down box.
6. Click **Next** to continue.
7. At the **Possible Owners** dialog box, both servers should be in the Possible Owners list box. Accept this default by clicking **Next**.

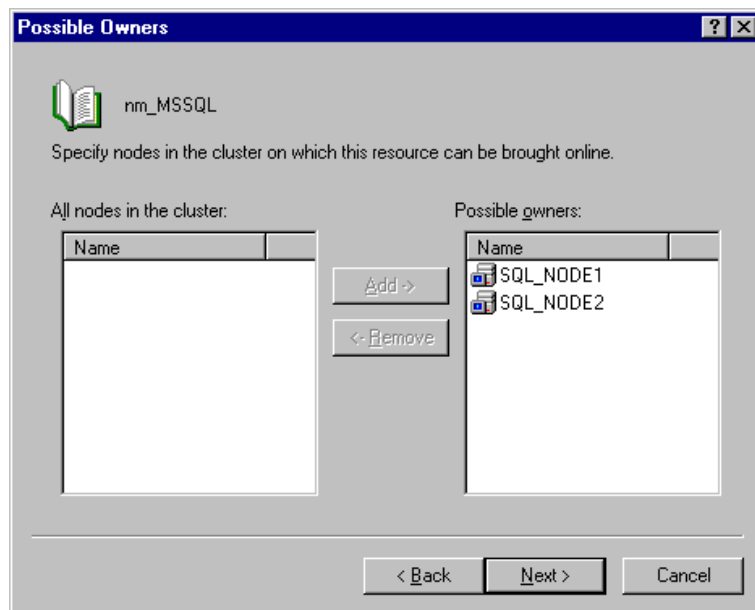


Figure 5-6. Possible Owners Dialog Box

- The only dependency required is the IP Address Resource, **ip_MSSQL**, so move it to the **Resource Dependencies** list box and click **Next**.

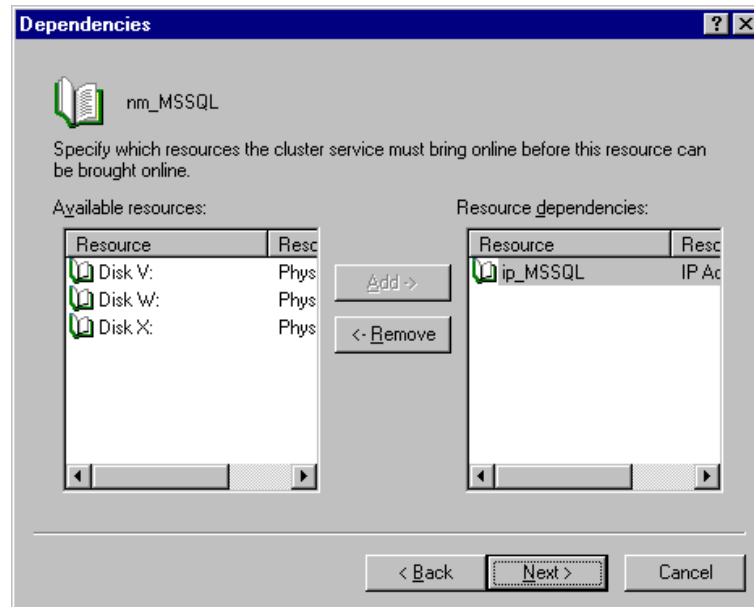


Figure 5-7. Dependencies Dialog Box

5-10 *Configuring Microsoft Cluster Server*

9. From the **Network Name Parameters** dialog box, enter a Network name to use.
10. Click **Finish** to complete creating the **Network Name Resource**.

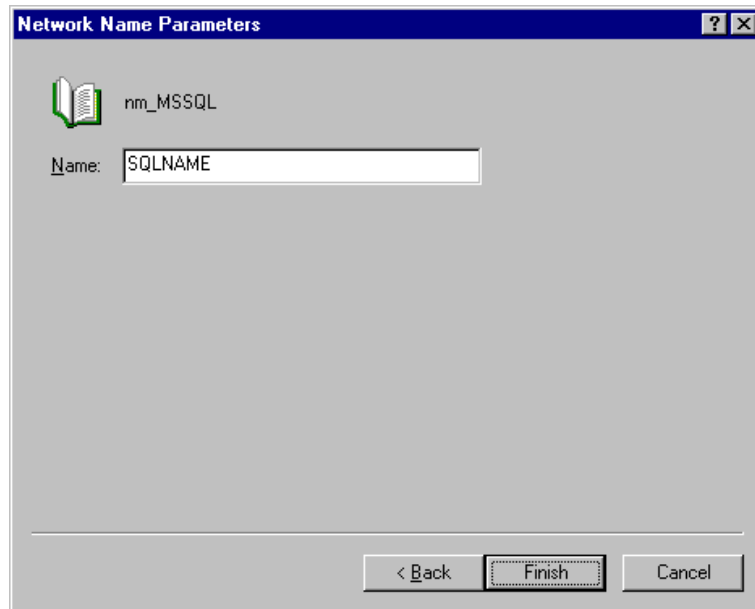


Figure 5-8. Network Name Parameters Dialog Box

Creating Generic Service Resource for the Database Engine

Use the following information to setup your MSSQLServer Generic Service Resource.

Table 5-6
SQL Server Group (Generic Service)

Resource Name	srv_MSSQL
Resource Type	Generic Service
Service Name	MSSQLServer
Dependencies	Disks V:, W:, X:, nm_MSSQL, and ip_MSSQL

- To create the Generic Service Resource, select the **SQL Server** resource group and then click the right mouse button. Select **New→Resource** from the floating menu and the **New Resource** dialog box is displayed.

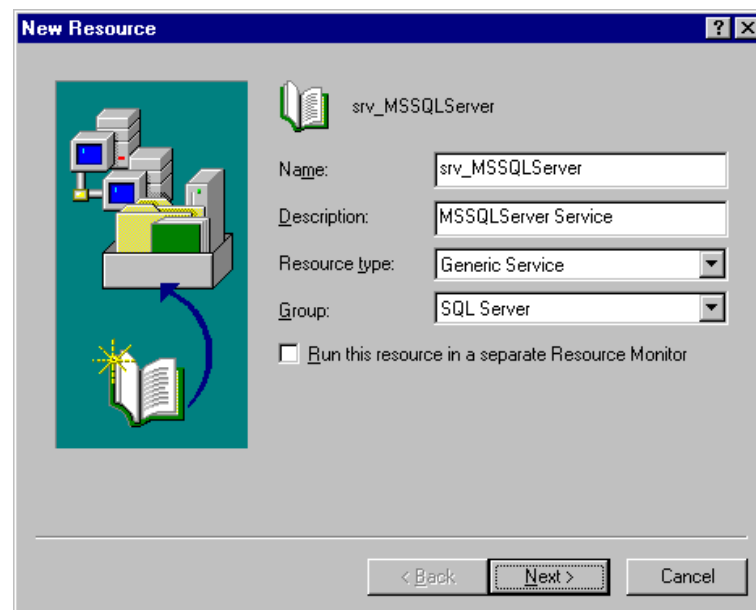


Figure 5-9. New Resource Dialog Box

5-12 Configuring Microsoft Cluster Server

2. Enter a name, `srv_MSSQLServer`, for the **Generic Service Resource**.
3. Enter desired text for the **Description**.
4. Select **Generic Service** for the **Resource Type** from the drop down box.
5. Select **SQL Server** for the **Group** from the drop down box.
6. Click **Next** to continue.
7. At the **Possible Owners** dialog box, both servers should be in the **Possible Owners** list box. Accept this default by clicking **Next**.

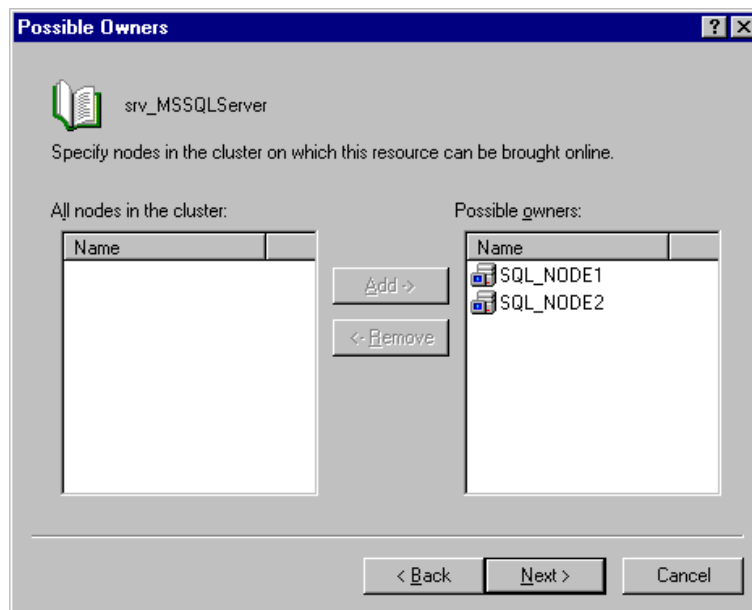


Figure 5-10. Possible Owners Dialog Box

8. The **Generic Service Resource** has several resource dependencies. Move all the resources from the Available Resources list box to the **Resource Dependencies** list box and click **Next**.

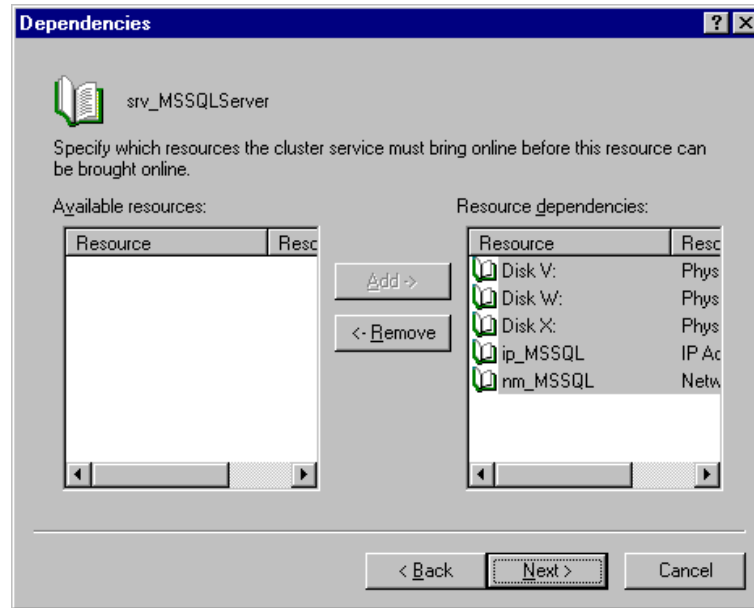


Figure 5-11. Dependencies Dialog Box

5-14 *Configuring Microsoft Cluster Server*

9. From the **Generic Service Parameters** dialog box, enter the actual name of the service, **MSSQLServer** for the Microsoft SQL Server Database Engine, then click **NEXT** to continue.

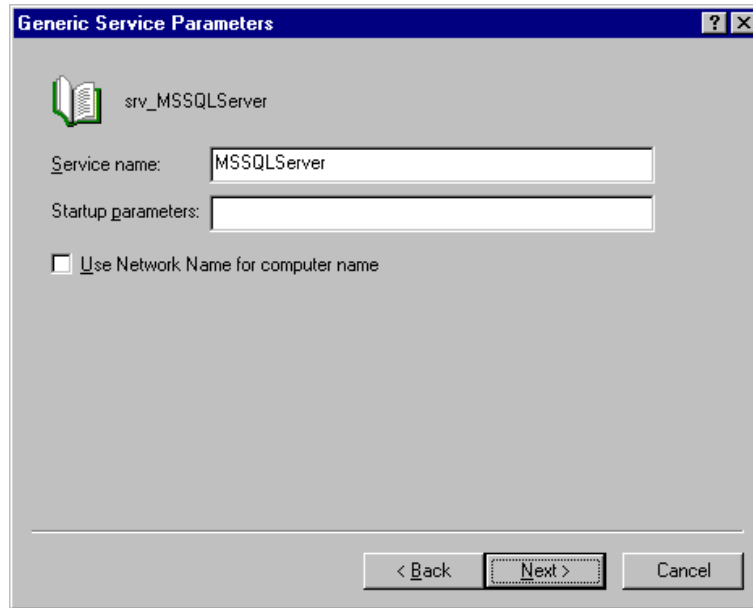


Figure 5-12. Generic Service Parameters Dialog Box

10. The next screen is the **Registry Replication** dialog box. For a generic SQL Server service failover, there are no registry settings that need to be replicated to all the nodes in the cluster. Click **FINISH** to complete creating the **Generic Service Resource**.

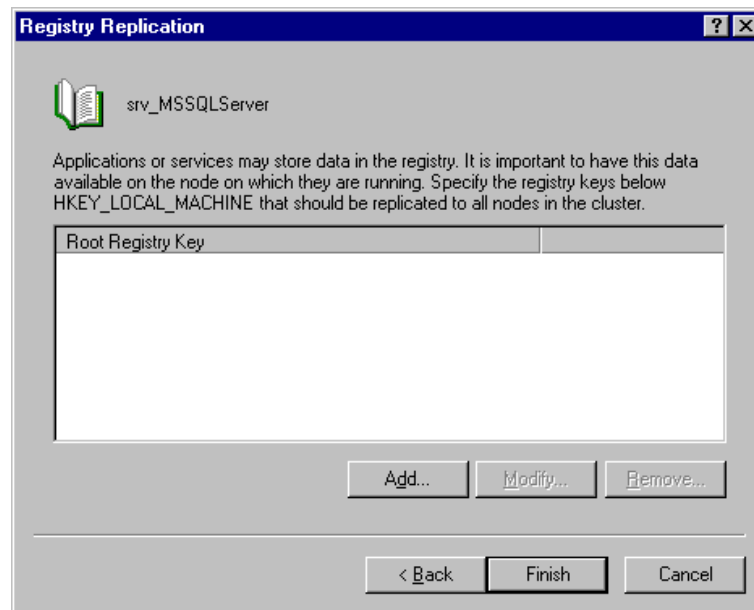


Figure 5-13. Registry Replication Dialog Box

Creating Generic Service Resource for the Database Engine

Use the following information to setup your SQLExecutive Generic Service Resource.

Table 5-7
SQL Server Group (Generic Service)

Resource Name	srv_SQLExecutive
Resource Type	Generic Service
Service Name	SQLExecutive
Dependencies	Disks V:,W:, X:, nm_MSSQL, and ip_MSSQL

1. To create the Generic Service Resource, select the **SQL Server** resource group and then click the right mouse button. Select **New→Resource** from the floating menu and the **New Resource** dialog box is displayed.

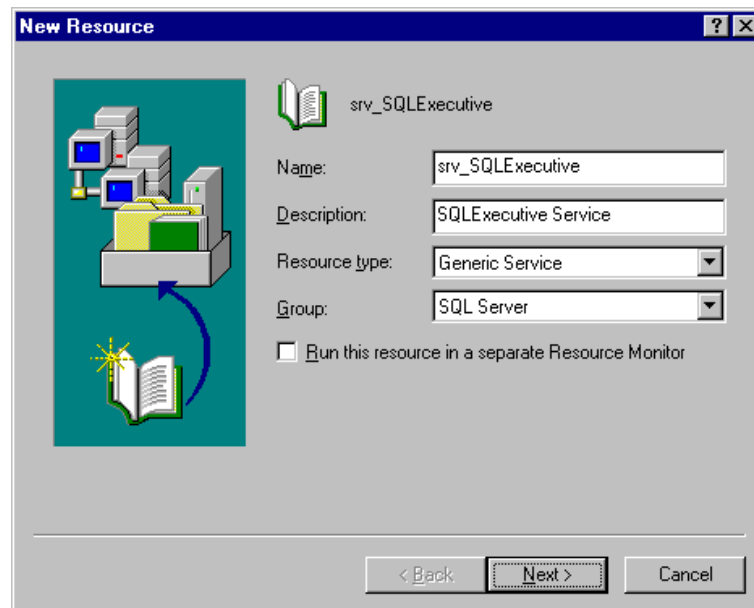


Figure 5-14. New Resource Dialog Box

2. Enter a name, **srv_SQLExecutive**, for the **Generic Service Resource**.
3. Enter desired text for the **Description**.
4. Select **Generic Service** for the **Resource Type** from the drop down box.
5. Select **SQL Server** for the Group from the drop down box.
6. Click **Next** to continue.
7. At the **Possible Owners** dialog box, both servers should be in the **Possible Owners** list box. Accept this default and click **Next**.

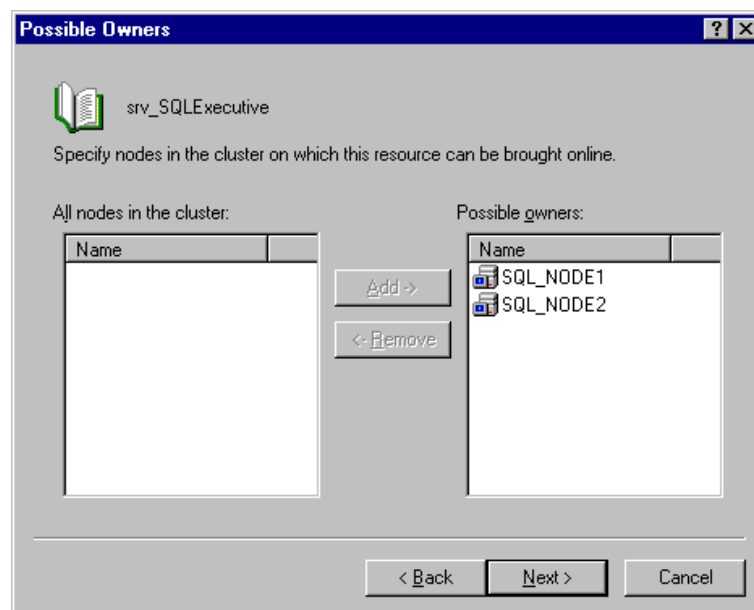


Figure 5-15. Possible Owners Dialog Box

5-18 *Configuring Microsoft Cluster Server*

8. The **SQLExecutive Generic Service Resource** has several resource dependencies. Move all the resources from the Available Resources list box to the **Resource Dependencies** list box and click **Next**.

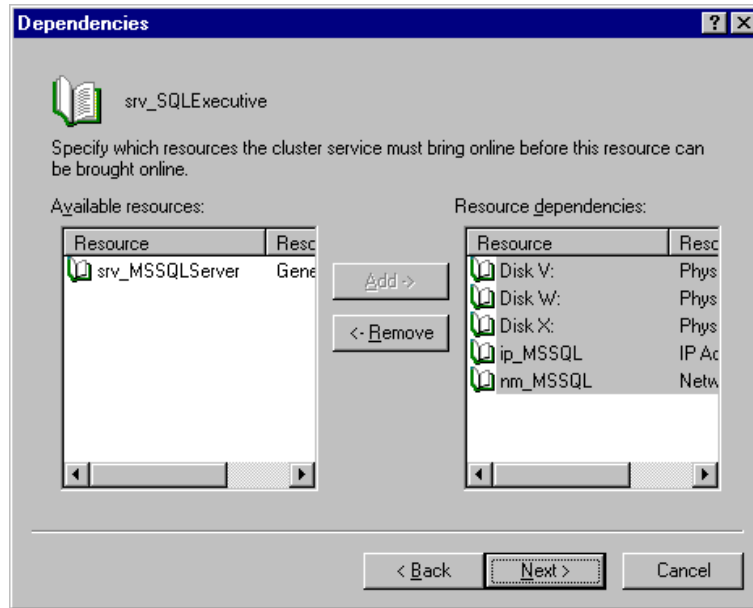


Figure 5-16. Dependencies Dialog Box

- From the **Generic Service Parameters** dialog box, enter the actual name of the service, **SQLExecutive** for the Microsoft SQL Server Executive Service, click **NEXT** to continue.

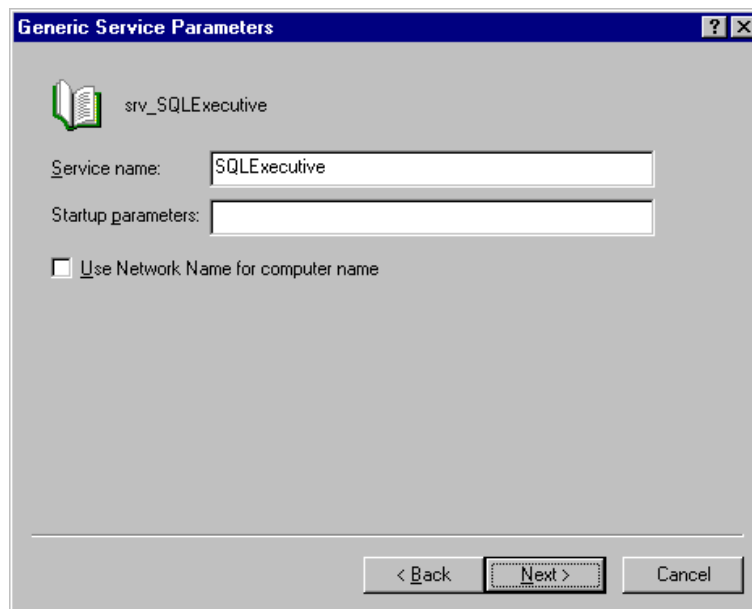


Figure 5-17. Generic Service Parameters Dialog Box

- As with the **MSSQLServer** resource, there are no registry settings that need to be replicated. Click **Finish** to complete creating the **Generic Service Resource**.

To bring the new resources online, right-click on the **SQL Server** resource group and select **Bring Online** from the floating menu.

Chapter 6

Verifying the Failover

To verify the failover, the SQL Client Utilities must be installed on the client and the Client Net-Library configured.

1. To install the client utilities, insert the Microsoft SQL Server 6.5 CD into the Client Workstation's CD-ROM Drive
2. Run `x:\i386\setup` (where *x* is the drive letter of the CD-ROM drive)
3. Click **CONTINUE** when the "Welcome" screen is displayed.
4. Enter Name and Organization information, then click **CONTINUE**.
5. Verify Name and Organization information, then click **CONTINUE**.
6. Select **Install Utilities Only**.

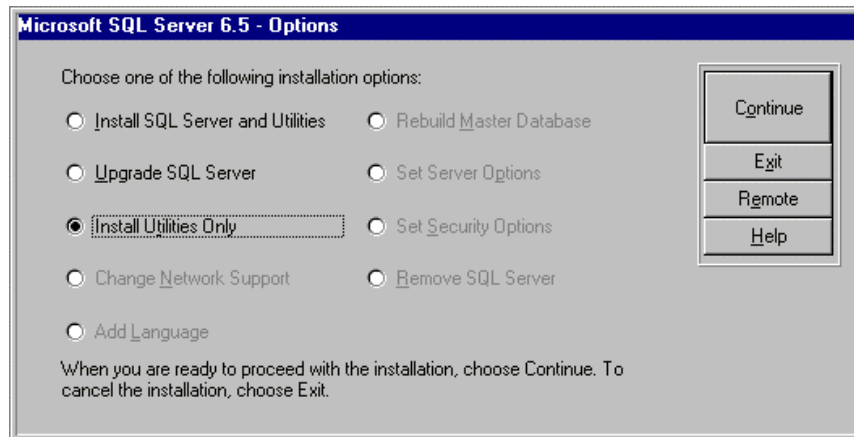


Figure 6-1. Microsoft SQL Server 6.5 Options Dialog Box

6-2 *Verifying the Failover*

7. Select all utilities and choose the drive and directory to install SQL client utilities, then click **CONTINUE**.

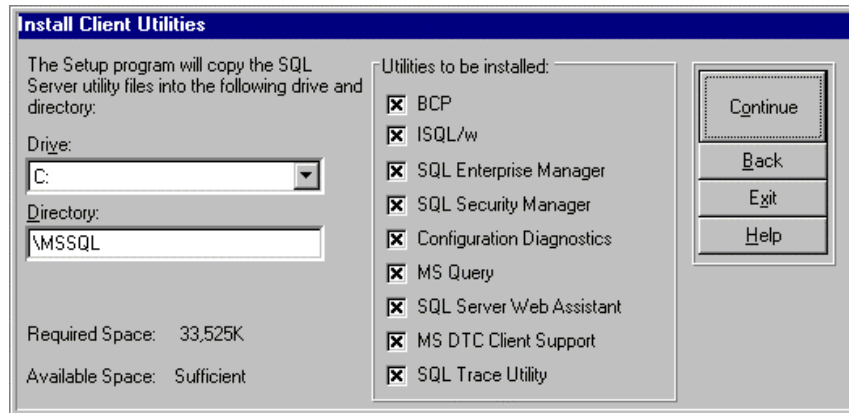


Figure 6-2. Install Client Utilities Dialog Box

8. Select **Install on Hard Disk**, then click **CONTINUE**.

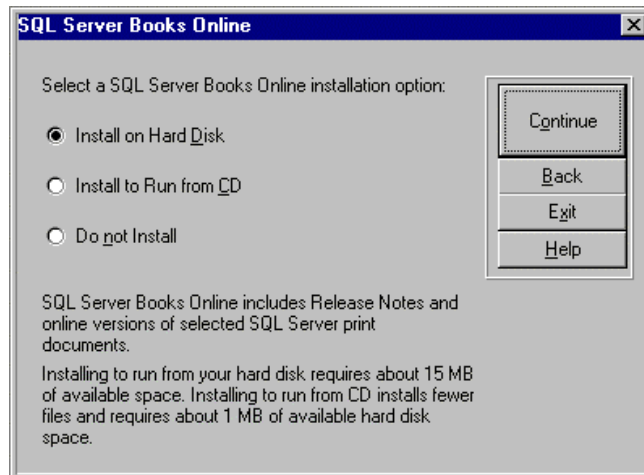


Figure 6-3. Microsoft SQL Server 6.5 Options Dialog Box

9. When finished, click **OK**.
10. Exit to Windows NT.

6-4 Verifying the Failover

The next step is to configure the Net-Library interface. Start the **SQL Server Client Configuration Utility**. It is located in the Microsoft SQL Server 6.5 program group.

1. Click on the Net Library tab and set the Default Network to TCP/IP Sockets.

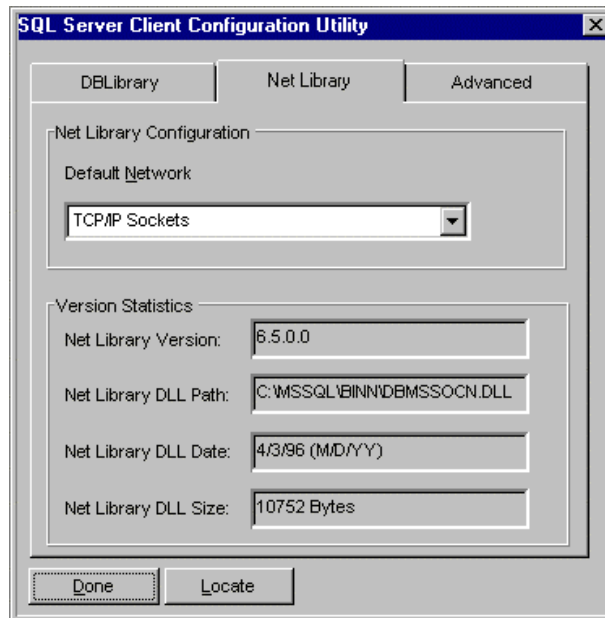


Figure 6-4. SQL Server Client Configuration Utility (Net Library) Dialog Box

2. Click on the **Advanced** tab.
 3. Enter **SQLNAME** for **Server** to represent this connection to the clients.
 4. Select **TCP/IP Sockets** for the **DLL Name**.
-

5. Enter **nm_MSSQL** for the **Connection String**.

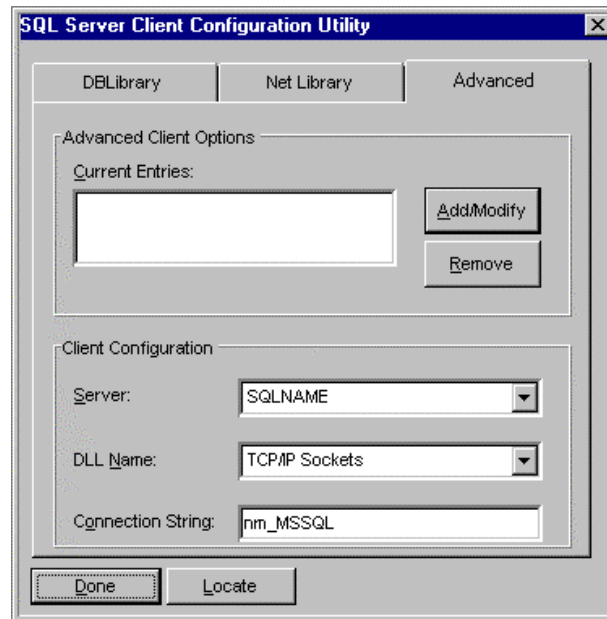


Figure 6-5. SQL Server Client Configuration Utility (Advanced) Dialog Box

6. Click **Add/Modify**.
7. Click **Done** to save the new configuration.

Once the client has been configured, the failover can be verified.

1. Start the SQL Enterprise Manager.
2. Register **SQL_NODE1**, **SQL_NODE2**, and **SQLNAME** under SQL 6.5. Use “**sa**” as the Login ID and a blank password.

Note: When registering the servers, if you receive the message “Unable to connect to server...Register anyway?”, click **YES**. This error is received when registering the node that does not have control of SQL Server.

6-6 *Verifying the Failover*

3. Open **Cluster Administrator** on one of the servers and move the **SQL Server Group**.

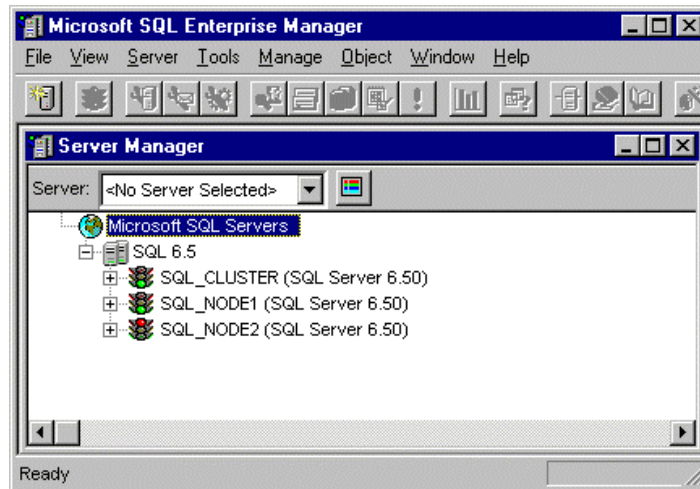


Figure 6-6. SQL Server Client Configuration Utility (Advanced) Dialog Box

Appendix A

Model Hardware Configuration

Server 1

Compaq ProLiant 5000, 4P P5/200, 512-MB memory.

Table A-1
Server Configuration Information

Slot Number	Description	IRQ
Embedded Disk Ctrl	C875 Ultra Fast Wide SCSI Controller	14
Slot 8	Compaq Smart II/P Array Controller	n/a
Slot 1	Netelligent 10/100 TX (Interconnect Network)	5
Slot 2	Fibre Channel Host Adapter	15

Table A-2
Disk Configuration Information

Disk Controller	Controller Order	SCSI ID or Logical Drv	Disk Configuration	Raid Level	Drive Letter
Smart II/P	1st	0	4 x 2.1-GB	5	C
Fibre Host Ctrl	2nd	1	2 x 9.1-GB	1	W
		2	2 x 9.1-GB	1	X
		3	4 x 9.1-GB	5	Y
Embedded Disk Ctrl	3rd	5	CD-ROM	n/a	Z

Server 2

Compaq ProLiant 5000, 4P P5/200, 512-MB memory.

Table A-3
Server Configuration Information

Slot Number	Description	IRQ
Embedded Disk Ctrl	C875 Ultra Fast Wide SCSI Controller	14
Slot 8	Compaq Smart II/P Array Controller	n/a
Slot 1	Netelligent 10/100 TX (Interconnect Network)	5
Slot 2	Fibre Channel Host Adapter	15

Table A-4
Disk Configuration Information

Disk Controller	Controller Order	SCSI ID or Logical Drv	Disk Configuration	Raid Level	Drive Letter
Smart II/P	1st	0	4 x 2.1-GB	5	C
Fibre Host Ctrl	2nd	1	2 x 9.1-GB	1	W
		2	2 x 9.1-GB	1	X
		3	4 x 9.1-GB	5	Y
Embedded Disk Ctrl	3rd	5	CD-ROM	n/a	Z

Appendix B

Troubleshooting

The following table provides basic trouble shooting guidelines specific to MS SQL Server. For trouble shooting tips with Microsoft Cluster Server, refer to *Introduction to Compaq ProLiant Clusters*.

Problem	Reason	Solution
SQL_NODE2 will not start or complete the setup to rebuild the registry	The rebuild command was not executed properly	Enter the rebuild command <u>exactly</u> as it is shown: V:\MSSQL\BINN>setup /t RegistryRebuild = ON

Appendix C

Client Reconnection in a Failover

As important as configuring the Servers is in a clustering environment, it is also very important to take into consideration the clients. Depending on the server application and its clustering capabilities, the client computers may need to be aware of the cluster environment.

In the case of SQL Server, there are some things that client programs, which access data on a clustered SQL Server database, must consider. In particular, the issue of the client connection to the database and what occurs when that connection fails.

When a client connects to a SQL Server database, the server side engine (mssqlserver) stores information about the connection. This information includes the connection type (TCP, Named Pipes, IPX, etc.), the login name and password, as well as any outstanding queries and their results may be cached. When SQL Server fails (for example by a power failure) the client still assumes that it is connected to the server until it later attempts to access the database. At this time, it sends a request to the database server and awaits the results. In a single server environment, the database server would not exist anymore, and ODBC or DB-Library would return an error message to the client application stating that the network connection is gone.

In a clustered database, when SQL Server fails on its primary server, the server service, its IP address number and its other resources are moved to the secondary server in the cluster. After this movement takes place, all the database services are brought back online and offered to the network. The client, not knowing that the move has taken place, sends its next request to the database server. The database server accepts the request, looks at the security information associated with the request (login name, password, etc) and says "I do not know this connection". It then sends a server error back to ODBC or DB-Library informing the client that the connection information is invalid.

C-2 *Client Reconnection in a Failover*

It would seem that the result of these two situations is the same, and they essentially are. In both cases, the client cannot access the data, but in reality they are very different. In the first case, no matter how many times the client tries to access the information, it fails. In the second case, the client can simply attempt to re-login to the database server and be revalidated. This allows the client to continue.

Glossary

Availability The ability of a system to appear to the users as if it was operating continuously, even though failures have occurred.

Cluster A cluster is a set of independent computer systems working together as a single system. The cluster software directs client requests to one of the systems in the cluster based on resource accessibility, server load, and application requirements. When a system in the cluster fails the cluster software will recover and disperse the work from the failed system amongst the remaining systems in the cluster. When the overall load exceeds the capabilities of the systems in the cluster, additional systems may be added to the cluster. The failure of a system in the cluster will not affect the other systems and in certain cases the client applications should be unaware of the failure, except for some loss of service for a short period of time.

Given the above definition, it would be hard to distinguish a cluster from a general distributed system; therefore, clusters provide the following additional capabilities:

- Every system in the cluster must have full connectivity and communications with all other systems in the cluster.
- Systems in the cluster know all the other systems in the cluster; they join in order to form a cluster. The cluster systems also know when systems join or leave the cluster, via a connection manager.
- Systems in the cluster know what resources are available on all other members of the cluster.
- There is a virtual circuit, provided by the connection manager that provides reliable delivery of messages between systems in the cluster.

G-2 Glossary

Connect Descriptor	A specially formatted description of the destination for a network connection. Connect descriptors are constructed using a set of keywords and values mapped to service names.
Failover	The time it takes a resource to failover from one system to another. For example, if a resource is to be polled at a 1-second interval, then it may be determined that after two poll intervals, that a resource is dead and that it should be restarted or failed over. Also, assuming that the local restart count for the resource is 4, then 4 of these timeouts would be required before the resource is failed over to another system. Given a 1-second interval, there would be a period of 2 seconds times the 4 retries - or a total of 8 seconds before the resource failed over to another system.
Member	A system which has joined a cluster.
Node	<i>See</i> System.
Quorum	A voting mechanism maintained by the connection manager. A simple quorum voting mechanism is used to indicate when more than half of the available votes are present in the cluster. Note that a member (or many members) in the cluster can have more than one vote. In addition, a resource available within the cluster can have a vote. This latter ability allows two systems cluster to function in the presence of a communication or system failure, by having the system that continues functioning and reserves the resource to obtain a quorum.
Quorum resource	A quorum resource is any resource that has writable persistent storage for maintaining cluster database change log records.

Resource	A physical or logical entity that is managed. They include, but are not limited to: disks, tapes, printers, CD-ROMs, IP address, etc.
Server	The layer of software running on a cluster node which performs service registration or advertisement. Any software that uses this layer inherits its properties.
Server application	The actual application software running on a cluster node, regardless of whether it does service registration.
Service	A data set or operation set exported by application servers to their clients. This term is distinguished from a Windows NT Service.
Service Name	A short, convenient name mapped to a network address contained in a TNS connect descriptor. Users need only know the appropriate service name to make a TNS connection.
Shared disk	A cluster organization that requires all systems of the cluster to have access to shared Disks.
Shared nothing	A cluster organization in which disks are 'owned' by a single system of the cluster and requests for disk access is directed to the system that 'owns' the disk.
Shared resource	A cluster organization in which some resources are accessible to all systems in the cluster.
System	A complete computer system capable of operating independently (either a single processor system or an SMP system), for example, a PC.

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