



Virtuozzo Containers for Windows 6.0

Deploying Microsoft Clusters

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Microsoft Cluster Types

The Windows Server operating system comes with two main built-in clustering technologies:

- *Failover cluster*
- *Microsoft Network Load Balancing (NLB)*

Failover Clusters

Failover clusters allow you to provide high availability for your mission-critical applications (including the Virtuozzo Containers for Windows software itself) through the failover of resources. In Virtuozzo Containers for Windows, you can deploy failover clusters in one of the following ways:

- Create a failover cluster of two or more Hardware Nodes that will host the Virtuozzo Containers for Windows software including all its mission-critical services and Containers. If one Hardware Node fails, another Node will take its responsibilities.
- Make Containers participate as full members in the cluster, like any other standalone server running the Windows Server operating system, and increase the availability of your mission-critical applications.

The process of deploying failover clusters in Virtuozzo Containers-based systems is described in **Deploying Virtuozzo Containers for Windows Failover Clusters** (p. 5) and **Creating Clusters From Containers** (p. 46).

Note: Throughout this guide, we use the term *failover cluster* to refer to the clustering technology in Windows Server 2008 R2.

NLB Clusters

The *NLB* technology allows you to provide scalability and high availability for TCP- and UDP-based services and applications (e.g., for Web servers and Terminal Services) by load-balancing incoming IP traffic across several servers in the cluster. For detailed information on deploying NLB clusters, see **Setting Up an NLB Cluster** (p. 52).

Deploying Virtuozzo Containers for Windows Failover Clusters

In Virtuozzo Containers for Windows 6.0, you can use the Windows failover cluster feature to create failover clusters consisting of two or more Hardware Nodes. Including Hardware Nodes in a failover cluster increases the availability of the Virtuozzo Containers for Windows software and Containers. If one Hardware Node in the cluster fails, another Node will take its responsibilities.

The process of deploying a Virtuozzo Containers for Windows failover cluster includes the following steps:

- 1 Choosing the cluster model that best suits your needs.
- 2 Setting up hardware for the cluster.
- 3 Configuring all physical servers to participate in the cluster (hereinafter, we will also refer to them as *cluster nodes* or *nodes*).
- 4 Setting up an Active Directory domain and adding the cluster nodes to it.

Note: You can also add the cluster nodes to an existing Active Directory domain, if you have one.

- 5 Setting up a shared storage and connecting it to the cluster nodes.
- 6 Creating a failover cluster and adding all your nodes to the cluster.
- 7 Setting up the failover cluster.

All these steps are described in the following subsections in detail.

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Designing a Cluster Configuration

Before you start deploying a Virtuozzo Containers for Windows failover cluster, you should decide on the cluster configuration that will meet your demands best of all. You can create Virtuozzo Containers for Windows failover clusters of one of the following types:

- *Active/passive clusters.* An active/passive cluster includes both active and standby nodes. In this type of clusters, standby nodes are only used if one of the active nodes fails.
- *Active/active clusters.* An active/active cluster consists of active nodes only, each running the Virtuozzo Containers for Windows software and hosting a number of Containers. In the event of a failover, all Containers running on the problem node are failed over to one of the healthy active nodes.

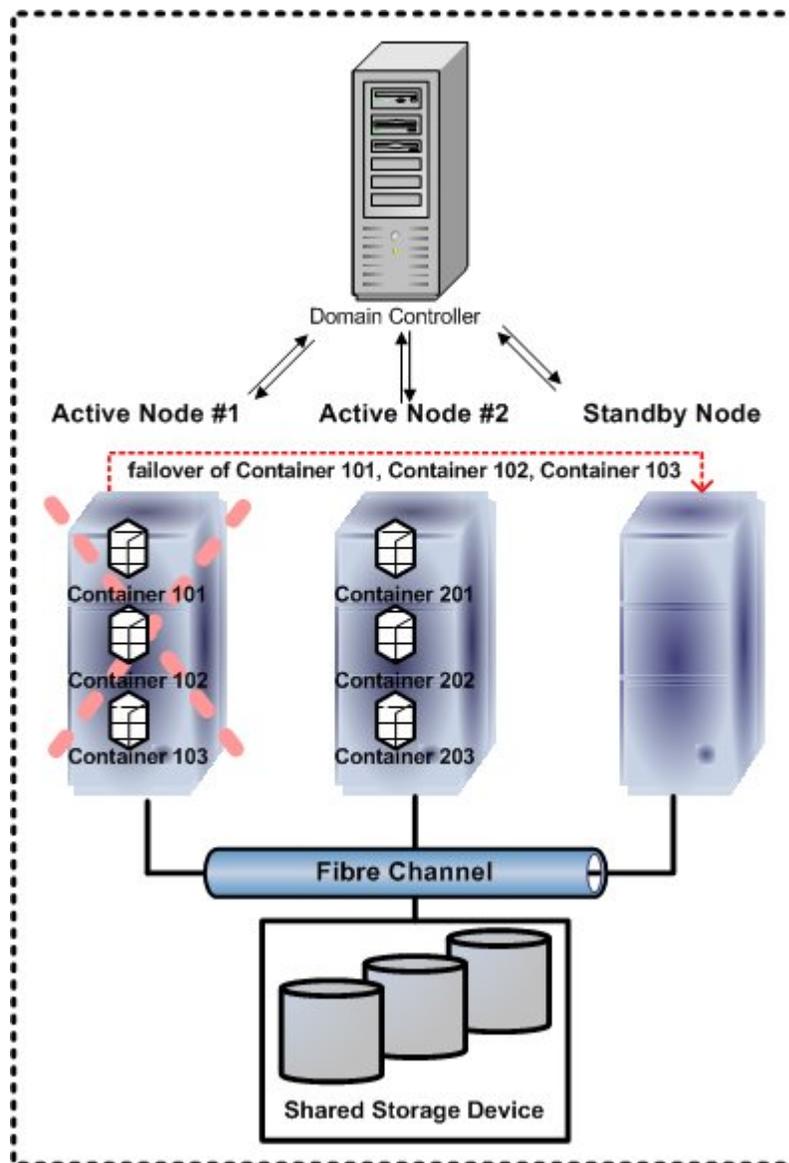
The following subsections discuss both types of failover clusters in detail.

Active/Passive Failover Clusters

Active/passive clusters include both active and standby nodes. An example of an active/passive cluster is a four-node cluster where three nodes are active, running the Virtuozzo Containers for Windows software and hosting a number of Containers, and one node is in the standby state, waiting for an active node failure and ready to take the responsibility of its resources. An active/passive cluster can also consist of five active cluster nodes and two standby nodes where each of the active nodes is able to fail over to any of the two standby nodes.

The following picture shows an example configuration of an active/passive failover cluster:

Note: We will use the given configuration throughout this chapter to demonstrate the Virtuozzo Containers for Windows failover cluster creation.



In this clustering scenario:

- The cluster comprises two active nodes (*Active Node #1* and *Active Node #2*) hosting a number of Containers and one passive node (*Standby Node*). All nodes in the cluster have one and the same version of the Windows Server operating system and the Virtuozzo Containers for Windows software installed. If one of the active nodes in the cluster fails or is taken offline as part of planned maintenance, the services and Containers from this node are failed over to the standby node.
- All the nodes in the cluster are connected via Fibre Channel optical cables to a reliable and fault tolerant shared SCSI storage device. It is used to store all the cluster configuration data and Virtuozzo Containers for Windows resources and allows active nodes in the cluster to access these resources.

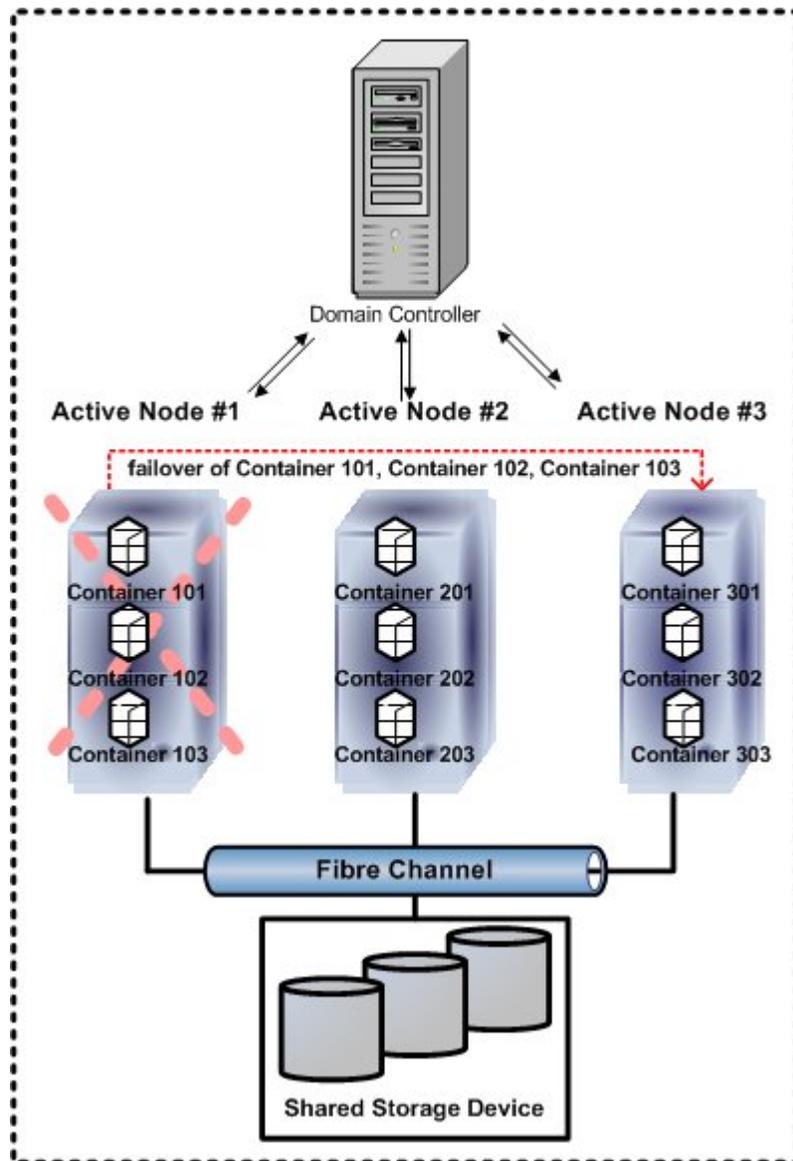
- All the cluster nodes are located in the same Active Directory (AD) domain. A dedicated server is set up in this domain to act as the domain controller (shown as *Domain Controller* in the picture).

Note: In our example, we will create an Active Directory domain from scratch. However, you can make use of an existing AD domain and include all your cluster nodes in this domain.

Active/Active Failover Clusters

Virtuozzo Containers for Windows allows you to create active/active failover clusters where all Hardware Nodes are acting as active nodes. The concept of active/active clusters is based on the ability to simultaneously run more than one group with Virtuozzo Containers for Windows resources (i.e. with Virtuozzo Containers for Windows-related services and Containers) on one and the same Hardware Node. In such clusters, each node is capable of taking on the additional workload, the failed over services and Containers, from a problem node along with running their own version of Virtuozzo Containers for Windows and hosting their own Containers.

The following picture shows you an example of an active/active cluster configuration:



This clustering configuration is similar to that described in the previous section for an active/passive cluster. The cluster comprises three nodes: *Active Node #1*, *Active Node #2*, *Active Node #3*. All nodes are running one and the same version of the Windows Server operating system and the Virtuozzo Containers for Windows software, located in the same AD domain, and connected via Fibre Channel optical cables to a shared SCSI storage device.

However, unlike the active/passive configuration, all nodes in this cluster are active and host a number of running Containers. If any of the nodes in the cluster fails or is taken offline as part of planned maintenance, the Virtuozzo Containers for Windows-related services and Containers from this node are automatically failed over to one of the two remaining active nodes. If, say, *Active Node #1* hosting Container 101, 102, and 103 fails, all these Containers will be moved to and started on either *Active Node #2* or *Active Node #3*. The decision on where to move the resources from the problem node is made by the clustering software.

Setting Active/Active Failover Cluster to Work

The process of deploying an active/active Virtuozzo Containers for Windows failover cluster slightly differs depending on whether you are creating your failover cluster from scratch or transforming any of your existing active/passive clusters:

- If you are creating a new Virtuozzo Containers for Windows failover cluster, follow the instructions given in the following subsections to set up the cluster.
- If you already have a Virtuozzo Containers for Windows active/passive cluster and want to transform it into an active/active one, do the following:
 1. Reinstall Virtuozzo Containers for Windows on each passive node in the cluster by deleting the current software version and installing it again using the instructions in the **Installing Virtuozzo Containers for Windows on Cluster Nodes** section (p. 36).

Note: When reinstalling the Virtuozzo Containers for Windows software, you must select the **Active node** radio button for each node that will participate in the active/active cluster.

2. Install all available Virtuozzo Containers for Windows updates. Refer to the *Virtuozzo Containers for Windows 6.0 User's Guide* to learn how you can do it.

Important! We highly recommend that you install the same set of Virtuozzo Containers for Windows and Windows Server updates on all nodes in the Virtuozzo Containers for Windows failover cluster.

Active/Active Failover Cluster Restrictions

Before starting to deploy an active/active Virtuozzo Containers for Windows failover cluster, you should have a clear understanding of all limitations imposed on your virtual infrastructure by this kind of cluster:

- Virtuozzo Containers for Windows failover clusters do not currently have a mechanism to correctly process Containers with identical IDs. So, you should always see to it that all Containers residing on all nodes in the cluster have different IDs.
- Containers failed over from a problem node to a healthy one make use of the OS and application templates installed on the healthy node. So, to provide an error-free operation of your Containers, make sure that all nodes in the cluster have the same set of OS and application templates installed.
- Deploying an active/active cluster requires the proper hardware configuration of all cluster nodes. As the resources from a problem node may be failed over to any of the remaining active nodes, all nodes in the active/active cluster must have enough resources (CPU, main memory, etc.) to take on the additional workload from a failed node and ensure adequate performance in the case of a failover.

If any of the nodes does not have sufficient resources to support this additional workload (e.g. the node's own services and Containers consume the majority of system resources), it is recommended to deploy an active/passive failover cluster to avoid degradation in your overall cluster performance.

Setting Up Hardware for the Cluster

Once you know which cluster model to deploy, you can start setting up hardware for your cluster. This procedure includes the following basic operations:

- 1** Deciding on the hardware to be included in the cluster. The amount and type of hardware may vary depending on the purpose and availability requirements of your cluster. However, the following types of hardware are always present in any cluster:
 - *Cluster nodes* represented by two or more physical servers capable of running the Windows Server operating system.
 - *Shared storage device* usually represented by a common disk array on a SAN and used to store all Virtuozzo Containers-related data (Container data, templates, backups, and so on).
 - *Switches* (Fibre Channel or SCSI) providing client access to the cluster and enabling the communication between each cluster node and the shared cluster storage.
- 2** Uniting all hardware components into one subnet and ensuring that each hardware component can access all the other components in the subnet.

For more information about installing and configuring cluster hardware, follow [http://technet.microsoft.com/en-us/library/dd197454\(W.S.10\).aspx](http://technet.microsoft.com/en-us/library/dd197454(W.S.10).aspx).

To deploy our example cluster configuration that will include two active nodes and one passive node, we use the following hardware:

- A shared SCSI storage device,
- A switch,
- Fibre optic cables,
- Four physical servers capable of running the Windows Server operating system. Three servers will act as cluster nodes and one server will be used as a domain controller.

All the physical servers in our example meet the following hardware requirements:

- Pentium IV processor (quad-core Intel Xeon recommended),
- 2048 MB of memory (16 GB recommended),
- 80 GB of disk space (500 GB recommended),
- Two network interface cards (NICs) for each cluster server and one NIC for the domain controller.

Configuring Physical Servers

After you have prepared the hardware for your failover cluster, you need to configure three physical servers for participating in the cluster and one physical server for converting into a domain controller. To do this, perform the following operations:

- 1 Install the Windows Server operating system on each server (mandatory). The process of installing Windows Server is described in detail in the documentation shipped with this operating system.

Note: All cluster nodes must run the same version of the operating system, for example, the 64-bit version of Windows Server 2008 R2 (Enterprise Edition).

- 2 Install the failover clustering feature on the physical server (mandatory). This operation must be performed only on physical servers running Windows Server 2008 R2. For more information, see <http://technet.microsoft.com/en-us/library/cc772178.aspx>.
- 3 Configure the network adapters on all physical servers (mandatory):

For each cluster node:

- Assign a static IP address to the first network adapter. This adapter will be used to connect the server to the private network providing communication among all nodes in the cluster.
- Assign a static IP address to the second network adapter. This adapter will be used to connect the server to the public network (usually, your local area network). In comparison to the IP address assigned to the first network adapter, this IP address must belong to a different subnet.

For the domain controller:

- Assign a static IP address to the network adapter. This adapter will be used to connect the domain controller to other servers in the Active Directory domain.
- 4 Validate your physical server configuration (optional though highly recommended). This operation can be performed only on physical servers running Windows Server 2008 R2. For more information, see [http://technet.microsoft.com/en-us/library/cc732035\(W.S.10\).aspx](http://technet.microsoft.com/en-us/library/cc732035(W.S.10).aspx).

Setting Up a Domain

In the next step, you need to set up an Active Directory domain and make your servers members of this domain. This procedure includes the following steps:

- 1 Deploying an Active Directory domain.
- 2 Creating a domain administrator account.
- 3 Adding the cluster nodes to the domain.

All these steps are described in the following subsections in detail.

Notes:

1. If you already have an existing Active Directory domain, you can add your cluster nodes to this domain. In this case you can skip **Steps 1** and **2** and proceed directly to **Step 3**.
2. Throughout this section, we assume that you are setting up a domain on a server running Windows Server 2008 R2.

Creating a Domain

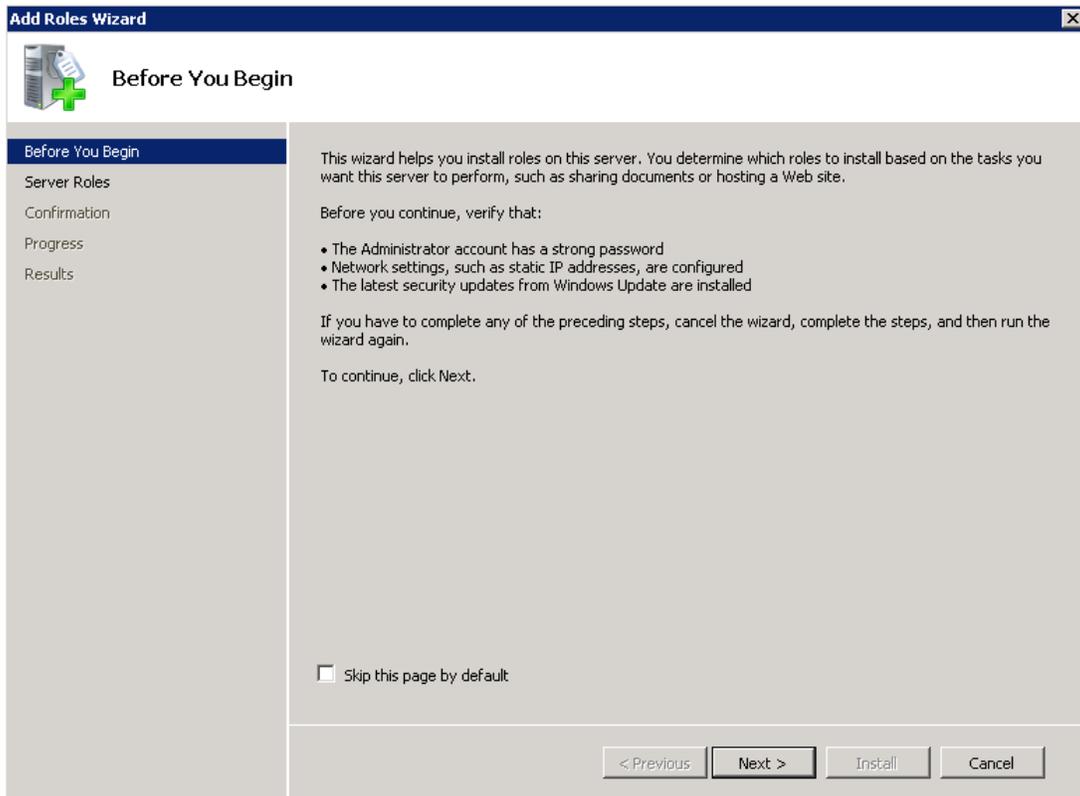
First, you have to set up an Active Directory domain. To do this, you need a dedicated physical server capable of running the Windows Server operating system. This server will act as a domain controller and have the Active Directory service installed. The process of setting up an Active directory domain includes two steps:

- 1 Installing the Active Directory Domain Controller role.
- 2 Creating the Active Directory domain.

Installing the Active Directory Controller role

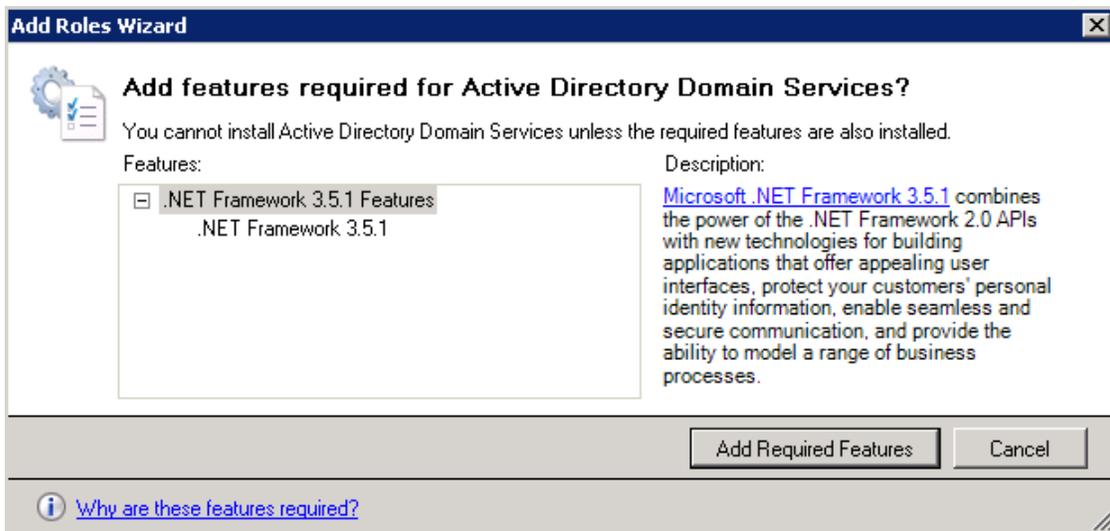
In the first step, you need to install the Active Directory Domain Controller role on the physical server that is to act as the domain controller. By default, this role is not installed on servers during the Windows Server 2008 R2 installation. To install the role:

- 1 Open the Server Manager console.
- 2 Click the **Roles** item in the left pane of the console.
- 3 In the **Roles** pane, click **Add Roles** to launch the **Add Roles** wizard.

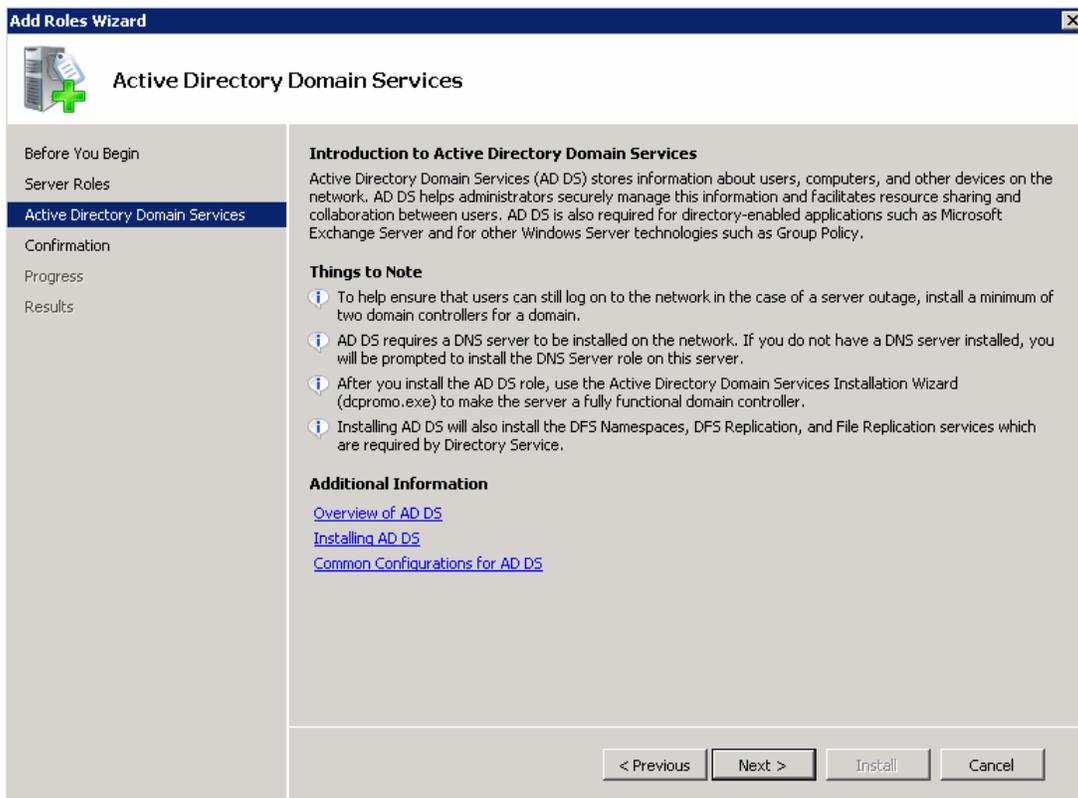


4 Click **Next**.

5 Select the check box next to **Active Directory Domain Services**. The wizard may ask you to install a number of additional features required for this role. For example:



Click **Add Required Features**, and then click **Next**.

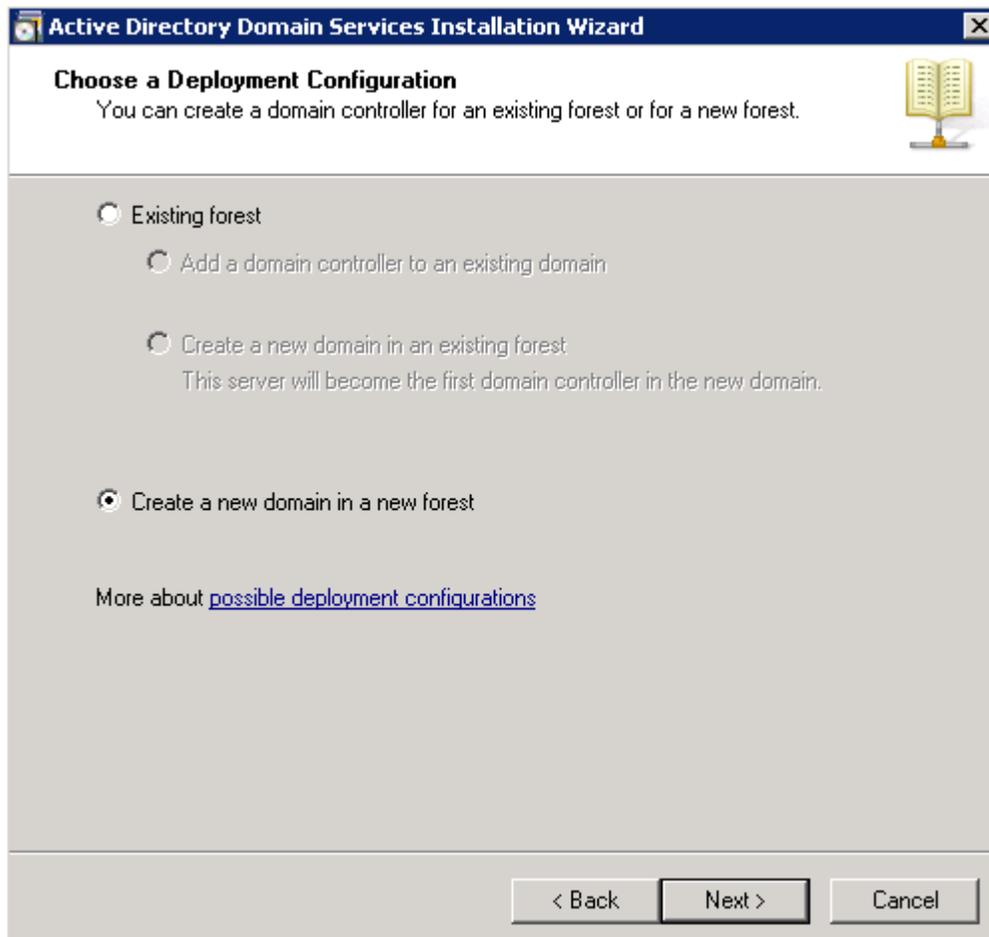


- 6 Read the information, and click **Next**.
- 7 In the **Confirm Installation Selections** window, review the roles and features that will be installed on the server, and click **Install**.
- 8 Once the installation is complete, click **Close**.

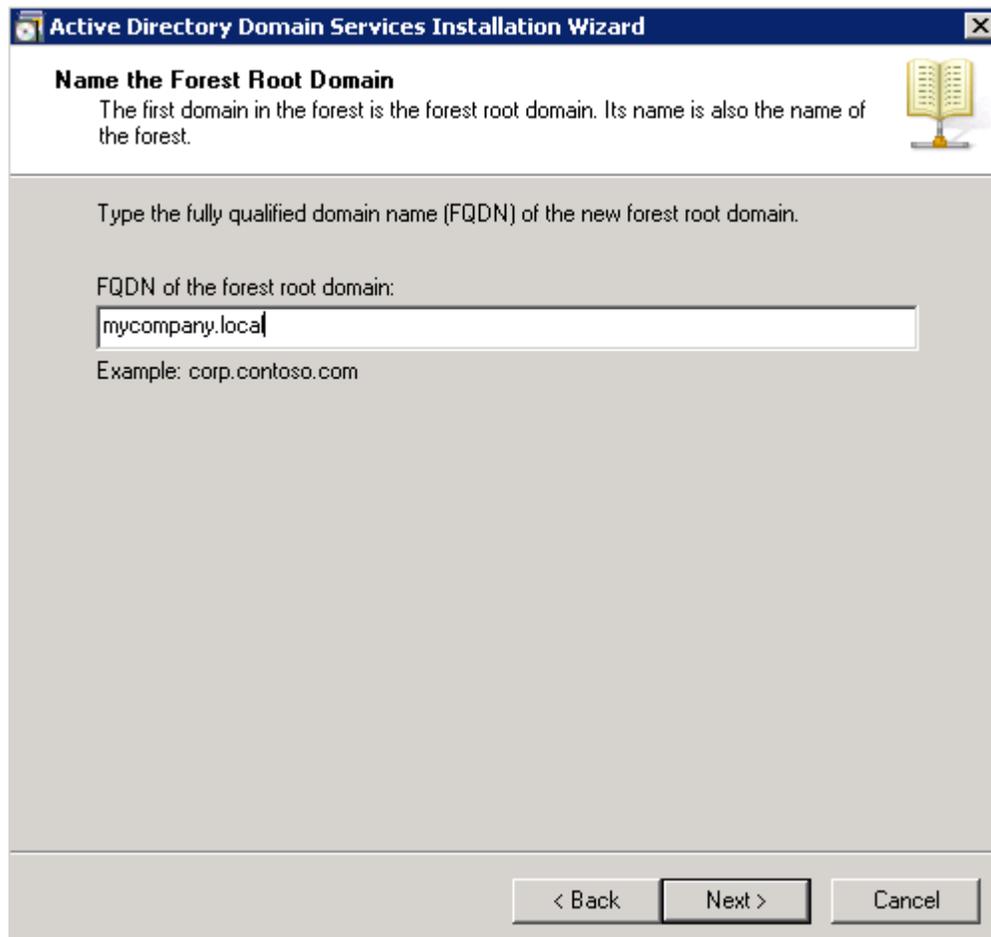
Creating the Active Directory domain

Now that you have installed the necessary roles and features, you can start creating the Active Directory domain. To do this:

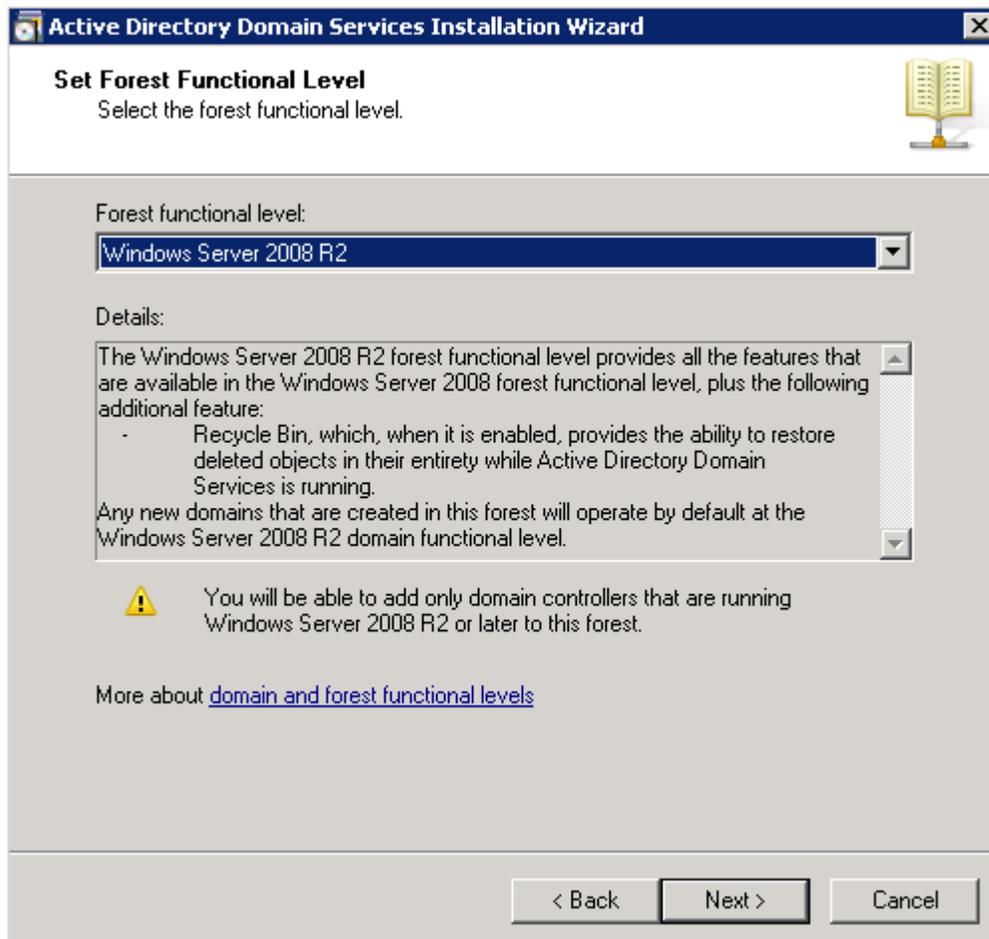
- 1 Click **Start > Run**, and execute the `dcpromo` command in the **Run** dialog to launch the **Active Directory Installation** wizard.
- 2 In the **Welcome** window, click **Next**.
- 3 In the **Operating System Compatibility** window, read the displayed information, and click **Next**.
- 4 In the **Choose a Deployment Configuration** window, select the **Create a new domain in a new forest** radio button, and click **Next**.



- 5 In the **Name the Forest Root Domain** window, specify a full DNS name for the new domain, and click **Next**. You can choose any descriptive name you like. In our example, we will assign the `mycompany.local` name to the domain.



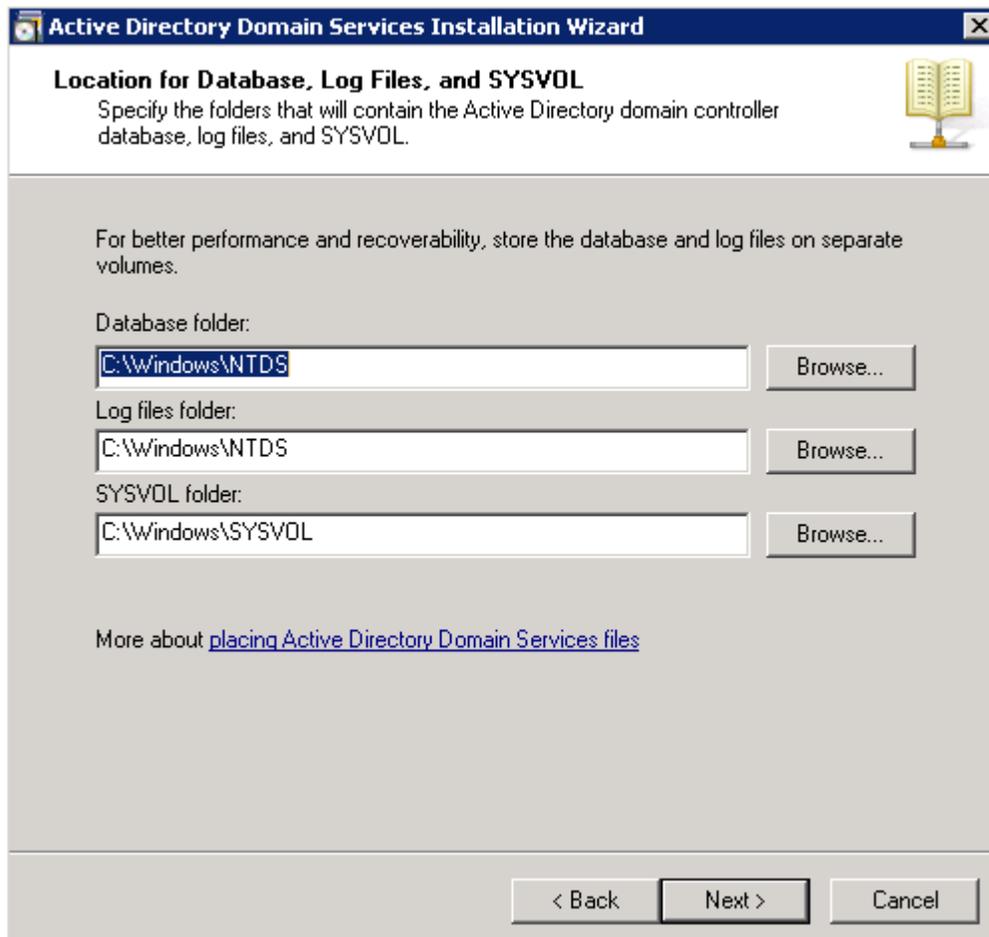
- 6 In the **Set Forest Functional Level** window, select the forest functional level. If your cluster will contain only nodes with Windows Server 2008 R2, select the **Windows Server 2008 R2** option, and click **Next**.



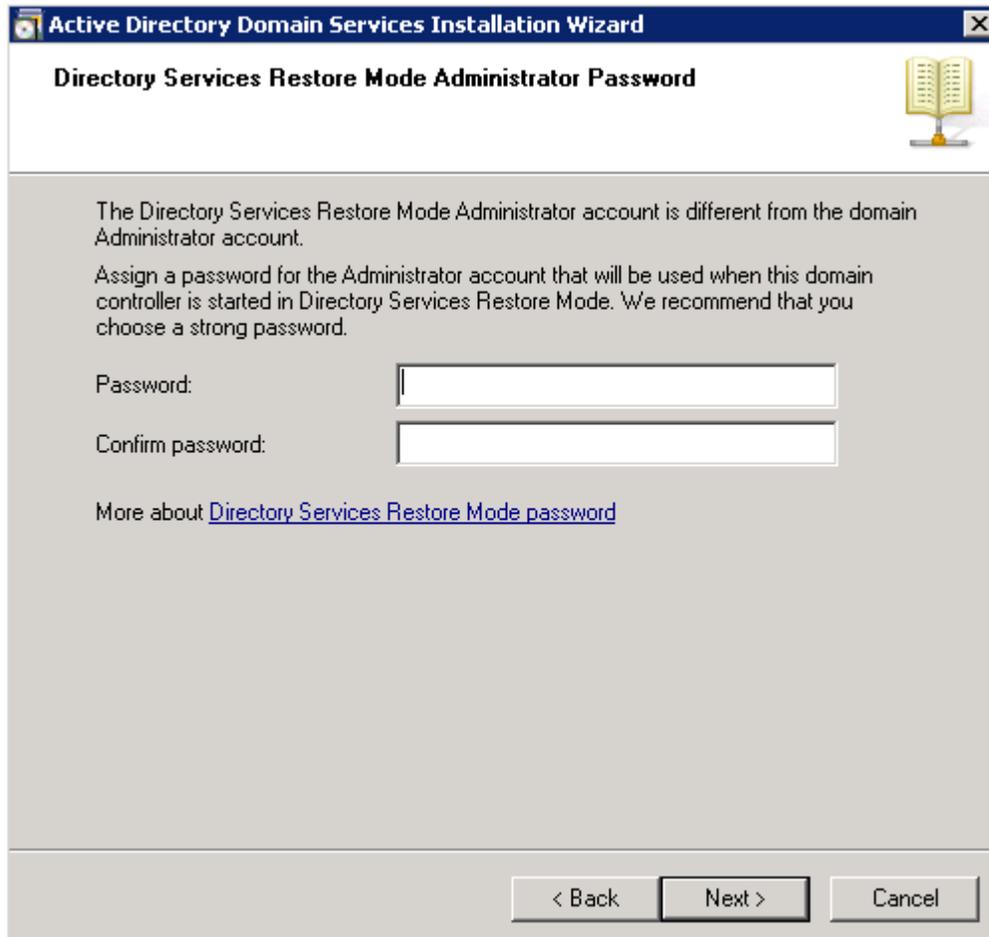
- 7 In the **Additional Domain Controller Options** window, make sure the **DNS server** option is selected, and click **Next**. If you see the following warning, ignore it by clicking **Yes**.



- 8 In the **Location for Database, Log Files, and SYSVOL** window, accept the default values offered by the wizard, and click **Next**.



- 9 In the **Directory Services Restore Mode Administrator Password** window, specify an arbitrary password for the Directory Services Restore Mode administrator. You will need this password to boot the domain controller in Directory Services Restore Mode (e.g., if the Active Directory service has failed or needs to be restored). Make sure the password meets the Windows length and complexity requirements. Click **Next**.



- 10** The last window allows you to review the parameters provided by you in the previous steps of the wizard. To modify any parameters, click **Back**; otherwise, click **Next**.
- 11** A window will open showing you the operation progress. Select the **Reboot on completion** check box to automatically restart the server once the Active Directory domain is created.

For more information on creating and configuring Active Directory domains, refer to <http://support.microsoft.com/kb/324753/en-us>.

Adding Nodes to the Domain

Now that you have created the Active Directory domain and the domain administrator account, you can add your nodes to the domain. To do this:

- 1** Log in to the first node you want to add to the domain, and click **Start > Control Panel > System and Security > System**.
- 2** In the **Computer name, domain, and workgroup settings** section, click **Change settings**.
- 3** On the **Computer Name** tab of the displayed window, click **Change**.
- 4** In the **Computer Name Changes** window, do the following:

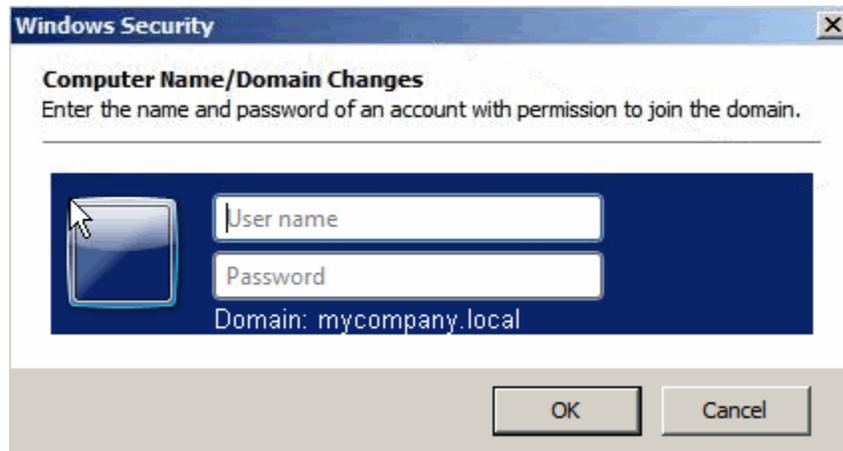
- In the **Computer name** field, specify a server hostname. This name will be used to uniquely identify the given node among other nodes in the cluster. By default, you are offered to use the hostname assigned to the node during the Windows Server installation. However, we recommend that you change this hostname to something more descriptive (e.g., CLUSTERNODE1).
- Select the **Domain** radio button and type the domain DNS name (you specified this name during the Active Directory domain). In our example, the domain DNS name must be set to mycompany.local.

After providing the necessary information, your window should look like the following:



When you are ready, click **OK**.

- 5 In the **Computer Name Changes** window, type the username and password of the domain administrator account, and click **OK**.



- 6 Click **OK** to close the displayed message welcoming you to the domain, and then click **OK** once more to close the **Computer Name Changes** window.
- 7 Restart the node.
- 8 Perform **Steps 1-7** for both remaining nodes.

Connecting Servers to a Shared Storage

Next, you should configure the shared storage and connect it to all your cluster nodes. The way of configuring storage devices and connecting them to cluster nodes varies from vendor to vendor. So we recommend that you refer to the vendor's guidelines and recommendations to properly set up your storage.

For your reference, we list below the general steps that you usually have to perform to configure a shared SCSI device:

- 1 Power off all your cluster nodes.
- 2 Prepare the necessary controllers for the shared storage bus.
- 3 Connect the SCSI device to the shared bus, and then join the bus to your cluster nodes.
- 4 Power on the first cluster node.
- 5 Format all the disks on the cluster storage device as NTFS, and configure them as basic disks.
- 6 Partition the disks on the cluster storage device.

Pay special attention to the disk to be allocated to the cluster quorum resource. The quorum resource maintains the cluster configuration data; so, we highly recommend that you use a separate disk (about 500 MB in size) for this resource.

- 7 Assign drive letters to the disks on the cluster storage device.

Note: All the disks on the cluster storage device must be assigned drive letters. If a disk does not have a letter, it cannot be added to a clustered service intended for hosting Virtuozzo Containers resources. For information on clustered services, see **Configuring the Cluster** (p. 29).

For more information about configuring shared storage devices in cluster environments, refer to <http://technet.microsoft.com/en-us/library/ff182359%28v=ws.10%29.aspx>.

Setting Up a Cluster

Now you are ready to set up a failover cluster that will ensure the high availability of your Virtuozzo Containers for Windows installations. The process of setting up this kind of cluster includes the following steps:

- 1 Creating the failover cluster and configuring the first cluster node.
- 2 Configuring all the remaining nodes in the cluster.

These steps are described in the following subsections in detail.

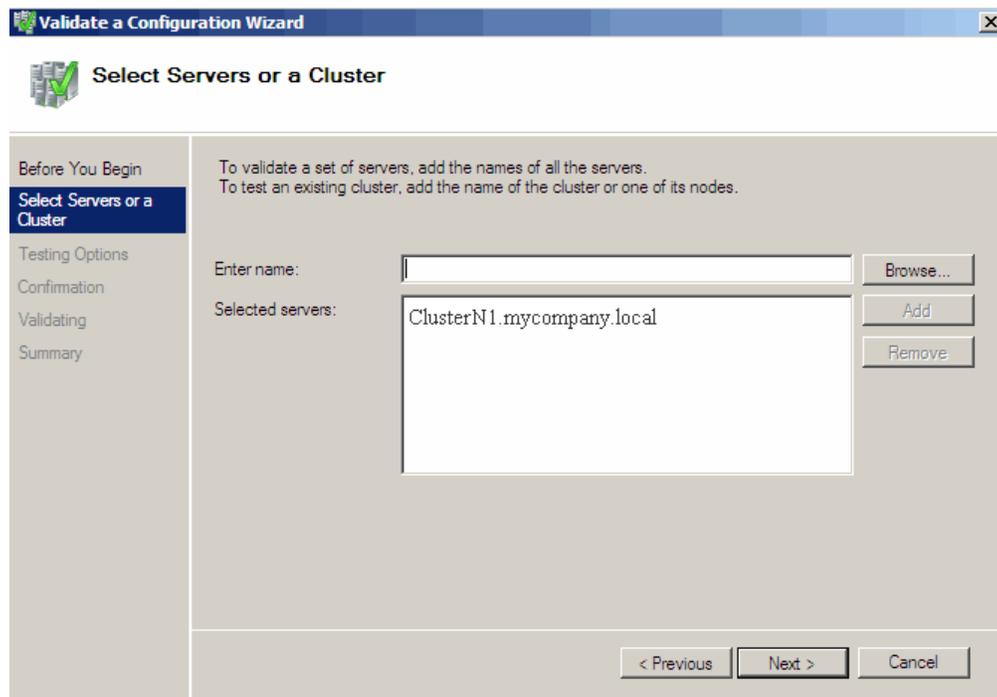
Deploying a Failover Cluster in Windows Server 2008 R2

This section describes how to set up a failover cluster on servers running Windows Server 2008 R2.

Validating Hardware

If you plan to create a failover cluster from servers running Windows Server 2008 R2, you first need to ensure that your servers hardware is supported for use with the Windows Server 2008 R2 clustering software. To do this:

- 1 Log in to any of your cluster nodes using the domain administrator account; you created this account in **Setting Up a Domain Administrator Account**.
- 2 Install the Failover Clustering feature on the node, if it is not yet installed.
- 3 Click **Start > Administrative Tools > Failover Cluster Manager** to open the Failover Cluster Manager snap-in.
- 4 In the **Management** section, click **Validate a Configuration** to start the **Validate a Configuration** wizard.
- 5 In the **Before You Begin** window, read the provided information, and click **Next**.
- 6 In the **Select Servers or a Cluster** window, specify the server to be validated, and click **Next**. To save time, you can specify all your nodes you plan to include in the cluster.



7 In the **Testing Options** window, click **Next**.

8 In the **Confirmation** window, review the servers to be validated and the tests to be run during the validation, and click **Next**.

You can view the progress in the **Validating** window.

9 After the validation is complete, review the validation results in the **Summary** window, and click **Finish** to close the wizard.

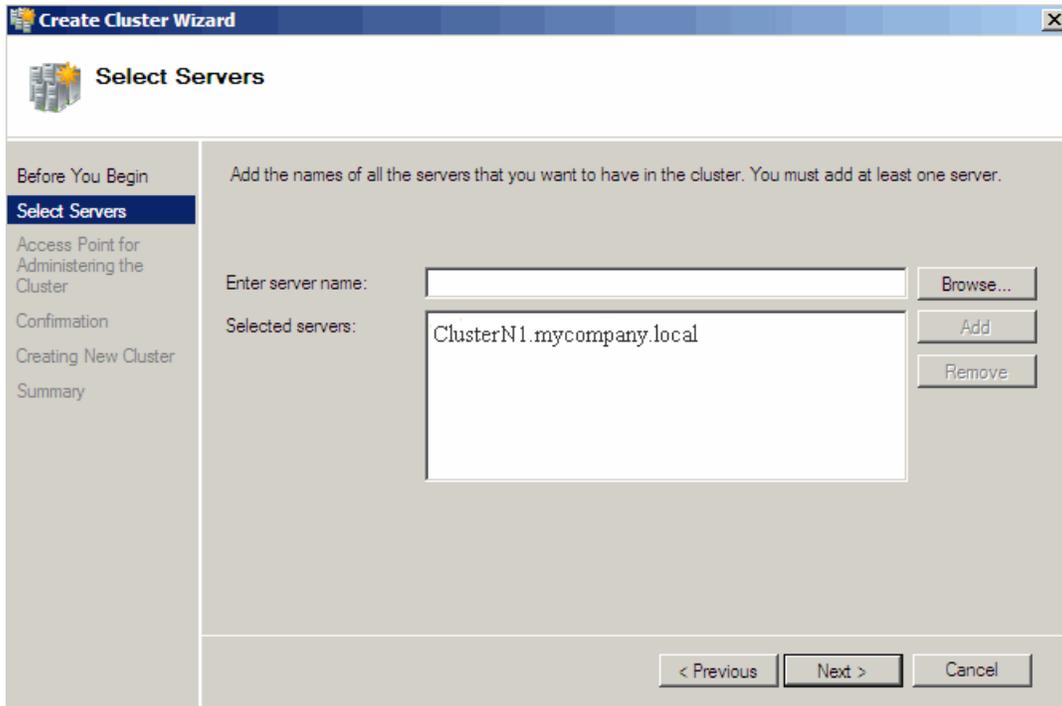
For more information on validating hardware for a failover cluster, see [http://technet.microsoft.com/en-us/library/cc732035\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/cc732035(WS.10).aspx).

Creating a Cluster in Windows Server 2008 R2

The processes of creating a failover cluster and configuring the first cluster node take place simultaneously and are described below:

- 1 Log in to any of your cluster nodes using the domain administrator account (you created this account in **Setting Up a Domain Administrator Account**). This node will be registered as the first node in the cluster.
- 2 Click **Start > Administrative Tools > Failover Cluster Management** to open the Failover Cluster Management snap-in.
- 3 In the center pane under **Management**, click **Create a Cluster** to launch the **Create Cluster** wizard.
- 4 In the **Before You Begin** window, click **Next** to start validating your server hardware. This step is skipped if you have already validated the hardware.

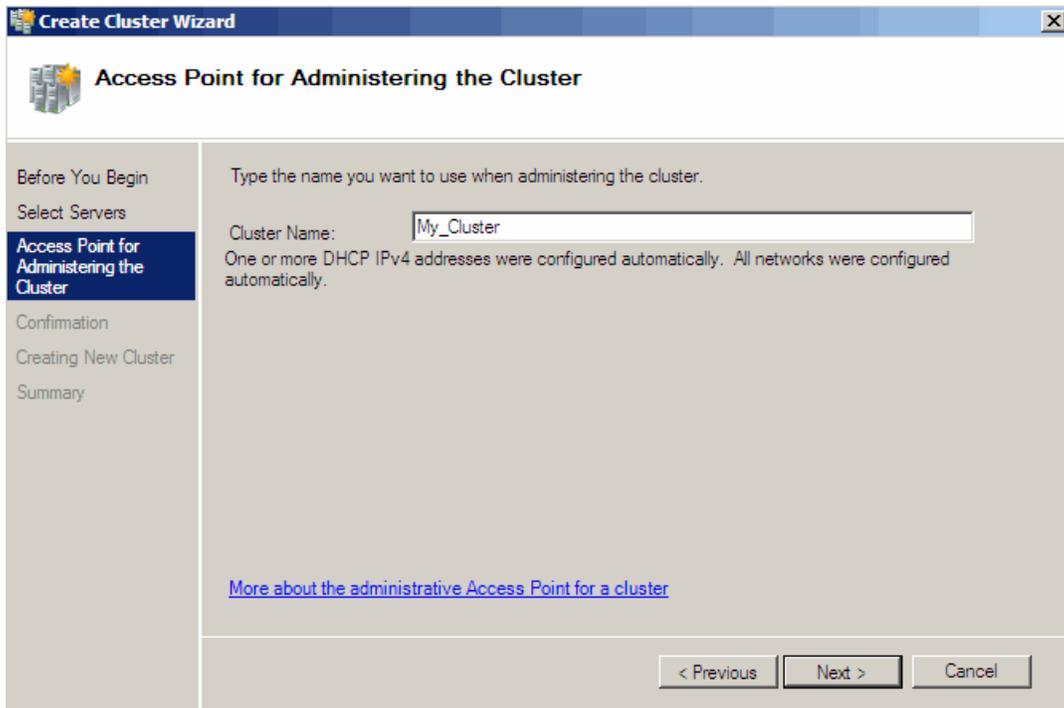
- 5 In the **Select Servers** window, specify the node hostname or IP address, and click **Add**.



In this step, you can specify all nodes you want to add to the cluster. For the purposes of this guide, however, we add only one node in this step and will add all the other nodes after creating the cluster.

When you are ready, click **Next**.

- 6 Next, you are asked to assign a name to the cluster. Type a descriptive name for the cluster in the **Cluster Name** field (e.g., `My_Cluster`), and click **Next**. As the cluster administrator, you will then use this name to connect to the cluster with cluster management applications (e.g., Cluster Administrator or `cluster.exe`) and manage the cluster in different ways (e.g., configure some of its settings or monitor its activity).



- 7 In the **Confirmation** window, review the parameters that will be used for creating the cluster, and click **Next**.

You can view the progress in the **Creating New Cluster** window.

- 8 After the cluster has been successfully created, the **Summary** window appears. Click **Finish** to close the wizard.

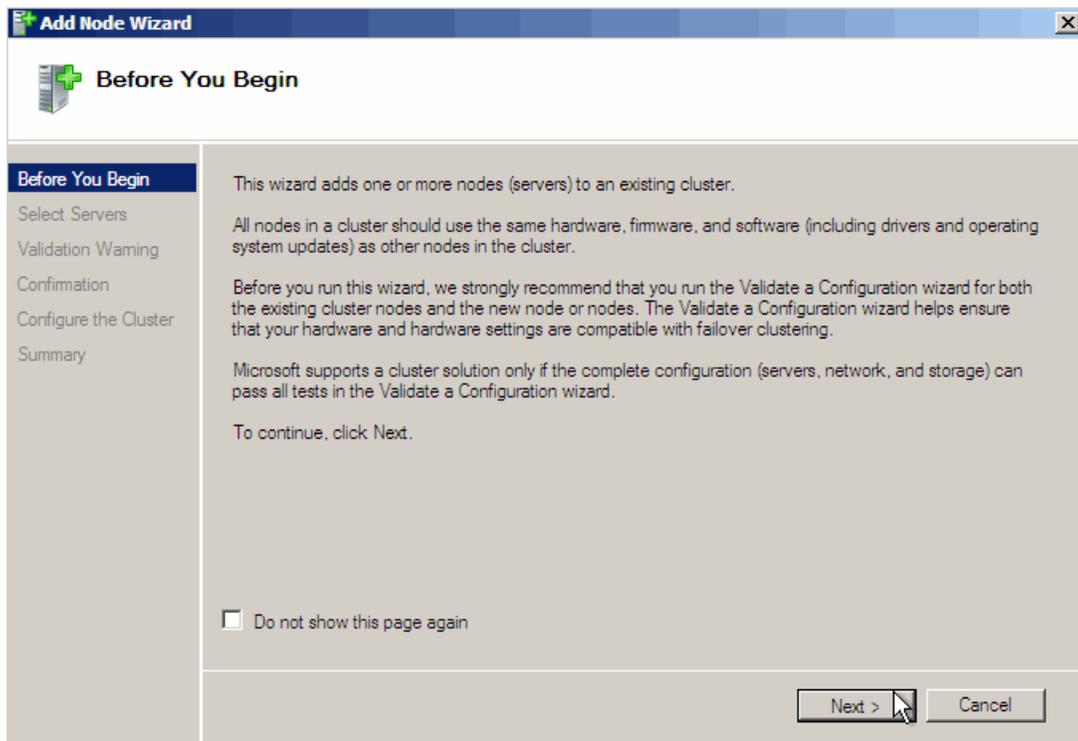
The cluster name appears in the left pane of the Failover Cluster Management snap-in.



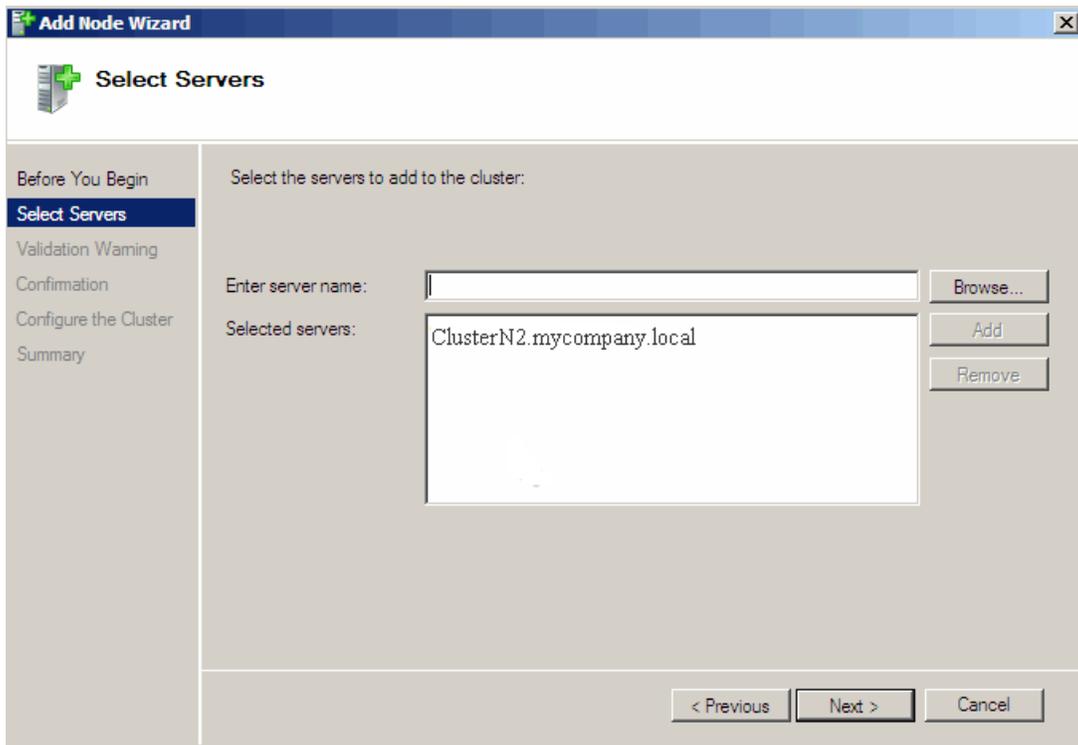
Adding Nodes to the Cluster

The process of adding the second and all the remaining nodes to the failover cluster is almost identical to that of setting up the first cluster node and is described below:

- 1 Log in as the domain administrator to the cluster node that you registered in the previous step.
- 2 Click **Start > Administrative Tools > Failover Cluster Management** to open the Failover Cluster Management snap-in.
- 3 In the left pane, right-click the cluster name, and select **Add Node**.
- 4 In the **Before You Begin** window, click **Next** to proceed with the wizard.

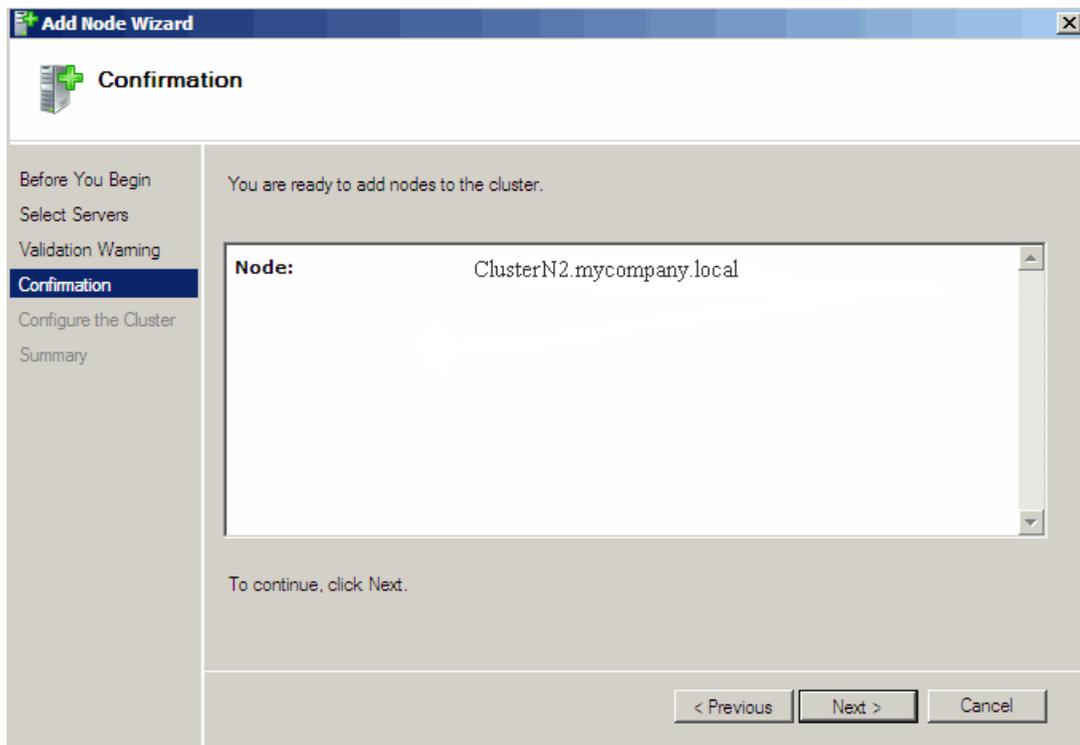


- 5 In the **Select Servers** window, specify the nodes to be added to the cluster.



To add a node, type its hostname or IP address in the **Enter server name** field, and click **Add**. After specifying all the necessary nodes, click **Next**.

- 6** In the **Validation Warning** window, read the information provided, and click **Next** to start validating your server hardware.
- 7** In the **Confirmation** window, review the nodes that will be added to the cluster, and click **Next**.



The progress of adding nodes to the cluster is shown in the **Configure the Cluster** window.

- 8 Once your nodes have been successfully added to the cluster, the **Summary** window appears. Click **Finish** to close the wizard.

Configuring the Cluster

After you have created the failover cluster and registered all nodes with it, you need to configure some of its settings to prepare the cluster for installing the Virtuozzo Containers for Windows software. You need to do the following:

- 1 Create clustered services .
- 2 Add disk resources to services.
- 3 Configure the quorum mode.

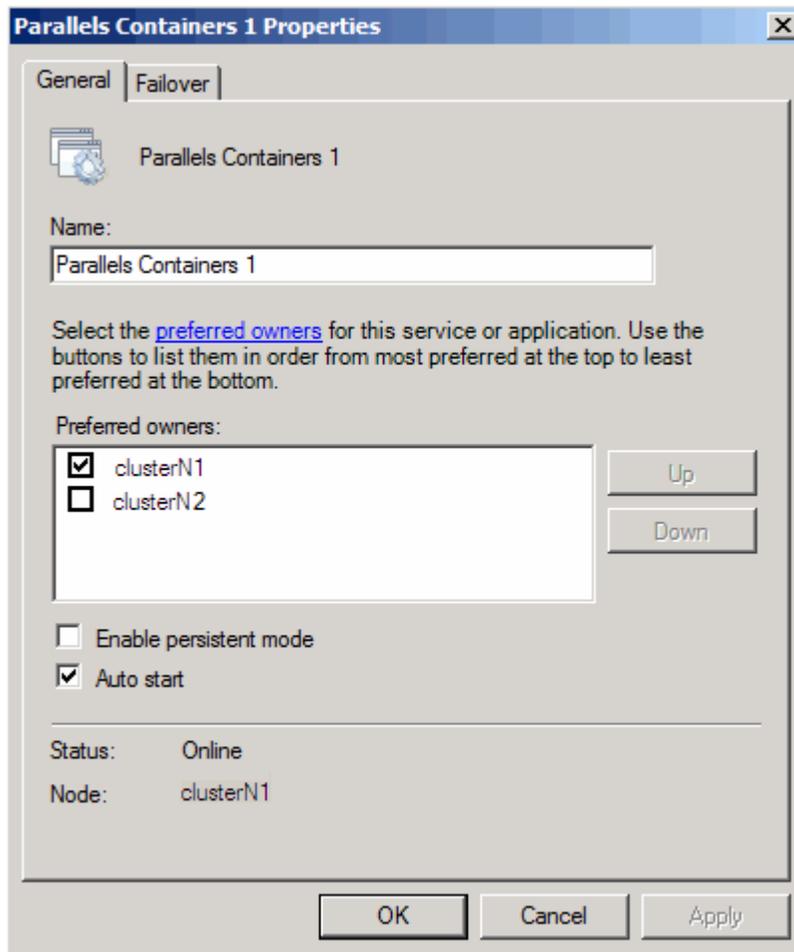
Detailed information on these configuration steps is given below.

Creating Clustered Services

In the first step, you need to create clustered services. These services will contain all Virtuozzo Containers for Windows resources and fail over to another node in the case of a failure. You must create a separate service for each active node in the cluster.

To create a clustered service:

- 1 In the left pane of the Failover Cluster Manager snap-in, right-click the **Service and Applications** item, and select **More Actions > Create Empty Service or Application**.
After a while, the new service appears in the **Services and Applications** pane.
- 2 Right-click the service, and choose **Properties**.
- 3 Type a descriptive name for the service in the **Name** field, and click **OK**.



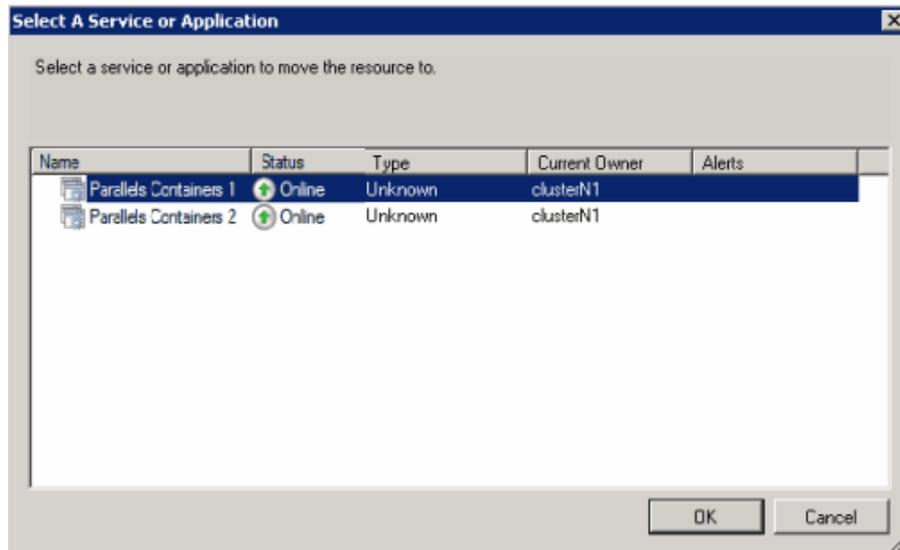
Adding Disk Resources to Resource Groups

Next, you need to add disk resources to the clustered services you created in the previous step. Each clustered service intended for hosting Virtuozzo Containers for Windows resources must contain at least one disk resource. When you create a failover cluster, the clustering software automatically processes all disks on your shared storage and adds them to the failover cluster. You can view these disks by clicking the **Storage** item in the Failover Cluster Manager snap-in.

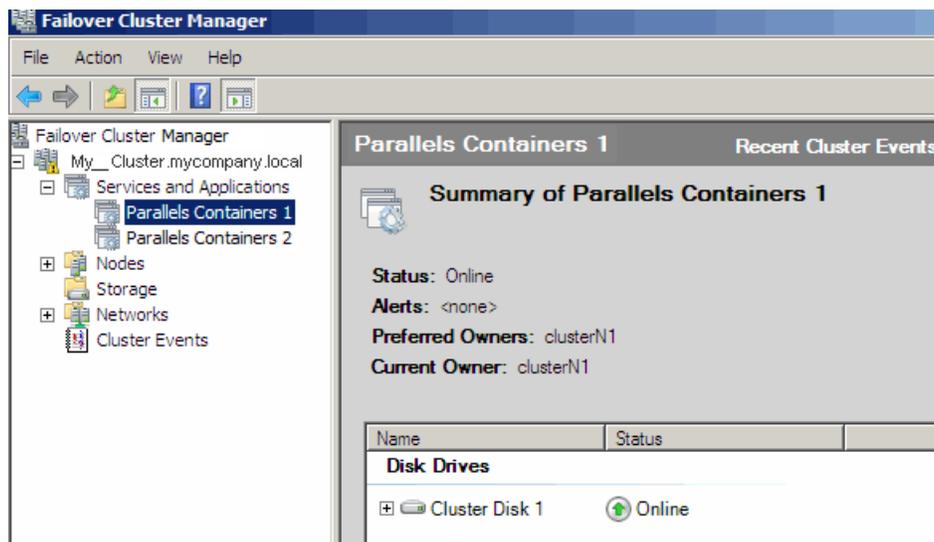
To add a disk resource to a service, do the following:

- 1 In the Failover Cluster Manager snap-in, double-click the cluster name, and click **Storage**.

- 2 Right-click the disk resource, and select **More Actions > Move this resource to another service or application**.
- 3 In the **Select a Service or Application** window, select the service you want to add the disk resource to, and click **OK**.



To check that the disk resource has been successfully added to the service, expand the **Services and Applications** item, and click the service name. The added disk should be listed under **Disk Drives**, and its status should be set to **online**.



When working with disk resources, keep in mind the following:

- Each service intended for hosting Virtuozzo Containers for Windows resources must contain at least one disk resource.

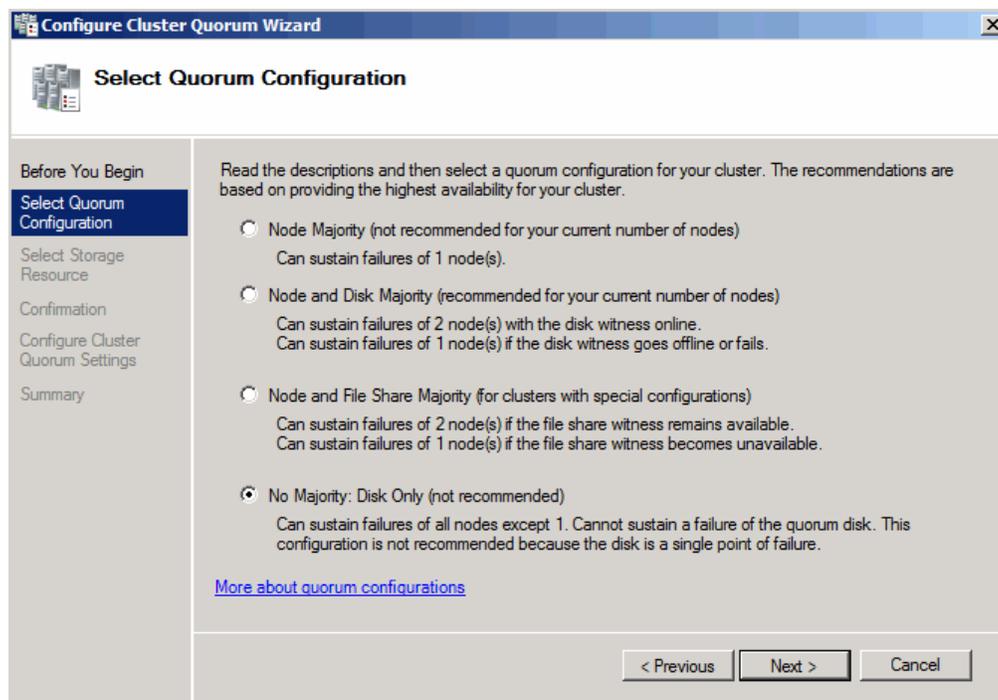
- A separate disk is also needed for hosting the *quorum* resource if you decide to store the quorum on a specific disk. For details, see **Configuring the Quorum Mode** below. In this case, you can calculate the number of disks using this formula: $disks_number = groups_number + 1$. For example, if you have 3 services, you need to create at least 4 disk resources.
- If the number of clustered services exceeds the number of disk resources you currently have or you need a disk for hosting the quorum resource, you can add additional disk resources to the cluster. For information on how you can do this, see the **Adding Disks Resources to the Cluster** section below.

Configuring the Quorum Mode

In the last step, you need to choose the quorum mode for use in your cluster. Follow this link to find out what quorum mode is recommended for your failover cluster implementation:
[http://technet.microsoft.com/en-us/library/dd197496\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/dd197496(WS.10).aspx).

After deciding on the right quorum mode, you can enable it by doing the following:

- 1 In the left pane of the Failover Cluster Manager snap-in, click the name of the cluster.
- 2 In the **Actions** pane, select **More Actions** > **Configure Cluster Quorum Settings** to launch the **Configure Cluster Quorum** wizard.
- 3 In the **Before You Begin** window, read the provided information, and click **Next**.
- 4 In the **Select Quorum Configuration** window, choose the quorum configuration that best meets your needs, and click **Next**.



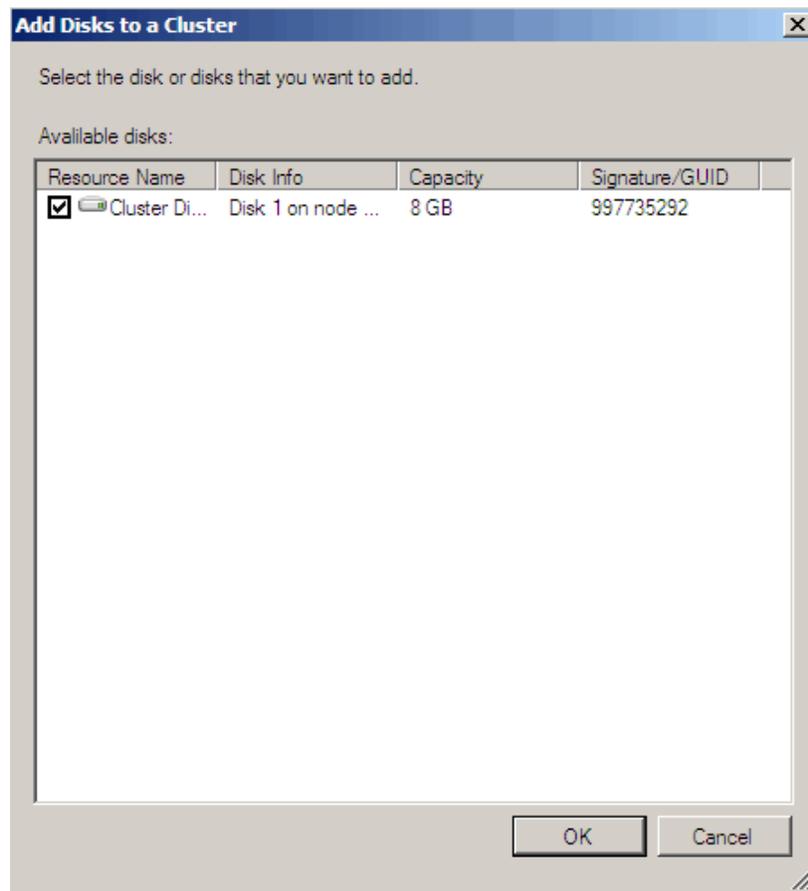
- 5 Follow the instructions of the wizard to complete the quorum configuration.

Adding Disk Resources to the Cluster

Sometimes, you may need to add an additional disk resource to the failover cluster. For example, this may be the case if the number of clustered services exceeds the number of disk resources you currently have or if you need a disk for hosting the quorum resource.

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

- 1 Make sure your shared storage has at least one free disk configured for including in the cluster. For more information on configuring shared storages and their disks, see **Connecting Servers to a Shared Storage** (p. 22).
- 2 In the Failover Cluster Manager snap-in, double-click the cluster name.
- 3 Right-click the **Storage** item, and select **Add a disk**.
- 4 In the **Add Disks to a Cluster** window, select the check boxes next to the disk you want to add to the cluster, and click **OK**.



After a while, the disk should appear in the center pane of the Failover Cluster Manager snap-in.

Checking Cluster Operation

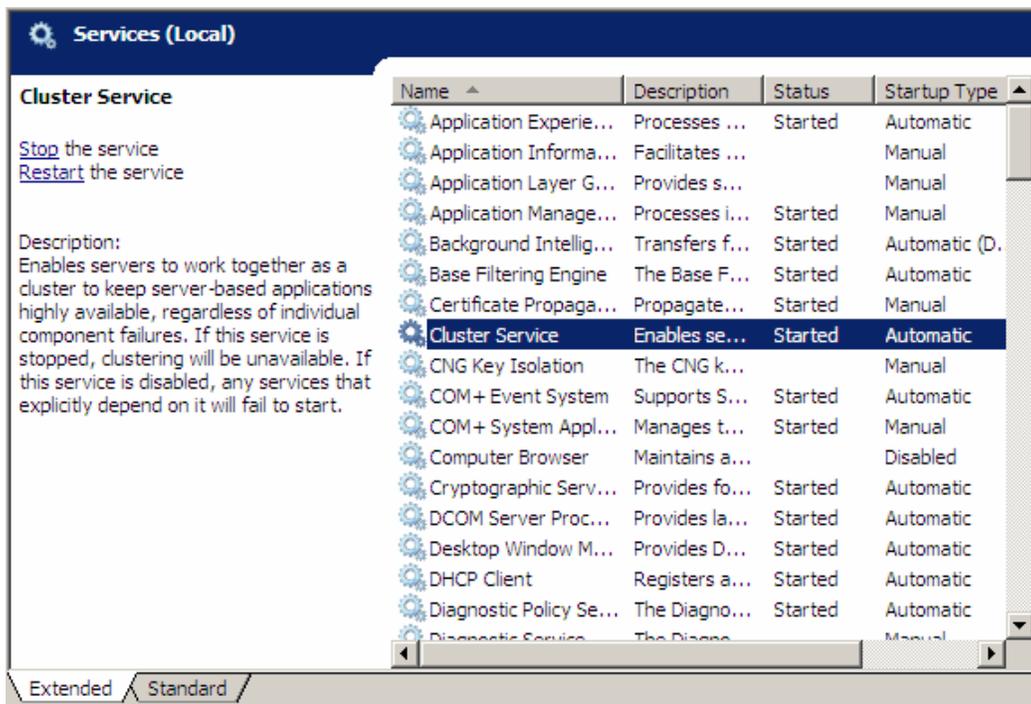
You can use the procedures below to verify the correct operation of your failover cluster.

First Procedure (viewing the status of cluster nodes in Failover Cluster Manager):

- 1 Log in to any of your cluster nodes using the domain administrator account.
- 2 Click **Start > Administrative Tools > Failover Cluster Manager** to open the Failover Cluster Manager snap-in.
- 3 Verify that all nodes are listed under the corresponding cluster and their resources are online.

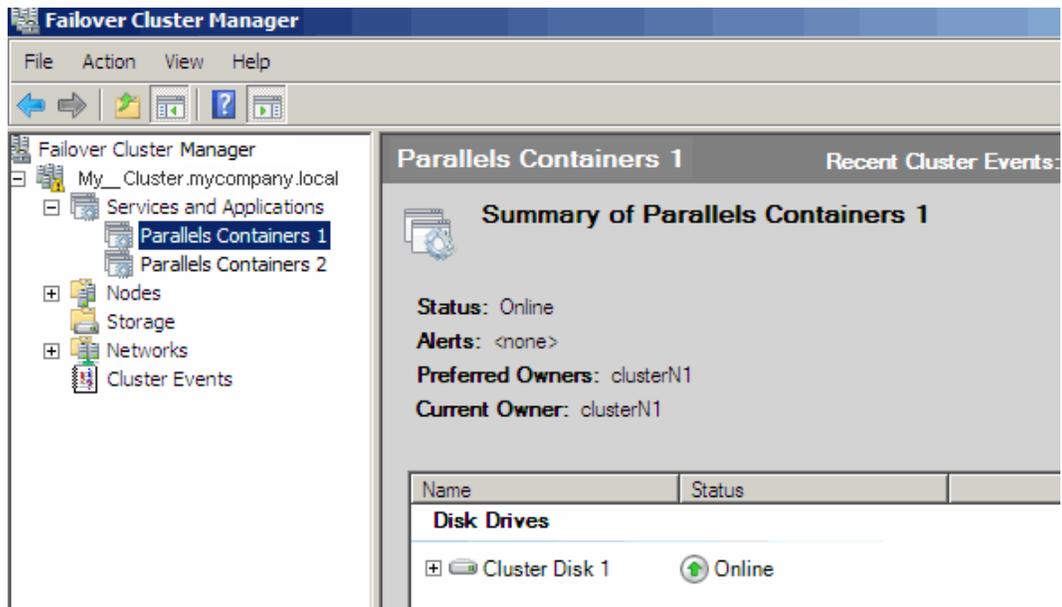
Second Procedure (checking the Cluster service availability):

- 1 On each cluster node, click **Start > Administrative Tools > Services** to launch the Services snap-in.
- 2 In the right pane of the displayed window, verify that the `Cluster Service` service is listed in the **Services** table and its status is set to `Started`.



Third Procedure (checking the failover of cluster resources):

- 1 Log in to any of your cluster nodes using the domain administrator account.
- 2 Click **Start > Administrative Tools > Failover Cluster Manager** to open the Failover Cluster Manager snap-in.
- 3 Expand the **Services and Applications** item, and click the name of a clustered service. The center pane will display all the resources currently included in the service.

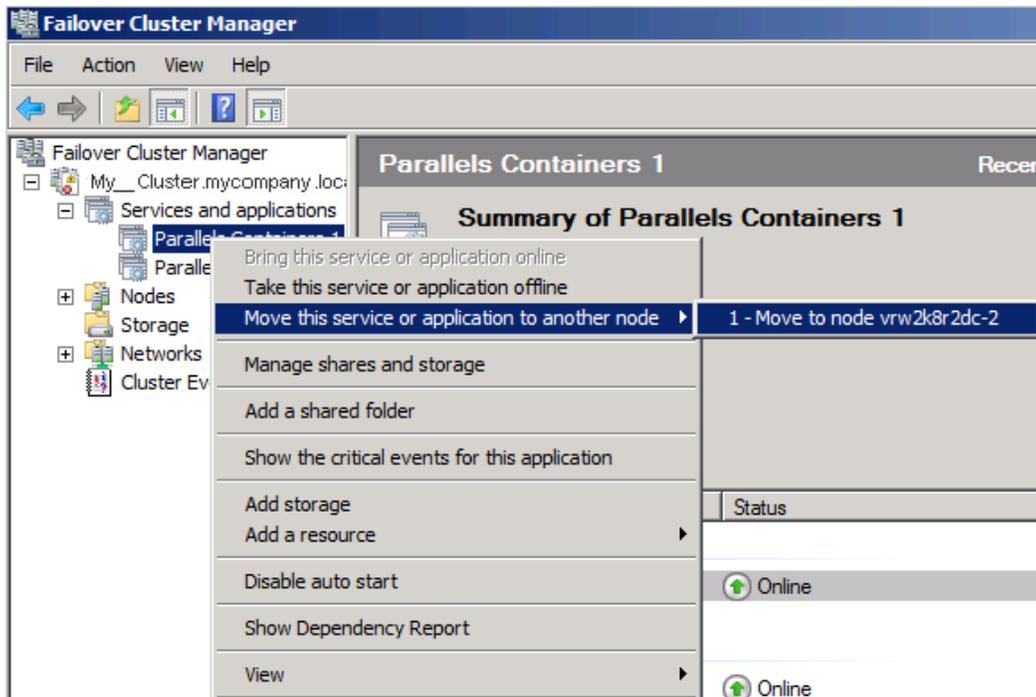


- 4 Choose a resource to use for simulating the failover, right-click it, and select **More Actions > Simulate failure of this resource**.

The resource should come back online either on the same or on another node in the cluster.

Fourth Procedure (checking the failover of clustered services):

- 1 Log in to any of your cluster nodes using the domain administrator account.
- 2 Click **Start > Administrative Tools > Failover Cluster Manager** to open the Failover Cluster Manager snap-in.
- 3 Expand the **Services and Applications** item, right-click a clustered service, and select **Move this service or application to another node > Move to node Node_Name**.



Make sure that the clustered service and all its resources have come back online on the selected node.

4 Repeat **Steps 1-3** for each clustered service.

Installing Virtuozzo Containers for Windows on Cluster Nodes

The procedure of installing Virtuozzo Containers for Windows on servers (also known as nodes) participating in a failover cluster slightly differs from that of installing it on standalone servers. Use the guidelines below to correctly install Virtuozzo Containers for Windows on your cluster nodes.

General Guidelines

Before starting the installation, be sure to read the following information:

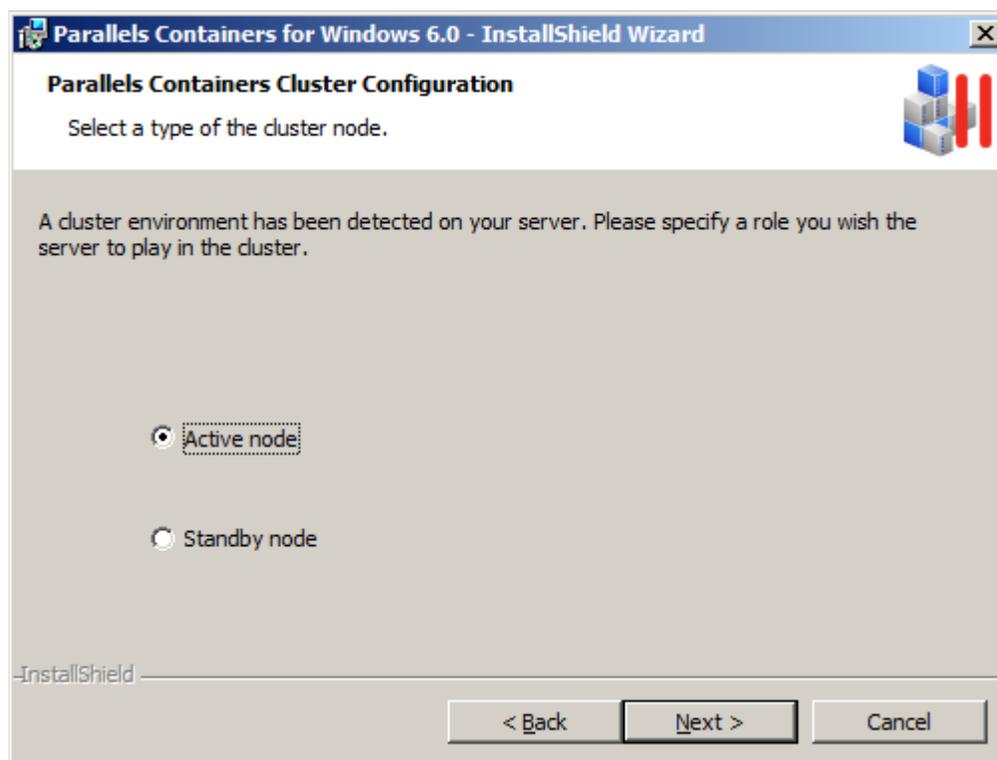
- You must install the Virtuozzo Containers for Windows software on each node you plan to include in the failover cluster.
- You must install the Virtuozzo Containers for Windows software on one cluster node at a time.
- The order of installing the Virtuozzo Containers for Windows software on active and passive nodes is not important. It means that you can, for example, first install Virtuozzo Containers for Windows on an active node, then proceed with a standby node, and then install the software on another active node.

- The Virtuozzo Containers for Windows installation files must be located either on a local disk drive or on a CD or DVD inserted in the node's local CD/DVD-ROM drive. The Virtuozzo Containers for Windows installation will fail if the installation files are located on a network drive or clustered disk.

Installation Guidelines

To install Virtuozzo Containers for Windows on a cluster node, do the following:

- 1 Follow the installation instructions in the *Virtuozzo Containers for Windows 6.0 Installation Guide* until the **Virtuozzo Containers for Windows Cluster Configuration** window is displayed. In this window you are asked to specify a role you want the Hardware Node to play in the cluster.

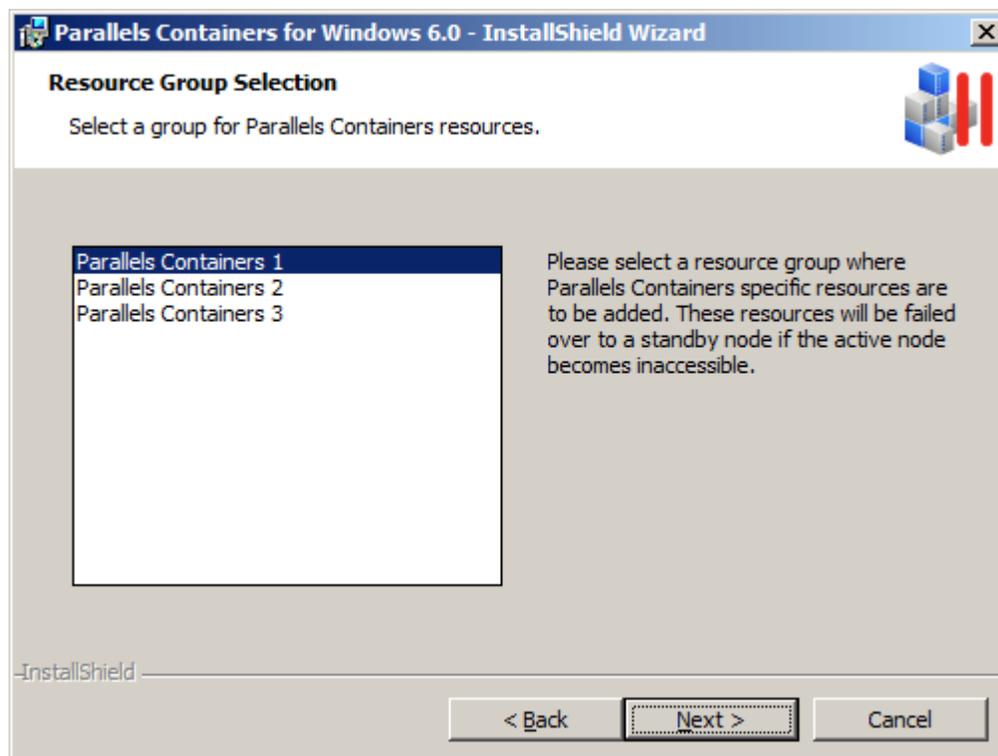


You can choose one of the following options:

- Select the **Active node** radio button to make the server operate as an active node in the cluster. This node will host all relevant Virtuozzo Containers for Windows resources and fail them over to a standby node in the case of a failure. If you are going to deploy an active/active failover cluster, you must select the **Active node** radio button for each node that will participate in this cluster. For more information on active/active clusters, see **Active/Active Failover Clusters** (p. 8).
- Select the **Standby node** radio button to make the server operate as a standby node in the cluster. This node will take control over the Virtuozzo Containers software and its resources in the case of an active node failure.

When assigning roles to your nodes in the Virtuozzo failover cluster, keep in mind the following:

- a** You can choose any of the aforementioned options irrespective of the role played by the server in the cluster before installing Virtuozzo Containers for Windows on it.
 - b** A role is not a permanent property of a cluster node, i.e. one and the same node can act as both active and standby in different periods of time, irrespective of the role assigned to the node during the Virtuozzo Containers for Windows installation. For example, a standby node can become active when it takes control over the group responsible for keeping Virtuozzo Containers for Windows-specific resources in the event of an active node failure. The failed active node, in turn, automatically becomes standby when it is taken online after its failure provided that the Failback feature is not enabled for Virtuozzo Containers for Windows resources on this node (for more information on the Failback feature, see the next section).
- 2** On the **Resource Group Selection** screen, choose a resource group (known as a clustered service in Windows Server 2008 R2) for Virtuozzo Containers for Windows-specific resources that will be able to fail over to a standby node in the case of a failure.



The table on this screen lists all groups existing in your cluster and containing the *physical disk* resource. The latter must be present in a group to successfully add the Virtuozzo Containers for Windows resources to this group. The main Virtuozzo Containers for Windows resources which are failed over to a standby node in the event of an active node failure are given below:

- Virtuozzo VZFS Database
- Virtuozzo Server
- Virtuozzo Automator Agent
- Virtuozzo Automator Agent Compat

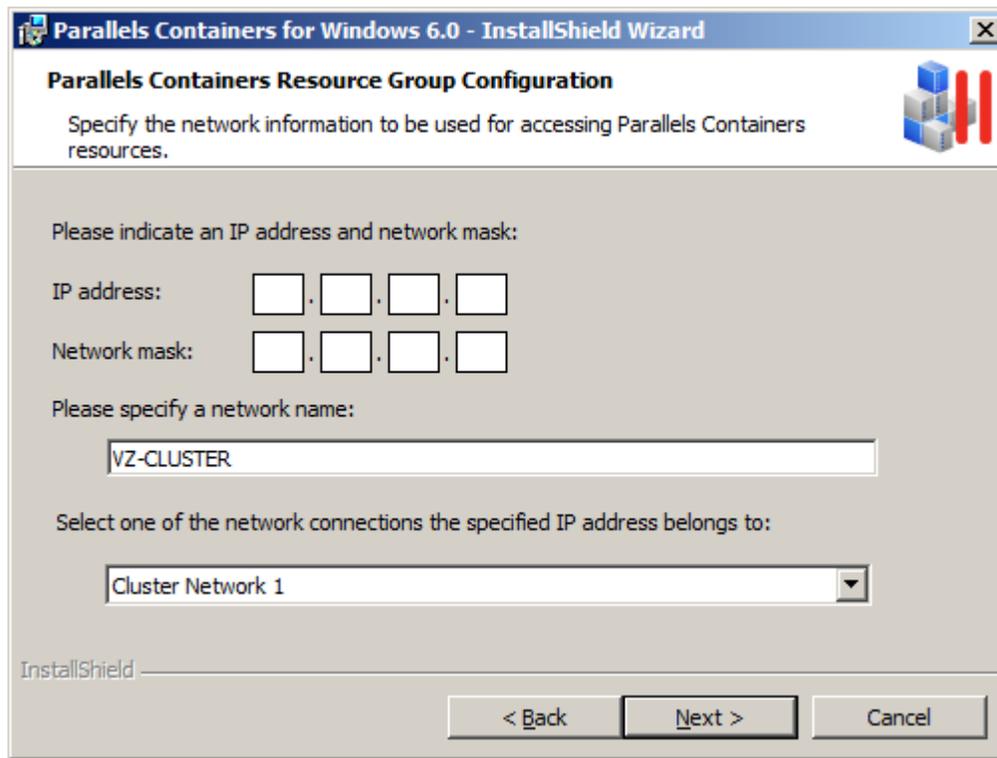
- Container1

Besides, any Container is registered as the `Virtuozzo Container` resource in the cluster during its startup on the active node.

Note: This step is skipped if you are deploying Virtuozzo Containers for Windows on a standby node.

- 3** When specifying the location of Virtuozzo Containers for Windows program files, Container data, and backups on the **Locations of Virtuozzo Containers for Windows Data and Program Files** screen, keep in mind the following:
 - All nodes in the cluster (both active and standby) must have the Virtuozzo program files installed in one and the same folder (e.g., `C:\Program Files\Parallels\Containers`).
 - For each active node in the cluster, Virtuozzo Containers allows you to store Container data and backups only on one of those disks that are registered in the resource group you specified on the **Resource Group Selection** screen (see **Step 2** above).
 - When choosing a disk for storing Container data and backups, make sure that this disk has a drive letter assigned to it.
 - For all standby nodes in the cluster, you are not allowed to modify the location of Container data and backups since these nodes make use of the corresponding folders created during the Virtuozzo Containers installation on the active node and only in the case of an active node failure.
- 4** On the **Virtuozzo Containers for Windows Resource Group Configuration** screen, configure the network parameters for the resources group you chose for hosting Virtuozzo Containers for Windows-specific resources (see **Step 2** above):
 - In the **IP address** and **Network mask** fields, specify an IP address and network mask. Make sure that the indicated IP address is static, unique, and not assigned to any other computer on the network, including the other nodes in the cluster.
 - In the **Specify a network name...** field, indicate a network name. This name will be associated with the IP address you specify in the **IP address** field above. Make sure that this network name is not already assigned to any other node in the cluster.
 - In the **Select one of the network connections...** field, choose a network connection the IP address specified in the **IP address** field belongs to.

After installing Virtuozzo Containers for Windows, you can use the indicated IP address or network name to connect to the cluster node via the Virtuozzo Automator application and manage this node and its Containers using this application.



Notes:

1. This step is skipped if you are deploying Virtuozzo Containers for Windows on a standby node.
2. The fields on the **Virtuozzo Containers for Windows Resource Group Configuration** screen are automatically filled in by the installer if you added all the necessary network parameters before starting the Virtuozzo Containers installation. See **Configuring the Cluster** (p. 29) for details.

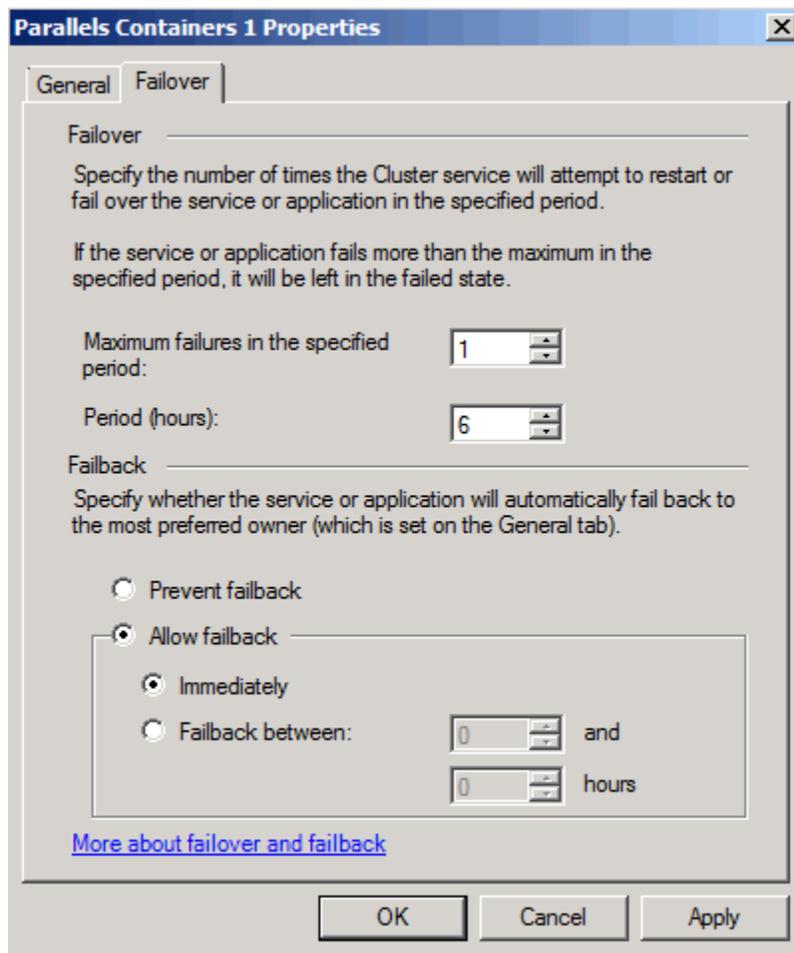
The other peculiarities that should be taken into account when installing Virtuozzo Containers for Windows on cluster nodes are the following:

- A number of operations which are normally performed during the Virtuozzo Containers installation on a standalone server are skipped when installing Virtuozzo Containers on a standby node (e.g. the step of installing Virtuozzo Containers for Windows components and creating the Service Container). This is explained by the fact that standby nodes do not have their own Virtuozzo Containers for Windows resources. They only can make use of the resources controlled by the corresponding active node (e.g., in the case of an active node failure or when the active node is taken offline as part of your maintenance plan).
- Make sure that a valid Virtuozzo Containers for Windows license is installed not only on the active nodes but also on all standby nodes participating in the cluster. Otherwise, your standby nodes will not be able to take control over the Virtuozzo Containers software and its resources in the case of an active node failure.
- We highly recommend that you install the same set of Virtuozzo Containers for Windows and Windows Server updates on all nodes in the failover cluster.

Configuring Automatic Failback

By default, if an active node fails, a standby node becomes active taking control over the group hosted on the active node and keeping all Virtuozzo Containers for Windows-related resources. After the failure associated with the active node has been repaired and the node has been brought online again, this node becomes standby. You can change this behavior by enabling the *Failback* feature, which allows the group to automatically fail back from a standby node to an active one when the latter is taken online again. You can turn on the Failback feature as follows.

- 1 Log in to any of your cluster nodes, and click **Start > All Programs > Administrative Tools > Failover Cluster Manager** to open the Failover Cluster Manager snap-in.
- 2 Expand the **Services and applications** item, right-click the clustered service for which you want to enable the Failback feature, and choose **Properties**.
- 3 On the **Failover** tab of the displayed window, select the **Allow failback** radio button, and do one of the following:
 - Select the **Immediately** radio button if you want the clustered service to immediately fail back to an originally active node when it is brought online again.
 - Select the **Failback between...** radio button, and set the time interval after which the clustered service will fail back to an originally active node.



Adding Nodes to the Failover Cluster

Sometimes, you may wish to join additional nodes to your failover cluster. For example, this may be the case if you wish to increase the number of active or standby nodes participating in the cluster or need to replace a broken node with a new one. The process of adding a new node to a failover cluster is identical to that of configuring any of its original nodes and includes the following basic operations:

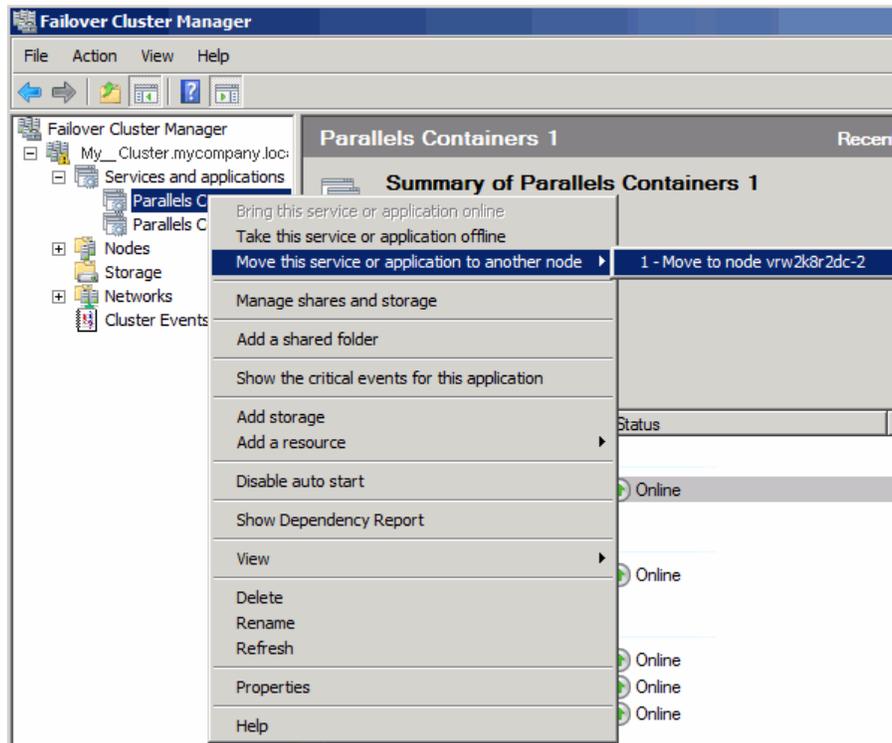
- 1 Preparing all the necessary hardware for the node. For details, see **Setting Up Hardware for the Cluster** (p. 11).
- 2 Configuring the node. For details, see **Configuring Physical Servers** (p. 12).
- 3 Adding the node to the Active Directory domain. For details, see **Adding Nodes to the Domain** (p. 20).
- 4 Connecting the node to your shared storage. For details, see **Connecting Servers to a Shared Storage** (p. 22).
- 5 Adding the node to the failover cluster. For details, see **Setting Up the Cluster** (p. 23).

- 6 Installing Virtuozzo Containers for Windows on the newly configured cluster node. For details, see **Installing Virtuozzo Containers for Windows on Cluster Nodes** (p. 36).

Testing the Failover Cluster

You can test the operation of your failover cluster by completing the following tasks:

- 1 Log in to any of your cluster nodes using the domain administrator account.
- 2 Click **Start > Administrative Tools > Failover Cluster Management** to open the Failover Cluster Management snap-in.
- 3 Expand the **Services and Applications** item, right-click the group with Virtuozzo Containers for Windows resources, and select **Move this service or application to another node > Node_Name** (where *Node_Name* is the name of the cluster node where the group will be moved).



- 4 Make sure that the group has been successfully moved to the selected node and all resources are online.

Troubleshooting Failover Clusters

This section describes some problems you may encounter when working with failover clusters and provides possible solutions to these problems.

Failure to bring a resource group offline or online

You try to bring a Virtuozzo Containers for Windows resource group offline or online, but the operation takes a long time and eventually fails. The reason for this problem may be as follows.

Some Containers, each treated as a Virtuozzo Containers for Windows resource, may require a long time to start or shut down. If this time exceeds the values of the Pending Timeout and Deadlock Timeout parameters set for the resource, the operation fails and the clustering software puts the resource group to the `Failed` state.

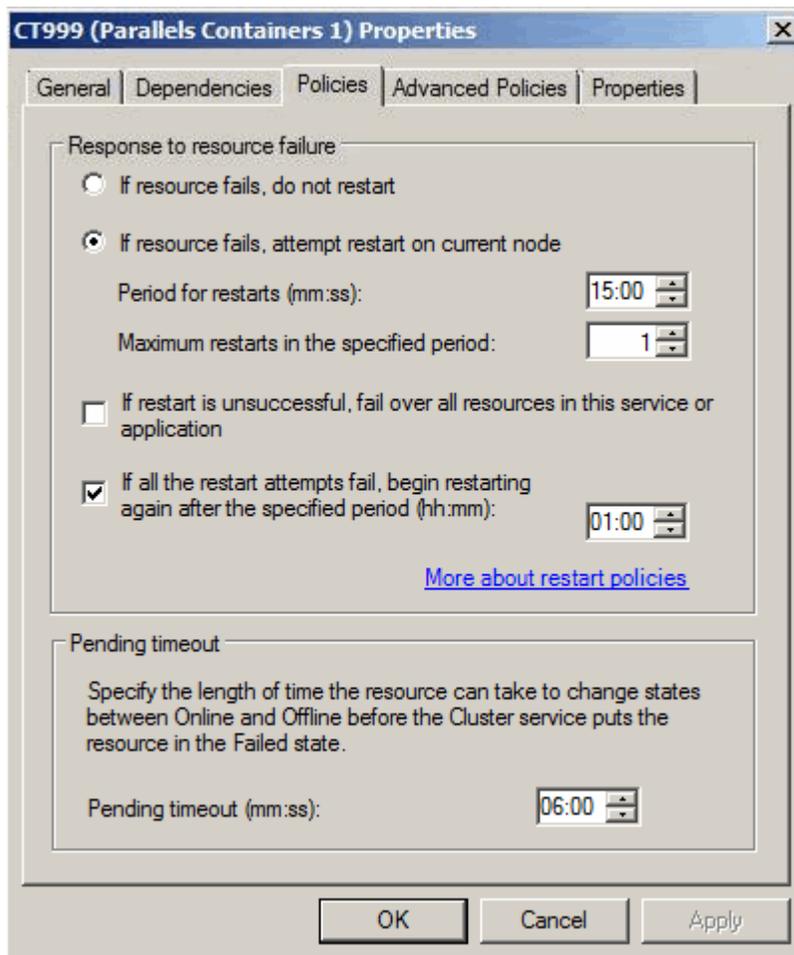
Solution

To solve the problem, make sure that the time needed to stop and start your Containers does not exceed the values set for the Pending Timeout and Deadlock Timeout parameters. Both parameters are configurable per Container so be sure to check them for each Container. If necessary, tune these parameters to meet your demands.

Configuring the Pending Timeout parameter

To configure the pending timeout for a Virtuozzo Containers for Windows resource:

- 1 In the Failover Cluster Manager snap-in , expand the console tree under the cluster you want to configure.
- 2 Expand the **Services and applications** folder.
- 3 Click the resource group hosting the Container for which you want to change the pending timeout.
- 4 In the center pane, right-click the resource (that is, the necessary Container), and click **Properties**.
- 5 Click the **Policies** tab.



- 6 In the **Pending timeout** section, specify the desired pending timeout, and click **OK**.

Configuring the Deadlock Timeout parameter

The Deadlock Timeout parameter is available (and therefore can be configured) only for Hardware Nodes running Windows Server 2008 R2. You can configure this parameter using the `cluster res` command. For example, to increase the Deadlock Timeout value to 5 minutes (which equals 300 000 milliseconds) for Container 999 that belongs to the `vz1` group, you can run this command:

```
C:\...\Administrator>cluster res "999 (VZ1)" -prop DeadlockTimeout=300000
```

Note: You need to be a member of the local Administrators group to complete the operations above.

Creating Clusters From Containers

Virtuozzo Containers for Windows allows you to include Containers in a failover cluster so that they can act as full participants (nodes) in the cluster and provide high availability for your applications and services. In Virtuozzo Containers for Windows, you can create a cluster in one of the following ways:

- using a SAN (Storage Area Network)-based shared storage device
- using a 'loopback file'-based shared storage device

As is evident from their names, these ways differ from each other in the type of the shared storage device to be used in the cluster. While the first way assumes using a shared physical disk drive as a shared storage device, the second way requires the usage of a special loopback file created on the Hardware Node and emulating a shared physical disk drive in the cluster. Both ways of the cluster creation are described in the following subsections in detail.

Note: The examples used in the following subsections show only several possible cluster configurations you can to deploy in your working environments. You can hold to these configurations or work out your own ones and build your own cluster architecture.

In This Chapter

Setting Up a SAN-Based Cluster	46
Setting Up a 'Loopback File'-Based Cluster	48

Setting Up a SAN-Based Cluster

In Virtuozzo Containers for Windows, you can include Containers, along with standalone physical servers, in clusters to provide higher availability for your applications and services (for example, for the MS SQL Server application). When creating such a cluster, keep in mind that all Containers participating in the cluster must reside on different Hardware Nodes since one and the same shared storage device on a Node (usually, a shared SCSI disk) can be forwarded to only one Container on this Node.

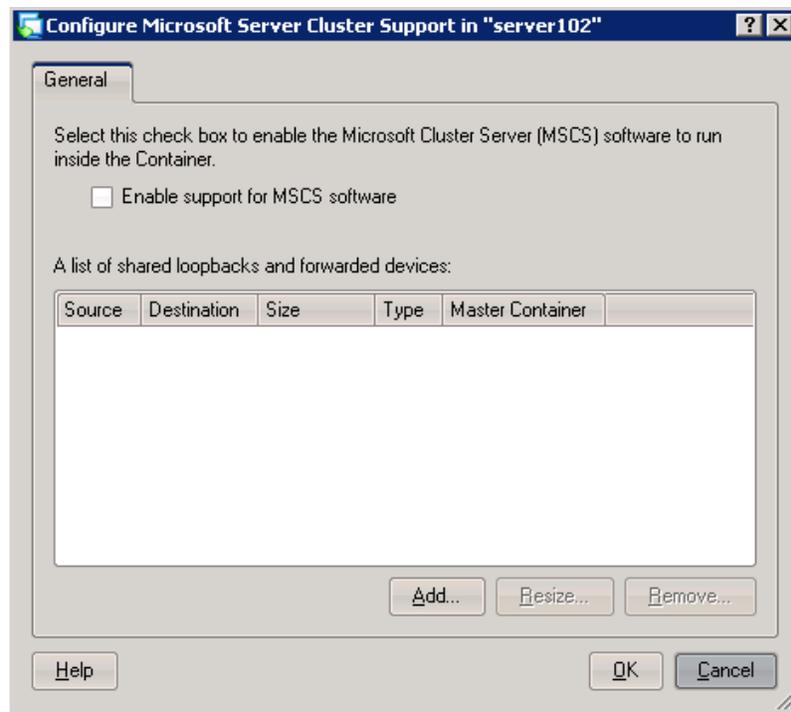
Notes:

1. It is a good practice to make a standalone physical server act as an active node in the cluster and a Container as the standby one.

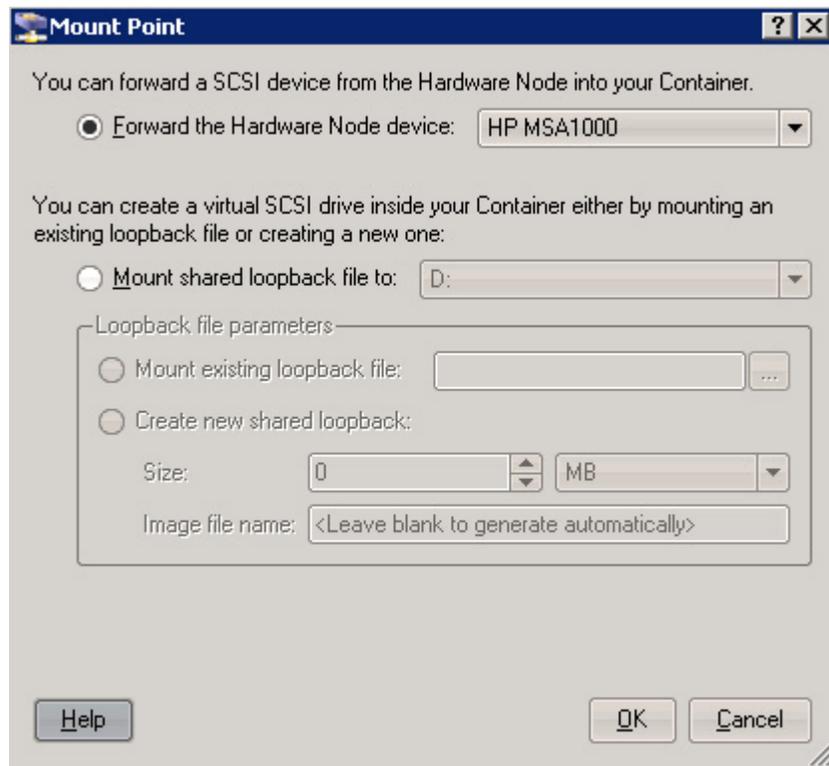
2. Consult the documentation for the application you want to cluster to learn how many nodes you need to include in the cluster and what roles (active or passive) the nodes will play in it.

The following example demonstrates how to create a cluster that will include two Containers and use a SAN-based shared storage device (a SCSI disk drive) as a cluster storage—the place where your high-availability applications and all their data will be hosted:

- 1 Enable the clustering support (which is disabled by default for all Containers on the Node) inside the Container you wish to act as the active node in the cluster. To do this:
 - a Select the **Virtuozzo Containers** item under the corresponding Hardware Node name.
 - b Right-click the Container to be included in the cluster, and select **Tasks > Configure Support for Windows Cluster** on the context menu:



- c In the displayed window, select the **Enable support for MSCS software** check box.
 - d Click **OK**.
 - e If the Container is running, restart it for the changes to take effect.
- 2 Forward the shared SCSI disk to be used as a cluster storage to the Container:
 - a Select the **Virtuozzo Containers** item under the corresponding Hardware Node name.
 - b Right-click the Container which is to act as the active node in the cluster, and select **Tasks > Configure Support for Windows Cluster**.
 - c In the displayed window, click the **Add** button:



- d** Select the **Forward the Hardware Node device** radio button, and choose the needed SCSI device on the drop-down menu.
- e** Click **OK**.
- 3** Perform **Steps 1-2** for each standby Container to be included in the cluster.
- 4** Log in to the Container via RDP, create the cluster, and register both Containers in the cluster. For information on how to create clusters, refer to **Setting Up a Cluster** (p. 23).

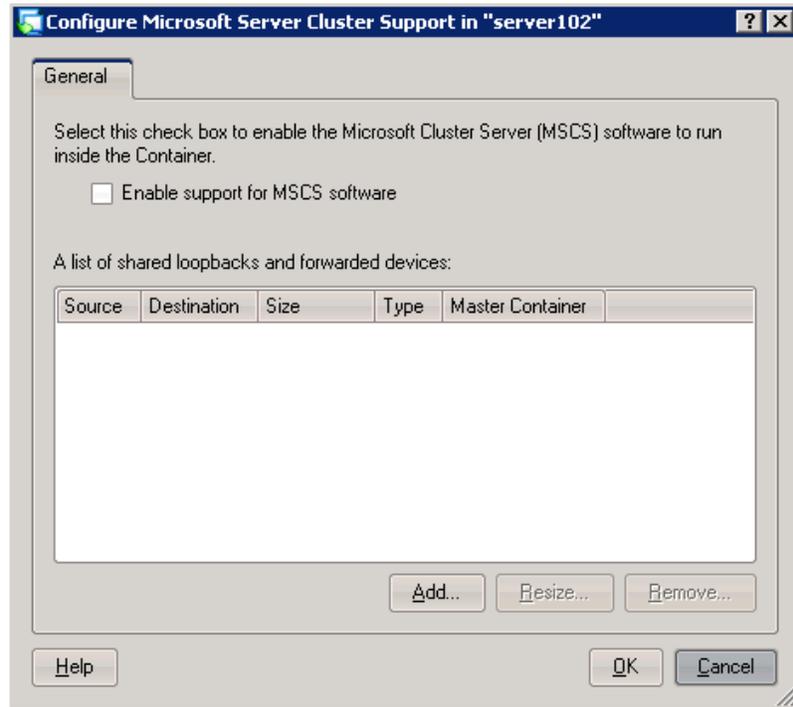
Note: All SCSI disk drives forwarded from the Hardware Node to a Container are not kept during the Container migration.

Setting Up a 'Loopback File'-Based Cluster

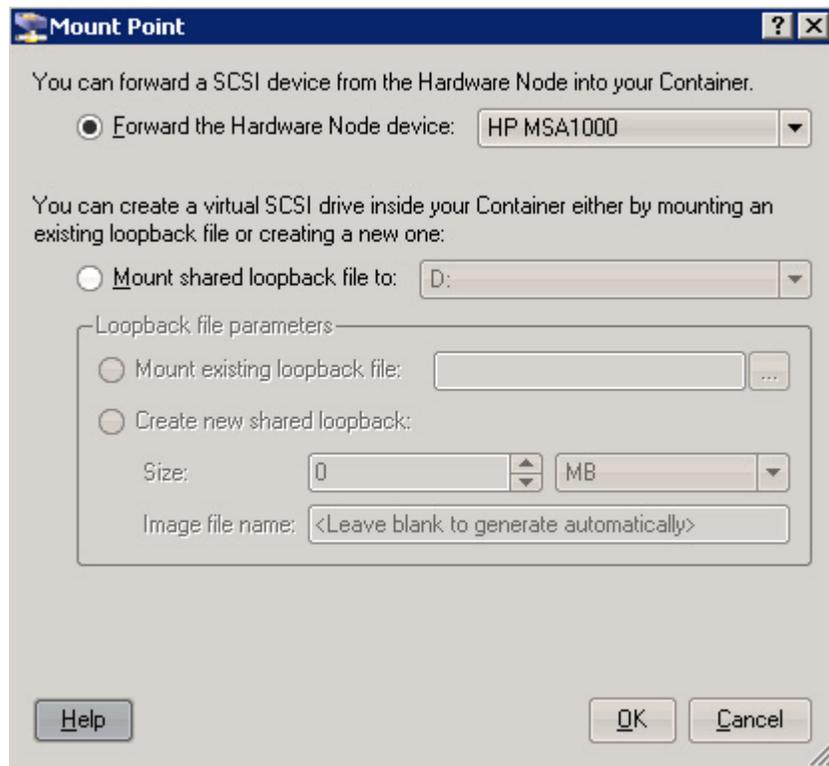
Another way of creating a cluster in Virtuozzo Containers for Windows-based systems is to use loopback files as shared cluster storage devices. These files are mounted inside the corresponding Containers and emulate SCSI devices on a single SCSI bus inside these Containers. To create a cluster using a loopback file as a cluster storage device, perform the following operations:

- 1** Decide on the Containers to be included in the cluster. Keep in mind that all Containers to participate in the cluster must reside on one and the same Hardware Node, i.e. on the Node where the corresponding loopback file is located.

- 2 Enable the clustering support (which is disabled by default for all Containers on the Node) inside the Container you want to act as the active node in the cluster. To do this:
 - a Select the **Virtuozzo Containers** item under the corresponding Hardware Node name.
 - b Right-click the Container to be included in the cluster, and select **Tasks > Configure Support for Windows Cluster**.



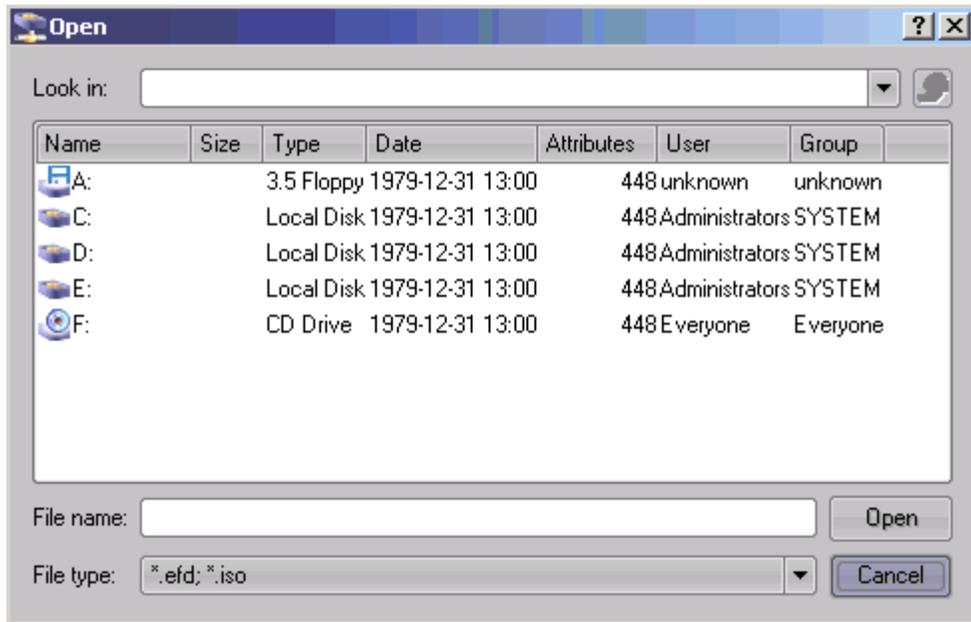
- c In the displayed window, select the **Enable support for MSCS software** check box.
 - d Click **OK**.
 - e If the Container is running, restart it for the changes to take effect.
- 3 Create a loopback file to be used as the shared SCSI disk in the cluster:
 - a Select the **Virtuozzo Containers** item under the corresponding Hardware Node name.
 - b Right-click the Container which is to act as the active node in the cluster, and select **Tasks > Configure Support for Windows Cluster** on the context menu.
 - c In the displayed window, click the **Add** button:



- d** In the **Mount Point** window, select the **Mount shared loopback file to** radio button and, on the drop-down menu, choose a drive letter under which the loopback file emulating the SCSI device will be mounted inside the Container. Decide on the loopback file to be used as the shared storage device:

 - Create a new loopback file inside the Container by selecting the **Create new shared loopback** radio button and specifying the size and the name of the loopback file.
 - Mount an existing loopback file from the Hardware Node by selecting the **Mount existing loopback file** radio button, clicking the ... button, and specifying the path to the needed loopback file in the displayed window.
- e** Click **OK**.
- 4** Log in to the Container via RDP, and create the cluster. For information on how to create clusters, refer to **Setting Up a Cluster** (p. 23).
- 5** Perform **Steps 2-3** for each 'passive' Container to be included in the cluster. When executing **Step 3**, mount the same loopback file(s) as the one(s) mounted inside the active Container:

 - a** Select the **Mount existing loopback file** radio button in the **Mount Point** window.
 - b** Click the ... button, and in the displayed window, specify the path to the needed loopback file, for example:



Loopback files are located in the `X:\vz\private\CT_ID` folder on the Hardware Node where `CT_ID` denotes the ID of the Container where the corresponding loopback file was created.

- c Click **Open**, and then click **OK**.
- 6 Add all standby Containers to the cluster. For information on how to add servers to an existing cluster, see **Setting Up a Cluster** (p. 23).

Notes:

1. A Container with a shared loopback file created inside cannot be migrated.
2. If a Container has one or more shared loopback files mounted (e.g., all standby Containers in the example above), these loopback files will not be kept during the Container migration.

Setting Up an NLB Cluster

In Virtuozzo Containers for Windows, any Container can act as a full participant in a Network Load Balancing (NLB) cluster. This allows you to deploy the following NLB cluster configurations in your network:

- NLB clusters that include two or more Containers residing on the same Hardware Node.
- NLB clusters that include two or more Containers residing on different Hardware Nodes.
- NLB clusters that include one or more Containers and physical servers.

The NLB clusters containing a number of Containers provide you with the same functionality as the clusters uniting standalone servers only. For example, you can use the created NLB cluster to balance incoming web-based traffic by splitting its load among several Containers to improve response times and reliability, add new Containers to the cluster and remove existing ones, etc. However, the procedure of creating an NLB cluster in Virtuozzo Containers for Windows-based systems slightly differs from that of setting up an NLB cluster containing dedicated physical hosts only and is described below.

The following example demonstrates how to create an NLB cluster containing two Containers - Container 101 and Container 102. So, if you experience the failure of, say, Container 101 in the NLB cluster, you can still serve user requests on the remaining NLB cluster member - Container 102. To create such a cluster, you should perform the following operations:

Note: If Containers (or physical servers) you plan to include in the cluster are running Windows Server 2008 R2, install the Network Load Balancing feature on each of these servers before starting the cluster creation.

- 1 Make sure that Container 101 and Container 102 are operating in the bridged mode and bound to one and the same physical adapter on the Hardware Node. If they are not, refer to the **Connecting Bridged Containers to Network** section of the *Virtuozzo Containers for Windows 6.0 User's Guide* for the information on how you can do it.

Note: All participants of an NLB cluster, irrespective of whether it is a Container or a physical server, should belong to the same broadcast domain. For Containers residing on the same Hardware Node, this can be done by simply configuring their network adapters to operate in the bridged mode. If Containers reside on different Nodes, you should additionally ensure that the physical adapters where the corresponding Container virtual network adapters are bridged belong to the same broadcast domain.

- 2 Decide on the Container operation mode in your NLB cluster. By default, all Containers are set to function in the unicast mode. To change the Container default mode to multicast, proceed as follows:
 - To set the multicast mode for Container 101, run the following command:

```
C:\...\Administrator>vzctl set 101 --nlb_mode multicast
```

- To set the multicast mode for Container 102, run the following command:

```
C:\...\Administrator>vzctl set 102 --nlb_mode multicast
```

Note: If your NLB cluster is operating in the multicast mode and client computers access it through a router, make sure that the router can map the cluster IP address to the MAC address associated with this IP address. If the router cannot, create the corresponding static ARP entry in the router. For more information about NLB clusters operating in the multicast mode, refer to the *Network Load Balancing parameters: Cluster Operation Mode* document available at <http://technet2.microsoft.com/windowsserver/en/library/57c24429-0268-4ed8-afdf-fd4b0b6539b71033.aspx?mfr=true>.

3 Assign valid IP addresses to Container 101 and Container 102, if you have not already done so before. Let Container 101 have the IP address of 192.168.1.156 and Container 102 the IP address of 192.168.1.157.

4 Add a 'virtual' (Cluster) IP address to Container 101 and Container 102. Let this 'virtual' IP address be 192.168.1.200:

- Add the cluster IP address to Container 101:

```
C:\...\Administrator>vzctl set 101 --cluster_ip 192.168.1.200 --save
Command 'set' is successfully finished
```

- Add the cluster IP address to Container 102:

```
C:\...\Administrator>vzctl set 102 --cluster_ip 192.168.1.200 --save
Command 'set' is successfully finished
```

5 Start the NLB service inside Container 101 and 102:

- For Container 101, issue the following command:

```
C:\...\Administrator>vzctl set 101 --nlb yes --save
Command 'set' is successfully finished
```

- For Container 102, execute the following command:

```
C:\...\Administrator>vzctl set 102 --nlb yes --save
Command 'set' is successfully finished
```

Note: If you are planning to include more than 2 Containers in your NLB cluster, you should execute **Steps 2** and **4** for each Container to be joined to the cluster.

6 Add the NLB role to Containers 101 and 102:

- For Container 101, issue the following command:

```
C:\...\Administrator>vzctl addrole 101 --role NLB --restart
Command 'addrole' is successfully finished
```

- For Container 102, execute the following command:

```
C:\...\Administrator>vzctl addrole 102 --role NLB --restart
Command 'addrole' is successfully finished
```

7 Start Container 101 and Container 102 using the `vzctl start` command.

After the second node has been successfully added to the NLB cluster, you can start using the cluster in the same way you would use any other NLB cluster containing standalone computers only.

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