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High availability and disaster recovery with Microsoft, Citrix and HP

Using virtualization, automation and next-generation storage to improve business continuity

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Executive summary

Organizations must maintain the availability of IT assets and data in the event of planned or unplanned downtime. *Business continuity* solutions designed to prevent downtime provide *high availability* to maintain operations in the event of a local system or component failure (e.g., servers or clusters) and *disaster recovery* to failover to a secondary site should the entire primary site go down. Until recently, however, the cost, complexity and operational intensity of business continuity solutions meant that organizations were forced to strictly prioritize which IT assets they could protect—if any.

A joint solution from Microsoft, HP and Citrix reduces the cost, complexity and operational intensity of delivering and maintaining a business continuity solution. This joint solution makes it fast and easy to set up highly available systems that maintain ongoing operations. As a result, organizations can now safeguard most, if not all, of their IT assets and data. This whitepaper describes how the joint Microsoft, HP and Citrix solution delivers these business results in the event of unplanned downtime associated with a component, system or even an entire site failure.

Why organizations need business continuity

In today's global 24 x 7 business operating environment, organizations need to provide comprehensive business continuity solutions for their IT assets and data in order to minimize interruptions from planned and unplanned IT downtime.

A complete business continuity solution delivers data protection, high availability and disaster recovery.

- Data protection guards against data corruption within an intact infrastructure.
- High availability keeps applications up and running despite component or environmental failures or during planned operational procedures.
- Disaster recovery recovers operations when the primary datacenter site fails completely and / or the high availability mechanisms can no longer maintain application availability. With disaster recovery in place, organizations can resume operations at a secondary site.

This white paper will focus on the infrastructure needed to deliver high availability and disaster recovery.

When designing a business continuity plan, organizations typically begin by determining the level of protection each of their applications requires. This means defining recovery point objectives (RPOs) for allowable data loss and recovery time objectives (RTOs) defining how long applications can afford to be down. Assigning RPOs and RTOs helps organizations prioritize which applications should receive the most attention and what capabilities are needed within the infrastructure.

Until recently, such prioritization has been essential because the cost, complexity and operational intensity of providing business continuity meant that many organizations had to be highly selective in choosing which applications to protect. Traditional high availability and disaster recovery solutions require a great deal of duplicate hardware and software, numerous management tasks to set up and maintain backup servers and storage systems, and considerable operational knowledge to failover to a secondary site and failback. Because of the high costs and management complexity, many organizations have been able to protect few if any of their applications.

MS-HP-Citrix:
Reducing cost, complexity and operational intensity for business continuity

Now, Microsoft, HP and Citrix have partnered to provide a solution that includes host, storage and workflow automation products that work together to minimize the cost, complexity and operational intensity of business continuity. This joint solution makes setting up and managing business continuity easy enough that organizations large and small can implement high availability and disaster recovery for most of their applications with minimal technical expertise.

This joint solution is comprised of the following:

- **Microsoft products –** The joint solution incorporates Microsoft Windows Server® 2008 R2 with Hyper-V™ and Failover Clustering, the Microsoft System Center Operations Manager and the Microsoft Systems Center Virtual Machine Manager. These products reduce costs, complexity and operational intensity of providing business continuity through virtualization, provide high availability through server clustering and enable disaster recovery through support for replication.

- **HP products –** The HP P4000 iSCSI SAN storage minimizes storage costs and reduces storage complexity for virtualized systems. The P4000 provides high availability via storage clustering technology and support for disaster recovery through data replication.

- **Citrix products –** Citrix Essentials™ for Microsoft Hyper-V™ reduces complexity and operational intensity by simplifying set up, provisioning and management for the combined Microsoft-HP solution for high availability and disaster recovery scenarios. It also enables disaster recovery testing, and automates disaster recovery failover and failback to maximize system availability.

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Delivering high availability

Traditional high availability solutions are expensive and operationally intensive. High availability software itself is expensive and these costs are compounded by the need for duplicate/redundant hardware and excess storage capacity. Overall costs for a high availability solution can easily run into the millions of dollars.

Traditional solutions also require extensive manual configuration to ensure that failover occurs correctly. The process of configuring servers and storage for high availability systems is inefficient because it requires the coordinated efforts of two groups and can take weeks or months. When a system goes down, extensive manual operations are necessary to initiate failover, resulting in significant downtime.

Requirements

A combination of technologies reduces the cost and complexity of delivering high availability solutions and simplifies their management. These include virtualization, clustering, synchronous replication, high availability storage and new systems management solutions.

- **Virtualization –** Virtualized environments reduce costs through server consolidation, which enables organizations to reduce the need for duplicate hardware by running multiple virtual machines performing backup on the same physical hardware. This provides failover targets without requiring completely idle servers. Virtual machines can be backed up, migrated or copied to any industry standard server with no interruption in service. Additionally, virtualized environments support high availability through features that monitor server availability and, in the event of server failure, restart virtual machines on alternate servers.

- **Clustering –** High availability server clustering ensures that if a server fails, the virtual machines are automatically restarted on an alternate server without disrupting operations for users. Clusters consist of two or more servers (physical or virtual) running with the same configuration. Clustering software keeps the application data updated on both servers and restarts the backup server in the event of a failure on the primary server.

- **Synchronous replication –** While most clusters are typically located within a single site, *stretch clusters* can be spread over multiple locations. Stretch clusters require the use of synchronous replication, which keeps data synchronized on members of the same cluster by committing data to the local and remote cluster at the same time. Because of its latency and bandwidth demands, synchronous replication is typically used only when the primary and secondary clusters are located in close proximity—typically less than 60 miles.

- **Shared storage –** Organizations must have storage that is shared or *seen* by all the servers in the cluster. The storage itself also needs to be highly available. After all, server failover has little practical impact on business continuity if the storage is unavailable.

All of the virtual machine's data must reside on a shared fiber channel or iSCSI array which presents a *pool* of storage to all the servers within the cluster.

- **Management software –** Organizations need a solution to simplify the setup and provisioning of their virtualized environments.

How the Microsoft-HP-Citrix solution delivers high availability

The combined Microsoft-HP-Citrix solution delivers high availability with greater simplicity and cost effectiveness than other solutions. Management capabilities, which are included with all of the products, make it fast and easy to set up and manage a high availability environment capable of protecting all of an organization's applications. With this high availability solution, IT systems remain fully operational in the event of component failures or planned management operations so that users can continue normal operations despite the unavailability of any portion of the system.

The platform:
Microsoft maximizes server utilization and enables high availability

To the joint solution, Microsoft contributes Windows Server 2008 R2 with Hyper-V technology and Failover Clustering as well as capabilities that simplify management of its virtual server environments.

Hyper-V reduces costs through server consolidation – Hyper-V is hypervisor-based virtualization technology from Microsoft that is fully integrated into all Windows Server 2008 x64 operating systems. Hyper-V provides all the benefits of virtualization from within Windows Server 2008 without the need to install and learn separate software. Users can take maximum advantage of the server hardware by running multiple virtual machines, possibly running multiple operating systems, on a single physical server. Hyper-V virtual machines can run on any standard hardware without requiring detailed configuration, eliminating the need for redundant mirrored environments.

Windows Server 2008 Failover Clustering (WSFC) furnishes high availability – WSFC offers both local clustering and stretch clustering. WSFC supports physical and virtual environments, including physical-to-physical, virtual-to-virtual and physical-to-virtual configurations.

Local clustering allows organizations to switch from one local server to another to provide local high availability. WSFC stretch clustering writes data to both the primary storage system and a remote storage system, enabling failover to a remote location. Stretch clustering furnishes multi-site high availability when the two sites are relatively close together—perhaps on two floors in the same building or two buildings in a local campus and protects against downtime due to local disasters, such as a fire or power outage. Microsoft stretch clustering seamlessly integrates with the HP synchronous replication solution. When used together, stretch clustering and HP replication can help smaller companies without a formal disaster recovery location to mitigate against departmental failures.

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With Windows Server 2008, Microsoft has dramatically simplified the process of setting up clusters. With an intuitive interface, fewer steps and high levels of automation, this process is easy enough for anyone to perform without sophisticated technical expertise.

Live Migration and Quick Migration capabilities simplify failover – The Live Migration capability supports business continuity during planned downtime while Quick Migration does the same for unplanned downtime. These capabilities make it fast and easy to move virtual machines to different physical machines.

Multipath I/O (MPIO) supports reliable shared storage – MPIO is a high availability mechanism for the storage network that enables multiple I/O paths to the SAN. MPIO protects against component failures within the subnet (e.g., switch, cable and router) or NIC failures on the servers or storage.

Microsoft System Center Virtual Machine Manager 2008 enhances the management of virtual machines – System Center Virtual Machine Manager is enterprise-class management software that enables administrators to easily and effectively manage physical and virtual environments from a single management console. It includes an enterprise management suite to manage both Hyper-V and virtual machine placement.

Microsoft System Center Operations Manager 2007 improves availability and performance – System Center Operations Manager provides end-to-end service management that enables organizations to enhance availability and performance across IT services in their datacenter.

The infrastructure:
HP improves cost effectiveness and simplifies management of shared storage

Many of virtualization's benefits, including built-in, cost-effective high availability, require support from external shared storage with a comprehensive feature set. HP P4000 SANs improve the cost effectiveness and simplify the management of the SAN necessary to support virtualized systems.

HP P4000 iSCSI SAN is based on storage clustering and Network RAID (i.e. integrated synchronous replication) that protects against multiple component failures to provide continuous availability, making it an ideal match for the high availability features offered by Hyper-V. While most SAN solutions require organizations to purchase and implement a separate replication product, the P4000 includes these replication capabilities and fully automates them, eliminating the need for any extra cost or effort to set up replication within the SAN.

A P4000 array is deployed as a collection of storage nodes—each consisting of a rack-mount box, controller, network connectors and storage—that operates as a single storage unit. Network RAID automatically writes data to multiple storage nodes in the cluster to ensure high availability. The SAN can suffer the loss of up to half its storage nodes while the storage pool as a whole remains up and running.

As an integral part of the solution, the P4000 also gives organizations the unique ability to create a multi-site SAN simply by placing up to half the nodes in the storage pool in a different location, all connected by the network. Failover and failback are automatic and transparent to application servers because the array itself keeps track of which storage blocks are up to date and automatically updates outdated blocks when the failed part of the SAN is restored. This capability provides an easy to set up and manage disaster recovery solution for companies who have multiple local datacenter locations within a campus or between floors in a building, and want complete protection against limited environmental failures.

For longer distances a multi-site SAN is not feasible due to the performance impact of higher-latency networks between sites. The P4000 SAN also includes an asynchronous replication mechanism called Remote Copy which is optimized for long-distance DR configurations. Remote Copy is designed for slower links and includes features such as bandwidth throttling and scheduling.

The glue:
Citrix simplifies setup and configuration of storage for a Hyper-V cluster

Configuring Hyper-V hosts for high availability has traditionally required mapping the correct storage components to all Hyper-V hosts in a cluster, which can be time consuming and complex. Citrix Essentials for Microsoft Hyper-V includes StorageLink™, which simplifies the setup and configuration of storage for a Microsoft Hyper-V cluster, when it is connected to a HP P4000 SAN to provide high availability solutions. It automatically discovers the storage and allows an administrator to allocate the storage to virtual machines, using simple configuration wizards. Citrix Essentials StorageLink, which can be thought of as the glue that enables the platform and infrastructure to work together, makes it easy for customers to introduce new hosts and storage into a Hyper-V cluster without complex configuration edits or changes. This includes allowing the customer to assign all necessary storage, LUNs, clones and snapshots to a new host in the cluster or mapping new storage to all the hosts. It also makes it easy for virtualization administrators to take advantage of powerful SAN storage services (e.g., snapshots and thin provisioning), to roll out and manage virtual environments, without requiring the close involvement of the storage administrator.

Delivering disaster recovery
While local clustering can provide high availability should one or more nodes or applications fail, it will not safeguard an organization if the entire primary location goes down because of a disaster such as an earthquake, fire or other natural or man-made disasters. To meet their service levels agreed upon with the business, IT professionals need to maintain IT operations in the face of unplanned events.

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Maintaining IT operations when the primary site goes down requires failing over the entire datacenter to a second site in a distant location. Since any downtime of the primary site leads to a loss in business, organizations must be able to recover to their secondary sites as quickly as possible to minimize loss of critical business data. Yet, in the event of a disaster, highly trained IT professionals may not be available to perform the failover operation. Organizations therefore need a business continuity solution that is fully automated so that even someone with little or no IT knowledge can bring the IT services back on line quickly and consistently. In order to have full confidence that this automated failover will work properly during an emergency, organizations need tools that can help them perform extensive planning, testing and validation. Once the primary site comes back up, organizations also need tools to simplify failback operations to the primary site.

Obstacles to implementing automated, fully validated failover and failback have long included expense, complexity and operational intensiveness. Disaster recovery has been complex because it is a cross-functional IT task that requires the collaboration of IT management groups for servers, the network and storage technology. It also requires constant syncing of configurations because recovery success is greatly reduced if the primary and secondary sites become *out of sync*. Historically, this has meant that much time and operational cost went to ensuring that primary and secondary sites remained in complete lock-step. Organizations without automated disaster recovery have relied on backup and offsite archiving processes that have lengthy recovery times and are operationally intensive.

Requirements

In addition to high availability technologies, organizations seeking disaster recovery need:

- Asynchronous replication, which enables data to be replicated over longer distances using less bandwidth than synchronous replication to reduce network bandwidth demands and costs.

- Simple disaster recovery workflows, which aid in the process of implementing disaster recovery in an efficient, error-free fashion.

- Automated host failover, which reduces operational intensiveness during testing and failover operations to minimize downtime.

The Microsoft-HP-Citrix disaster recovery solution

The joint Microsoft, HP, and Citrix solution reduces the expense, complexity and operational intensiveness of disaster recovery.

The platform:
Microsoft simplifies remote failover

If a disaster takes an entire geographic location out of service, Microsoft Hyper-V virtualization allows virtual machines to be restarted at an alternate site from remote copies of their logical volumes. Unlike the painstaking startup required with physical servers, virtual machines can be started easily at the remote site.

The infrastructure:
HP storage reduces costs

HP's asynchronous replication (Remote Copy) can support a two-site configuration or it can replicate copies to any number of remote sites. P4000 SANs use thin provisioning and remote copies to make Remote Copy time and space efficient as well as risk free.

- **Space efficiency reduces storage costs –** The add-on asynchronous replication software available with many SAN products requires multiple copies and full-space reservation, which can cause reserves to amount to several times the actual storage requirement. Remote replication solutions using P4000 SANs require only two copies of a volume's data, one at the primary and one at the remote site. A space efficient snapshot of the volume's data requires no space reservation. Finally, the remote copy can be mounted at the remote site without creation of an additional copy. Thin provisioning means that the local and remote copies use only the amount of storage actually required, eliminating the cost of over provisioning storage.

- **Bandwidth efficiency reduces networking costs and improves performance –** Remote Copy is implemented as a series of scheduled remote volume snapshots. Each time a remote copy is executed a local snapshot is created and then only the changed blocks are copied between sites. This makes efficient use of bandwidth between sites, improving performance and reducing bandwidth cost. Failback is also more straightforward and much faster because only the blocks changed since the failure need to be copied.

- **Reduces risk of lost data –** With traditional asynchronous replication software that updates remote copies a block at a time, remote copies can be inconsistent because the blocks representing a transaction may not all be copied as a unit. With P4000 SANs, each periodic remote copy is 100 percent complete or the changed blocks are not applied to the remote volume so there is no concern about missing data blocks or blocks out of order.

- **Simplified failback –** To minimize the time and effort necessary to failback once that primary site comes back on line, the P4000 includes a Failback Wizard to fully automate the failback process.

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The glue:
Citrix minimizes operational intensity

Citrix Essentials for Microsoft Hyper-V includes StorageLink Site Recovery technology to allow virtualization administrators to take advantage of storage array replication services to enable remote fail-over for their Hyper-V environments. Hyper-V administrators can use Site Recovery technology for simple setup, configuration, staging and testing of disaster recovery plans so they can get their disaster recovery site up and running quickly.

- **Simplified set up –** Virtualization administrators can set up storage-based replication of virtual machines on their own, without the involvement of storage administrators through simple point-and-click wizards.

- **Easier failover –** Virtualization administrators can use simple point-and-click wizards to protect, failover and recover their virtual machines. They can use Hyper-V or System Center controls to start the virtual machines at the secondary site.

- **Better testing of disaster recovery plans –** Virtualization administrators can test disaster recovery plans by staging replicated virtual machines at the secondary site without disrupting ongoing replication of production virtual machines at the primary site. Storage Link uses instant cloning or snapshot capabilities to create a duplicate of recovery virtual machines and allow administrators to start and run virtual machines on isolated virtual networks, maintaining business continuity as they test disaster recovery plans.

- **Automated failover of virtual machines speeds disaster recovery –** Organizations can use StorageLink Site Recovery with workflow orchestration tools in Citrix Essentials and Microsoft MultiSite clustering to automatically failover protected virtual machines in the event of a disaster. This reduces operational intensity and speeds disaster recovery.

- **Fast Failback –** Organizations can use StorageLink Site Recovery and the P4000 Failback Wizard to failback their virtual machines to the primary site. This minimizes downtime at the primary site.

Conclusion:
The MS-HP-Citrix solution reduces cost, complexity and operational intensity for business continuity

The combined Microsoft-HP-Citrix business continuity solution provides organizations with a cost effective solution that reduces complexity and operational intensity, making it fast, simple and affordable to implement business continuity for most applications.

Lower costs

Cost savings are delivered throughout the joint Microsoft-HP-Citrix solution. Windows Server 2008 R2's built-in Hyper-V capabilities consolidate failover server resources, reducing the cost of servers, datacenters, and energy. HP P4000 SAN storage minimizes the cost of storage for virtualized Windows Servers by eliminating redundant copies and the need for over provisioning storage. Citrix Essentials reduces the cost associated with managing storage by simplifying the setup, configuration of storage and execution of disaster recovery plans for a Microsoft Hyper-V cluster when it is connected to a HP P4000 SAN to provide high availability solutions. Finally, unlike other vendors that charge significant amounts for high availability and disaster recovery capabilities, these capabilities are all included in the cost of Microsoft-HP-Citrix solutions.

Less complexity and operational intensity

The combined Microsoft-HP-Citrix solution is considerably less complex and operationally less intensive than other business continuity options. Included virtualization capabilities that allow virtual machines to run on any standard hardware reduce complexity by eliminating the need to configure applications for specific hardware. Microsoft management solutions make it easy to move virtual machines among any standard hardware. HP includes easy-to-use storage management capabilities and failback wizards. Citrix Essentials allows organizations to easily create and test failover operations before disaster strikes. It also automates the processes required to execute failover, eliminating operationally intensive manual processes and allowing organizations to resume IT operations much more quickly.

Greater business continuity for more applications

With the reduced cost and complexity delivered by the joint MS-HP-Citrix solution, organizations can now extend complete business continuity including high availability and disaster recovery to most applications.

For more information on how you can use the Microsoft, HP, and Citrix solution to achieve business continuity for your IT assets and data, please contact us at:
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