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HIGH-AVAILABILITY CLUSTERING IN MICROSOFT WINDOWS SERVER 2008

Cluster environments enable multiple systems to provide higher availability for applications and services than a single system can typically provide. The Microsoft® Windows Server® 2008 OS introduces multiple enhancements designed to increase the availability, scalability, and manageability of failover clusters.

As system uptime becomes increasingly important for critical operations, many enterprises are turning to cluster configurations for handling increased workload and availability requirements. Clustering enables multiple systems to work together to deliver high availability, scalability, and manageability and facilitates organization-wide consolidation of servers, storage, and IT staff.

Deploying clusters of Dell™ PowerEdge™ servers running the Microsoft Windows Server 2008 OS offers multiple advantages in enterprise environments:

- **High availability:** Failover clusters help minimize downtime. When a software or hardware failure occurs on one node, applications or services on that node can fail over to other nodes in the cluster and restart there, typically with only a slight delay or momentary decrease in performance for client systems. Windows Server 2008 is designed to provide higher availability than previous OS versions by removing the quorum disk as a single point of failure.
- **Outstanding scalability:** Microsoft clustering technologies advance scale-out capabilities by allowing up to 16 nodes per cluster—enabling more efficient use of storage systems and storage area networks than was possible with the 8 nodes supported in Windows Server 2003. When the cluster has reached its workload capacity, administrators can add nodes

to the cluster and then redistribute load-balancing application instances to the newly added nodes.

- **Simple management:** Managing a cluster rather than each system individually helps simplify administration. In addition, virtual servers ease management by providing a single point of administration for the cluster resources, and because client applications connect to these virtual servers, cluster-aware applications can reconnect without manual intervention.

This article outlines the basics of failover clustering in Windows Server 2008 as well as key feature enhancements, which include simplified setup and migration; enhanced management; increased availability, scalability, and reliability; and enhanced networking and security. Enterprises can take advantage of tested and integrated Dell clustering solutions built on standards-based Dell servers and storage to further simplify deployment and help maintain the availability of critical enterprise applications and services.

HIGH AVAILABILITY WITH MICROSOFT CLUSTER SERVICE

Microsoft Cluster Service (MSCS), a component of Windows Server 2008 Enterprise Edition and Datacenter Edition, allows virtual servers to fail over between physical servers running the cluster service. Client systems connect to the IP address of the virtual

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server, and are then directed to the physical server node that currently owns the clustered application or service (see Figure 1); the clients are unaware of which physical server they are connected to. If a software or hardware failure occurs, the application or service can restart on the same physical server. If the application or service fails to restart on the same physical server, the cluster resource group containing the virtual server and the application or service fails over to another physical server. Clients connected to that virtual server typically can reconnect and resume access to the application or service with just a momentary disruption.

Multiple virtual servers can run in a single cluster. In an active/active or activeⁿ cluster (where n is the number of active nodes), each node owns at least one virtual server. In an active/passive or $N + 1$ cluster (where N and 1 are the numbers of active and passive nodes, respectively), at least one cluster node does not own a virtual server and functions as the backup for the active cluster nodes.

Although a single MSCS cluster can support multiple applications or multiple instances of a single application, each application or application instance accesses a separate data set. An MSCS cluster provides application failover, but does not load balance a single application instance across multiple servers. Administrators can also initiate failover manually, which they might do when performing routine maintenance on cluster nodes.

WINDOWS SERVER 2008 CLUSTERING ENHANCEMENTS

Windows Server 2008 introduces multiple enhancements to cluster setup, migration, management, and other features to help increase availability, reliability, and manageability. Administrators should also be aware of two key changes in cluster installation options: the Validate a Configuration Wizard and the Server Core installation option.

Before configuring a cluster, administrators can run the Validate a Configuration wizard to help determine whether the configuration can work in the cluster environment. The tests in this wizard are designed to verify that the configuration meets specific hardware and software requirements for clustering and that the network and storage can properly support cluster operations. Microsoft does not require that cluster configurations have the "Certified for Windows Server 2008" logo and be listed in the Windows Server Catalog to qualify for Microsoft support, but configurations must pass all tests in this wizard. Administrators should also visit DELL.COM/HA for configurations and component revisions that have been tested and validated by Dell.

The Server Core installation option in Windows Server 2008, which provides a minimal environment for running specific server roles and helps reduce management requirements and potential points of attack, also supports failover clustering. Administrators can manage Server Core installa-

tions through the command-line interface or from a remote management station.¹

Simplified cluster setup and migration

Windows Server 2008 incorporates several wizards designed to simplify the process of creating a new cluster or migrating resource groups from a cluster running Windows Server 2003 to one running Windows Server 2008. The Create Cluster wizard has streamlined, easy-to-follow steps to allow administrators to create a new cluster quickly and easily (see Figure 2). The High Availability wizard can automatically create resources for a high-availability service or application with the correct dependencies. The setup process is fully scriptable for automatic deployment.

The Migrate a Cluster wizard is designed to migrate resource groups from a cluster running Windows Server 2003 to one running Windows Server 2008. It helps capture certain resource group settings from the Windows Server 2003 cluster and apply them to a new Windows Server 2008 cluster (see Figure 3).²

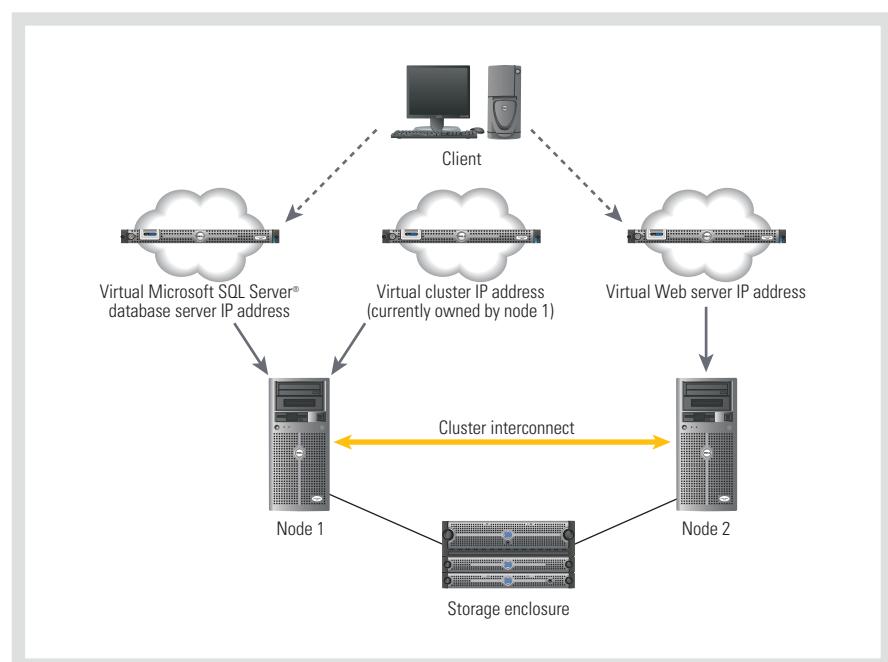


Figure 1. Example active/active cluster using Microsoft Cluster Service

¹For more information, see "Using the Microsoft Windows Server 2008 Server Core Installation Option," by Peter Tsai, Barun Chaudhary, Steven Grigsby, and Joseph Rojas, in *Dell Power Solutions*, May 2008, DELL.COM/Downloads/Global/Power/ps2q08-20070611-Tsai.pdf.

²For more information, see "Migrating Failover Clusters to Microsoft Windows Server 2008 on Dell PowerEdge Servers," by Bhushan Gavankar, Subhashini Prem, and Daniel Moges, in *Dell Power Solutions*, May 2008, DELL.COM/Downloads/Global/Power/ps2q08-20080224-Gavankar.pdf.

Enhanced cluster management

The Windows Server 2008 cluster management interface is designed to be simpler and more intuitive than previous versions. Administrators can use this interface to manage their high-availability applications rather than just the cluster itself, and can perform additional tasks using the command-line interface or Windows Management Instrumentation (WMI).

Backup and restore and troubleshooting functionality have also been simplified. Windows Server 2008 failover clustering includes comprehensive integration with Microsoft Volume Shadow Copy Service (VSS) to help administrators back up and restore cluster configurations. The Event Tracing feature, meanwhile, enables administrators to quickly gather a sequence of events across cluster nodes in a single location, helping avoid the need to review individual cluster logs or system event logs to determine an event sequence during troubleshooting.

Increased availability, scalability, and reliability

Windows Server 2008 failover clustering introduces multiple enhancements to

help increase cluster availability, scalability, and stability, including support for additional cluster nodes, new quorum models, online modifications to cluster resource groups, and new methods for reserving a disk and breaking a reservation.

Administrators can now create clusters of up to 16 nodes (increased from 8 in Windows Server 2003), enabling clusters to handle multiple server failures and offering administrators additional options when deploying applications and configuring failover policies that can meet enterprise requirements. In addition, Windows Server 2008 introduces new quorum models to help eliminate the quorum disk as a single point of failure. In the node and disk majority quorum model, for example, the cluster configuration is stored on the shared witness disk and replicated among nodes, allowing the cluster to function even if the witness disk fails. The node and file share majority quorum model—an enhancement to the Windows Server 2003 majority node set model—enables the deployment of geographically dispersed clusters across multiple sites to support disaster recovery. A primary site

failure with a Windows Server 2003 majority node set cluster typically required manual intervention to bring the resources at the secondary site online, whereas using a file share located at a third site as a witness can allow this process to become automatic.

To help increase cluster scalability and flexibility, Windows Server 2008 clusters allow administrators to add resources to a group or modify dependencies among resources while the group is online. Administrators can add resources such as physical disks to a resource group without interrupting applications or services.

To enhance cluster reliability, Windows Server 2008 uses persistent reservation commands to reserve cluster shared disks and break disk reservations during cluster arbitration. This method enables load balancing among the paths in multipath storage devices and helps avoid using logical unit (LUN) or target resets—a disruptive approach for breaking disk reservations used in Windows Server 2003. Some Windows Server 2003 Microsoft Multipath I/O device-specific modules translate RESERVE (6),

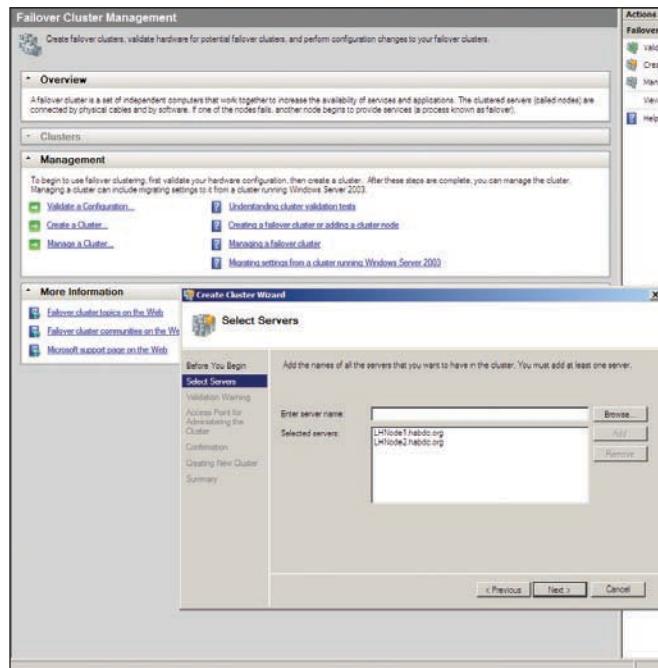


Figure 2. Microsoft Windows Server 2008 Create Cluster wizard

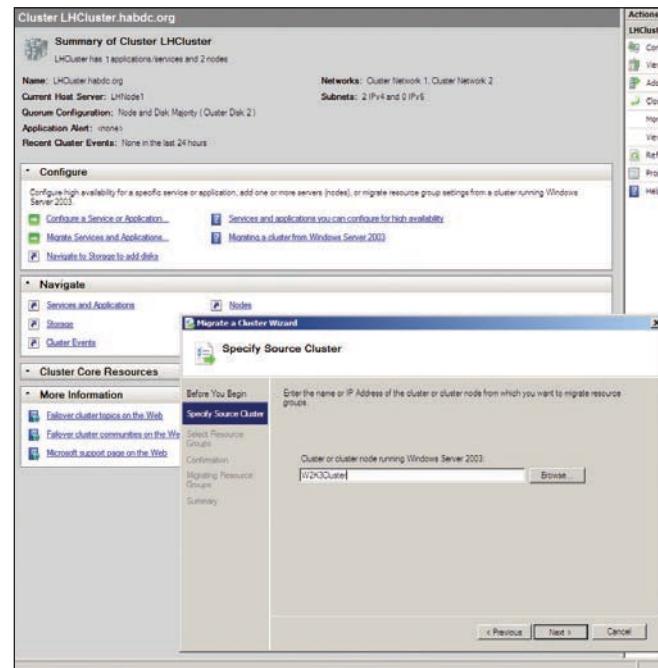


Figure 3. Microsoft Windows Server 2008 Migrate a Cluster wizard

RELEASE (6), and RESET commands to appropriate persistent reservation commands to help achieve similar results.

Other key availability, scalability, and reliability enhancements to Windows Server 2008 failover clustering include the following:

- **Support for Globally Unique Identifier (GUID) Partition Table (GPT) disks:** GPT, part of the Extensible Firmware Interface (EFI), is a standard for the layout of the partition table on a physical hard disk. GPT disks provide built-in redundancy by storing partition information at both the beginning and end of a disk and support partition sizes larger than 2 TB, helping provide increased redundancy and larger disk sizes compared with master boot record disks.
- **Enhanced maintenance mode:** Administrators can now use maintenance or extended maintenance mode to check, fix, back up, or restore cluster shared disks with minimal disruption to the cluster.
- **New resource dependency:** Administrators can now use OR operations on resource dependencies in addition to AND operations. For example, in a cluster with multiple IP address resources in the resource group, the group can be online if any of the IP addresses are online.
- **Multiple subnets:** Cluster nodes can now be on different IP subnets, helping increase cluster availability and simplify the process of implementing geographically dispersed clusters.

Enhanced networking and security

Windows Server 2008 failover clustering includes comprehensive support for IP version 6 (IPv6), which administrators can use for both cluster communications and client access, and support for network name resolution using only Domain Name System (DNS), which helps avoid the need to configure Microsoft Windows® Internet Naming Service (WINS) on the cluster and the need to broadcast Network BIOS (NetBIOS) in the network traffic. In

addition, Windows Server 2008 clusters use TCP for communication between nodes—typically a more robust and reliable protocol than User Datagram Protocol (UDP), which is used in Windows Server 2003 clusters.

Key security features include enhanced authentication and encryption using IP security (IPsec). Administrators can also use auditing to track who has been accessing a cluster and at what specific dates and times.

DELL CLUSTERING SOLUTIONS

Dell offers highly available two-node clusters using Serial Attached SCSI (SAS) storage and running Windows Server 2008 Enterprise Edition. These clusters are well suited for file and print, messaging, or database servers for workgroups.

Dell also offers 2- to 16-node clusters of Dell PowerEdge servers based on Dell/EMC Fibre Channel storage or on Dell PowerVault™ or Dell/EMC Internet SCSI (iSCSI) storage. Cluster components are designed to be fully redundant and scalable to help meet enterprise requirements. Individual components can be repaired or replaced, and the cluster itself can be upgraded with the latest software, driver, and firmware versions while it is still online serving client systems. Administrators can connect multiple clusters and non-clustered servers to redundant fabrics, and these clusters and servers can share multiple storage systems and tape libraries. The storage systems used in these clusters offer optional advanced features such as storage mirroring or snapshot copies of disks for backup. These clusters are well suited for highly available messaging servers, database servers with large data sets, and consolidation of applications, servers, or storage.

HIGHLY AVAILABLE CLUSTERS FOR CRITICAL APPLICATIONS

The enhancements to failover clustering in Windows Server 2008 are designed to help simplify deployment, increase performance, enhance security, and promote

increased uptime for clustered applications and services. Dell PowerEdge clusters running Windows Server 2008 combine the high performance, availability, scalability, and reliability features of Dell servers and storage with the powerful clustering capabilities in Windows Server 2008 to help enterprises achieve high availability for critical applications and services. 

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