Microsoft Technical Solutions

How To Setup Microsoft Windows Server 2008 Failover Clustering

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## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface</td>
<td>2</td>
</tr>
<tr>
<td>Customer Support</td>
<td>3</td>
</tr>
<tr>
<td>Disclaimers</td>
<td>3</td>
</tr>
<tr>
<td>Document Revision</td>
<td>3</td>
</tr>
<tr>
<td>Introduction to Clustering</td>
<td>4</td>
</tr>
<tr>
<td>Overview</td>
<td>4</td>
</tr>
<tr>
<td>History</td>
<td>4</td>
</tr>
<tr>
<td>Platforms</td>
<td>4</td>
</tr>
<tr>
<td>Active/Active Clusters</td>
<td>4</td>
</tr>
<tr>
<td>Active/Passive Clusters</td>
<td>4</td>
</tr>
<tr>
<td>Quorum Configurations</td>
<td>5</td>
</tr>
<tr>
<td>Using MPIO with Windows Clusters</td>
<td>6</td>
</tr>
<tr>
<td>Network Configuration</td>
<td>6</td>
</tr>
<tr>
<td>Public Interface</td>
<td>6</td>
</tr>
<tr>
<td>Private Interface</td>
<td>7</td>
</tr>
<tr>
<td>Setup and Configuration</td>
<td>8</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>8</td>
</tr>
<tr>
<td>Server Configuration</td>
<td>8</td>
</tr>
<tr>
<td>Installing the Failover Clustering Feature</td>
<td>8</td>
</tr>
<tr>
<td>Creating a New Cluster</td>
<td>10</td>
</tr>
<tr>
<td>Cluster Setup</td>
<td>10</td>
</tr>
<tr>
<td>Cluster Validate</td>
<td>12</td>
</tr>
<tr>
<td>Configure Cluster Quorum</td>
<td>12</td>
</tr>
<tr>
<td>Adding Disks to a Cluster</td>
<td>15</td>
</tr>
<tr>
<td>High Availability</td>
<td>16</td>
</tr>
<tr>
<td>Creating a High Availability File Server</td>
<td>16</td>
</tr>
<tr>
<td>Provision a Shared Folder for the File Cluster</td>
<td>18</td>
</tr>
<tr>
<td>Administrative Tasks</td>
<td>21</td>
</tr>
<tr>
<td>Testing Failover</td>
<td>21</td>
</tr>
<tr>
<td>Automated Storage Provisioning</td>
<td>22</td>
</tr>
</tbody>
</table>
Preface

This purpose of this document is to provide additional guidance around the process of setting up and configuring a Windows Server 2008 Failover Cluster using Microsoft Failover Clustering with Compellent Storage Center.

These guidelines should be evaluated thoroughly as every environment configuration is different, and should not be construed as final recommendations in the configuration of your Compellent Storage Center or Microsoft Clustering environments.


Customer Support

Compellent provides live support 1-866-EZSTORE (866.397.8673), 24 hours a day, 7 days a week, 365 days a year. For additional support, email Compellent at support@compellent.com. Compellent responds to emails during normal business hours.

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<thead>
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</thead>
<tbody>
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</tbody>
</table>
Introduction to Clustering

Overview

Windows Server 2008 Failover Clustering provides the capability to tie multiple servers together to offer high availability for business-critical applications and services. Clustering is designed to maintain data integrity and provide failover support. Windows Server 2008 Failover Clustering can scale up to 16 nodes in a single cluster.

History

In 1995, Microsoft released its initial attempt at clustering called “Wolfpack”. Wolfpack was developed as an additional add-in for Windows NT 4.0 Enterprise Edition. Since then, Microsoft Cluster Server (MSCS) has evolved through several OS releases and is available in the Enterprise Edition of Windows Server 2003 and Windows Server 2003 R2. MSCS was renamed in Windows Server 2008 to Windows Server 2008 Failover Clustering.

Platforms

In order to use Windows Server 2008 Failover Clustering, you must be running one of the following platforms:

- Windows Server 2008 Enterprise Edition
- Windows Server 2008 Datacenter Edition
- Windows Server 2008 R2 Enterprise Edition
- Windows Server 2008 R2 Datacenter Edition

Active/Active Clusters

In active/active clusters, all nodes are active. In the event of a failover, the remaining active node takes on the additional processing operations, which causes a reduction in the overall performance of the cluster. Active/passive cluster configurations are generally recommended over active/active configurations because they often increase performance, availability, and scalability. Microsoft Exchange 2003 and SQL Server 2000 support a configuration that falls into the realm of what would be considered as an active/active cluster configuration. These particular configurations will not be discussed as they are beyond the intended scope of this document.

Active/Passive Clusters

In active/passive clustering, the cluster includes active nodes and passive nodes. The passive nodes are only used if an active node fails. Active/Passive clusters are commonly known as failover clusters. For example, file and print environments use the active/passive cluster model since two nodes cannot own the same disk resource at one time. Windows Server 2008 Failover Clustering operates in this mode.
Quorum Configurations

The following information on quorums was taken from the Microsoft document “Server Clusters: Quorum Options” and Windows 2008 help resources.

Each cluster has a special resource known as the quorum resource. A quorum resource can be any resource that does the following:

- Provides a means for arbitration leading to membership and cluster state decisions.
- Provides physical storage to store configuration information.

A quorum log is simply a configuration database for the server cluster. It holds cluster configuration information such as which servers are part of the cluster, what resources are installed in the cluster, and what state those resources are in (for example, online or offline). The quorum log is located by default in \MSC\quolog.log.

The quorum is important because it provides consistency. Since the basic idea of a cluster is multiple physical servers acting as a single virtual server, it is critical that each of the physical servers have a consistent view of how the cluster is configured. The quorum acts as the definitive repository for all configuration information relating to the cluster. In the event that the Cluster Service is unable to read the quorum log, it will not start, as it is not able to guarantee that the cluster will be in a consistent state, which is one of the primary requirements for a cluster.

In addition, the quorum is used as the tie-breaker to avoid “split-brain” scenarios. A split-brain scenario happens when all of the network communication links between two or more cluster nodes fail. In these cases, the cluster may be split into two or more partitions that cannot communicate with each other. The quorum is used to guarantee that any cluster resource is only brought online on only one node. It does this by allowing the partition that “owns” the quorum to continue, while the other partitions are evicted from the cluster.

NOTE: In most situations, use the quorum configuration that the cluster software identifies as appropriate for your cluster. Change the quorum configuration only if you have determined that the change is appropriate for your cluster. The full function of a cluster depends not just on quorum, but on the capacity of each node to support the services and applications that fail over to that node. For example, a cluster that has five nodes could still have quorum after two nodes fail, but each remaining cluster node would continue serving clients only if it had enough capacity to support the services and applications that failed over to it.

Node Majority

This type of quorum configuration is recommended for clusters with an odd number of nodes.

A Node Majority quorum configuration can sustain failures of half the nodes (rounding up) plus one. For example, a seven node cluster can sustain three node failures.

Node and Disk Majority

This type of quorum configuration is recommended for clusters with an even number of nodes.
A Node and Disk Majority quorum configuration can sustain failures of half the nodes (rounding up) if the witness disk remains online. For example, a six node cluster in which the witness disk is online could sustain three node failures. This configuration can also sustain failures of half the nodes (rounding up) minus one if the witness disk goes offline or fails. For example, a six node cluster with a failed witness disk could sustain two (3-1=2) node failures.

**Node and File Share Majority**

This type of quorum configuration is recommended for clusters with special configurations.

A Node and File Share Majority configuration works in a similar way to Node and Disk Majority, but instead of a witness disk, this cluster uses a witness file share.

If you use Node and File Share Majority, at least one of the available cluster nodes must contain a copy of the cluster configuration before you can start the cluster. Otherwise, you must force the starting of the cluster through a particular node.

**No Majority: Disk Only**

This type of quorum configuration is not recommended.

With a No Majority: Disk Only configuration, the cluster can sustain failures of all nodes except one (if the disk is online). However, this configuration is not recommended because the disk might be a single point of failure.

**Using MPIO with Windows Clusters**

Using MPIO with clustering is supported in both round-robin and failover-only MPIO configurations. Windows Server 2008 automatically defaults Compellent Storage Center volumes to a “failover-only” MPIO configuration, while Windows Server 2008 R2 defaults to “round-robin”.

In Windows Server 2008, the MPIO load balance policy for each volume can be modified in Disk Management under the MPIO tab of the volume properties. With Windows 2008 R2, a default load balance policy for MPIO can be selected, and any new volumes on the server will automatically be set to use the specified MPIO load balance policy.

Refer to the Compellent Multipath Manager User Guide for more information on configuring MPIO in Windows Server 2008.

**Network Configuration**

**Public Interface**

The public interface contains the IP address of the server as it would be accessed over the network. It should contain the specific subnet mask, default
gateway, and DNS server addresses for accessing the network.

### Private Interface

The private interface is reserved for cluster communications and is commonly referred to as the “heartbeat”. In a two node cluster, a crossover cable is used to directly connect the first node to the second node. In a larger cluster configuration, a separate subnet or private network should be dedicated as a switch or hub will have to be used for these cluster communications. Because little is required for communication, a 10mbps half-duplex connection is all that is required.

It is common to use the 10.x.x.x network for the private interface. Here is an example of how you would configure the TCP/IP settings of the private interface.

A few other configuration pointers:

- **Do not** specify a default gateway or DNS servers. It is not necessary.
- On the DNS Settings tab, be sure to **uncheck** “Register this connection’s addresses in DNS”.
- On the WINS Settings tab, **uncheck** “Enable LMHOSTS lookup” and **select** “Disable NetBIOS over TCP/IP”.
- **Configure** your network interface for a speed and duplex setting of 10/Half.
- **Label** your network interfaces respectively, “Private” and “Public”.

Prerequisites

The following are required to successfully configure Failover Clustering:

- Windows Server, Enterprise Edition that is a domain member
- Compellent Storage Center
- Properly zoned Fibre or iSCSI connectivity
- Two Ethernet ports (min. one for public and one for private connectivity)
- One static IP address for public network connectivity

Server Configuration

Identify the server that will be the first node in the new cluster. This will be referred to as Node 1 in this document.

It is required that this server is a member of a domain. To form a cluster, cluster nodes must be member servers.

Installing the Failover Clustering Feature

This process must be followed on each node. To install Failover Clustering:

1. Start Server Manager by going to Start, All Programs, Administrative Tools, Server Manager.
2. In the tree view, click on Features, then in the right pane, Click Add Features.
3. On the Select Features dialog of the Add Features Wizard, check Failover Clustering and click Next.

4. Click Install to continue.

5. Once the installation succeeds, click Close.
Creating a New Cluster

Cluster Setup

The Failover Cluster Management MMC is used to create failover clusters, validate hardware for potential failover clusters, and perform configuration changes to failover clusters. To create a new cluster:


2. In the action pane, Click Create a Cluster.

3. In the “Before You Begin” dialog of the Create Cluster Wizard, click Next.

4. Enter the servers that you wish to be part of the cluster. After you enter the server name, click Add. When all servers have been entered, click Next.
5. In the “Validation Warning” dialog of the Create Cluster Wizard, select whether you wish to run the configuration validation tests, then click Next.

NOTE: These tests are important and are required to obtain assistance from Microsoft Premier Support.

6. Type the Cluster Name that you want the cluster to be called, and provide an IP address for the cluster. This will be used to manage the cluster. Click Next.

7. Verify the information, and then click Next.

8. Once the cluster creation is completed, click Finish.
Cluster Validate

Historically, cluster configurations (Windows 2000 and Windows 2003) had to be certified through the Windows Hardware Quality Lab (WHQL) in order to be approved and eligible for support by Microsoft. With Windows Server 2008, “Cluster Validate” is a tool that is included with Windows Server 2008 to test the functionality and compatibility of the servers and storage involved in a cluster. This tool verifies that the storage meets the requirements (supports specific commands) to operate in a failover cluster. The end-user can run Cluster Validate and save the output as proof of supportability for the configuration.

It is Compellent’s recommendation that Cluster Validate be performed on any cluster configuration that uses Compellent Storage Center to ensure supportability of the customer with Microsoft Premier Support should an issue arise.

Cluster Validate is a wizard-driven tool in the Failover Cluster Management MMC that can be run as part of configuring a new cluster or at any time thereafter. The Cluster Validate tool assumes that the storage is attached and accessible by all nodes participating in the test.

Configure Cluster Quorum

By default, in a configuration where two nodes exist, the default quorum configuration is Node Majority. Depending upon the quorum configuration you plan to run, a quorum volume will have to be created and mapped to the cluster nodes. If you have chosen a quorum configuration that requires a disk witness, start by creating a 1GB volume on the Compellent Storage Center and mapping it to all nodes of the cluster. Once this is complete, rescan the disks on Node 1 using Disk Management. Initialize the LUN, create the partition and format with NTFS. Standard practice is to assign the drive letter Q: to the quorum volume.

This example demonstrates how to change the cluster quorum configuration to Node and Disk Majority. To change the quorum type, or modify quorum configuration settings:
1. From Failover Cluster Management, right-click the cluster, More Actions, then “Configure Cluster Quorum Settings”.


3. Read the descriptions and select the Node and Disk Majority checkbox for the cluster. Click Next.

4. Select the disk that you previous mapped to the cluster and intended to use as the quorum. Click Next.

5. Confirm the configuration selected, and then click Next.
6. Click Finish.
Adding disks to the cluster is a simple process once the new volume has been created on the Compellent Storage Center and then mapped to each node of the cluster. Once the mapping is complete and the disk has been initialized from Node 1, complete the following steps from Node 1 to add a new disk (or disks) to the cluster:

1. Create a new volume on the Storage Center and map to all nodes in the cluster.

2. In the Failover Cluster Management tool, expand the cluster, and then click on Storage.

3. In the Actions pane, click Add a Disk.

4. Select the disk or disks you want to add, and then click OK. The disk will be mounted and brought online.

5. If desired, the drive letter of the cluster disk can be changed. Right-click on the cluster disk, and then click Change drive letter.
High Availability

In previous versions of Windows clustering, cluster groups contained the resources necessary to manage failover and determined how failover was handled. In Windows 2008 Failover Clustering, cluster groups are now known as “Services and Applications”. Examples of a service or application might be a virtual machine, DNS, or a file server.

Creating a High Availability File Server

In this example, we’ll use a disk that has been added to the cluster to create a highly available file server.

1. From the Failover Cluster Management tool, in the task pane, click Configure a Service or Application.

3. Select the service or application you want to configure for high availability – in this case, select File Server. Click Next.

4. Type the name that clients will use when accessing this file server cluster. Also, specify the IP address that should be used, and then click Next.

5. Select the storage volumes that have been added to the cluster and that you want to assign to this file server cluster, and then click Next.

6. Verify the confirmation and then click Next.
7. Once the file server application configuration is complete, the server and disk assigned will be visible in the Failover Cluster Management tool.

Provision a Shared Folder for the File Cluster

Provisioning of shared folders on the cluster volumes that are contained in the file server cluster is required to provide failover of these resources in the event of a node or service failure. Follow these steps to provision a shared folder in the file server cluster:

1. In the Failover Cluster Management tool, expand the cluster and then Services and Applications. Select the new File Server cluster and then in the Action pane, click Add a Shared folder.

2. Select the location that you want to create the folder on, and then click Next.
3. Specify NTFS permissions to control how users and groups access this folder. Click Next.

4. Select each protocol over which users can access this shared folder.

   NOTE: If you choose the same share name for both SMB and NFS, you will see a dialog asking for confirmation of this configuration.

5. Click on the Advanced button to specify how this shared folder us to be used by clients accessing it over SMB. This includes maximum connections allowed, access-based enumeration, and offline availability. When complete, click Next.
6. Specify share permissions for SMB-based access to the folder, and then click Next.

7. If selected previously, specify share permissions for NFS-based access to the shared folder, and then click Next.

   NOTE: Anonymous access is not supported on clusters. Instead, modify NTFS permissions on the folder to grant access to the Everyone security group.

8. You can publish an SMB share to an existing DFS namespace by specifying the name and folders you want created.
9. Review the settings and click Create to provision the shared folder with the settings selected.

10. Once the provision process has completed, click Close.

Administrative Tasks

Here are a few useful administrative tasks that may be required over the course of managing your cluster.

Testing Failover

Short of pulling the power on one of your nodes to test the failover capabilities, you can use the Failover Cluster Management MMC to move the “application” from one node to another.

To move a configured service or application to another node:
1. From the Failover Cluster Management MMC, expand the cluster, then Services and Applications. Right-click the application you want to failover and then select “Move this service or application to another node”. Click the node to move to.

Automated Storage Provisioning

Windows Server 2008 Failover Clustering provides additional capabilities which leverage Compellent’s VDS hardware provider. With this hardware provider installed (provided with the Compellent NAS, or available from Knowledge Center for standalone servers), the process of provisioning storage to a cluster as well as provisioning any required shared can be completed quickly using a wizard provided in the Failover Cluster Management MMC.

This process walks through the wizard used to provision the storage.

1. Click Start, All Programs, Administrative Tools, Share and Storage Management.

2. In the Action pane, click Provision Storage.

3. On the Storage Source dialog of the Provision Storage Wizard, select “On a storage subsystem”, and then click Next.
4. Select the Storage Center that is configured for the VDS hardware provider, and then click Next.

5. Select “Simple” as the LUN type, and click Next.

6. Specify a name and size for the LUN, and click Next.
7. Select "All servers in the cluster" to map it to all nodes in the cluster, and then click Next.

![Server Assignment](image)

8. Select the cluster that will be accessing the LUN, and then click Next.

**NOTE:** All paths specified will be mapped, so be sure that MPIO is installed if multiple paths are selected.

![Server Access](image)

9. Select the service or application that the disk will be associated with, and then click Next.

![Highly Available Server](image)
10. Assign the drive letter to assign to the volume, and then click Next.

11. Format the volume and provide a volume label, and then click Next.

12. Review the settings and then click Create.
13. Once the provisioning process is complete, click Close.

14. Use the Provision Shared Folder wizard to finish the process of sharing folders for the new volume.
Appendix

Additional Links

Tech Tip: Windows Firewall Rule Needed to Enable Share Provisioning