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# HIGHLY AVAILABLE VIRTUALIZATION WITH MICROSOFT HYPER-V AND SCVMM 2008

In virtualized environments, high availability can be critical to avoiding lost revenue, maintaining productivity, and protecting data from system failure. Combining Microsoft® Hyper-V™ technology with Microsoft System Center Virtual Machine Manager (SCVMM) 2008 on Dell™ platforms can help organizations create highly available virtualized systems while offering simplified management, dynamic performance, workload optimization, and reduced costs.

**V**irtualization solutions can offer significant benefits, helping boost IT efficiency and capacity and providing a robust, simplified environment while also helping significantly reduce costs. However, virtualization can also create single points of failure in critical environments: for example, if an enterprise is running 10 production workloads on 10 separate physical servers, the failure of a single server would likely be inconvenient but not disastrous. However, in a virtualized environment with 10 production workloads running in 10 virtual machines (VMs) on a single physical server, the failure of that server could be catastrophic.

In addition, computing systems have become such an integral part of enterprise environments that severe consequences can occur when the systems become unavailable. When critical functions such as the Microsoft Active Directory® directory service, the Microsoft Exchange messaging platform, or Microsoft Office SharePoint® Server services are not accessible, enterprises may face lost revenue, lost productivity, reduced customer satisfaction, data loss, or even diminished decision-making capabilities. As a result, these computing systems must be available 24/7.

Introductory virtualization projects often focus on reducing capital expenses rather than on

implementing holistic virtualized solutions. A comprehensive virtualized environment, however, goes beyond consolidation to take advantage of the encapsulation and portability of VMs as well as flexible, powerful management tools. These features enable administrators to use virtualization to help increase availability, manage workloads effectively without overprovisioning hardware, and implement disaster recovery plans.

Microsoft Hyper-V technology and Microsoft System Center Virtual Machine Manager (SCVMM) 2008 provide the core foundational components of a comprehensive solution, helping organizations simplify virtualized IT infrastructures, reduce costs, and increase availability. With integrated administration, administrators can use a single console to help centralize management of a heterogeneous VM infrastructure, increase physical server utilization, quickly provision new VMs, and provide dynamic performance and resource optimization of hardware, operating systems, and applications. Dell can help enterprises implement these features to extend their use of virtualization and help provide enhanced service levels, responsiveness, and enterprise agility (see the “Microsoft Hyper-V in the real world” sidebar in this article).

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## QUICK MIGRATION

In assessing the cost-effectiveness of a high-availability environment, administrators must balance the cost of downtime against the cost of a proposed solution. The first consideration to help minimize failures should be the quality and reliability of servers and storage. To this end, Dell servers and storage incorporate a broad array of redundant features designed to maximize availability. High-availability clusters can provide the additional level of availability required for critical applications. Hyper-V takes this a step further by introducing an advanced level of integration between the Microsoft Windows Server® 2008 clustering feature and the Hyper-V quick migration feature (see Figure 1).

The quick migration feature can help increase the availability and flexibility of critical services during planned downtime for maintenance, or quickly restore services after unplanned downtime. It enables administrators to rapidly fail over a running VM from one physical host to another with minimal downtime.

## HOST CLUSTERING AND GUEST CLUSTERING

Hyper-V provides two different clustering options—host clustering and guest clustering—which can be used separately or together. Host clustering is the more common of the two. It enables VM host-to-host failover without requiring the

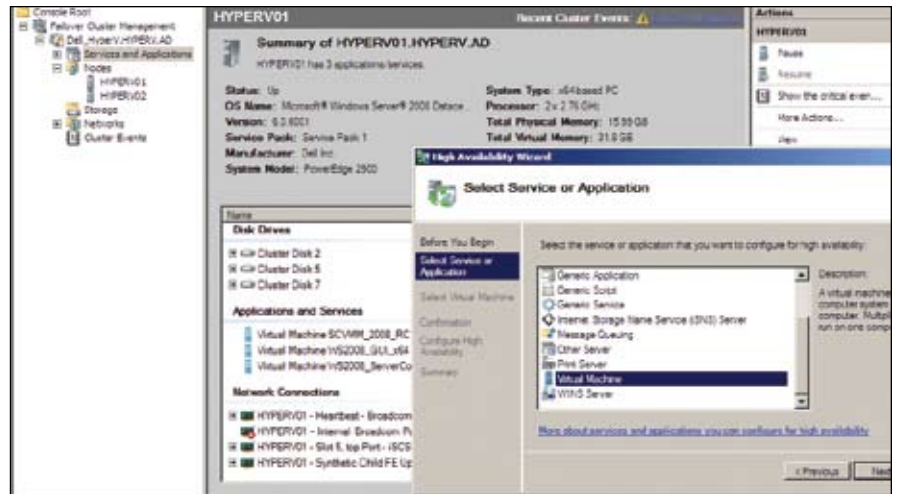


Figure 1. Microsoft Hyper-V quick migration

applications to be cluster aware; the Windows Server 2008 clustering feature manages the failover at the host level. This capability enables applications that traditionally have been incompatible with clustering to become highly available with little or no additional configuration or modification. Host clustering requires that host systems be running Windows Server 2008 Enterprise x64 Edition or Datacenter x64 Edition using a full or Server Core installation. VMs can run any guest OS supported by Hyper-V (see the “Microsoft Hyper-V guest OS support” sidebar in this article).

Guest clustering is less common than host clustering, but takes a similar approach to the one used to cluster other Microsoft Windows® OS-based applications outside

a Hyper-V environment. Cluster services within the guest OS manage the failover at the VM level. Guest clustering requires that host systems be running Windows Server 2008 Enterprise x64 Edition or Datacenter x64 Edition using a full or Server Core installation. VMs can run any cluster-enabled Windows server OS (Windows 2000 Server, Windows Server 2003, or Windows Server 2008). In addition, guest clustering requires cluster-aware applications such as the Microsoft SQL Server® 2008 Enterprise Edition database platform or the Microsoft Exchange Server 2007 Enterprise Edition messaging platform. Because this approach contains the clustered applications within a VM, it also enables ancillary benefits such as increased

## MICROSOFT HYPER-V IN THE REAL WORLD

Two companies currently benefiting from highly available Microsoft Hyper-V solutions from Dell are Maxol Group, a venerable Irish-owned oil company, and HotSchedules, which provides a leading software-as-a-service (SaaS) labor scheduling and workforce management system.

**Maxol Group.** Maxol takes advantage of Hyper-V to help increase the reliability of its data centers. “We can keep all our virtual machines available at all times,” says Nicholas Merton, a member of the IT support team at Maxol Dublin. “If anything happens to one server, the cluster automatically moves the affected workloads to a new server, transparent to users. With Hyper-V, we’ll essentially eliminate downtime, which is important as we move into several e-commerce ventures that require high reliability.”

**HotSchedules.** High availability is a critical requirement for HotSchedules. Dell helped the company’s IT group design a virtualized infrastructure based on Hyper-V failover clusters. “We currently have 2,400 client installations online. We could very well triple that number in the next year, just by adding a few large chains,” says Ray Pawlikowski, president of HotSchedules. “With the Dell infrastructure running Hyper-V, we could easily deploy 120 virtual servers on just 12 physical machines to accommodate that growth without maxing out our data center. The new infrastructure lets the business pursue those large clients with confidence.”

## MICROSOFT HYPER-V GUEST OS SUPPORT

Microsoft Hyper-V virtual machines (VMs) can run any supported guest OS that has been validated and granted integration component support. Integration components are sets of drivers and services designed to provide additional device support within VMs, help maintain consistent VM states, and enhance guest OS performance by enabling the guest OS to use synthetic devices. Integration components included with Hyper-V include a VMBus driver to provide transport for synthetic devices, time synchronization to keep VM clocks synchronized with the root partition, mouse integration, a video driver, a synthetic network driver, and synthetic storage drivers.

For a list of the latest guest operating systems supported by Hyper-V, visit [www.microsoft.com/windowsserver2008/en/us/hyperv-supported-guest-os.aspx](http://www.microsoft.com/windowsserver2008/en/us/hyperv-supported-guest-os.aspx).

hardware utilization, quick and intelligent provisioning, and increased availability options.

SQL Server and Exchange can be made highly available in a number of ways, each with its own particular considerations. Administrators should weigh the advantages and disadvantages of each approach carefully before deciding on a specific plan.

### PLANNED FAILOVER AND UNPLANNED FAILOVER

In addition to understanding the two types of clustering options, administrators should also be sure they understand the two types of failover events: planned failover and unplanned failover. A planned failover is an administrator-invoked migration of VMs from one or more clustered nodes to one or more other available nodes. These

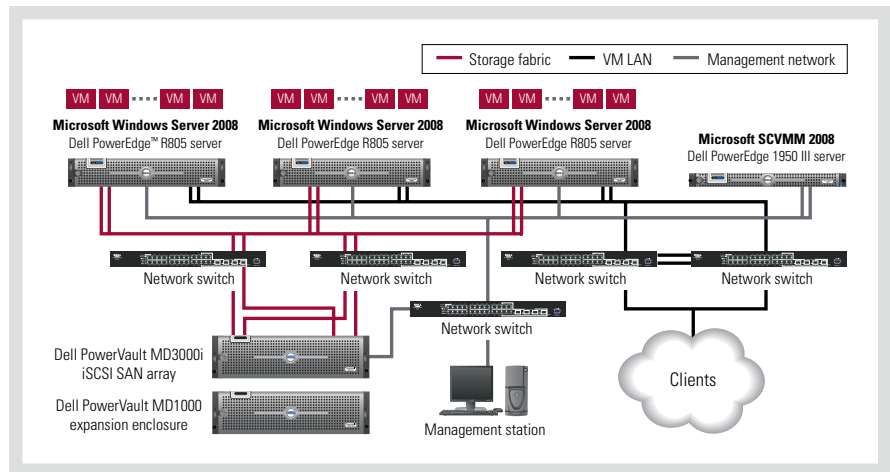


Figure 2. Example Dell high-availability reference configuration

failovers are most commonly used during maintenance windows or to provision a workload across clustered nodes. The Hyper-V quick migration feature saves the state of a running VM by writing the VM memory to disk on shared storage, moves the storage ownership from one node to another, and then restores the VM state on the second node. The failover speed depends on several factors, including amount of memory, storage and interconnect performance, and even the guest OS version used in the VM. In a typical environment, failover would generally complete in 15-120 seconds.

Conversely, an unplanned failover occurs without administrative interaction and typically results from a hardware device failure or power outage. In the case of unplanned downtime, the workload state cannot be saved; instead, the resources written to the disk would be failed over from the shared storage automatically based on administrator-defined options. The duration of the service outage is typically longer than that of a planned failover because the VMs must complete the entire boot sequence rather than the saved state sequence used in a planned failover. (Both VMware® VMotion™ technology and the Hyper-V quick migration feature must reboot guest VMs following an unplanned failover.)

### BEST PRACTICES FOR HYPER-V HIGH AVAILABILITY

Implementing Hyper-V high-availability solutions can be challenging even for experienced IT administrators. Necessary cluster components and dependencies include the following:

- **Host nodes:** Each Hyper-V cluster uses 2-16 compliant physical servers to host VM workloads. These servers should run Windows Server 2008 Enterprise x64 Edition or Datacenter x64 Edition to host the failover clustering feature as well as the Hyper-V role. The guest VMs can run any combination of client- or server-based operating systems currently supported with Hyper-V.
- **Shared storage:** Shared storage should be provisioned to support the clusters. This requirement is delivered on Internet SCSI (iSCSI)- or Fibre Channel-based storage area networks (SANs) with high-performance hard disks. Direct attach storage (DAS) can also be added on Dell PowerVault™ MD3000 enclosures. Windows Server 2008 provides connectivity natively for iSCSI through the Microsoft iSCSI Software Initiator, while the Microsoft Multipath I/O framework helps make SAN connectivity straightforward to configure and helps increase availability.

- **Network interconnects:** Hyper-V clusters require network interconnects for a series of objectives and dependencies. These dependencies include network interface cards (NICs) for parent, guest, or iSCSI interconnects; host bus adapters (HBAs) for Fibre Channel-based storage; and Serial Attached SCSI (SAS) adapters for DAS arrays.
- **Other dependencies:** Administrators should also know the requirements of their particular environment, which may include Active Directory domain services, Domain Name System (DNS), TCP/IP addressing, and appropriate credentials.

Dell best practices for implementing highly available systems based on Hyper-V include the following:

- Use servers that carry the “Designed for Windows” logo.
  - Use SCVMM 2008 to manage complex solutions and help ensure intelligent workload provisioning.
  - Use tools such as PlateSpin PowerRecon to assess and establish baselines for the physical environment’s performance requirements before proceeding with a virtualization implementation.
  - Install the latest Microsoft Quick Fix Engineering (QFE) updates for Hyper-V and clustering through Windows Server Update Services.
  - Validate that the shared storage solution is compliant with both Windows Server 2008 and Hyper-V clustering; some solutions may be Windows Server 2008 compliant but not support Hyper-V clustering. Check with the storage vendor to learn whether updates to existing firmware and drivers are necessary.
  - Use the Node and Disk Majority option for the cluster witness (called the quorum in previous Windows Server versions) model in most single-site cluster deployments. Defer to the storage vendor for the optimal selection.
- Use Server Core deployments as often as possible for host servers and/or VMs. In addition to providing administrative benefits, VMs using Server Core installations can fail over significantly faster than VMs using comparably configured full installations with a graphical user interface. In addition, because Server Core installations typically require less memory and hard disk resources than full installations, the same host space can support additional VMs.
  - For hard disks, provision one or more discrete logical units (LUNs) to each VM to enable individualized VM failover. Use tools such as Sanbolc Kayo if cluster file systems and multiple VMs per LUN are necessary. In addition, use highly available mount points for implementing more than 21 drive letters (LUNs) within a cluster, and use fixed virtual hard disks for optimal flexibility and enhanced performance.
  - For scalable solutions, add a single dedicated Gigabit Ethernet NIC port for every four VMs, depending on individual VM network I/O requirements. These guest network NIC ports are in addition to the other required ports recommended for Hyper-V parent partition accessibility, cluster heartbeats, and iSCSI connectivity (if required).<sup>1</sup>


### MICROSOFT SUPPORT FOR VIRTUALIZED APPLICATIONS

Virtualization in critical enterprise environments has often been hampered by complex and confusing support policies. For example, many vendors provide “best effort” virtualization support that requires administrators to reproduce the problem on physical hardware before they will offer support.

As of August 2008, Microsoft has radically changed its policies for the most commonly used Microsoft applications—including SQL Server, Exchange, and the System

Center family—to provide support in virtualized environments. These support changes apply not only to Hyper-V, but to hypervisors from other vendors as well. For Microsoft to support its applications on hypervisors from other vendors, these vendors must participate in the Microsoft Server Virtualization Validation Program.<sup>2</sup>

### SIMPLIFIED HIGH AVAILABILITY FOR VIRTUALIZED ENVIRONMENTS

Microsoft Hyper-V technology combined with SCVMM 2008 can provide organizations with flexible, highly available virtualization for Dell platforms. As a result, enterprises move beyond basic hardware consolidation toward a holistic virtualized environment designed for simplified management, dynamic performance and resource optimization, and reduced infrastructure and operational costs. 

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<sup>1</sup> For more information on best practices, see “Hyper-V Planning and Deployment Guide,” by Microsoft Corporation, August 2008, [www.microsoft.com/downloads/details.aspx?FamilyID=5DA4058E-72CC-4B8D-BBB1-5E16A136EF42](http://www.microsoft.com/downloads/details.aspx?FamilyID=5DA4058E-72CC-4B8D-BBB1-5E16A136EF42); and “Step-by-Step Guide for Testing Hyper-V and Failover Clustering,” by Microsoft Corporation, May 2008, [www.microsoft.com/downloads/details.aspx?FamilyID=CD828712-8D1E-45D1-A290-7EDADF1E4E9C](http://www.microsoft.com/downloads/details.aspx?FamilyID=CD828712-8D1E-45D1-A290-7EDADF1E4E9C).

<sup>2</sup> For more information on Microsoft support policies for virtualized environments, visit [support.microsoft.com/?kbid=957006](http://support.microsoft.com/?kbid=957006). For more information on the Server Virtualization Validation Program, visit [www.windowsservercatalog.com/svvp](http://www.windowsservercatalog.com/svvp).