Dell Compellent Storage Center

How to Setup a Microsoft Windows Server 2012 Failover Cluster

Reference Guide

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Dell Compellent Technical Solutions Group
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# Preface

## 1.1 Audience

The audience for this document is system administrators who are responsible for the setup and maintenance of Windows servers and associated storage. Readers should have a working knowledge of Windows and the Dell Compellent Storage Center.

## 1.2 Purpose

This document provides an overview of Failover Clustering and additional guidance for the process of setting up and configuring a Failover Cluster on Windows Server 2012 when using the Dell Compellent Storage Center.

## 1.3 Customer Support

Dell 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 Dell Compellent at support@compellent.com. Dell Compellent responds to emails during normal business hours.
2 Introduction to Windows Server 2012 Failover Clustering

2.1 Overview

Window Server 2012 Failover Clustering provides the capability to tie multiple servers together to offer high availability and scalability for business-critical applications such as Microsoft Exchange, Hyper-V, Microsoft SQL Server, and file servers. Clustering is designed to maintain data integrity and provide failover support. Windows Server 2012 Failover Clustering can scale up 64 nodes in a single cluster.

Windows Server 2012 Failover Clustering includes new and changed functionality from the prior release included in Windows Server 2008 R2. This functionality supports increased scalability, continuously available file-based server application storage, easier management, faster failover, and more flexible architectures for failover clusters. For a complete list of changes and new features included in Windows Server 2012 Failover Clustering, please refer to Microsoft TechNet.

Failover Clustering is included in both the Standard and Datacenter versions of Windows Server 2012.

2.2 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 increased performance, availability, and scalability. Microsoft Exchange 2013 and SQL Server 2012 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 scope of this document. For detailed information about Microsoft Exchange 2013 and SQL Server 2012 clustering, please refer to Dell Compellent Knowledge Center.

2.3 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.
2.4 Quorum Configurations

The following information on quorums contains information taken from the Microsoft TechNet article entitled: “Configure and Manage the Quorum in a Windows Server 2012 Failover Cluster”

The quorum for a cluster is determined by the number of voting elements that must be part of active cluster membership for that cluster to start properly or continue running. By default, every node in the cluster has a single quorum vote. In addition, a quorum witness (when configured) has an additional single quorum vote. You can configure one quorum witness for each cluster. A quorum witness can be a designated disk resource or a file share resource. Each element can cast one “vote” to determine whether the cluster can run. Whether a cluster has quorum to function properly is determined by the majority of the voting elements in the active cluster membership.

To increase the high availability of the cluster, and the roles that are hosted on that cluster, it is important to set the cluster quorum configuration appropriately.

The cluster quorum configuration has a direct effect on the high availability of the cluster, for the following reasons:

- It helps ensure that the failover cluster can start properly or continue running when the active cluster membership changes. Membership changes can occur because of planned or unplanned node shutdown, or when there are disruptions in connectivity between the nodes or with cluster storage.

- When a subset of nodes cannot communicate with another subset of nodes (a split cluster), the cluster quorum configuration helps ensure that only one of the subsets continues running as a cluster. The subsets that do not have enough quorum votes will stop running as a cluster. The subset that has the majority of quorum votes can continue to host clustered roles. This helps avoid partitioning the cluster, so that the same application is not hosted in more than one partition.

- Configuring a witness vote helps the cluster sustain one extra node down in certain configurations. For more information about configuring a quorum witness, see Witness configuration later in this section.

Be aware that the full function of a cluster depends on quorum in addition to the following factors:

- Network connectivity between cluster nodes
- The capacity of each node to host the clustered roles that get placed on that node
- The priority settings that are configured for the clustered roles
For example, a cluster that has five nodes can have quorum after two nodes fail. However, each remaining node would serve clients only if it had enough capacity to support the clustered roles that failed over to it and if the role settings prioritized the most important workloads.

The cluster software automatically configures the quorum for a new cluster, based on the number of nodes configured and the availability of shared storage. This is usually the most appropriate quorum configuration for that cluster. However, it is a good idea to review the quorum configuration after the cluster is created, before placing the cluster into production. To view the detailed cluster quorum configuration, you can use the Validate a Configuration Wizard to run the Validate Quorum Configuration test. In Failover Cluster Manager, the basic quorum configuration is displayed in the summary information for the selected cluster.

The following quorum types are available in Windows Server 2012 Failover Clustering:

**Node majority (no witness)**
Only nodes have votes. No quorum witness is configured. The cluster quorum is the majority of voting nodes in the active cluster membership.

**Node majority with witness (disk or file share)**
Nodes have votes. In addition, a quorum witness has a vote. The cluster quorum is the majority of voting nodes in the active cluster membership plus a witness vote.

A quorum witness can be a designated disk witness or a designated file share witness.

**No majority (disk witness only)**
No nodes have votes. Only a disk witness has a vote. The cluster quorum is determined by the state of the disk witness.

The cluster has quorum if one node is available and communicating with a specific disk in the cluster storage. Generally, this mode is not recommended, and it should not be selected because it creates a single point of failure for the cluster.

### 2.5 Using MPIO with Microsoft Failover Clusters

Using MPIO with clustering is supported in both round-robin and failover-only configurations. Windows Server 2012 automatically defaults Compellent Storage Center volumes to a “round-robin” MPIO configuration.

In Windows Server 2012, the MPIO load balance policy for each volume can be modified in Disk Management under the MPIO tab of the volume properties. A default load balance policy for MPIO can also be set, and any new volumes on the server will automatically be set to use the specified MPIO load balance policy.

# 3 Network Configuration

## 3.1 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.

**Note:** If possible, the public interface for cluster traffic should be on a dedicated NIC, separate from the NIC accessed for server management. A specific adapter can be selected for cluster traffic after a cluster has been set up.

![Network Connections](image)

**Figure 1: Network Connections**

## 3.2 Private Interface

The private interface is reserved for cluster communications and is commonly referred to as the “heartbeat”. In a two node cluster, a standard RJ-45 cable can be 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 will have to be used for these cluster communications. Because cluster communications require minimal bandwidth, a 10 Mbps half-duplex connection is all that is required.

It is common practice to use the 10.x.x.x network for the private interface. Below is an example of how to configure the TCP/IP settings of the private interface:
Referring to Figures 2 – 4 above, please note the following configuration settings:

- 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”.
- Label the network interfaces respectively, “Private” and “Public”.
3.3 NIC Teaming

By default, the create cluster process will automatically create a public and private cluster network based upon the IP address assigned to the cluster. The NIC adapters assigned to each network are automatically assigned based upon the subnet assigned to each adapter.

In cases where there are two or more adapters on each node that belong to the same subnet, the cluster will only use one of the adapters on each node to allow access from the public network. In order to use more than one adapter on the same subnet in the cluster, the adapters need to be teamed prior to cluster creation. In Windows Server 2012, NICs can be teamed via software from the NIC manufacturer (such as Intel or Broadcom), or through the built-in load balancing and failover option (LBFO) within the operating system. For more information on LBFO, please refer to Microsoft TechNet.

Note: Creating NIC teams from adapters already in use by a cluster can cause cluster stability issues, and is not recommended.

4 Setup and Configuration

4.1 Prerequisites

The following are required to successfully configure Failover Clustering:

- Windows Server 2012 Standard or Datacenter 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

4.2 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 domain member servers.
4.3 Installing the Failover Clustering Feature

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

1. Open Server Manager via the Start screen: Open Administrative Tools, and select Server Manager. Alternatively, Server Manager can be accessed via the icon on the Windows Desktop screen.

   ![Server Manager](image1)

   **Figure 5: Server Manager**

2. In Server Manager on the Dashboard screen, select Add roles and features.

   ![Add Roles and Features Wizard](image2)

   **Figure 6: Add Roles and Features Wizard**

3. Click Next.
4. Choose Role-based or feature-based installation and click **Next**.

![Select Installation type](image)

Figure 7: Select Installation type

5. Select the local server and click **Next**.

![Select destination server](image)

Figure 8: Select destination server

6. Click **Next** on the Select Server Roles screen.

![Select server roles](image)

Figure 9: Select server roles
7. On the Select Features screen, check the box next to Failover Clustering.

![Select features](image)

Figure 10: Select features

8. The following screen will appear asking you to add required features for Failover Clustering. Click Add Features.

![Add Roles and Features Wizard](image)

Figure 11: Add Roles and Features Wizard

9. Click Next when returned to the Select Features screen.
10. Verify the Failover Clustering feature and Administrative Tools are set to be installed.

![Figure 12: Confirm installation selections](image)

**Figure 12:** Confirm installation selections

11. Click **Install**

![Figure 13: Installation progress](image)

**Figure 13:** Installation progress

12. Click **Close** when installation is finished.

![Figure 14: Completed installation](image)

**Figure 14:** Completed installation
5 Creating a New Cluster

5.1 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 actions pane, click Create a Cluster.

3. Click Next on the Before You Begin screen.

Figure 15: Failover Cluster Manager

Figure 16: Create Cluster Wizard
4. Enter the servers that are to be part of the cluster. After the server name is entered, click **Add**. When all server names have been entered, click **Next**.

![Figure 17: Select Servers](image)

5. In the **Validation Warning** dialog of the Create Cluster Wizard, select to run the configuration validation tests and then click **Next**.

**Note**: Microsoft requires cluster validation be performed in order to obtain assistance from Premier Support.

**Note**: The Cluster Validation tool will report a failure if both nodes of the cluster are not presented with (or are unable to access) available storage from Storage Center. Please refer to the Dell Compellent Storage Center Users Guide for instructions on how to create a cluster object in Storage Center, and how to map volumes to a cluster object.

![Figure 18: Validation Warning](image)
6. When the **Before You Begin** dialog appears, click **Next**.

![Figure 19: Validate a Configuration Wizard](image-url)

7. On the **Testing Options** screen, verify **Run all tests** is selected, and click **Next**.

![Figure 20: Testing Options](image-url)

8. On the **Confirmation** screen click **Next** to begin cluster validation.

![Figure 21: Confirmation](image-url)

![Summary]

Figure 22: Summary

10. Type the cluster name, and provide an IP address for the cluster. This will be used to manage the cluster. Click Next.

![Cluster Access Point]

Figure 23: Cluster Access Point

11. Verify the information, and then click Next.

![Confirmation]

Figure 24: Confirmation
Note: By enabling the **Add all eligible storage to the cluster** checkbox, all storage that is presented to both nodes of the cluster and formatted with NTFS will be added to the cluster available storage pool.

12. Once the cluster creation is completed, click **Finish**.

![Figure 25: Summary](image)

## 5.2 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. Starting with Windows Server 2008, the Cluster Validate tool has been included with the Operating System 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 Dell Compellent’s best practices recommendation that Cluster Validate be performed on any cluster configuration that uses Dell Compellent Storage Center to ensure the customer can receive Microsoft Premier Support should a cluster issue arise.

Cluster Validate is a wizard-driven tool in Failover Cluster Manager 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.

## 5.3 Configure Cluster Quorum

By default, in a configuration where two nodes exist, the default quorum configuration is Node Majority. Depending upon the quorum configuration, a quorum volume will have to be created and mapped to the cluster nodes. If the chosen a quorum configuration 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 quorum type, or modify quorum configuration settings:

1. From Failover Cluster Manager, right-click the cluster name, select More Actions, and choose Configure Cluster Quorum Settings.

2. On the Before You Begin dialog of the Configure Cluster Quorum Wizard click Next.
3. **Choose Add or change the quorum witness** and click **Next**.

4. **Verify Configure a disk witness is selected**. Click **Next**.
5. Select the disk previously mapped to the cluster and intended to use as the quorum. Click Next.

![Figure 31: Configure Storage Witness](image)

6. Confirm the configuration selected, and then click Next.

![Figure 32: Confirmation](image)

7. Click Finish.

![Figure 33: Summary](image)
6 Adding Disks to a Cluster

Adding disks to the cluster is a simple process once the new volume has been created on the Dell Compellent Storage Center and then mapped to each node of the cluster. Complete the following steps from either node to add a new disk (or disks) to the cluster:

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

2. Initialize the newly added volume to make it available to the cluster:
   a. Open the Disk Management MMC: Start → Run → diskmgmt.msc <enter>.

   ![Figure 34: Disk Manager](image1)

   b. Click **Action → Rescan Disks** to detect the new Dell Compellent Volume. The newly available volume will show up as unknown and offline.

   ![Figure 35: New disk detected](image2)
c. Right-click on the new disk and choose **Online**.

![Figure 36: Bring disk online](image)

d. The disk will now show as **Not Initialized**. Right-click on the disk and choose **Initialize Disk**.

![Figure 37: Not initialized](image)

e. On the **Initialize Disk** screen, validate the correct disk is selected for initialization, and click **OK**.

![Figure 38: Initialize disk](image)

f. The new disk will now show **Online**.

![Figure 39: Disk online](image)
g. The disk must be formatted before it can be used by the cluster.
   i. Right-click on the disk and choose **New Simple Volume**.

![Figure 40: New Simple volume](image)

ii. Click **Next** on the dialog screen.

![Figure 41: New Simple Volume Wizard](image)

iii. Specify the **Volume size**, and click **Next**.

![Figure 42: Specify Volume Size](image)
iv. Assign a drive letter (if no drive letter is assigned the system will pick one automatically), click **Next**.

![Figure 43: Assign Drive Letter](image)

v. Specify partition format options. Click **Next**.

![Figure 44: Format Partition](image)

vi. Click **Finish**.

![Figure 45: Completing the New Simple Volume Wizard](image)
h. The disk will now show as a usable volume, and is available to be added to the cluster.

![Available disk](image1)

**Figure 46: Available disk**

3. In **Failover Cluster Manager**, expand the cluster, expand **Storage**, and then click on **Disks**.

![Failover Cluster Manager](image2)

**Figure 47: Failover Cluster Manager**

4. In the **Actions** pane, click **Add Disk**.

5. Select the disk or disks to add and then click **OK**. The disk(s) will be mounted and brought online.

![Add Disk to Cluster](image3)

**Figure 48: Add Disk to Cluster**
6. The newly added disk will be shown in Failover Cluster Manager.

![Figure 49: Available Cluster Disks](image)

### 7 High Availability

In previous versions of Windows clustering, cluster groups contained the resource necessary to manage failover and determined how failover was handled. In Windows Server 2008/R2 failover clustering, cluster groups were referred to as “Services and Applications”. In Windows Server 2012, highly available services and applications are referred to as “Roles”. Examples of a highly available cluster role might be a file server, WINS, or a virtual machine. It should be noted that in order to add a role to the cluster, that role or feature must already be installed on each node of the cluster. For example, in order to add the File Server role to the cluster, the File Server role must be installed from the Add Roles and Features Wizard on each node of the cluster.

**Note:** Windows Server 2012 includes many enhancements for clustering Hyper-V and virtual machines. For detailed information on how to install, configure and administer Windows Server 2012 Hyper-V clustering, please refer to the Dell Compellent Storage Center Best Practices for Hyper-V Guide on Knowledge Center.

#### 7.1 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 Failover Cluster Manager, right-click the cluster name, and choose Configure Role.
2. **Click Next** on the Before You Begin dialog screen of the High Availability Wizard.

3. **Select File Server** from the list of available roles. **Click Next.**
4. Select **File Server for general use**. Click **Next**.

![File Server Type](image1.png)

**Figure 53: File Server Type**

5. Enter a name that clients will use to access the file server. Enter a unique IP address for the file server. Click **Next**.

![Client Access Point](image2.png)

**Figure 54: Client Access Point**

6. Select an available storage volume to assign to the file server cluster. Click **Next**.

![Select Storage](image3.png)

**Figure 55: Select Storage**
7. **Confirm settings and click Next.**

![Figure 56: Confirm Settings](image1)

8. **Click Finish on the Summary screen.**

![Figure 57: Summary](image2)

9. **Once the file server role configuration has completed, the server, network access point and assigned storage will be visible in Failover Cluster Manager.**

![Figure 58: Roles Window](image3)
7.2 Provision a Shared Folder for the File Server

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 (SMB) folder in the file server cluster:

1. In Failover Cluster Manager, expand the cluster, click on Roles, right-click on the file server, and choose Add File Share.

   ![Figure 59: Context Menu](image)

2. The New Share Wizard appears. Select SMB Share – Advanced, and click Next.

   **Note:** By choosing the Advanced option, enhanced configuration settings such as data classification and quota management are available through the new share wizard. Also note that in order to select the Advanced option, the File Server Resource Manager Role must be installed on both nodes of the cluster.

   ![Figure 60: New Share Wizard](image)
3. Select the server and path for the share. Select **Next** when complete.

![Select server path](image1.png)

**Figure 61:** Select server path

4. Enter a Share name and click **Next**.

![Specify share name](image2.png)

**Figure 62:** Specify share name

5. Configure Share settings. Click **Next** to continue.

![Configure share settings](image3.png)

**Figure 63:** Configure share settings
6. Specify share permissions for SMB-based access to the folder. Click **Next**.

Figure 64: Specify permissions

7. (Optional) select the type of data that will be stored on the share. Enter an email address to be notified when denied users request access to the folder. Click **Next**.

Figure 65: Folder management properties

8. If desired, apply a quota to the share. Click **Next** to continue.

Figure 66: Apply quota
9. Confirm selections and click **Create** to add the share to the clustered file server.

![Figure 67: Confirm selections](image)

10. View share creation results. Click **Close** to exit.

![Figure 68: View results](image)

11. The new share is visible in the **Shares Tab** in the **Roles** window of File Server Manager.

![Figure 69: Rules window](image)
8 Administrative Tasks

8.1 Testing Failover/Moving Roles

Short of pulling the power on one of your nodes to test the failover capabilities, you can use Failover Cluster Manager to move the Role from one node to another.

To move a configured Role to another node:

1. From **Failover Cluster Manager**, expand the cluster, and highlight **Roles**. In the Roles window, **right-click** the Role to failover and then choose **Move**, then **Select Node**.

![Figure 70: Move context menu](image)

2. **Select the node to move the Role to**, and click **OK**.

![Figure 71: Move Clustered Role](image)

3. The Role will move to the other node. Verify the owner node in the Roles window:
8.2 Cluster-Aware Updating

New to Windows Server 2012, Cluster-Aware Update (CAU) is an automated feature that allows you to update clustered servers with little or no loss in availability during the update process. During an Updating Run, CAU transparently performs the following tasks:

- Puts each node of the cluster into node maintenance mode
- Moves the clustered roles off the node
- Installs the updates and any dependent updates
- Performs a restart if necessary
- Brings the node out of maintenance mode
- Restores the clustered roles on the node
- Moves to update the next node

CAU is a powerful feature that can be scheduled on regular, daily, weekly, or monthly intervals.

8.3 Windows PowerShell

As with previous versions of Windows Server, Windows Server 2012 includes Failover Cluster Cmdlets to allow for the installation, configuration and administration of failover clustering from within PowerShell. For a complete listing of all available Failover Clustering Cmdlets, please refer to Microsoft TechNet.