



HP Departmental Private Cloud Reference Architecture

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Introduction to Virtualization, HP Smart Bundles, and the HP Departmental Private Cloud Reference Architecture

Benefits of building virtualized infrastructure

Many mid-size businesses are turning to server virtualization and private cloud to reduce the cost of delivering IT services while improving workload availability. Server virtualization enables IT organizations to easily consolidate multiple applications onto a single physical machine or failover cluster, reducing hardware costs and reducing costs for power, cooling and data center floor space.

Virtualization improves IT agility, enabling dynamic allocation of resources (CPU, memory, storage and networking) to individual VMs so they can scale in alignment with workload demand. In addition, each operating system and application environment is stored on virtual hard disk files (VHD), so administrators can easily copy or clone these VHDs to create new virtual machines in a fraction of the time required to deploy a physical server.

Finally, virtual machines are highly portable and can easily be migrated to new physical host servers, allowing maintenance on physical infrastructure without application downtime and allowing IT staff to more easily balance workloads across available physical resources.

With the addition of systems management such as Microsoft® System Center, customers can move beyond virtualization and begin to implement private clouds. A private cloud extends virtualization features designed into Windows® Server, enabling standardized design, simple back-up, and self-service deployment of IT services. By removing the need to customize each and every IT service and by enabling line of business or application owners to control when they deploy services, IT organizations can further reduce operational expenses.

This whitepaper defines a best practices reference architecture and detailed implementation guide for building a highly available two node virtualization or private cloud solution ideally suited for mid-sized businesses and branch office deployments. The reference architecture is built with HP ProLiant DL360e servers, HP P2000 MSA Array System with SAS shared storage, HP E2910 switches, and HP Insight Control management software as well as Microsoft Windows Server 2012¹ or Windows Server 2008 R2 and Microsoft System Center.

HP Smart Bundles and the HP Departmental Private Cloud

Organizations new to virtualization often find it challenging to select a mix of server, storage, and networking infrastructure that strikes the correct right balance between performance, scalability, and cost. HP Smart Bundles for Hyper-V help remove complexity by defining virtualization configurations that meet a broad variety of customer needs and are flexible enough to be customized to meet individual requirements.

HP Smart Bundles for Hyper-V are composed of the following core hardware and software elements:

- Compute nodes
- Shared storage
- Network switches
- OS and virtualization software
- Management software

These elements have been chosen and sized based on HP and Microsoft best practices and are designed to deliver leading performance and scalability at a reasonable price point. There are currently three HP Smart Bundle configurations available:

Essential Tower Smart Bundle

The Essential Tower Smart Bundle allows customers to consolidate workloads such as Microsoft Small Business Server, a file server, and an email server into one machine—all without reinstalling any applications. This solution can save space, simplify data backup and server management, and lower the electricity bill at the same time.

¹ Note: As of the writing of this document, customers will be able to download a Windows Server 2012 device driver supplement for ProLiant Generation 8 servers in early September. Intelligent Provisioning as well as the final Service Pack for ProLiant (SPP) consolidated firmware and driver package will be available in mid-October. The P2000 G3 MSA Array System certification will be completed at the end of September.

Essential Rack HA Smart Bundle

The Essential Rack HA Smart Bundle combines the latest generation of the proven, industry-standard servers, the HP ProLiant DL360e Gen8, with the affordable HP P2000 G3 MSA Array System to provide a highly available virtualization and cloud solution that keeps your customer's applications online even if one of your servers experiences an outage.

Scalable Rack HA Smart Bundle

The Scalable Rack HA Smart Bundle combines the HP ProLiant DL380e Gen8 with the HP StoreVirtual VSA. This solution virtualizes internal server or JBOD storage to provide a high availability solution that grows with your customer's needs.

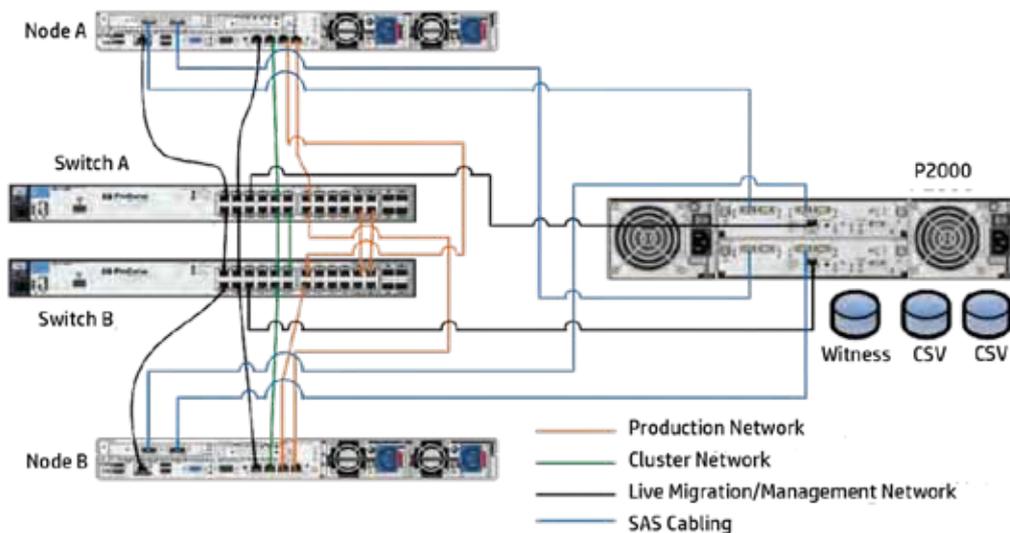
For more detailed information about HP Smart Bundles, visit hp.com/go/virthyper-v.

The HP Departmental Private Cloud Reference Architecture outlines the process for building a Hyper-V virtualized or private cloud environment using the **Essential Rack HA** configuration described in this section. The paper will first outline important solution design and sizing factors and briefly discuss the advantages of Microsoft's new Windows Server 2012 operating system. It will then provide detailed instructions for how to deploy server, storage and networking hardware, how to install and configure the Windows Server operating system, and how to configure Microsoft Hyper-V and Microsoft failover clusters. Finally, it will recommend how to deploy management services in either a standalone or Microsoft System Center managed environment. Customers that wish to deploy a full Microsoft Private Cloud should consider deploying Microsoft System Center.

HP Departmental Private Cloud Reference Architect design principles

HP Departmental Private Cloud solution is designed for mid-size customers that want to consolidate multiple application workloads onto a single highly available Hyper-V cluster, or larger customers that need a standardized mechanism for delivering IT services in a branch office, retail outlet, factory floor, or other facility that requires resources outside of the main data center.

The configuration has been designed to strike the best possible balance between delivering high availability and maintaining an attractive price point for budget constrained IT organizations.



Redundancy is built into server and storage subsystems, and Microsoft failover clustering and clustered shared volumes ensure that workloads remain online even if one of the connections between servers and shared storage is temporarily interrupted.

This section will discuss virtualization host server, failover cluster and Clustered Shared Volume (CSV), network, storage, CPU, memory, virtual machine, and management configuration best practices for the HP Departmental Private Cloud.

Reference Architecture Design

Virtualization Hosts

The virtualization hosts configured in the HP Departmental Private Cloud RA will have the Hyper-V role enabled and will host the VMs that you deploy. They will have SNMP and MPIO features enabled, and the two virtualization hosts will be clustered for high availability and redundancy using Microsoft Failover Clustering. Virtualization hosts are provided with separate networks for traffic related to management data, production data, Clustered Shared Volumes (CSV), and live migration. Respective HP P2000 G3 MSA storage software and drivers are installed and configured on the virtualization host to access the storage.

Failover Clustering and Clustered Shared Volumes

The HP Departmental Private Cloud RA is a two node cluster configuration. Microsoft failover clustering and clustered share volumes increase system availability by ensuring continuous communication between cluster nodes. This enables live migration of virtual machines during node maintenance and enables rapid VM recovery should a node in the cluster fail.

For more information, see [Using Cluster Shared Volumes in a Failover Cluster in Windows Server 2008 R2](http://technet.microsoft.com/en-us/library/ff182346(WS.10).aspx):
[http://technet.microsoft.com/en-us/library/ff182346\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/ff182346(WS.10).aspx)

Virtual Machine configuration

Memory, CPU, and storage settings for virtual machines are highly workload dependent and there is no general rule of thumb for resource allocation.

When deploying the HP Departmental Private Cloud in a production environment, the virtual machines should be configured with dynamic memory and the virtual hard disks (VHDs) as “Fixed Size.” Dynamic memory allows the hypervisor to reclaim memory unused by virtual machines and allocate it to other VMs on the host. This helps the host nodes in the cluster consume memory more efficiently and increase the density of VMs on the Hyper-V hosts.

Fixed size virtual hard disks are recommended because storage is provisioned as a contiguous block by the OS which improves performance, and because fixed size virtual hard disks lessen the risk of encountering unexpected storage capacity problems induced by dynamically expanding or differencing VHDs.

Storage

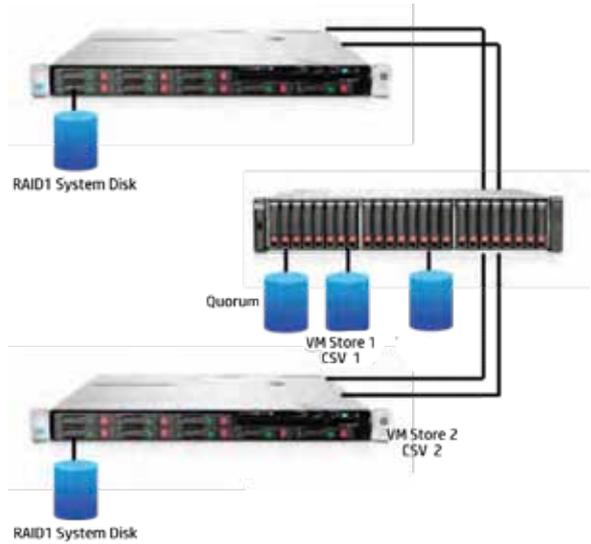
The HP P2000 G3 MSA Array System with SAS shared storage provides simple, high performance shared storage without the complexity of Fibre Channel and iSCSI connectivity.

The HP P2000 G3 MSA Array System specified in this reference architecture comes with 12 300 GB disks, providing 3.6 TB of raw storage. A single 1 GB LUN will be allocated to the failover cluster. The remaining storage will be assigned as virtual machine storage and configured as two 1.25 TB RAID 50 volumes with Clustered Shared Volumes enabled. RAID 50 was chosen in order to provide the optimum balance between performance and availability. RAID 50 stripes data across two RAID 5 drives using 6 drives each. Additional drive spindles increase performance and enable the configuration to continue running even with two drive failures. The configuration does require 2 parity disks which reduces total storage capacity.

In some instances, it may be preferable to have multiple logical volumes and multiple clustered share volumes hosting virtual machines. In these cases, it is possible to create three RAID 5 volumes with each volume configured as a Clustered Shared Volume (CSV). This may result in some stranded capacity and may also decrease performance due to the reduced drive count per volume.

Storage internal to the DL360 servers is configured as RAID 1 mirrored pairs. Customers that would prefer RAID 5 can purchase additional drives as necessary.

The Departmental Cloud RA configuration also specifies 500 GB of raw capacity for a snapshot pool. This pool is allocated to the “VM store” and needed when the customer wants to use the snapshot or clone functionality included with the HP P2000 G3 MSA.



Network

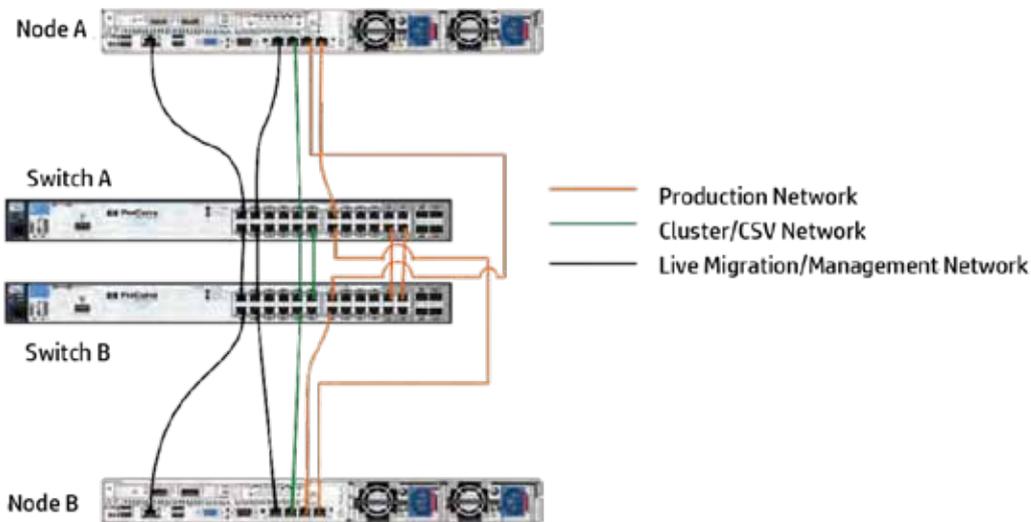
Network configuration is a critical element in deploying a high performance Hyper-V cluster. Microsoft recommends isolating production Ethernet, storage, systems management, failover cluster and clustered shared volume (CSV), as well as live migration traffic.

The DL360e Gen8 system contains four physical network adapters. In order to prioritize performance and availability, HP has defined the following networks for the HP Departmental Cloud RA configuration:

Adapter Number	Description	Public/Private
Adapter 1	Production Network	Teamed public
Adapter 2	Production Network	Teamed public
Adapter 3	Cluster/Cluster Shared Volume	Private
Adapter 4	Live Migration/Systems Management	Public

Production networks are teamed to enable cluster nodes to maintain connectivity even if one of the two connections to the production network should fail. Cluster nodes are connected to shared storage via a SAS HBA, so no Ethernet connectivity is required for the storage subsystem.

Live migration and management networks have been consolidated to enable teaming of production networks and because anticipated management traffic levels are low.



To separate the Networks on the HP Networking switches, every network uses a unique VLAN.

- Live Migration/Management
- Cluster/Cluster Shared Volumes
- Production

The switches are configured such that the VLAN's are assigned to group of ports, and these groups are interconnected between the switches. For these switch interconnects, it is possible to configure trunk groups between the two HP Networking switches.

Important:

The network configuration must be adapted to the individual customer situation, and network parameters, like IP-addresses, network masks and network names should be defined before the implementation starts. The following tables show the configuration of the lab environment, where the RA was developed. You can use them as a reference for your individual configuration.

IP-Address definitions:

Network	IP Address Range	Network Mask	Gateway	DNS Server	VLAN	Domain
LM/Management	10.251.5.---	255.255.255.0	10.251.5.1	10.251.3.2	10	Onsite.net
Cluster/CSV	10.251.4.---	255.255.255.0	10.251.4.1	10.251.3.2	20	Onsite.net
Production	10.251.3.---	255.255.255.0	10.251.3.1	10.251.3.2	30	Onsite.net
ILO Network	10.251.1.---	255.255.255.0	10.251.1.1	10.251.1.2	0	Onsite.net

Unit	Device	Device Name	iLO address	Host NIC 1/2 Production	Host NIC 3 Cluster/CSV	Host NIC 4 LM/Management
U26	HP E2910-24G al	Switch A	10.250.1.100			
U25	HP E2910-24G al	Switch B	10.250.1.101			
U24	DL360e Gen8	Node A	10.250.1.30	10.251.3.30	10.251.4.30	10.251.5.30
U23	DL360e Gen8	Node B	10.250.1.31	10.251.3.31	10.251.4.31	10.251.5.31
U22	P2000 G3 MSA	P2000CtrlA	10.250.1.10			
U21	P2000 G3 MSA	P2000CtrlB	10.250.1.11			



CPU

The DL360e Gen8 model specified in the HP Departmental Private Cloud RA contains two sockets with 6 cores per CPU. When planning VM capacity, it is important to reserve enough CPU capacity to allow all virtual machines run on one cluster node with acceptable performance levels, should the second node fail or need to be taken offline for maintenance.

Memory

The DL360e Gen8 has 12 DIMM slots (6 per processor which allows up to 384 GB Memory. The HP servers specified in the HP Departmental Private Cloud RA include 24 GB (6 x 4 GB per server). This leaves one bank of DIMMs free to size according to your needs, with 4 GB, 8 GB, 16 GB, or 32 GB DIMMs. Refer to HP and Microsoft sizing tools to help plan memory allocation per virtual machine. Memory allocation will vary significantly based on workloads.

When planning VM capacity for the Essential Rack HA configuration, it is important to reserve enough memory capacity to allow all virtual machines to run on one cluster node with acceptable performance levels, should the second node fail or need to be taken offline for maintenance. While there is not a specific rule of thumb, HP and Microsoft recommend that any given cluster node not be oversubscribed in excess of 120 percent.

Systems Management

The Essential Rack HA configuration can be managed in one of two ways:

1. As a Hyper-V cluster managed by a combination of Windows Server “Server Manager”, HP Integrated Lights-Out, and optionally HP Insight Control.
2. As a member of a larger virtualization ecosystem managed by System Center 2012 (Windows Server 2008 R2 and earlier) or System Center 2012 SP1² (Windows Server 2012)

Windows Server 2012 Server Manager now supports management of multiple servers. A single Windows Server 2012 instance can manage all physical servers and virtual machines in a mid-size business or branch office environment. Windows Server 2012 Hyper-V manager also enables management, control, and migration of virtual machines running on multiple physical hosts. Optionally use Insight Control as a centralized repository for hardware events and use iLO Advanced to control servers in instances where it is no longer possible to access the local operating system.

For environments of greater than 10 servers, HP recommends leveraging Microsoft System Center to manage both physical and virtual servers. HP also recommends the HP Insight Control which contains System Center management packs that expose the fault monitoring and control functions of HP ProLiant servers within the appropriate Microsoft System Center management console.

² Microsoft System Center 2012 SP1 will be released later in 2012.

Windows Server 2012 and Windows Server 2008 R2 comparison

The HP Departmental Private Cloud Reference Architecture supports Windows Server 2008 R2 and Windows Server 2012. Organizations that are deploying new virtualization environments or considering future private cloud deployments should consider Windows Server 2012 due to scalability, performance and feature advantages relative to Windows Server 2008 R2.

The following table outlines the performance and scalability characteristics of Windows Server 2012³ vs. Windows Server 2008 R2. While the differences may not be immediately relevant to smaller environments, Windows Server 2012 is ready to grow with you as your organization grows.

System	Resource	Windows Server 2008 R2	Windows Server 2012	Improvement
Host	Logical Processors	64	320	5×
	Physical Memory	1 TB	4 TB	4×
	Virtual CPUs per Host	512	2,048	4×
VM	Virtual CPUs per VM	4	64	16×
	Memory per VM	64 GB	1 TB	16×
	Active VMs per Host	384	1,024	2.7×
Cluster	Guest NUMA	No	Yes	-
	Maximum Nodes	16	64	4×
	Maximum VMs	1,000	4,000	4×

Windows Server 2012 also adds important new functionality for mid-size business and branch offices that make it an excellent choice for virtualized and private cloud environments.

“Shared Nothing” Live Migration

Shared nothing live migration allows systems administrators to migrate virtual machines between Hyper-V environments that do not share the same storage. This can mean enabling live migration between two standalone servers or enabling live migration between two clusters that connect to different shared storage resources. This enables virtualization administrators to balance virtualized workloads across all available CPU and memory resources without a requiring a planned outage.

Storage Live Migration

Storage live migration allows resources on shared storage (e.g. virtual machine VHD files) to be moved from one LUN to another without service interruption. This enables virtualization administrators to make the best possible use of storage resources without impacting access to IT services.

Enhanced Server Manager

Windows Server 2012 Server Manager can manage multiple servers from a single instance of Windows Server. Ideal for small networks of fewer than 10 devices, Server Manager provides information about server health status, alerts, and performance, and provides consolidated access to tools that enable configuration of Windows Server roles and features, virtual machine management, remote access and other capabilities.

Enhanced PowerShell

Windows Server 2012 exposes over 2300 PowerShell commandlets, providing programmatic access to all Windows functions enabled through the GUI. PowerShell also plays an important role in enabling run book automation delivered through System Center Orchestrator.

Built-in NIC Teaming

Windows Server 2012 now provides native NIC teaming, allowing administrators to bind two physical NICs into a single logical network port. This logical port can then be connected to separate physical switches, enhancing network reliability for physical and virtualized hosts. The Windows Server 2012 NIC teaming function can be configured via PowerShell.

Hyper-V Replica

Windows Server 2012 enables virtualization administrators to create snapshots (replicas) of virtual machines that can be asynchronously copied to remote sites. Virtual Machine snapshots can then be used to enable rapid recovery of applications in disaster situations.

³ This table contains scalability numbers based on the release candidate of Windows Server 2012.

HP Departmental Private Cloud hardware installation

This section provides detailed instructions for assembling hardware prior to network and storage configuration or installation of the operating system. Hardware configuration will occur in the following order:



Adding additional hardware components to the server

The HP Departmental Private Cloud RA configuration needs to be assembled at the customer site. Unpack the shipping cartons and locate the materials and documentation necessary for installing the hardware. All the rack mounting hardware necessary for installing the components into the rack is either included with the rack, the server, the switches, or the P2000.

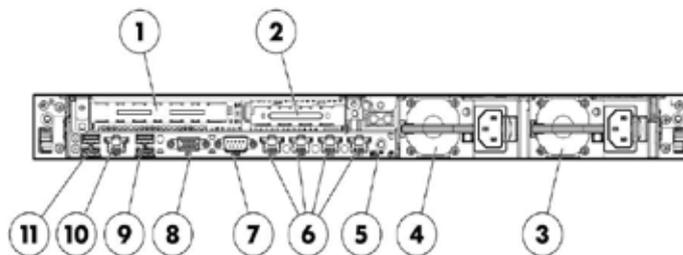
The contents of the shipping carton for each device will include:

- Server, storage, or networking device
- Power cord
- Printed setup documentation, documentation CD, software products
- Rack mounting hardware kit and documentation

In addition you may need:

- Tools
- Hardware options
- Operating system or application software

The DL360e Gen8 server is a preconfigured performance model (refer to the DL360e QuickSpecs http://h18004.www1.hp.com/products/quickspecs/14327_na/14327_na.html) with 2 CPUs and 24 GB RAM already installed. The bundle also includes two 146 GB disks per server (intended to host the Windows Server operating system), and a dual port SAS controller which should be installed before mounting the servers into the rack. Refer to the “HP ProLiant DL360e Gen8 Server User Guide” for further instructions http://h18004.www1.hp.com/products/servers/management/unified/gen_8.html.



Item	Description
1	Slot 2 PCIe, HP H221SAS Controller for Gen 8 Server
2	Slot 1 PCIe,
3	Power Supply
4	Power Supply
5	Unit ID LED/button
6	LOM Ports
7	Serial connector
8	Video connector
9/11	USB connectors
10	ILO Port

Mounting solution components into the Rack

The way in which you mount the HP Departmental Private Cloud RA configuration may differ based on constraints within the customer environment. Due to the length limitations of the P2000 SAS cable (2 meters), HP recommends mounting the HP P2000 G3 MSA immediately below the servers.

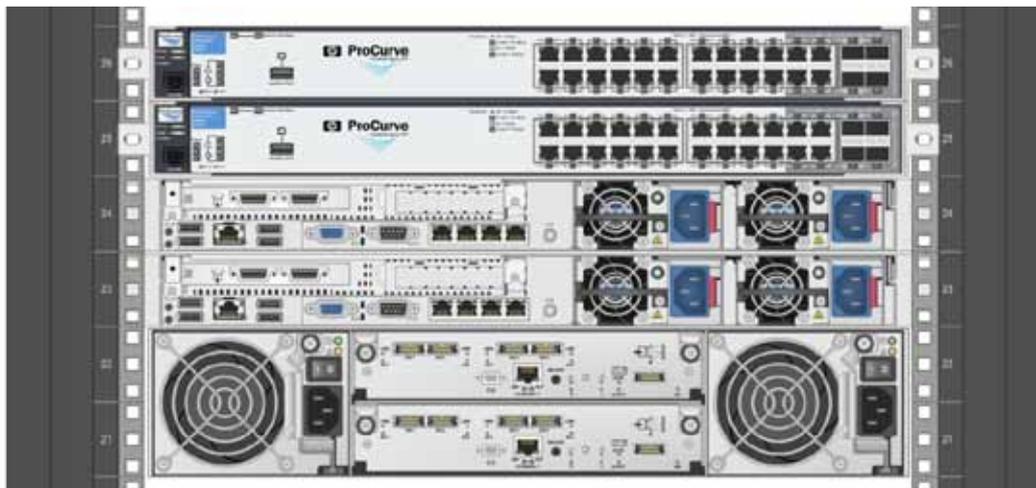
Note: Ethernet networking cables are not included in the kit and need to be purchased separately.

Rack mount example:

Front

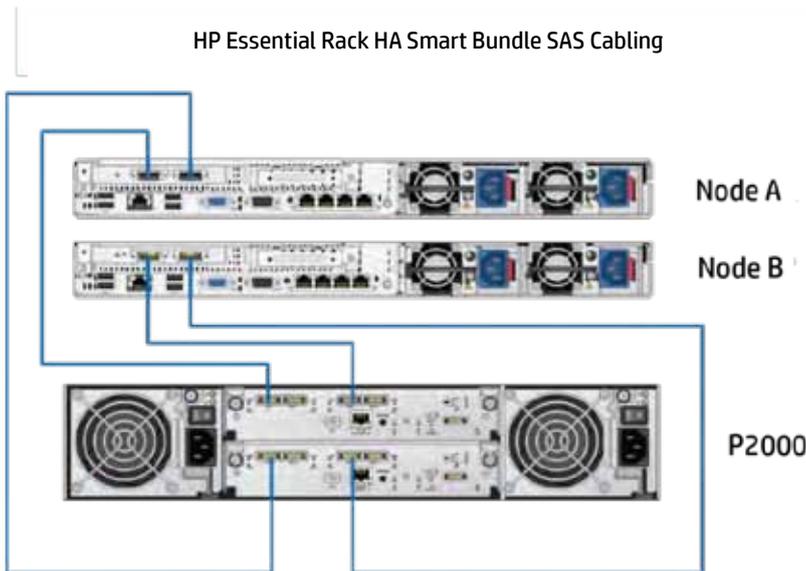


Back



Configuring SAS Cabling

The external mini SAS cables (packaged with the P2000) connect the SAS HBA of the DL360e to the P2000. To implement a highly available configuration with no single point of failure it is important to use the correct ports on the HBA's and HP P2000 G3 MSA SAS controller. Refer to the following picture to implement "straight cabling," where every host, using both HBA port's, is connected to both Storage controllers. For a possible 4 Node cluster the additional SAS ports on the P2000 can be used in a similar way. Refer to Appendix C for detailed cabling information.



Configuring Ethernet Network cabling

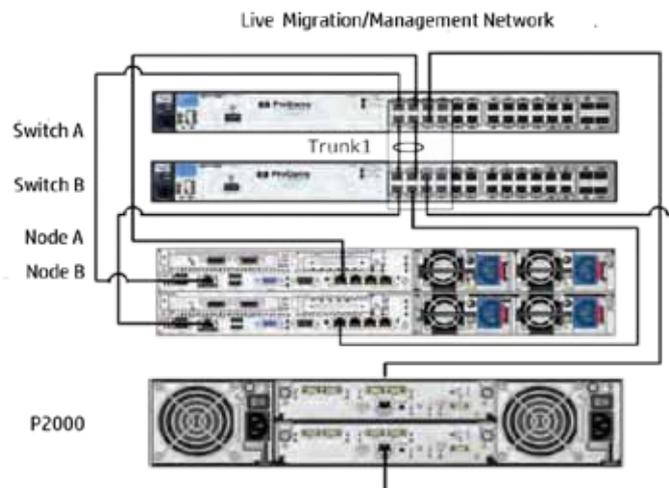
This section describes networking cabling for the Departmental Private Cloud. The following Network cabling can be used for a possible upgrade to a 4 Node cluster configuration.

Refer to Appendix C for additional cabling details.

Live Migration/Management Network

Install the following cable connections:

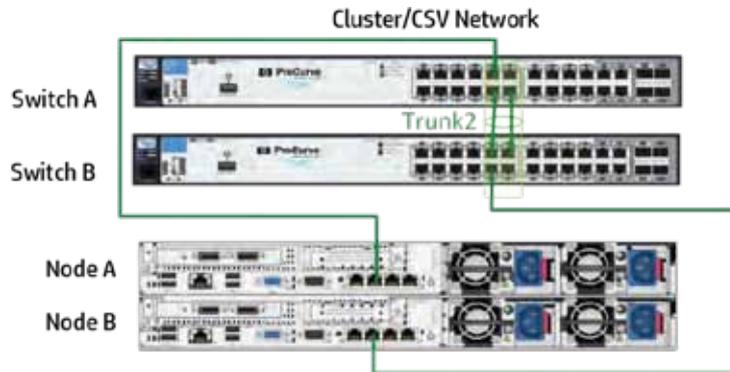
	Switch A connected to	Switch B connected to
Port 1	Node A iLO	Switch A Port 2 (Trunk 1)
Port 2	Switch B Port 1 (Trunk 1)	Node B iLO
Port 3	Node A NIC 4	Switch A Port 4 (Trunk 1)
Port 4	Switch B Port 3 (Trunk 1)	Node B NIC 4
Port 5	For expansion	P2000 Controller B
Port 6	P2000 Controller A	For expansion
Port 7	For expansion	To customer network
Port 8	To customer network	For expansion



Cluster/CSV Network

For the Cluster/CSV Network use the following ports:

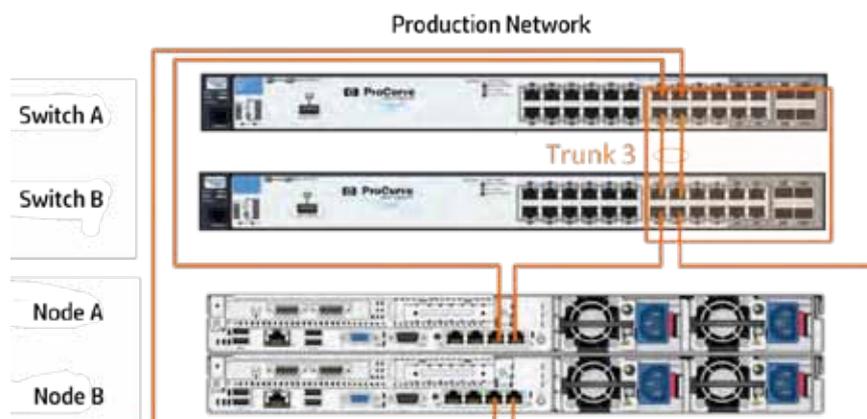
	Switch A connected to	Switch B connected to
Port 9	Node A NIC 3	Switch A Port10 (Trunk 2)
Port 10	Switch B Port 9 (Trunk 2)	Node B NIC 3
Port 11	For expansion	Switch A Port 12 (Trunk 2)
Port 12	Switch B Port 11 (Trunk 2)	For expansion



Production Network

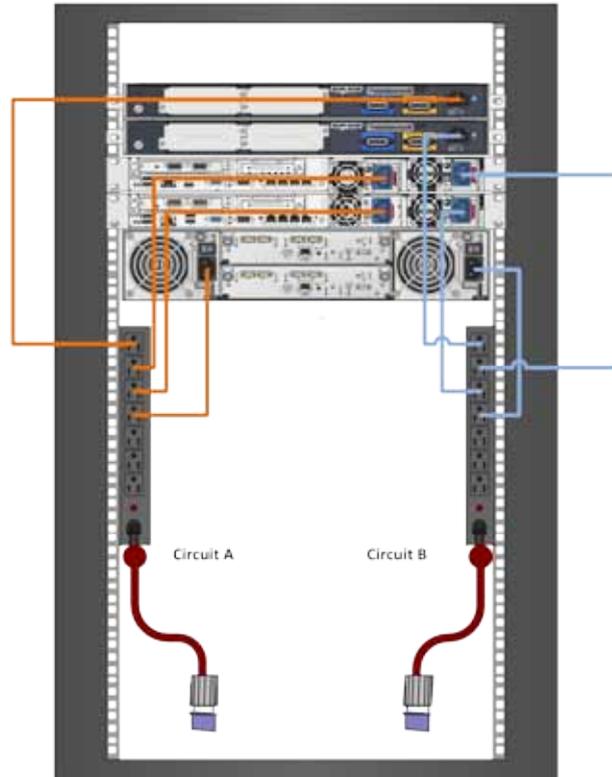
The production network uses the following ports:

	Switch A connected to	Switch B connected to
Port 13	Node A NIC 2	Switch A Port 14 (Trunk 3)
Port 14	Switch B Port 13 (Trunk 3)	Node A NIC 1
Port 15	Node B NIC 2	Switch A Port 16 (Trunk 3)
Port 16	Switch B Port 15 (Trunk 3)	Node B NIC 1
Port 17	For expansion	To customer network
Port 18	To customer network	For expansion
Port 19	For expansion	To customer network
Port 20	To customer network	For expansion
21–24	To customer network	To customer network



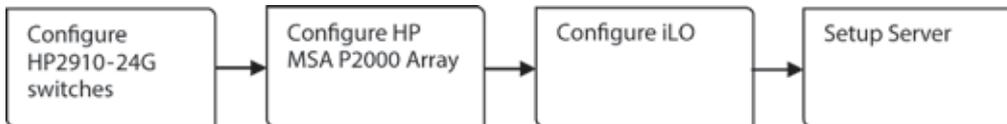
Power cabling

Power cabling needs to be redundant. Every node and the HP P2000 G3 MSA Array System must be connected to two independent circuits. The network switches have one power supply only and must be connected to different independent circuits. Talk with the customer about the usage of a UPS system. The more applications hosted on the Hyper-V cluster, the more the high availability characteristics of the solution design becomes important.



Hardware and Software Component Installation and Configuration Based on the Reference Architecture

This section describes how to prepare the servers, switches and P2000 for management. It covers also the necessary settings for the Ethernet switches, P2000, iLOs and servers, before OS installation can be started.



The steps for each section include the following operations:

HP 2910-24G al switch configuration

- Set the Management IP address
- Configuration of the trunk groups
- Define the VLAN configuration

HP MSA P2000 configuration

- Set the management IP address of the array controllers
- Create the Vdisk
- Create volumes

iLO setup

- Set the iLO network parameters
- Add the desired iLO users
- Add the iLO Advanced License

Server setup

- Confirm the BIOS parameters
- Confirm firmware versions and update if necessary

Hardware Component Configuration

Configuration of the HP E2910-24G al switches

The tasks for this section include:

Setting the management IP addresses of the switches

1. Configuring the trunk groups
2. Creating the VLANs

To configure the ProCurve switches you need a serial connector and a terminal emulation program to access the CLI Interface. The switches also have a Web-based GUI. In order to access the GUI, you must first configure the management network.

Important:

The Parameters used during this section are only examples used in a lab environment. They must be adapted to the customer's environment. The configuration steps need to be executed on both switches but with different parameters.

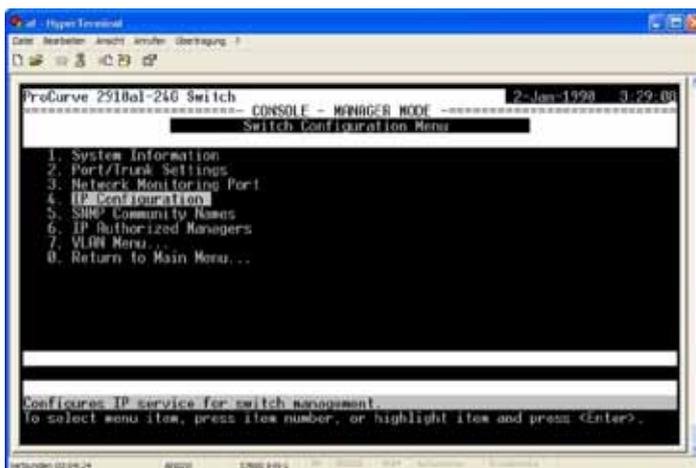
Setting the management IP addresses of the switches

1. To set the management IP addresses, you will need a computer where you have a serial port and a terminal emulation program like Putty. Connect the serial cable from the computer serial port to the serial port on the front of the switch. Open your terminal emulation program and connect with:
 - 57600 baud (the switch auto senses the speed)
 - 8 bits
 - No parity
 - 1 stop bit
 - Xon/Xoff flow control

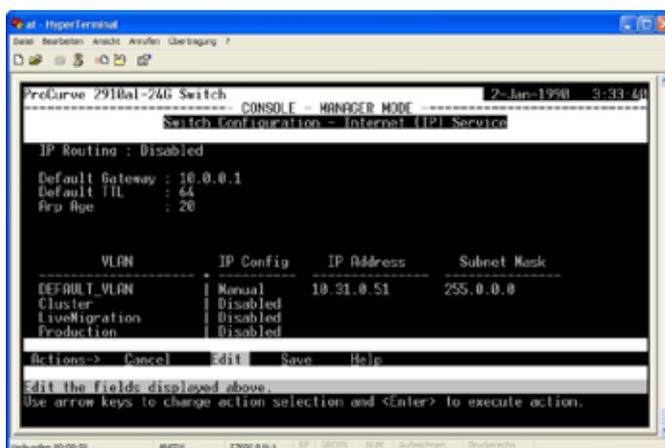
- Press return a few times. At the prompt, type “menu” to come to the MAIN Menu. Select “2. Switch Configuration.”



- On the next screen select “4. IP Configuration”



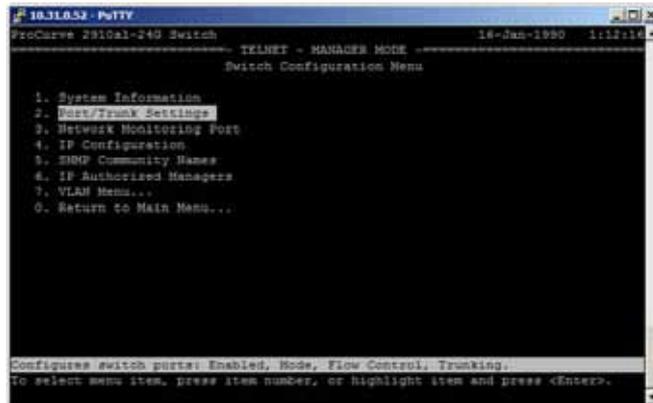
- At the IP configuration screen select edit and change the Management IP configuration to the desired settings. Refer to Appendix A for your individual settings.



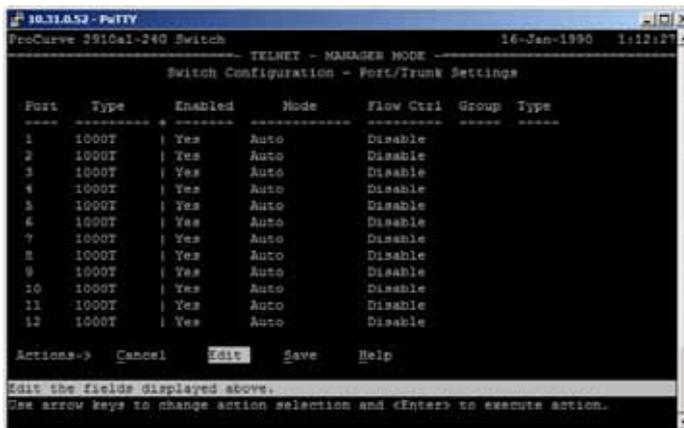
- Press enter and chose save to confirm the changes. The switch will reset with the new IP configuration settings.

Configure the trunk groups

1. Go back to the "Main Menu" → "Switch Configuration." Select "Port/Trunk Settings."



2. Select "Edit" in the action bar at the bottom.



3. In the edit menu move to the Group and Type area of the ports, with the arrow keys. Toggle the field to the correct value using the "space" key. The values for the reference architecture are:

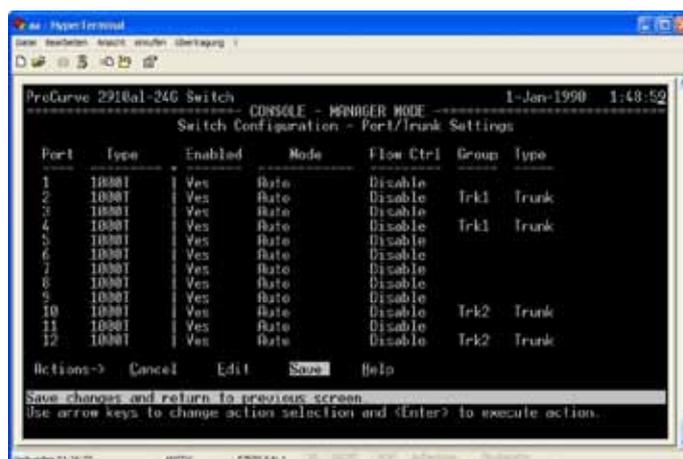
For Switch A:

- Port: 2, 4 Group: Trk1 Type: Trunk
- Port: 10, 12 Group: Trk2 Type: Trunk
- Port: 14, 16 Group: Trk3 Type: Trunk

For Switch B:

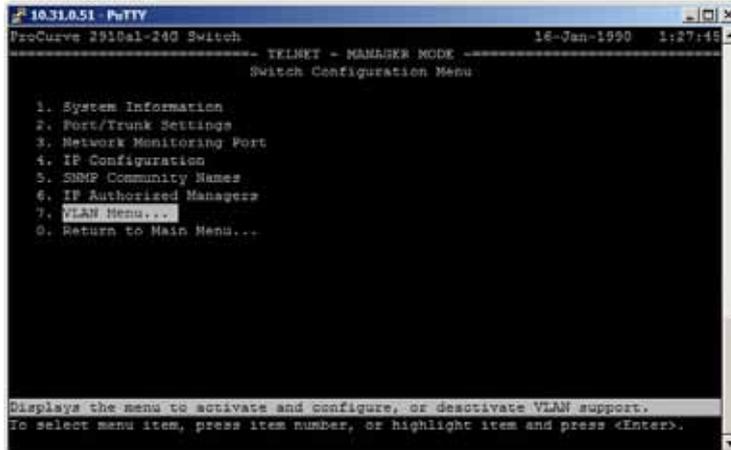
- Port: 1, 2 Group: Trk1 Type: Trunk
- Port: 9, 11 Group: Trk2 Type: Trunk
- Port: 13, 15 Group: Trk3 Type: Trunk

When you are finished, press enter and save the configuration.



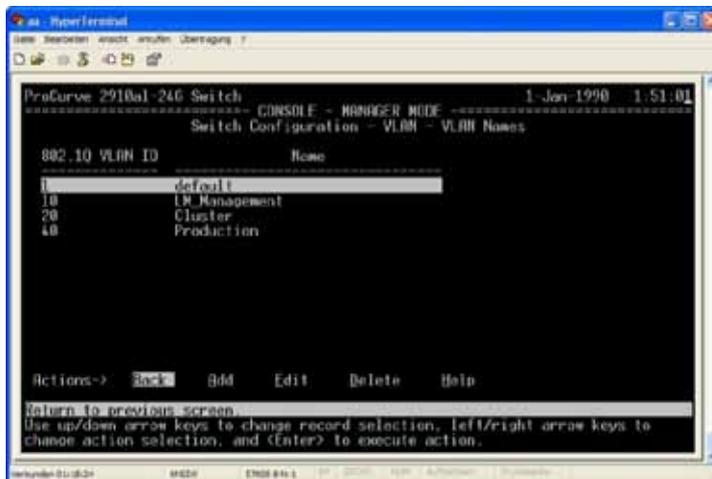
Create the VLANs

1. Go back to the “Main Menu” → “Switch Configuration.” Select “VLAN Menu”

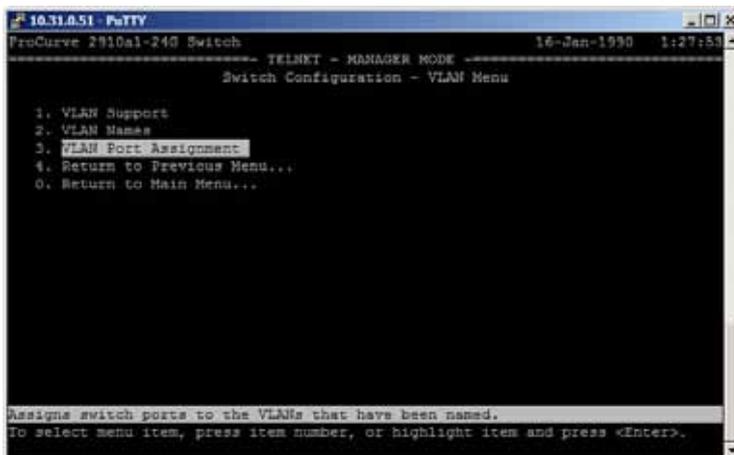


2. Select “2. VLAN Names.” Use the edit function to:

- Add VLAN “ZZ” LM_Management
- Add VLAN “XX” Cluster
- Add VLAN “YY” Production
- VLANXX, VLANYY and VLANZZ are the customer VLAN definitions. Refer to Appendix A for your individual settings.



3. Go back to the “VLAN Menu. Select “VLAN Port Assignment”



4. With the “Edit” function configure the following port/trunk assignments:

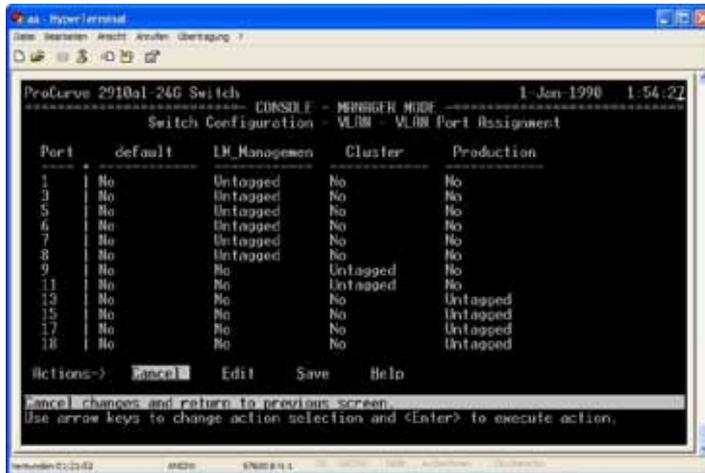
Switch A:

- LM_Management: Port 1, 3, 5–8, Trunk 1
- Cluster: Port 9, 11, Trunk 2
- Production: Port 13, 15–24, Trunk 3

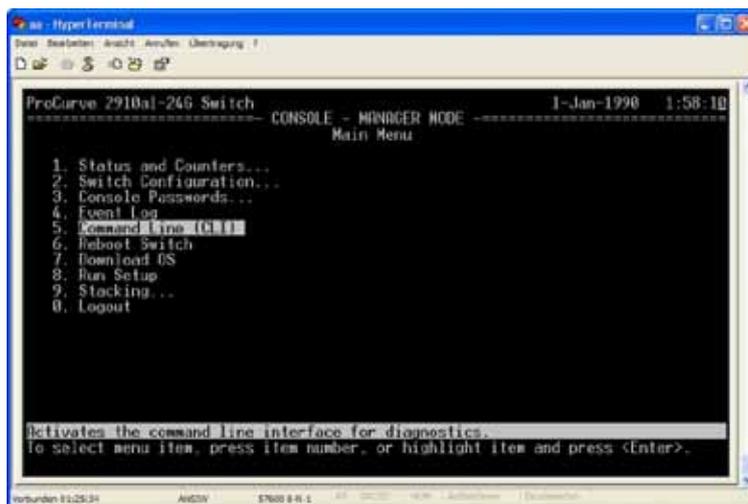
Switch B:

- LM_Management: Port 2, 4–8, Trunk 1
- Cluster: Port 10, 12, Trunk 2
- Production: Port 14, 16–24, Trunk 3

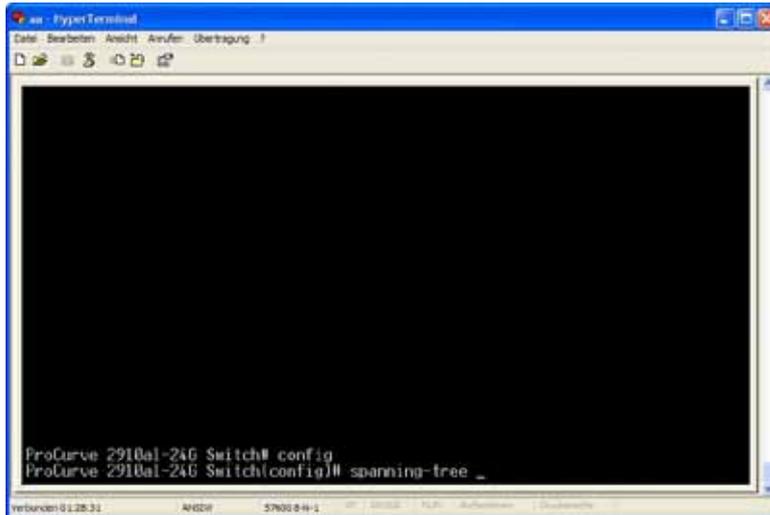
When you are done, press enter and save to exit.



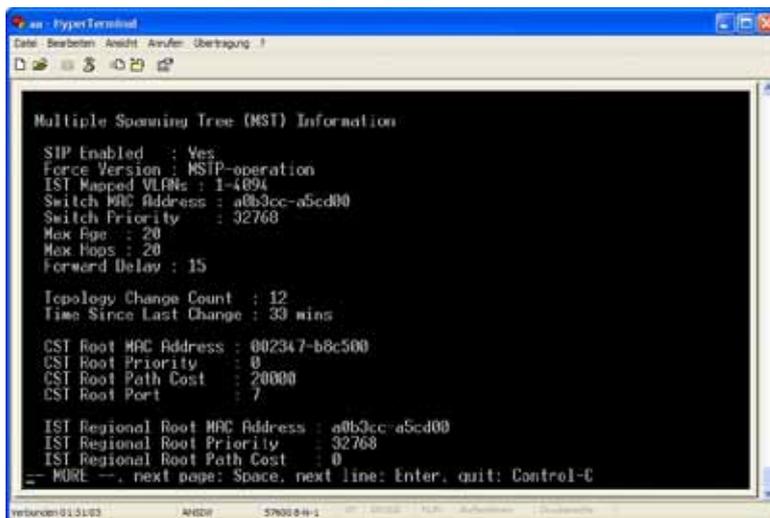
5. To reduce unnecessary traffic, because of loops in the network, spanning tree protocol must be used for every VLAN. The next set of instructions will cover how to enable spanning tree protocol. Navigate back to the main menu. Select “5. Command Line CLI.”



- At the prompt type “config.” Press return. Type “spanning-tree” and return.



- To confirm that spanning tree is enabled type “show spanning-tree.”



- Type menu. Save the changes.

Note: The spanning tree configuration needs to be documented for the customer.

The switch configuration is now complete. Log out. Future interaction with the switches can be also accomplished through the Web browser.

Configuration of the HP P2000 G3 MSA Array System

The tasks for this section include:

1. Setting the management IP address of the array controllers
2. Creating the Vdisk
3. Creating storage volumes

Setting the management IP address of the controllers

To execute these steps you need a Windows computer with a USB port. The HP P2000 has a network port for management. To access the Storage Management Utility, which is a Web-based GUI, we need to set the IP configuration on both controllers. To do that, the HP P2000 comes with a USB cable. To use the cable you need to download and install the USB driver from the HP Web site (Download drivers and software page, search for “P2000 SAS” and select your OS). This driver installs a new com port on your computer that you will use to connect to the P2000 array. Go to the device manager to discover which com port was created. Open a terminal program, specify the new com port, and connect with:

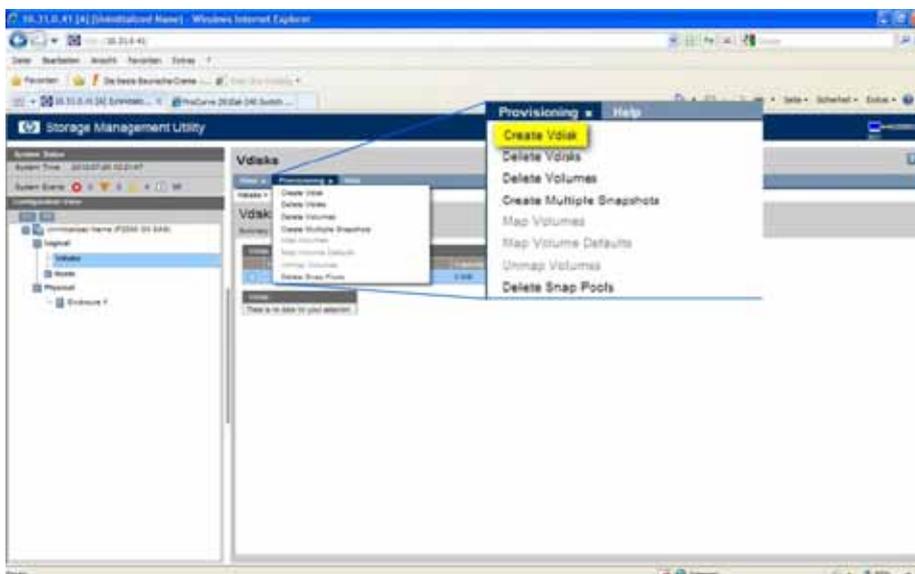
- 9600 baud
 - 8 bits
 - No parity
 - 1 stop bit
 - Hardware flow control
1. Establish the connection and log in with User: manage and Password: !manage
 2. At the prompt type the following using the network parameters defined earlier:
 - # set network-parameters ip x.x.x.x netmask y.y.y.y gateway
 - z.z.z.z controller a
 - # set network-parameters ip x.x.x.x netmask y.y.y.y gateway
 - z.z.z.z controller b

Refer to Appendix A for your individual settings.

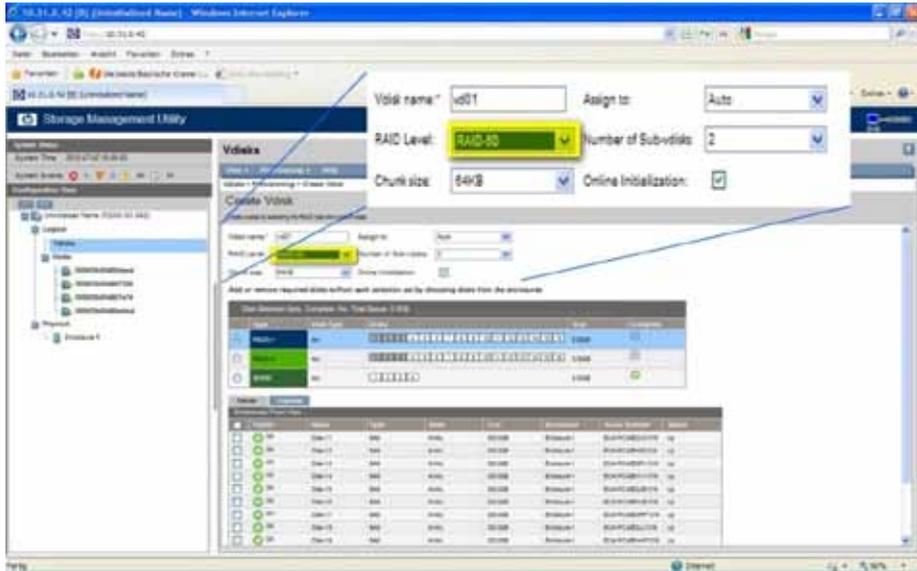
3. Exit the CLI and close the terminal program.

Create the Vdisk

1. Open a Web browser and enter the IP address of one of your array controllers. Login with user: manage and password: !manage
2. Select the array and click on “Create Vdisk” at the “Provisioning” drop down menu.



- For the RAID Level select RAID 50 from the drop down list.



- Select the first RAID subset "RAID 5-1" and mark the first 6 disks as the members of this subset.

RAID Level: RAID-50 Number of Sub-vidisks: 2
 Chunk size: 64KB Online Initialization:

Add or remove required disks to/from each selection set by choosing disks from the enclosures

Disk Selection Sets, Complete: No, Total Space: 1.8TB: 1.5TB 301.6GB

Type	Disk Type	Disks	Size	Complete
<input checked="" type="radio"/> RAID5-1	SAS	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	1,800.00GB	<input checked="" type="checkbox"/>
<input type="radio"/> RAID5-2	SAS	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	0.00GB	<input type="checkbox"/>
<input type="radio"/> SPARE	SAS	1 2 3 4	0.00GB	<input checked="" type="checkbox"/>

Tabular Graphical

Enclosures Front View

Health	Name	Type	State	Size	Enclosure	Serial Number	Status
<input checked="" type="checkbox"/>	Disk-1.1	SAS	RAID5-1	300.0GB	Enclosure-1	ECA1PC40EGV21216	Up
<input checked="" type="checkbox"/>	Disk-1.2	SAS	RAID5-1	300.0GB	Enclosure-1	ECA1PC40EH201216	Up
<input checked="" type="checkbox"/>	Disk-1.3	SAS	RAID5-1	300.0GB	Enclosure-1	ECA1PC40EGR11216	Up
<input checked="" type="checkbox"/>	Disk-1.4	SAS	RAID5-1	300.0GB	Enclosure-1	ECA1PC40EH1V1216	Up
<input checked="" type="checkbox"/>	Disk-1.5	SAS	RAID5-1	300.0GB	Enclosure-1	ECA1PC40EGB1216	Up
<input checked="" type="checkbox"/>	Disk-1.6	SAS	RAID5-1	300.0GB	Enclosure-1	ECA1PC40EHJ51216	Up
<input type="checkbox"/>	Disk-1.7	SAS	AVAIL	300.0GB	Enclosure-1	ECA1PC40EGRF1216	Up

- Now select the second RAID subset "RAID5-2" and mark the second 6 disks as the members of this subset. Click "Create Vdisk" at the bottom of the page.

Create Vdisk
 Create a vdisk by selecting the RAID type and a set of disks

Type	Disk Type	Disks	Size	Complete
<input type="radio"/> RAID5-1	SAS	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	1,800.00GB	<input checked="" type="checkbox"/>
<input checked="" type="radio"/> RAID5-2	SAS	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	1,800.00GB	<input checked="" type="checkbox"/>
<input type="radio"/> SPARE	SAS	1 2 3 4	0.00GB	<input checked="" type="checkbox"/>

Tabular Graphical

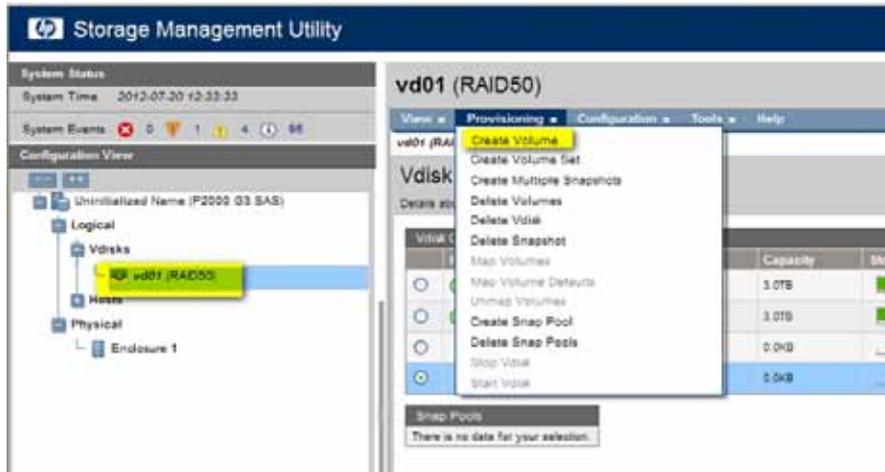
Enclosures Front View

Health	Name	Type	State	Size	Enclosure	Serial Number	Status
<input checked="" type="checkbox"/>	Disk-1.1	SAS	RAID5-1	300.0GB	Enclosure-1	ECA1PC40EDV21216	Up
<input checked="" type="checkbox"/>	Disk-1.2	SAS	RAID5-1	300.0GB	Enclosure-1	ECA1PC40EH201216	Up
<input checked="" type="checkbox"/>	Disk-1.3	SAS	RAID5-1	300.0GB	Enclosure-1	ECA1PC40EGR11216	Up
<input checked="" type="checkbox"/>	Disk-1.4	SAS	RAID5-1	300.0GB	Enclosure-1	ECA1PC40EH1V1216	Up
<input checked="" type="checkbox"/>	Disk-1.5	SAS	RAID5-1	300.0GB	Enclosure-1	ECA1PC40EGB1216	Up
<input checked="" type="checkbox"/>	Disk-1.6	SAS	RAID5-1	300.0GB	Enclosure-1	ECA1PC40EHJ51216	Up
<input checked="" type="checkbox"/>	Disk-1.7	SAS	RAID5-2	300.0GB	Enclosure-1	ECA1PC40EGRF1216	Up
<input checked="" type="checkbox"/>	Disk-1.8	SAS	RAID5-2	300.0GB	Enclosure-1	ECA1PC40EGU1216	Up
<input checked="" type="checkbox"/>	Disk-1.9	SAS	RAID5-2	300.0GB	Enclosure-1	ECA1PC40EHR1216	Up
<input checked="" type="checkbox"/>	Disk-1.10	SAS	RAID5-2	300.0GB	Enclosure-1	ECA1PC40EGRG1216	Up
<input checked="" type="checkbox"/>	Disk-1.11	SAS	RAID5-2	300.0GB	Enclosure-1	ECA1PC40EHR1216	Up
<input checked="" type="checkbox"/>	Disk-1.12	SAS	RAID5-2	300.0GB	Enclosure-1	ECA1PC40EHG1216	Up

Create Vdisk

Create the Volumes

1. Select the just created Vdisk and select “Create Volume” at the “Provisioning” drop down menu.



2. The first volume we create will be the quorum disk for the cluster. Specify a useful name like “quorum”, specify a size of 1 GB, check that the LUN is mapped as LUN 1, and check that read write access is enabled and it is presented on all SAS controller ports. Click Apply.



- The second volume we create will be the first CSV for the VMs. Specify a useful name like “VM_Store1”, Use half of the possible size(1248 GB), check that the LUN is mapped as LUN 2, read write access is enabled and it is presented on all SAS controller ports. When you want to use snapshot or clone features on the HP P2000, you need to enable snapshots and specify the Snap Pool size. Click Apply.

Create Volume
 Create a volume by assigning a name, selecting a size and setting the default mapping.

Volume name: VM_Store1

Size: 1248 GB

OpenVMS Volume? OpenVMS Volume UID: _____

Enable Snapshots:

Standard Policy

Snap Pool: Reserved Size: 100% Absolute Size: _____ Snap Pool: _____

Replication Preps:

Map:

LUN: 2 Access: Read-Write

Select ports from the view or list below:

Breakout | Transfer

Apply

- The third volume we create will be the second CSV for the VMs. Specify a useful name like “VM_Store2”, Use the maximum possible size (1248 GB), check that the LUN is mapped as LUN 3, read write access is enabled and it is presented on all SAS controller ports. When you want to use snapshot or clone features on the HP P2000, you need to enable snapshots and specify the Snap Pool size. Click Apply.

Create Volume
 Create a volume by assigning a name, selecting a size and setting the default mapping.

Volume name: VM_Store2

Size: 1248 GB

OpenVMS Volume? OpenVMS Volume UID: _____

Enable Snapshots:

Standard Policy

Snap Pool: Reserved Size: 100% Absolute Size: _____ Snap Pool: _____

Replication Preps:

Map:

LUN: 3 Access: Read-Write

Select ports from the view or list below:

Breakout | Transfer

Apply

- Shutdown the P2000 or disconnect the SAS cables between the host and the P2000 during the installation of the OS.

Warning: The default mapping method of the HP P2000 G3 MSA Array System allows every HBA access to all the LUNs configured in the P2000. When you have two HBA's in the same host having access to the array, multi path software must be installed. When you have two or more hosts accessing the P2000, they must be clustered. Refer to the “HP P2000 G3 MSA System SMU Reference Guide” for more information
<http://bizsupport2.austin.hp.com/bc/docs/support/SupportManual/c02520791/c02520791.pdf>

iLO Configuration

The tasks for this section include:

- Configuring the iLO IP settings
- Adding iLO users
- Adding iLO Advanced License

Configure the iLO IP settings

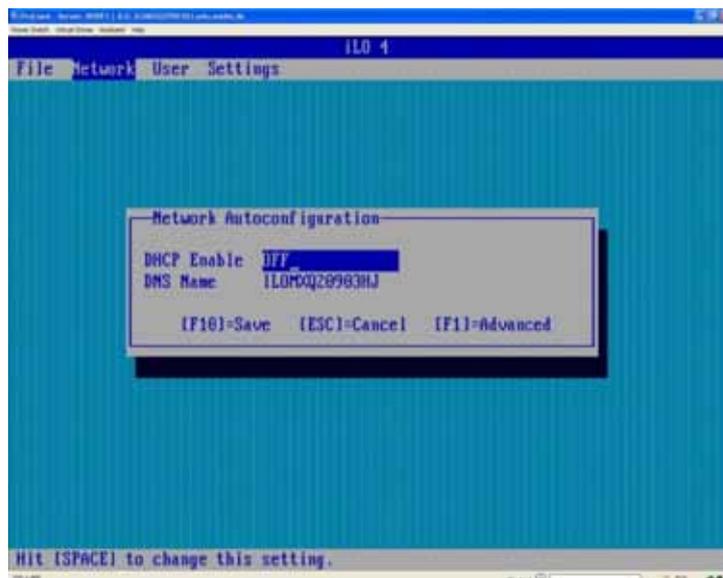
In order to configure the iLO Network settings we need a monitor, keyboard and mouse connected to the server.

Note: Perform these steps on the iLO for both DL360e servers.

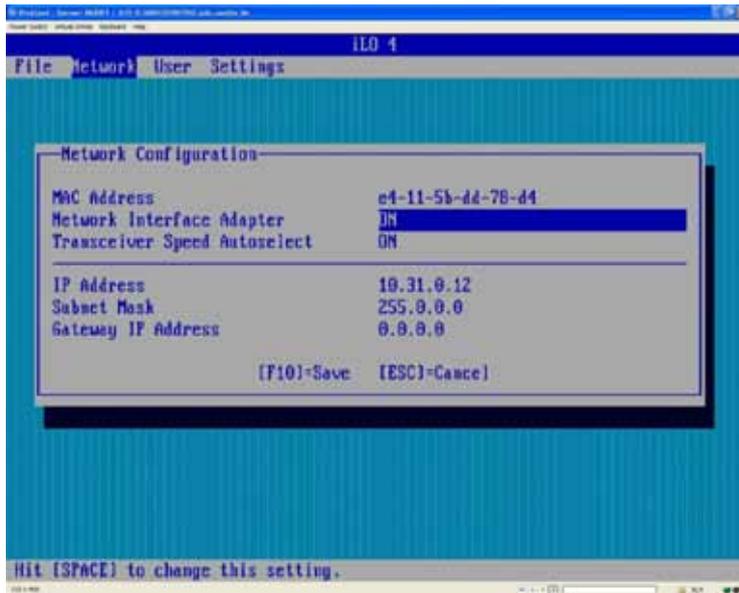
1. Power on the server and wait until you get to the point in the boot process where you can hit the F8 key to enter the iLO configuration.



2. Select Network → DHCP settings and set the value to “DHCP Enable OFF.” Press F10 to save the setting.



3. Select Network → IP configuration and specify your desired settings. Refer to Section 1 “Reference Architecture Design” for your individual settings.



4. Select F10 to save the changes.

Add iLO users

The iLO comes with a preconfigured password for the Administrator account from the factory. To create your own account, select “User” and configure a new user with administrative rights.

When you are finished select “File” and save the changes to exit the iLO configuration.

The iLO will then reset and update its configuration. The reset process takes roughly one minute.

Apply the iLO advanced License

With the newly created user, you can now add the iLO Advanced license into the Web GUI of the iLO.

1. Open a Web Browser and use the iLO IP addresses you just have configured. Log in with the previously created user and password. Navigate to Administration → Licensing and provide the license information. Select Install.



Note: A valid iLO Advanced License is included in the Insight Control package specified in the Essential Rack HA Smart Bundle which is the basis for this reference architecture. If you do not have a license, it is possible to download a 60 day trial license from the HP website at <http://www.hp.com/go/tryinsightcontrol>.

Server setup

The tasks for this section are:

- Control BIOS setup
- Firmware update

Verify BIOS setup

The server default settings are correct for Hyper-V deployments. If you are not sure whether the servers have the correct parameters set, you can open the ROM Based Setup Utility (RBSU) by pressing F9 during the startup. To reset the BIOS parameters to factory default values select “System Default Option” → “Restore Settings.”

Note: The System Default Options can delete all data on the system disks.

Firmware update

It is absolutely necessary to update the servers to the newest firmware before the OS is installed. Update firmware using HP Smart Update Manager contained in the HP Service Pack for ProLiant (SPP) or by downloading and updating individual components from the HP website.

We will use the Intelligent Provisioning feature of the iLO 4 new on ProLiant Gen 8 servers. Intelligent Provisioning connects to HP over the Internet and downloads the latest firmware and OS drivers for your hardware. It updates the firmware and injects the correct drivers into the OS installation source.

Note: With Windows 2008 R2 HP ProLiant Network Teaming Software needs to be installed after the Hyper-V Role is enabled.

Note: If you prefer not to allow your server to connect directly to the Internet, the best course of action is to download the SPP from the HP website and perform installations using HP Smart Update Manager which is contained within the SPP download package. For more information on using HP Smart Update Manager to update firmware and drivers, please consult the HP website at: <http://www.hp.com/go/hpsum>.

Operating System Installation and initial Configuration

This module describes the process for installing Windows Server 2012 or Windows Server 2008 R2 and preparing it for cluster creation and Hyper-V.



Installing the Windows Server Operating System with HP Intelligent Provisioning

HP Intelligent Provisioning is software embedded in flash memory on ProLiant Generation 8 servers that enables a number of server management tasks such as assisted OS installation, BIOS and firmware update, driver staging prior to OS installation, and internal array configuration. We will use Intelligent provisioning to deploy Windows Server 2012 and Window Server 2008 R2.

Note: These steps need to be completed on each of the servers that will be included in the Microsoft failover cluster.

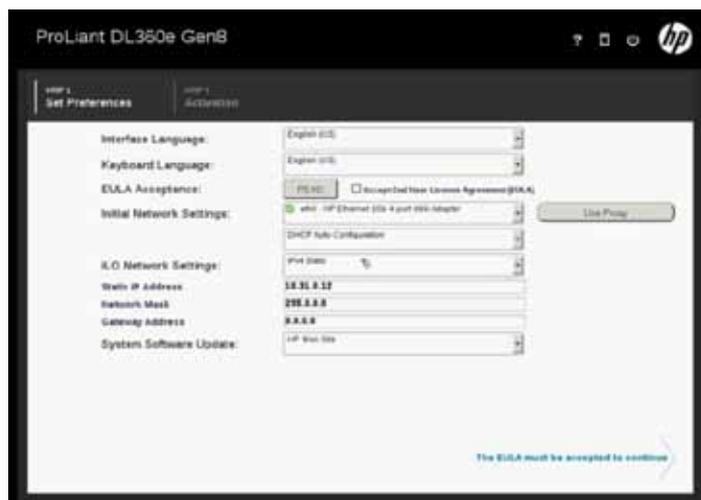
Windows Server 2012 installation

Note: For customers that do not want to download the SPP from the Internet during the server installation process, follow the process for installing Windows Server 2008 R2.

Note: As of the writing of this document, customers will be able to download Windows Server 2012 device driver supplement for ProLiant Generation 8 servers in early September. Intelligent Provisioning as well as the final Service Pack for ProLiant consolidated firmware and driver package will be available in mid-October. The P2000 G3 MSA Array System certification will be completed at the end of September.

Note: Intelligent Provisioning supports a variety of methods for supplying the OS media. In this walk-thru, we used a USB key to provide the OS distribution source files. The prepared USB media, with the ISO image of the OS in the root directory, should be inserted into the server on power up. If you have installed the optional DVD drive, are using an external DVD, or are using network based source files, then your steps may vary.

1. Power on the server and Press F10 to initiate Intelligent Provisioning.
2. The first time you start Intelligent Provisioning you must configure some initial settings and allow the system to access the Internet to download the latest firmware and drivers for the OS you want to install.
3. Select the correct “Interface Language”, and “Keyboard Language.” At the “Initial Network Settings” select a Network adapter which is connected to the Internet and configure it. In the example configuration we have selected eth0 and DHCP Auto Configuration. The iLO settings are imported from the iLO automatically. Select the HP website for the “System Software Update” source. Accept the EULA. Then, click on the blue arrow on the bottom right.



4. On the next page you need to agree to allow the Intelligent Provisioning software to connect to the HP website during the upgrade and OS installation process. Agree and go back to the “Main Menu.”
5. In the Main Menu select “Configure and Install” on the left.



6. Select the “Quick Configs” setting for “Balanced Power and Performance”, for the “System Software Update” leave the default “Update before OS Install.” The Smart Array Controller default setting for 2 disks is to create a RAID 1. That is the configuration we want. Set “Array Configuration” to “Keep Current Setting” Click on the arrow at the right.



7. Select Microsoft Windows, the recommended “Install Method” and the source location of the OS distribution media which could be connected over the iLO, on the Network, via DVD, or as an ISO image on a USB placed in the server. We are using an ISO image in this installation. Simply copy the image to the root directory of the USB media and plug it into the server on power up, and click on the right arrow.



8. Double click on the OS distribution source and wait a few seconds until it is validated. Confirm that you have the correct image of Windows 2012 or Windows 2008 R2.



- Validate the correct settings for the OS. Confirm that you are using Windows Server Datacenter and type in the Product Key.



- Review the summary and start the deployment process.

Important: Check that the installation target is the internal 136 GB RAID 1 Volume. If you have problems selecting the correct disk drive, disconnect the SAS cables from the P2000. It is possible that the volumes on the P2000 are already presented to the host.

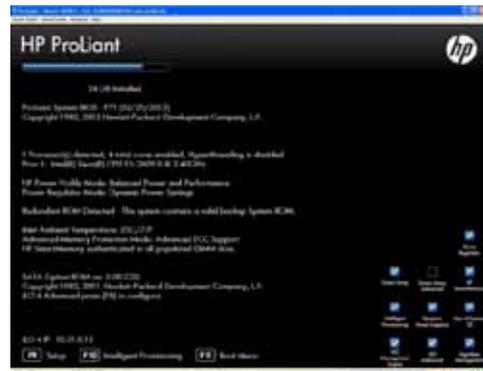
- The firmware update process can take a long time. The time required depends on the quality of Internet connectivity and the number of required updates. The OS deployment process takes around 30 minutes. The server will reboot several times during the installation process.



Windows 2008 R2 installation

Note: With Windows 2008 R2 HP ProLiant Network Teaming Software needs to be installed **after** the Hyper-V Role is enabled. When we install Windows Server 2008 R2, we will download the Support Pack for ProLiant (SPP) manually instead of connecting to the HP website and downloading it into the local flash. We will then install the SPP after we have installed Windows Server and enabled the Hyper-V role.

- Power on the server and Press F10 to initiate Intelligent Provisioning.



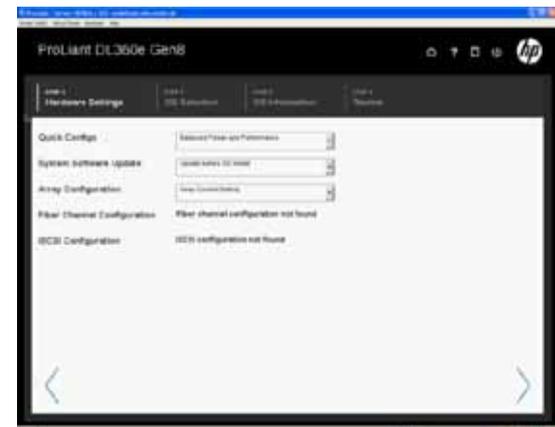
- The first time you start Intelligent Provisioning you must configure some initial settings and allow the system to access the Internet to download the latest firmware and drivers for the OS you want to install.
- Select the correct "Interface Language", and "Keyboard Language." At the "Initial Network Settings" select a Network adapter which is connected to the Internet and configure it. In the example configuration we selected eth0 and DHCP Auto Configuration. The iLO settings are imported automatically. Select the HP Web Site for the "System Software Update" source. Then, click on the blue arrow on the bottom right.



4. On the next page you need to agree to allow the Intelligent Provisioning software to connect to the HP web site during the upgrade and OS installation process. Agree and go back to the “Main Menu.”
5. In the Main Menu select “Configure and Install” on the right.



6. Select the “Quick Configs” setting for “Balanced Power and Performance”, for the “System Software Update” leave the default “Update before OS Install.” The Smart Array Controller default setting for 2 disks is to create a RAID 1. That is the configuration we want. Set “Array Configuration” to “Keep Current Setting” Click on the arrow at the right.



7. Select Microsoft Windows, the Manual “Install Method” For the “Source Media Type” select **Disc**. That can be any media connected over the iLO, or a directly attached USB drive. Click on the right arrow.



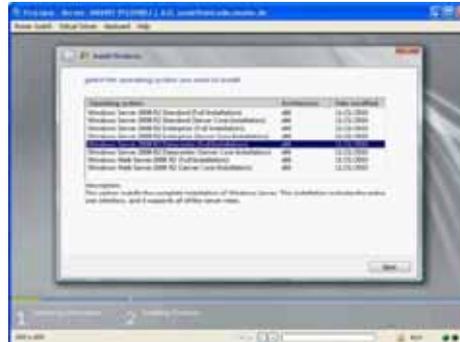
8. Wait until the program has verified the OS source media.
9. Wait until the system boots the source media.



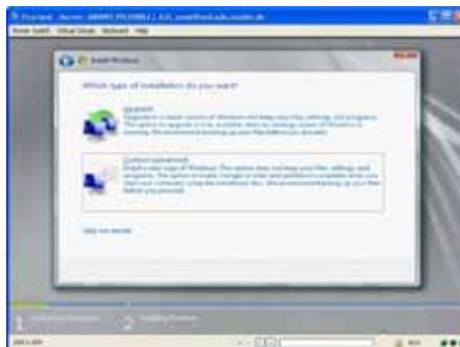
10. The normal Windows installation starts. Select the correct settings for your location.
11. Select **Install now** on the next screen.



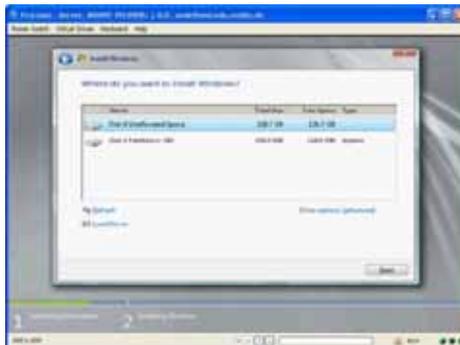
12. Select Windows Server 2008 R2 Datacenter.
13. Accept the license terms.



14. Select **Custom** installation.



15. Select the 136.7 GB internal Raid 1 Disk drive. Click **Next**.



Important: Check that the installation target is the internal 136 GB RAID 1 Volume. If you have problems selecting the correct disk drive, disconnect the SAS cables from the P2000. It is possible that the volumes on the P2000 are already presented to the host.

The OS deployment process takes around 30 minutes. The server will reboot several times during the installation process.

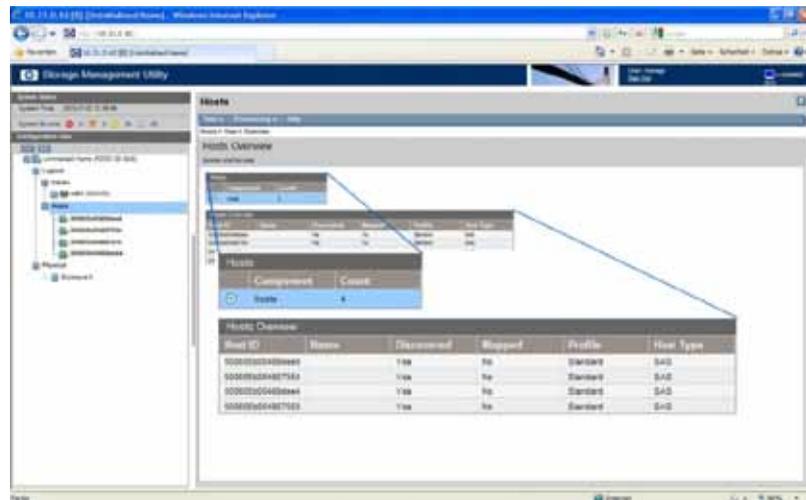
Windows Server 2012 initial OS configuration

Steps covered in this Module:

1. Confirm the P2000 access
2. Setting up the Administrator account and specify a valid password.
3. Enable Multi-path IO (MPIO) and check that it is working correct. MPIO provides highly available connections to the SAN.
4. Configure the Networks.
 - a. Configure NIC teaming. NIC teaming provides highly available connections to the Ethernet network.
 - b. Configure the IP parameter
5. Configure the Computer name
6. Control the date, time zone and time settings
7. Add the host to the appropriate domain

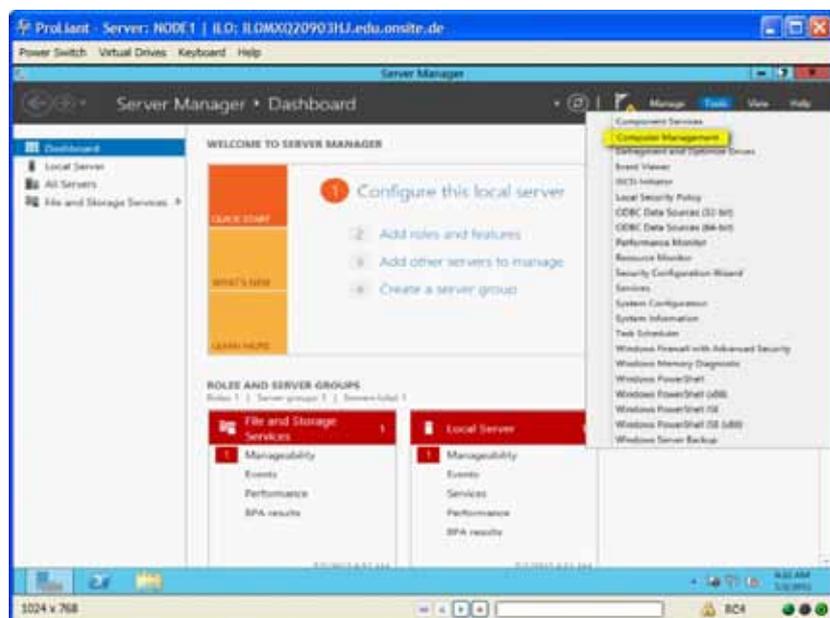
Confirm the P2000 access

Before we go on with the configuration of Windows Server 2012, the HP MSA P2000 should be up, running and connected to the two DL360e Gen8 servers that will serve as our Hyper-V hosts. To confirm the successful connection of P2000 storage to the host servers, log in to the P2000 and ensure that you can see all HBAs in the host list.

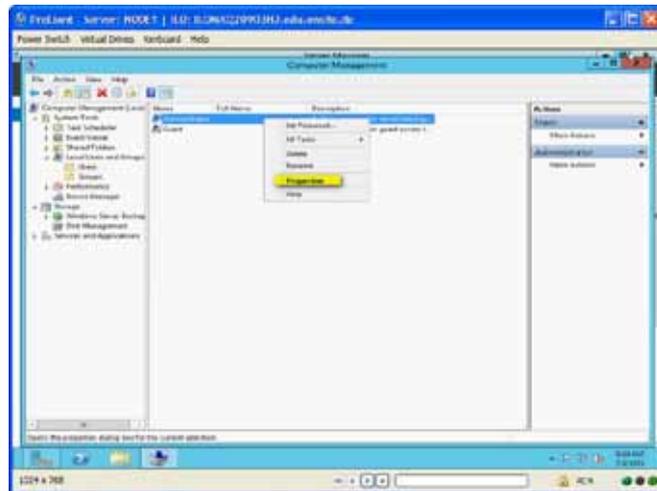


Set up the Administrator account

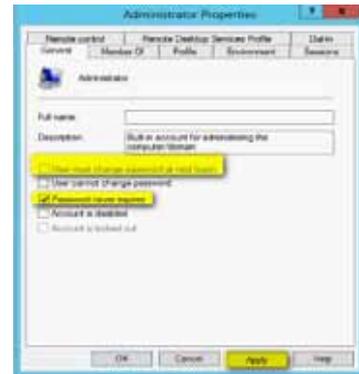
1. After the reboot the Administrator password needs to be set (There is no default password). Select "Tools" → "Computer Management"



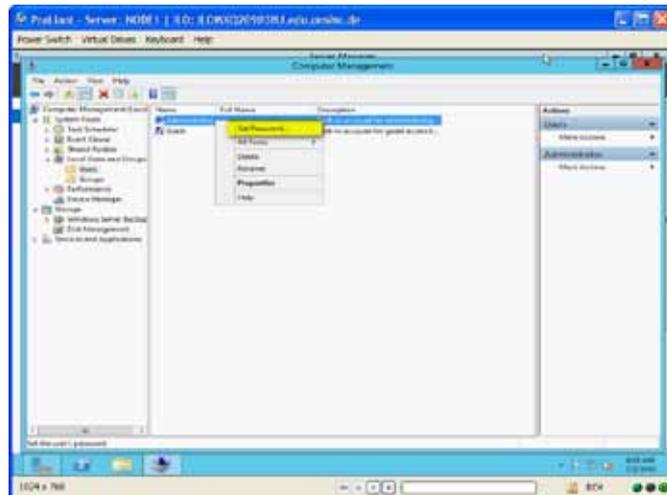
2. Select "Local Users and Groups" → "Users" → "Administrator" right click and select "Properties."



3. Deselect "User must change password at next logon, if you wish select "Password never expires." Click on "Apply."



4. Right click on the "Administrator" account and select "Set Password."



5. Select "Proceed" at the warning window.

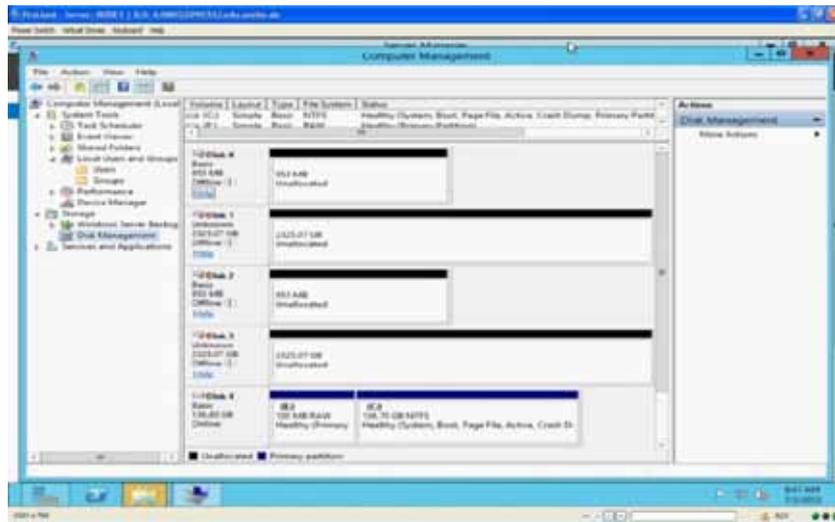
6. Type the new password twice and click OK.



Configure MPIO

MPIO stands for Multi-path IO and is a feature of Windows used to identify multiple paths to disks. This allows load balancing and path failover. The Windows feature must be enabled first, before the driver, initiated by the “mpclaim” command, can search the different paths, identify the disks and present the disk as a “single” MPIO disk to the OS.

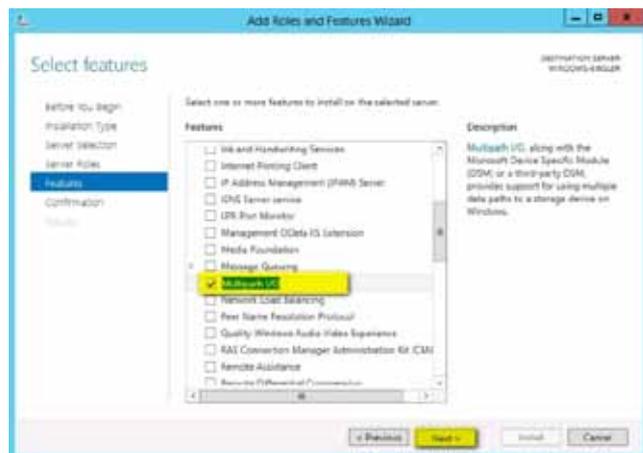
1. In Computer Management select “Disk Management.” Here you will see a total of 7 disks. The system disk, which has a drive letter assigned, two 1 GB disks and four 1.162 TB disks. The 1 GB and 1.162 TB disks are the volumes configured on the HP MSA P2000. Because the OS can connect to the 1 GB and 1.163 TB disks over two different paths, they show up in the disk manager twice. Once we install MPIO, the 1 GB and 1.162 TB disks will show up only once as intended.



2. Select the Local Server in the Server Manager. Go to the Manage drop down menu and select Add Roles and Features.



3. Click Next five times until you reach the Select features menu. Tick the Multipath I/O feature and select Next again.

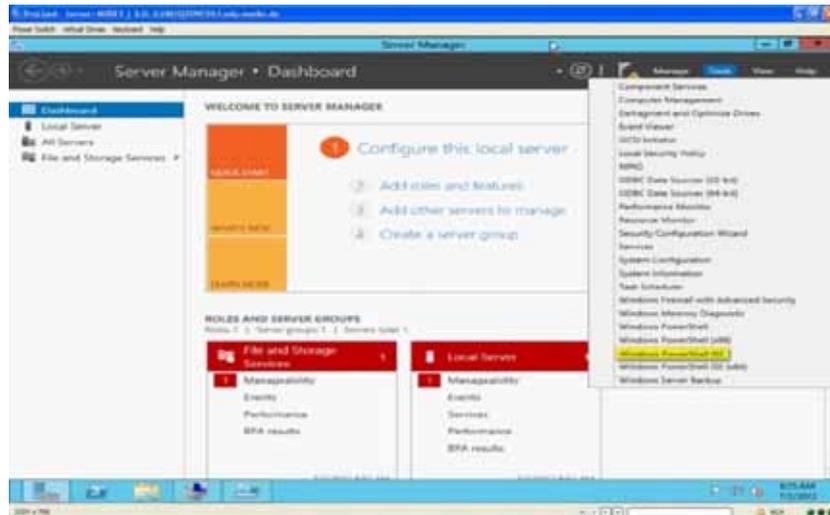


4. On the Confirmation page select Restart the destination server automatically if required. Click Yes at the warning pop up and select Install.



5. Click Close when the installation has finished.

- Go back to the server manager dashboard and select “Windows PowerShell ISE” under tools. Wait until PowerShell is loaded.

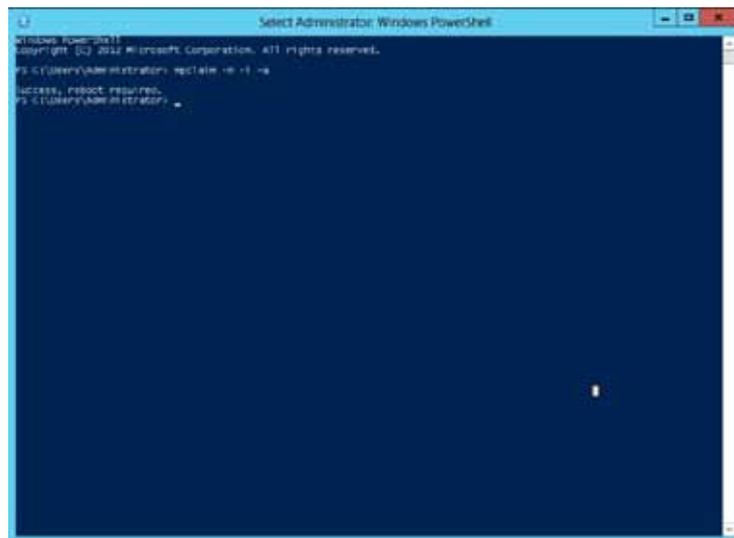


- Type in:

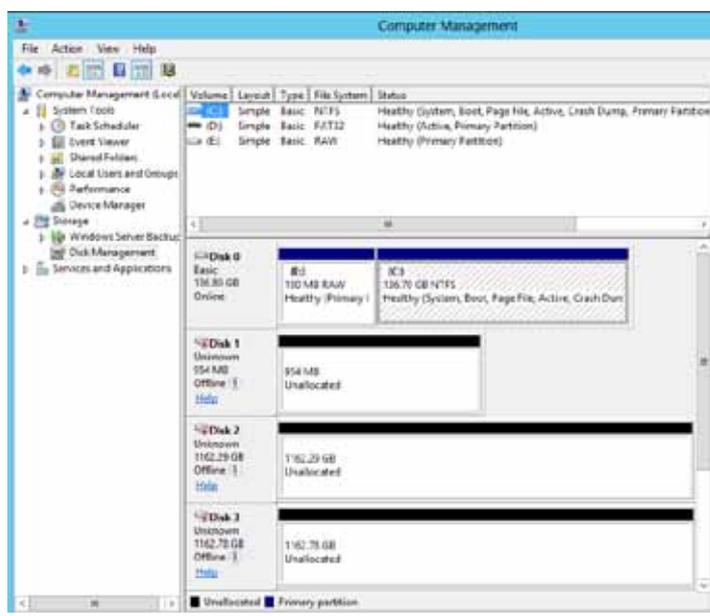
```
>>mpclaim -n -i -a
```

 Press Return

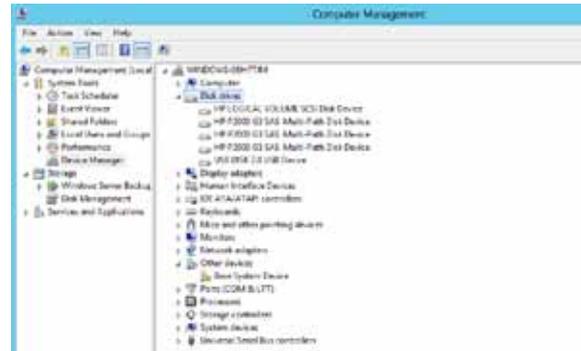
This step identifies the different paths to the physical disks, and presents the disk as a single Multi-path device to the OS.
 When the mpclaim command was successful, you get a message that a restart is necessary.



- Before you reboot the server, confirm that MPIO is active. Go back to the “Disk Management.” Now you should see only 4 disks.



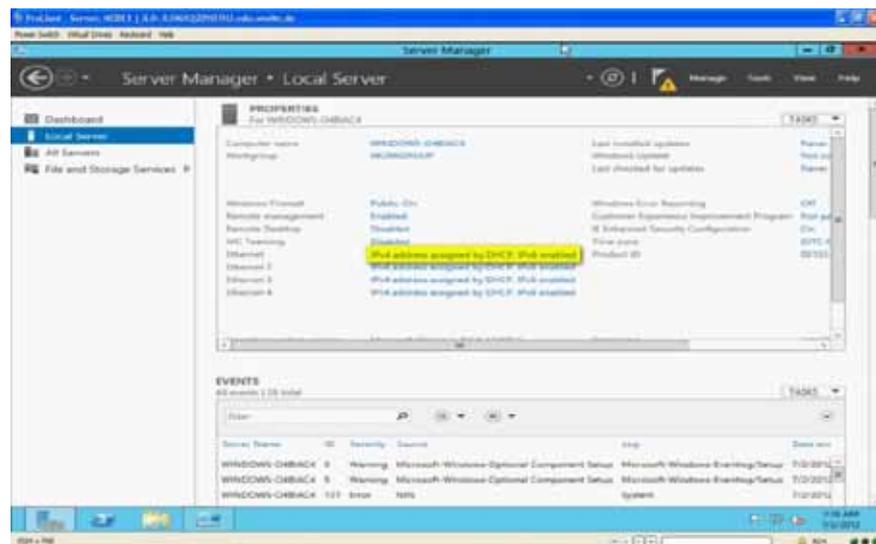
9. Select the “Device Manager.” Click on “Disk Drives”
Check that you see 3 disk drives labeled “HP P2000 G3 SAS Multi Path Disk Device.”
10. Initiate a reboot of the server, by pressing
Control + ALT + DEL.
11. Select the power symbol at the lower right corner.
Click on Restart.



Network configuration

The NIC naming in Windows is sometimes inconsistent. Verify, by unplugging the cables one by one, which physical NIC is associated with which network on the OS level.⁴

1. Go back to the Dashboard and select “Local Server”



2. Once you have confirmed the association of each physical NIC with each NIC enumerated by the OS, select NIC1 and rename it to “Production1.” Rename NIC2 to “Production2”, NIC3 to “Cluster” and NIC4 to “LMManagement.”

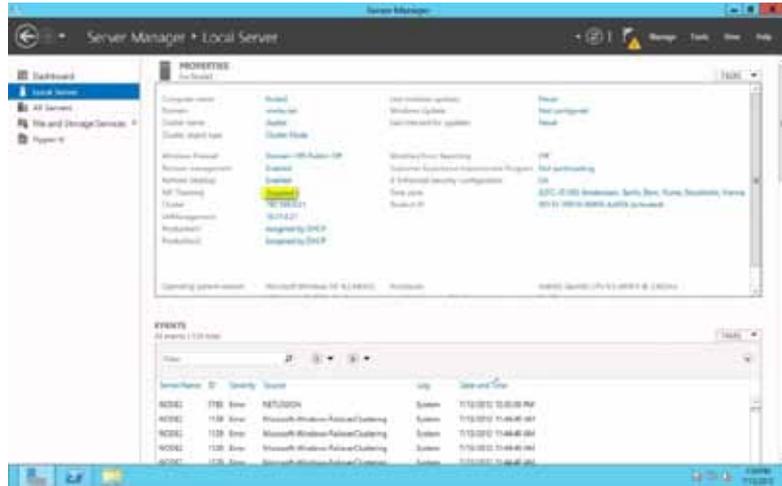


⁴ Windows Server 2012 introduces a feature called “Consistent Device Naming.” This feature ensures that Windows Server 2012 network port enumeration aligns with the physical port layout within the server. This feature requires a ProLiant Gen8 BIOS update which will be delivered in conjunction with the Windows Server 2012 Support Pack for ProLiant. This guide will be updated after the firmware update has been released.

Configure teaming

Windows Server 2012 has NIC teaming embedded in the Operating System. It builds a “team” from two NICs which acts as one and allows load balancing and failover between them.

1. Go back to the “Server Manager.” Select “Local Server” and click on “Teaming Disabled”, to configure the production team.



2. In the NIC Teaming window select Production1 and Production2 NIC and select “Add to New Team” in the “Task” drop down menu.



3. In the New Team window enter “Production Team” as the new name and click OK.



Configure the IP parameter

1. Close the NIC Team window. In “Local Server” Select the “Production Team” to configure the IP Parameter.



2. Right Click on Production Team, select Properties. Use your individual IP parameters. Refer to Appendix A for your individual settings.
3. Change the settings (IP address, subnet mask, etc.) of all 3 Networks according your individual setup. Refer to Appendix A for your individual settings.



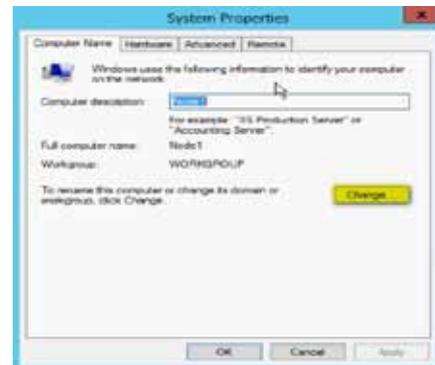
Check date, time and time zone

1. After the reboot log in again.
2. Select the “Local Server” at the Dashboard and check that the time and time zone are correct. They need to be the same as the Active Directory Controller, of the Domain you want to join in order to form the cluster.

Configure the network name and join the Domain

Microsoft Cluster needs to be member of an Active Directory Domain. The customer environment must have a Domain already configured. If the customer has NO AD Domain already in place, refer to Window Server documentation for instructions on domain creation.

1. To rename the server and join the Domain, open the Dashboard → Server Manager → Local Server and select workgroup.
2. Specify the computer name Node 1 or Node 2. Click on change.
3. Specify the computer name again. Select Domain and Specify your AD Domain name. Click OK.



4. In the Login Window specify valid domain administrator account credentials and click OK.
5. Select OK again at the Welcome pop up.
6. Select OK to reboot the computer.



Windows 2008 R2 initial OS configuration

Steps covered in this Module:

Similar to Windows 2012, after the basic installation has completed, we will need to configure specific OS parameters. The configuration steps that must be completed are as follows:

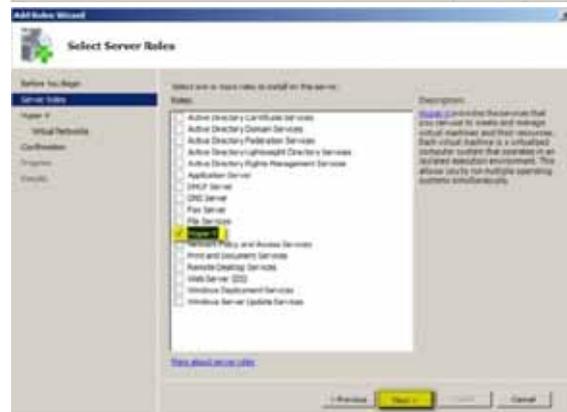
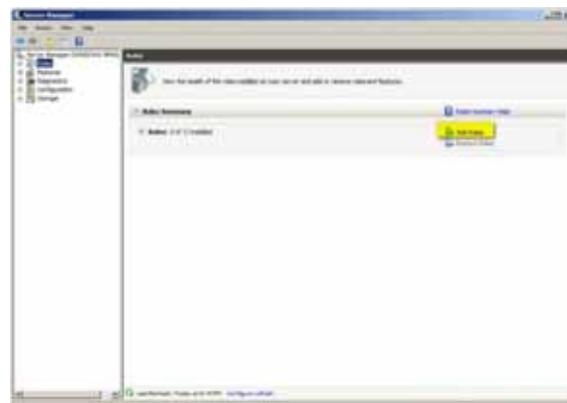
1. Setting up the Administrator account and specify a valid password
2. Enabling the Hyper-V role
3. Install the Service Pack for ProLiant SPP
4. Configuring the Network and teaming
5. Controlling the date, time zone and time settings
6. Enabling MPIO and check that it is working correct
7. Renaming the computer and join the domain

Setting up the Administrator account and specifying a valid password

1. After the last reboot you must specify a new password for the Administrator account.

Enable the Hyper-V Role

1. Open the Server Manager. Select Add Roles.
2. Click **Next** in the Add Roles Wizard.
3. Select **Hyper-V** and Click **Next**.
4. Select **Next**.
5. Select **Next**. Do NOT select any NIC to create a virtual network.
6. Select **Install** at the summary screen.
7. Click **Close** and agree to the reboot.

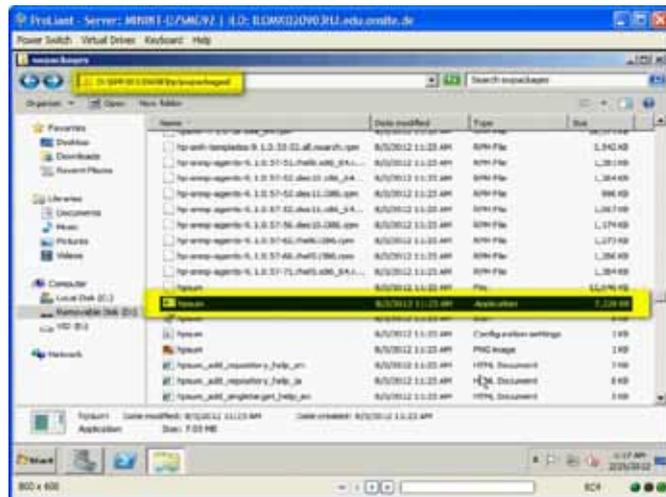


Install Service Pack for ProLiant

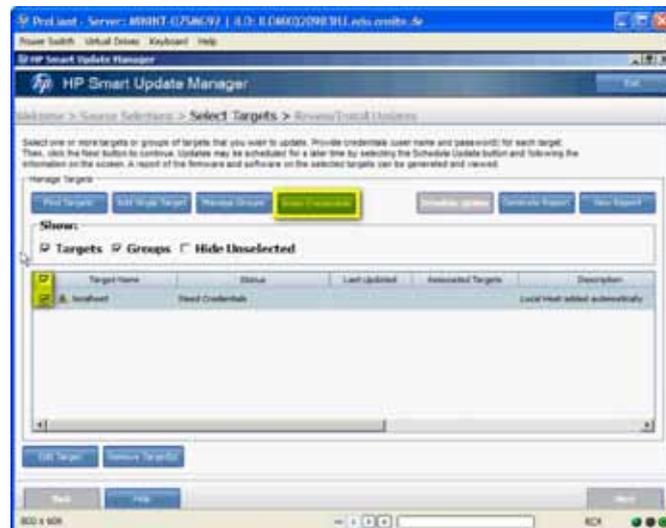
Download the latest SPP from the Web and make it available to Windows. <http://www.hp.com/go/spp>

Refer to the release Notes for information about the different upgrade methods. Here we execute the online upgrade method.

1. Open the Windows explorer and locate the SPP source directory. Navigate to "spproot"\hp\swpackages and open hpsum.exe.
2. Select **Next** at the Welcome screen.
3. Select **Next** at the Source Selection screen.



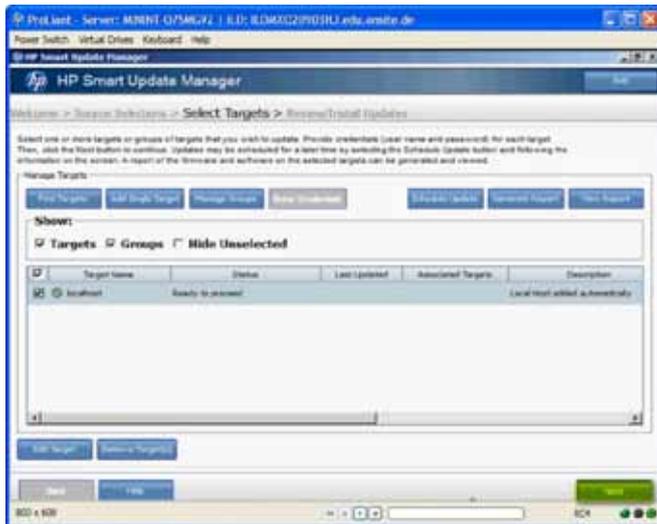
4. Select the **local host** as the target. Click on **Enter Credentials**.



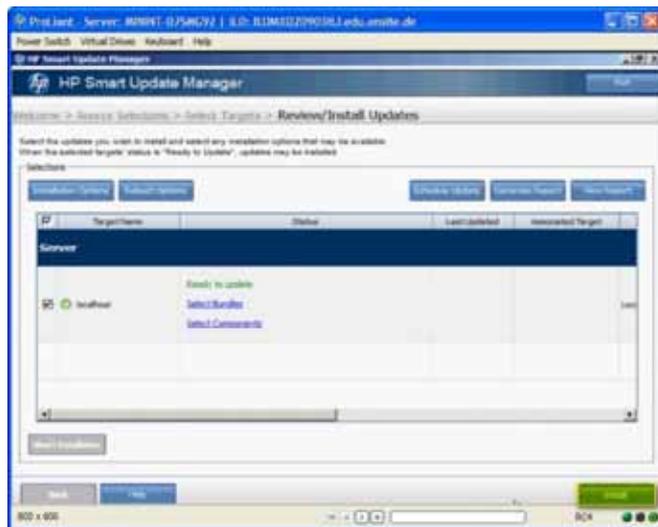
5. Enter the credentials for your host. Click **OK**.
6. Select **Next**.



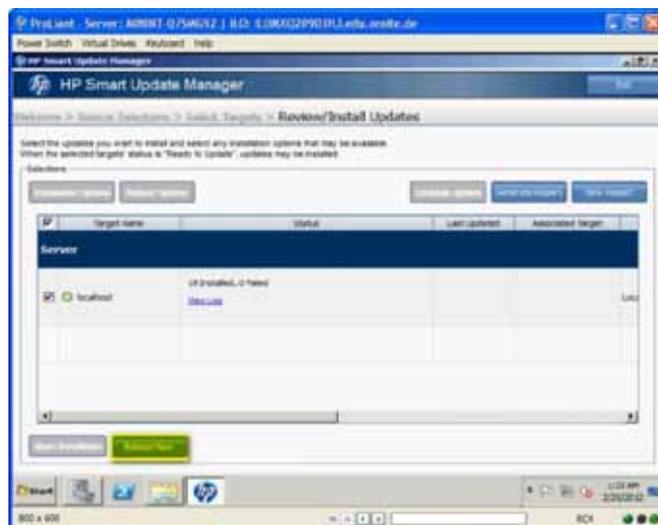
- Wait until the discovery Process is finished. Select **Next**.



- Select Install.
- Wait until the installation has finished.



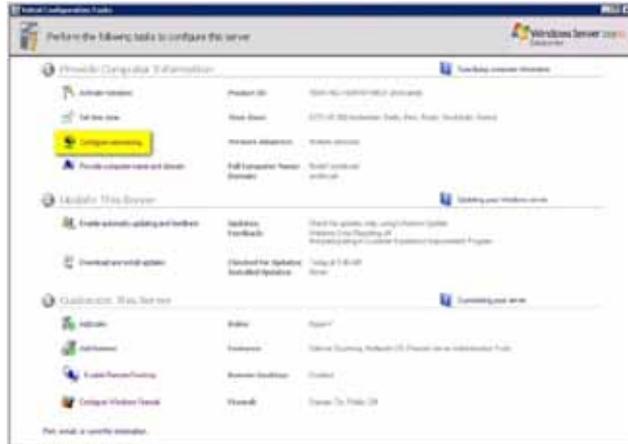
- Initiate a reboot.



Configure Network and teaming

The NIC naming in Windows is sometimes inconsistent. Verify, by unplugging the cables one by one, which physical NIC is associated with which network at the OS level.

1. In the Initial Configuration task window. Select **Configure Networking**.

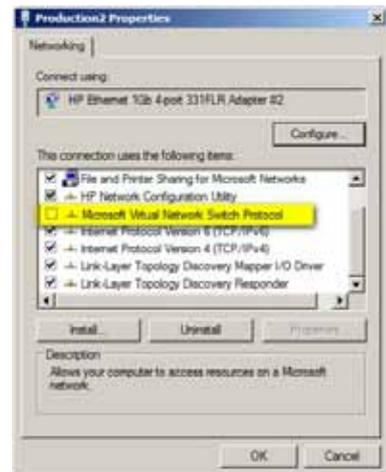


2. In the Networking Window, you will see 4 NICs they are labeled HP Ethernet 1 Gb 4-port 331FLR Adapter. The numbering starts with no number and ends with 4. Verify the physical NICs by unplugging the cables one by one and name the Connections to the following:

NIC1	→	Production1
NIC2	→	Production2
NIC3	→	Cluster
NIC4	→	LMMange



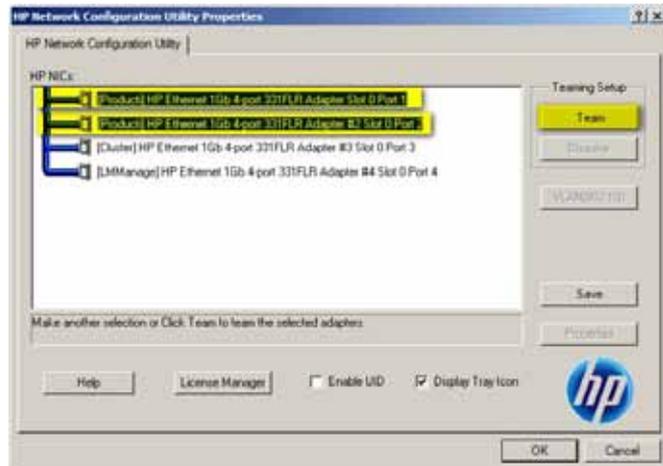
3. Open the Properties of Production1 and also Production2 NIC and confirm that a virtual switch is **not** configured on these NICs. In case it is configured deselect the Microsoft Virtual Network Switch Protocol.



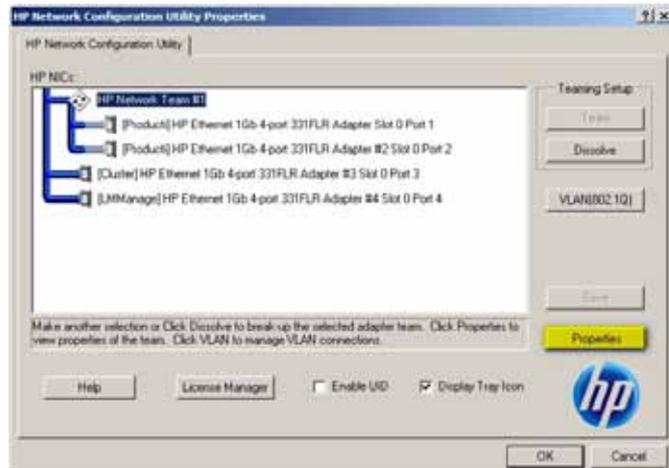
4. Open the HP Network Configuration Utility you find it in the task bar in the lower right corner.
5. Click **OK** in the NCU Version window.



- Select the first two NICs labeled Production. Click **Team**.



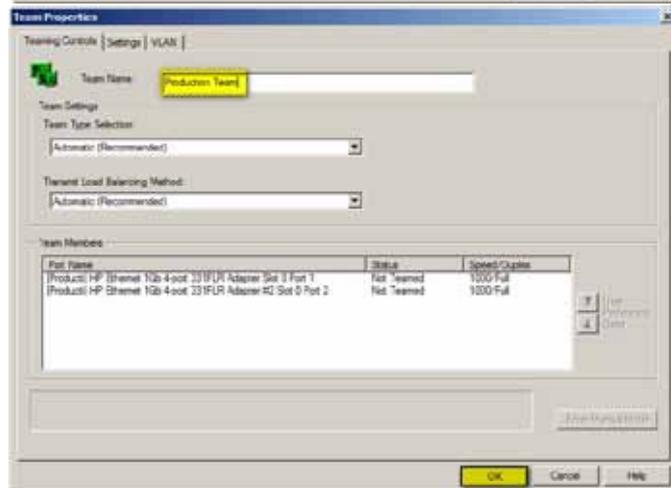
- Select Properties.



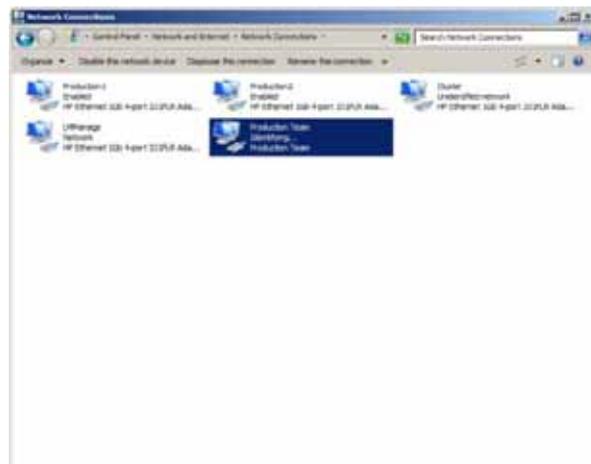
- Rename the team to **Production Team**. Click **OK**.

- Click **OK** again.

- Click **OK** when the configuration has finished.



- Open the Network connections again. There should now be a new team in the list. Rename the new team as "Production Team."



Now the network parameter can be set. Set the parameters for each of the 3 networks according your configuration.

Refer to Appendix A for your individual settings.

Verify the date, time zone and time settings

1. In the Initial Configuration task window, select Date and Time, and verify that the settings are correct.



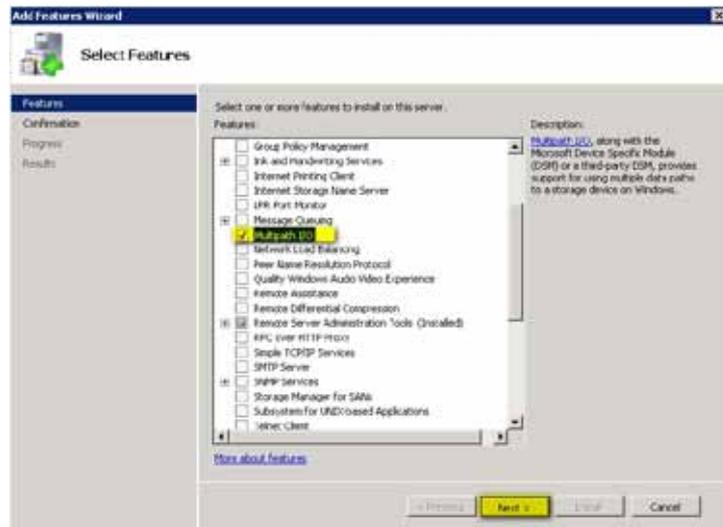
Enable MPIO

Multi-path IO (MPIO) is a feature in Windows 2008 R2 that enables the creation of highly available storage connections

1. Open the Server Manager. Select Features, Add Features.



2. Select Multipath I/O. Click Next.
3. Select Install.
4. Select Close, after the installation completes.



5. Open a Command Prompt or a PowerShell window. Enter the following at the prompt:

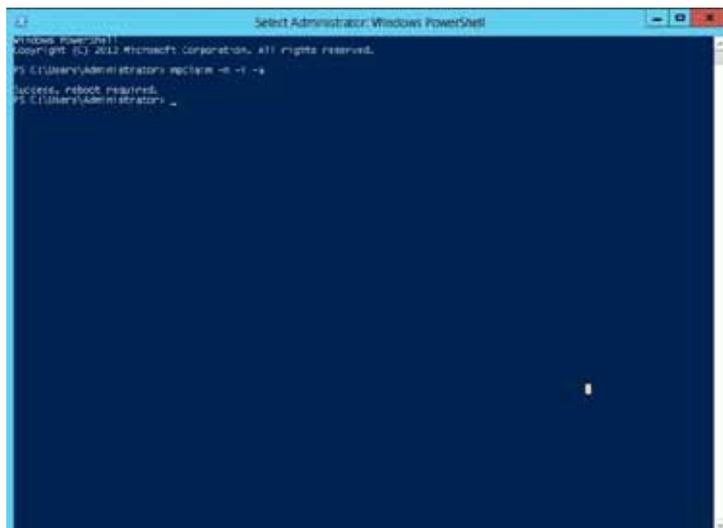
```
>>> mpclaim -n -i -a
```

Press Return

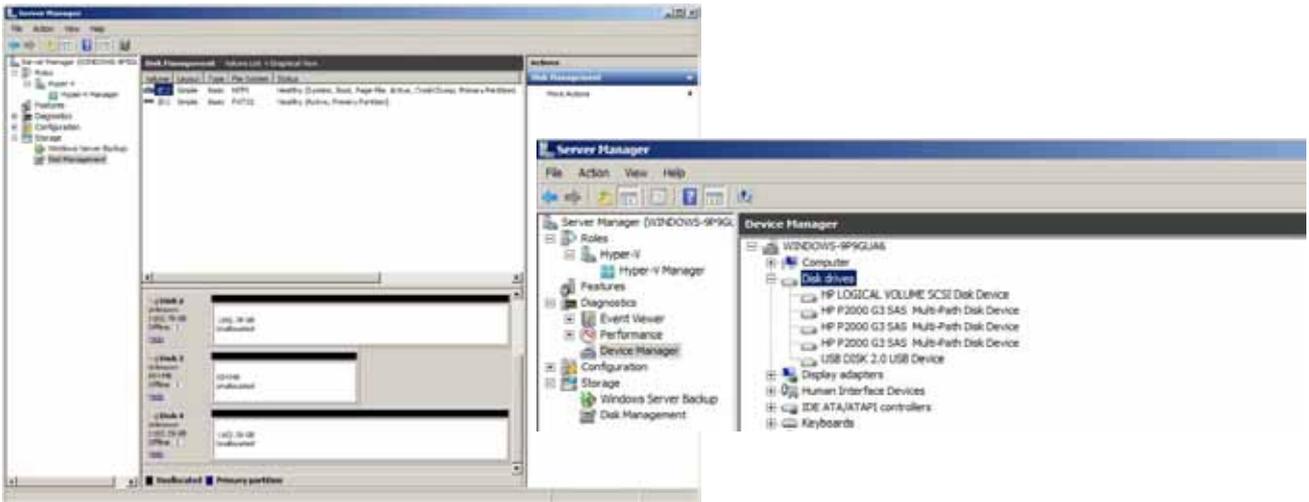
This step identifies the different paths to the physical disks, and presents the disk as a single Multi-path device to the OS.

When the `mpclaim` command was successful, you get a message that a restart is necessary.

6. Initiate a reboot.



- After the reboot, check in the disk Administrator and in the device admin confirm that you can see the correct configuration and MPIO is working. You should see the Quorum disk and both CSV volumes only on time.



Rename Computer and join the Domain

Microsoft Cluster needs to be member of an Active Directory Domain. The customer environment must have a Domain already configured. If the customer has NO AD Domain already in place, refer to Window Server documentation for instructions on domain creation.

- In the Initial Configuration task window select “Provide Computer Name and Domain.”
- Click “Change” to rename the computer. Rename it to Node 1 or Node 2. Select Domain and specify your Domain name. Click OK.

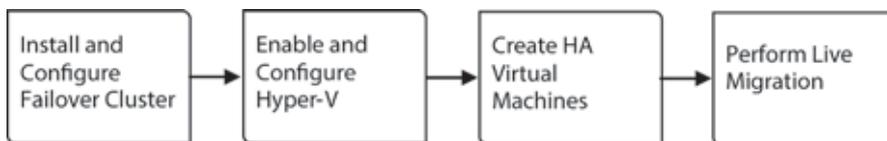


- In the Windows Security pop up specify valid Domain credentials. Click OK.
- Click OK in the “Computer Name/Domain Change” Window and initiate a restart.

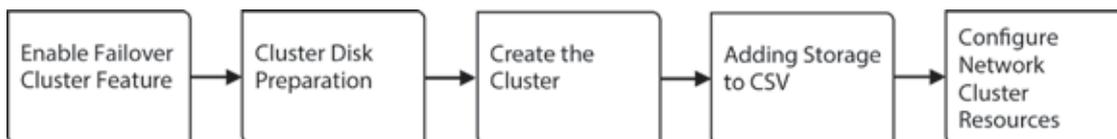


HP Departmental Private Cloud Operating System Configuration

Configure Operating System for Virtual Machine Provisioning on Windows Server 2012



Install and Configure Failover Cluster



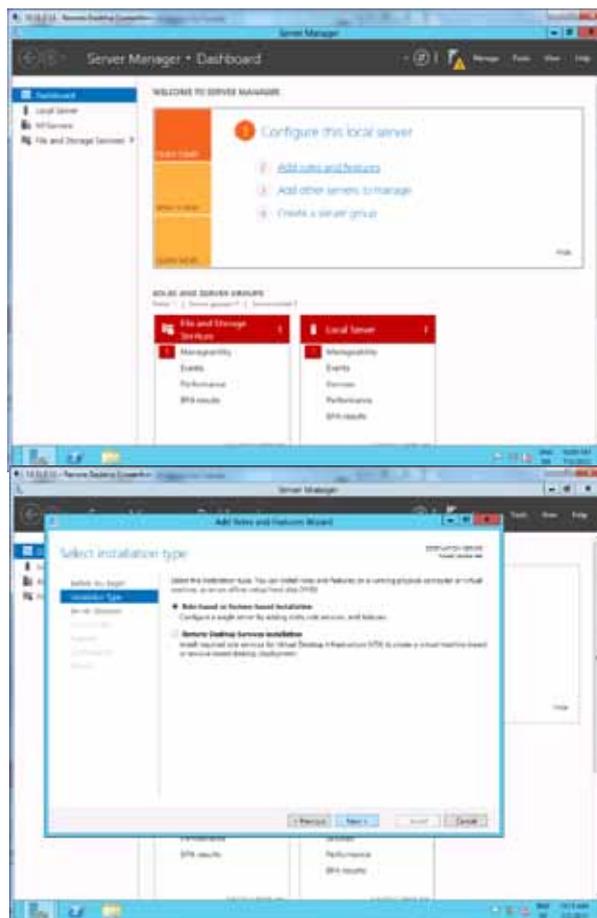
The Failover Cluster feature requires an Active Directory Domain. This document assumes that you have access to an Active Directory and the necessary domain administrative credentials. Before you enable the Failover Cluster feature and create the cluster, make sure that all DL360e servers have joined the domain.

The domain used for this reference architecture is onsite.net and the two blades Node 1 and Node 2 have joined the domain already.

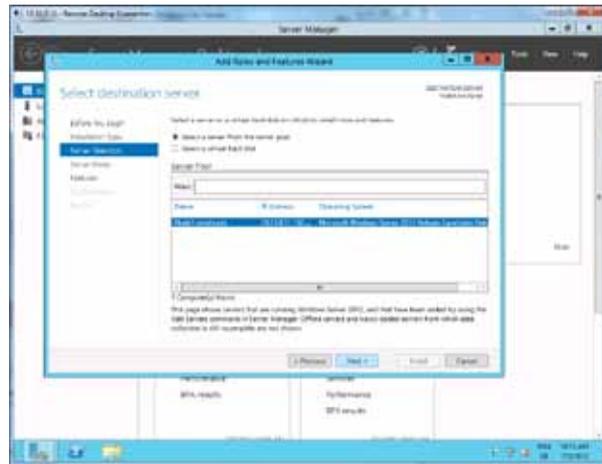
Enable the Failover Cluster Feature

The following steps have to be done on all servers, which will be added as cluster nodes.

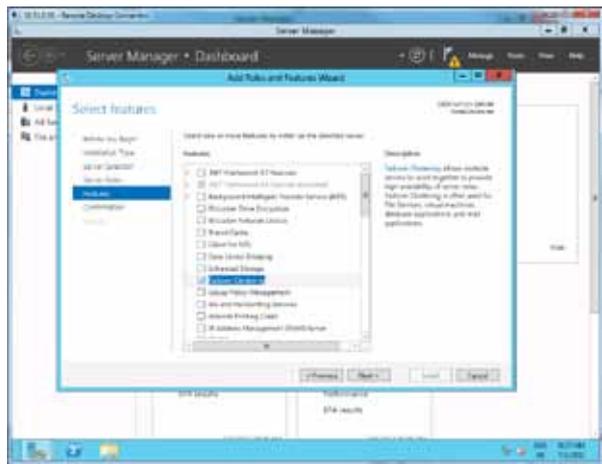
1. Logon to the first node using domain administrative credentials.
2. After the login, the **Server Manager Dashboard** displays. If it does not, click on the left most icon in the taskbar.
 - a. The Server Manager in Windows Server 2012 has been optimized for managing multiple servers. You can add servers to the Server Manager console by searching Active Directory, DNS (IP or Computer Name) or by importing them from a text file.
 - b. Servers can also be grouped. For example, all servers for the accounting department can be added to a group called "Accounting Servers."
3. On the dashboard click on **Add roles and features**.
4. The Add Roles and Features Wizard opens, click Next.
5. On the Installation Type screen, select role-based or feature-based installation and click Next.



6. On the **Server Selection** screen, the current server you are logged on to should be listed. Confirm that your server is selected and click **Next**.
7. Skip the Server Roles screen by clicking **Next**, since you will install the Failover Cluster feature.

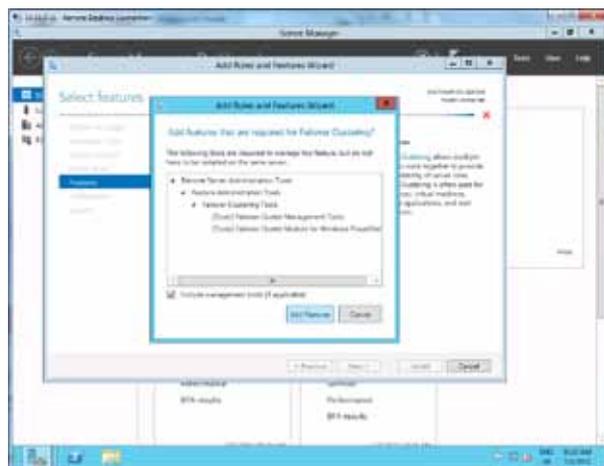


8. On the **Features** screen, select the **Failover Clustering** checkbox.

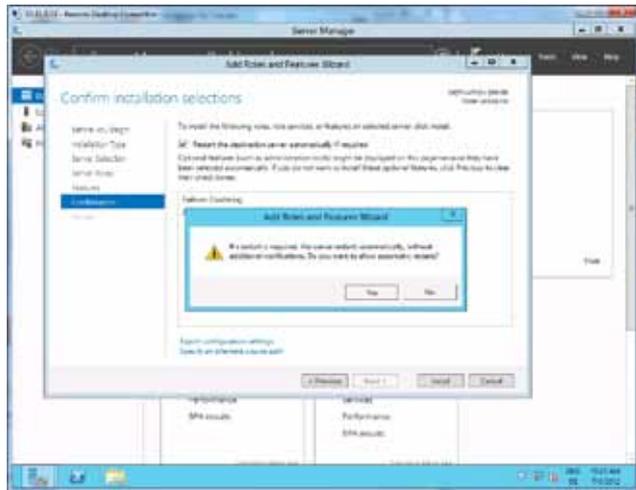


9. The Failover Cluster feature requires additional tools for managing the cluster. Make sure that the checkbox "Include Management tools (if applicable)" is selected and click on **Add Features**.

10. Click **Next**.



- On the Confirmation screen select the checkbox Restart the destination server automatically if required.



- Confirm the warning message and click **Yes**.

- Then click **Install**.

- Monitor the installation progress and wait for the process to finish. This time, no restart is required.

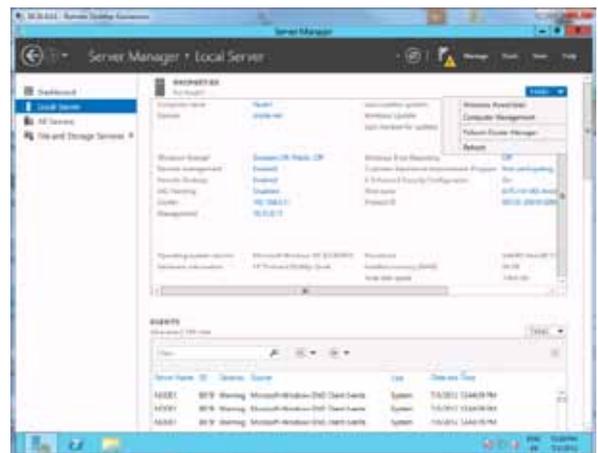
- Click **Close**.

- Repeat the above steps on all nodes that you want to include in the cluster.

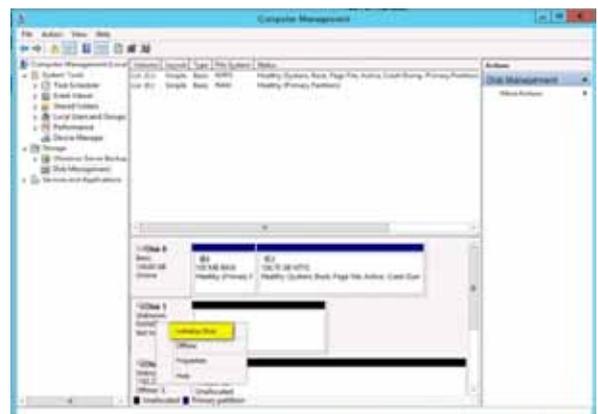
Cluster Disk Preparation

It is recommended to prepare the LUNs before creating the Cluster. For a cluster setup you need to have at least two available storage disks. On is used as the quorum and the remaining disks as cluster storage. The disks need to be formatted with NTFS.

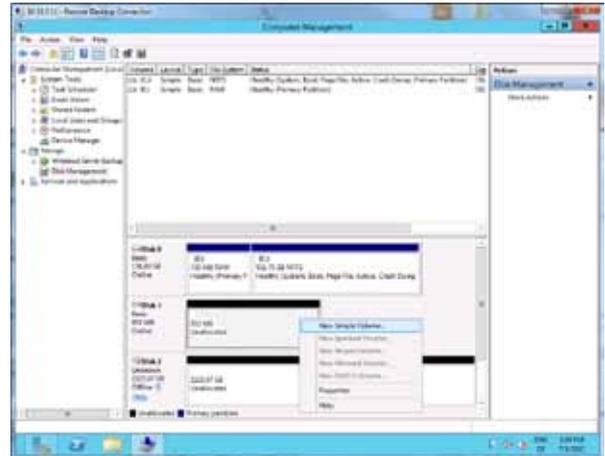
- In the **Server Manager Dashboard** in the left pane, click on **Local Server**.
- In the center pane, the **Properties** of the server you are logged on to will appear.
- On the right top of the window, locate "TASKS" and click the drop down, then select **Computer Management**.



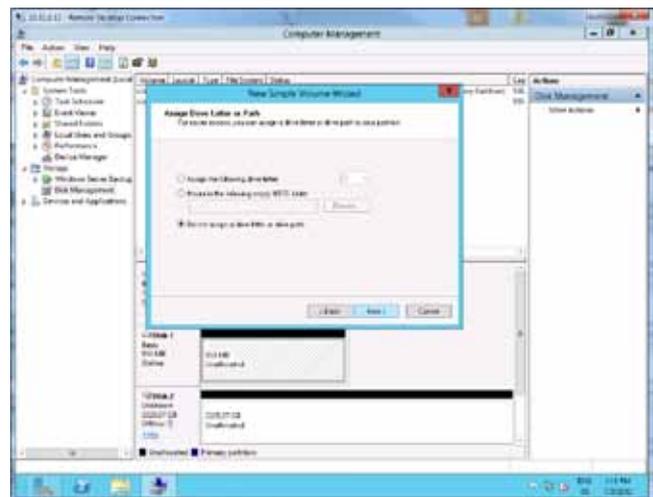
- In the left pane of the **Computer Management** window locate the **Storage** tree node, expand it and click **Disk Management**.
- In the **Disk Manager** right click the property box of **Disk 1** and select **Online**.
- If the disk is not initialized, right click and select **Initialize Disk**.



- Then right click the drive (935 MB Unallocated) and select **New simple volume**.
- In the **New Simple Volume Wizard** window click **Next**.
- Enter the maximum available disk space as volume size and click **Next**.

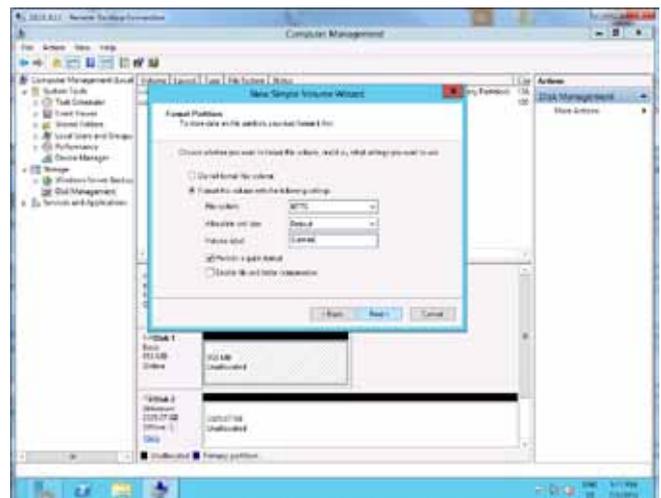


- The quorum disk is not required to have a drive letter assigned. Select **Do not assign a drive letter or drive path** and click **Next**.

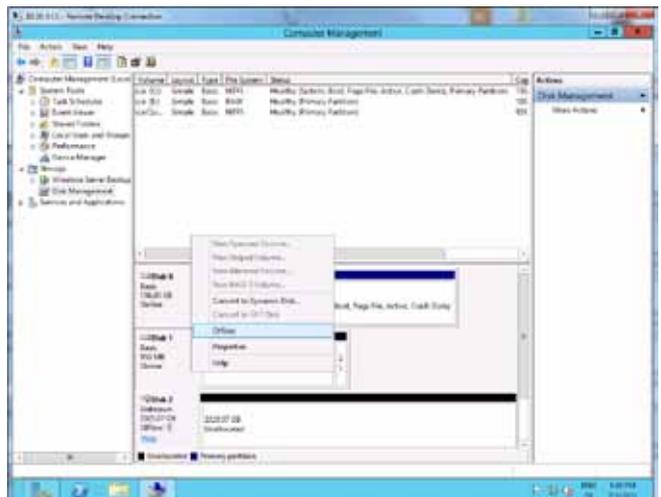


- On the **Format Partition** screen, select file system **NTFS** with **default allocation unit size** and enter Quorum as volume label.

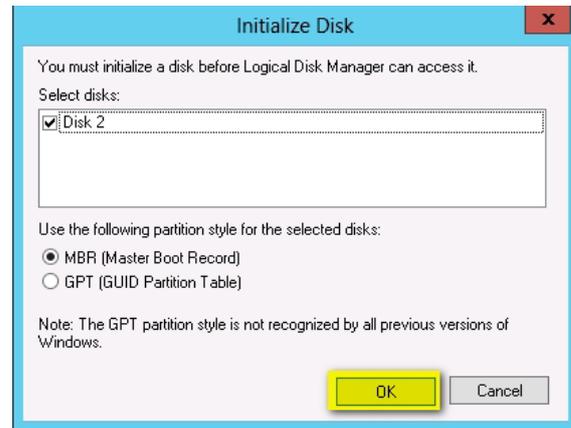
- You may perform a quick format but make sure that **enable file and folder compression** is **disabled**. Then click **Next** and finally **Finish**.



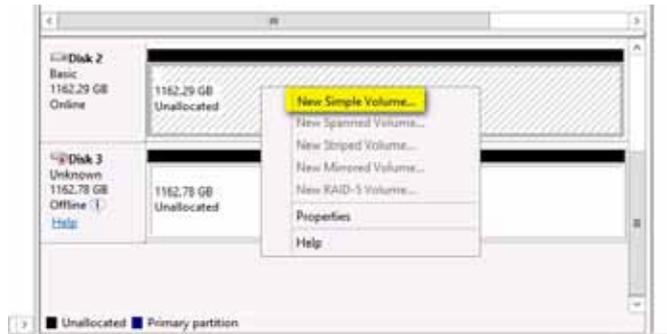
- Put** the disk offline again by right clicking the property box and selecting **Offline**.



14. **Right** click the property box of the next LUN (Disk 2) and select **Online**.
15. The disk will indicate that it has not been initialized. Right click the box again and select **Initialize Disk**.
16. The **Initialize Disk** window appears. Click **OK**.
 - a. GPT (GUID Partition Table) is only needed for disks larger than 2 TB.



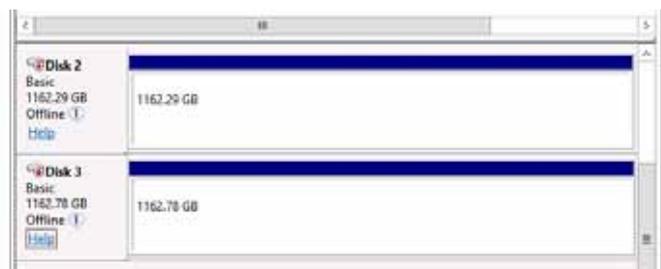
17. Now right click the disk (1162 GB Unallocated) and select **New Simple Volume**.
18. In the **New Simple Volume Wizard** window click **Next**.
19. As **Simple Volume size**, enter the maximum available disk space and click **Next**.



20. Do not assign a drive letter or path, click **Next**.
 - b. The shard storage disk does not have to be assigned a drive letter, as it will be used as CSV (Cluster Shared Volume). The CSV will be identified in the folder ClusterStorage with a dedicated folder. Each disk added will have its own folder starting with Volume 1 and proceeding sequentially through Volume X.
21. **Format** this volume with **NTFS** using the default size allocation, and label the volume with a descriptive name such as CSV1.



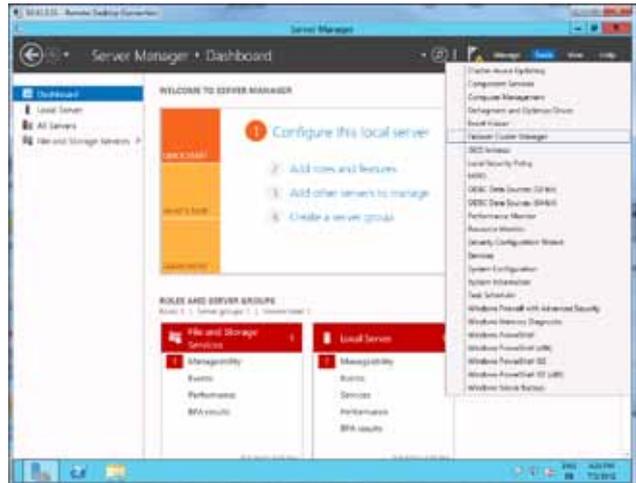
22. **Perform** a quick format but disable file and folder compression. Click **Next** and then **Finish**.
23. **Set** this disk to offline mode.
24. **Repeat** steps 14 to 23 for Disk 3 which is the second Cluster shared Volume: CSV2.
25. **Close** the Computer Manager.



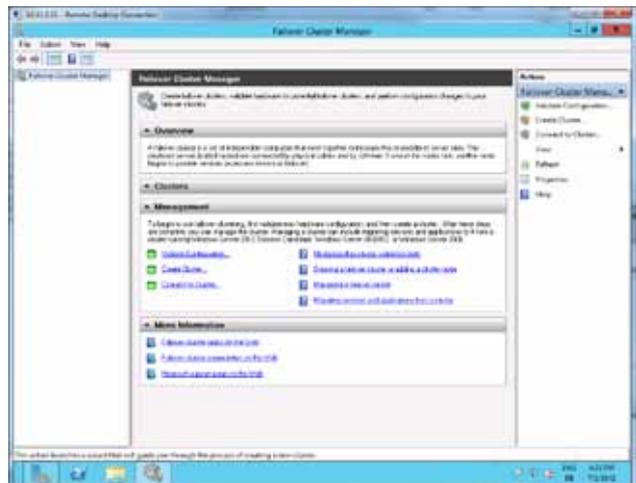
Create the Cluster

This can be done from any server that you want to have in the cluster and that has the Failover Cluster feature installed.

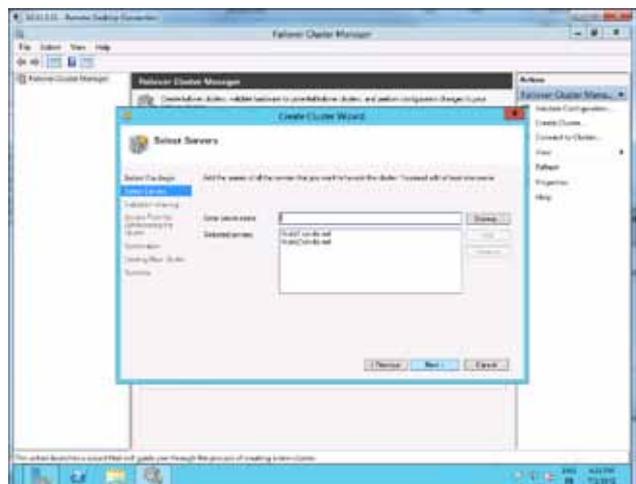
1. Logon to the server with domain administrative credentials.
2. On the **Server Manager** dashboard, click on **Tools** in the top ribbon.
3. Then click on Failover Cluster Manager.



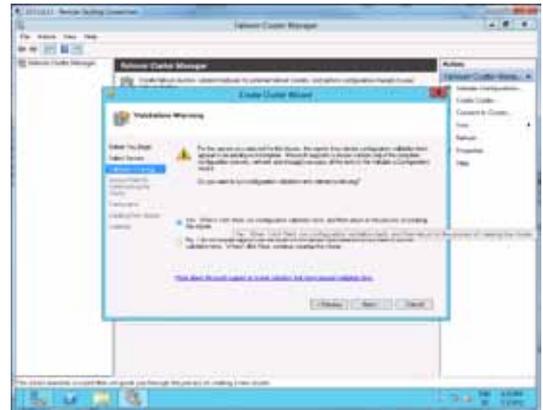
4. In the Failover Cluster Manager on the **Actions** pane click **Create Cluster**.
5. On the Create Cluster Wizard click **Next**.



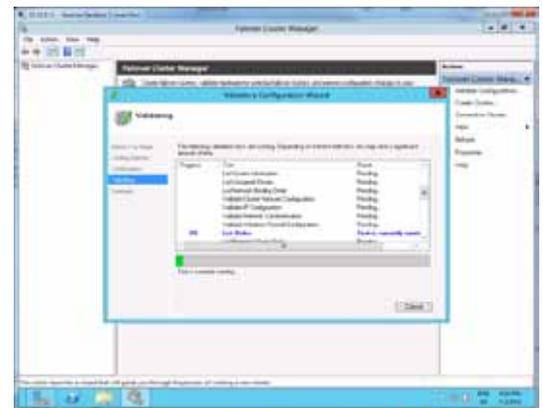
6. On the **Select Servers** screen enter the full qualified domain name (FQDN) of the current server then click **Add**.
7. Repeat step 6 with all servers you want to have in the cluster.
8. Once you have added all cluster nodes, click **Next**.



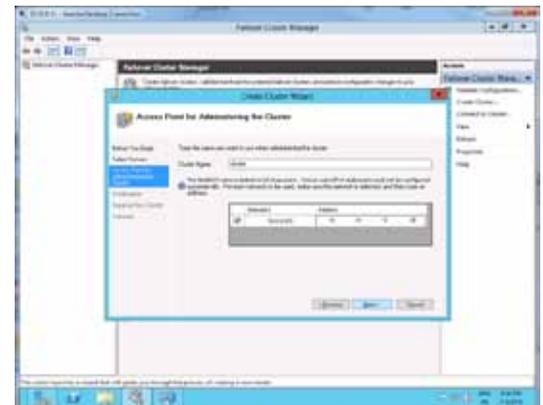
9. On the **Validation Warning** screen select **Yes** to run the validation tests and click **Next**.
10. The Validate a Configuration Wizard appears. Click **Next**.
11. Select **Run all tests** on the **Testing Options** screen and click **Next**.
12. Review the tests that will be run and click **Next**.



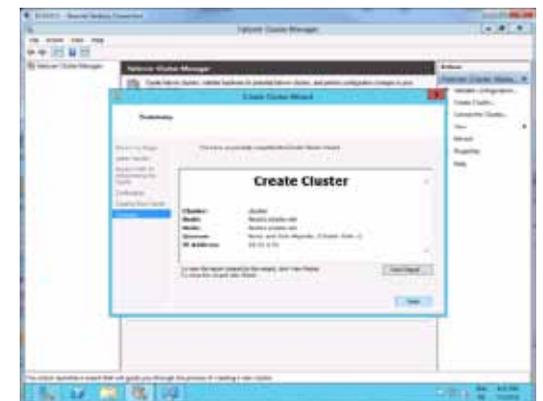
13. The tests take some time to finish. The progress and result of each test will be displayed immediately.
14. On the **Summary** screen the final test results are displayed. Click **Finish**.
 - a. You may want to review the detailed test report. In this case click on View Report.



15. You are now in the **Create Cluster Wizard** again. On the **Access Point for Administering the Cluster** enter the cluster name, for example "cluster."
16. Underneath the **Cluster Name** field you see the list of networks that could be used for the cluster. Select the networks you want to use for the cluster communication and management and provide the IP address to be used for the cluster.
 - a. If one or more networks do not appear, then these networks are not setup with a gateway defined. The Cluster Creation Wizard only displays networks with gateways.



17. Once you have entered the IP addresses click **Next**.
18. On the **Confirmation** page click **Next**.
19. The creation of the cluster will take some time.
20. Once the cluster has been created, the Summary screen will show. Click **Finish**.
 - a. To view a detailed report of the creation click on View Report.



Adding Storage to Cluster Shared Volumes

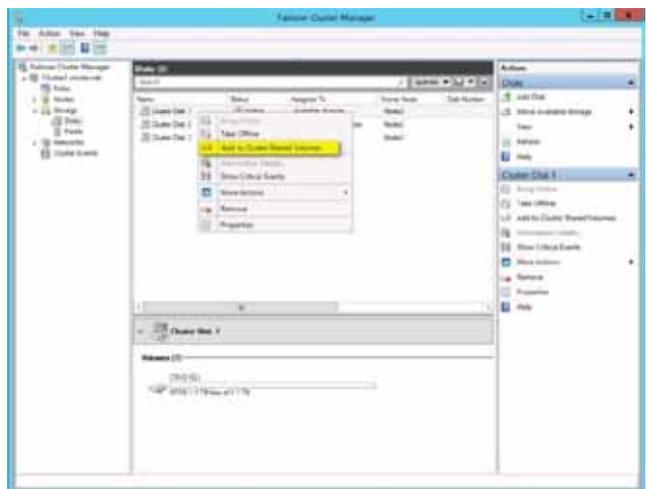
Unlike the previous versions of Failover Clustering, Cluster Shared Volumes (CSV) are enabled automatically with Windows Server 2012, but you have to add storage manually to the CSV using the Failover Cluster Manager.

1. Assuming the **Failover Cluster Manager** is still open, expand the cluster node.
2. Then expand the **Storage** node.

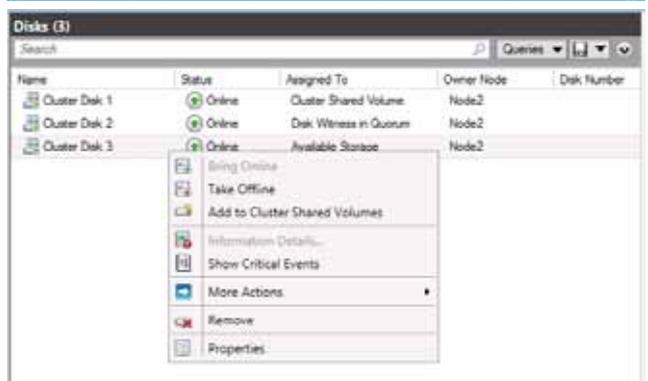


3. Click on the **Disks** node.
 - a. You see at least three disks, the quorum and the two CSV disks. The quorum is already assigned and no longer listed as available.

In the center pane, click on one of the available storage disks, for example Cluster Disk 1. At the bottom of the GUI you can see the details of the Disk including the volume label you have assigned earlier. Check that the Cluster Disk you have selected is labeled CSV1.



4. In the Actions pane click on **Add to Cluster Shared Volumes**, or right click the storage disk in the center pane and select Add to Cluster Shared Volumes.

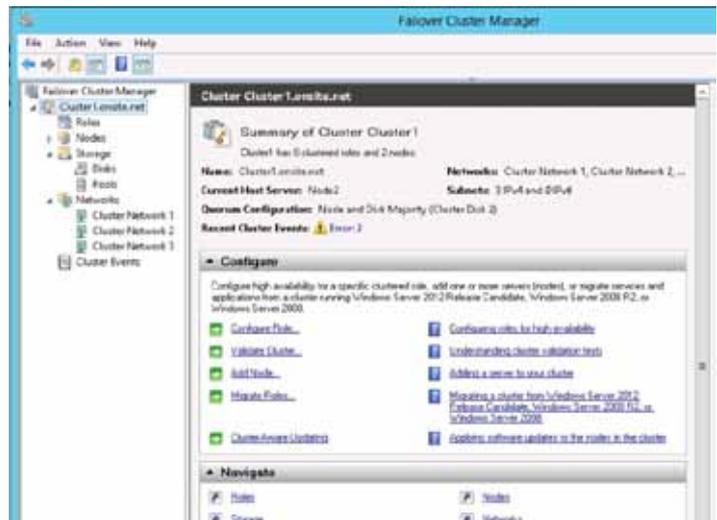


5. Do the same for CSV2 (the second available storage)
 - a. To verify that CSV has been created: Open an Explorer view and browse to C:\ClusterStorage you should see the folders Volume 1 and Volume 2.
 - b. Though the storage has been formatted using NTFS, adding it as CSV, the file system is automatically changed to CSVFS (Cluster Shared Volume File System).

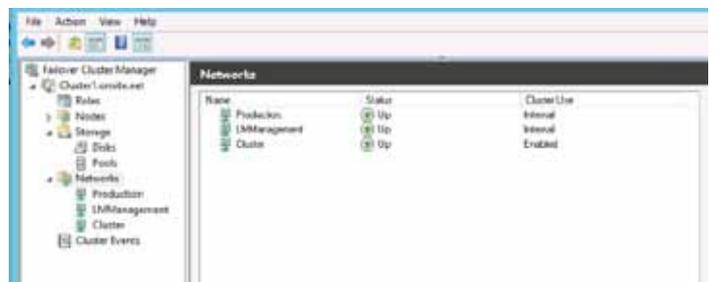
Configure Network Cluster Resources

The network settings have been described earlier in this document. At this point, we have created three networks: a teamed network for production traffic, a second network for live migration and management traffic, and a third network for cluster traffic. At the moment only one Network, the one specified during the cluster setup, is used for cluster communication. For availability it is better to have several networks configured.

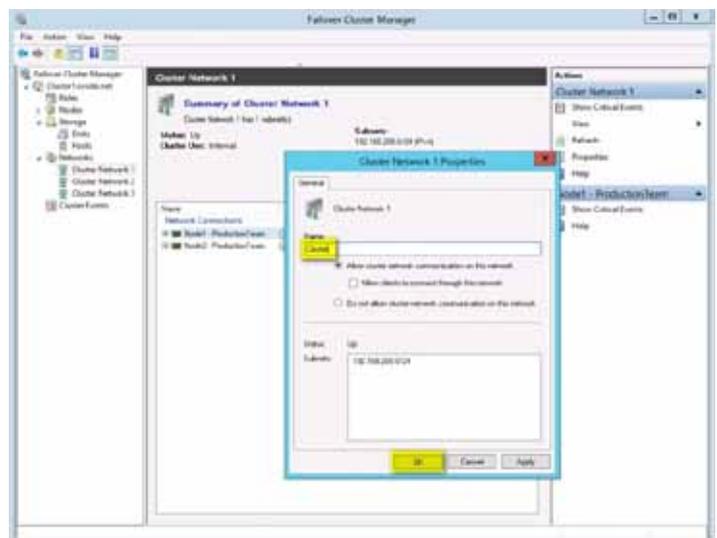
1. Assuming the **Failover Cluster Manager** is still open, expand the node **Networks** in the left pane.
 - a. You should see three networks.



2. For easier management and identification, you should rename these network display names. Right Click on the individual Networks, select properties. Identify the networks from the IP settings and rename the networks to Cluster, LMManagement, and Production.



3. Click on the **Cluster Network**.
 - a. In the center pane you see the nodes connected with this network.
4. In the **Actions** pane click on **Properties**.
5. For every Network you need to decide, if you want to allow external clients to connect through the network. To **allow** the cluster **network communication** on this network and **clients** to connect through this network, select the according boxes.



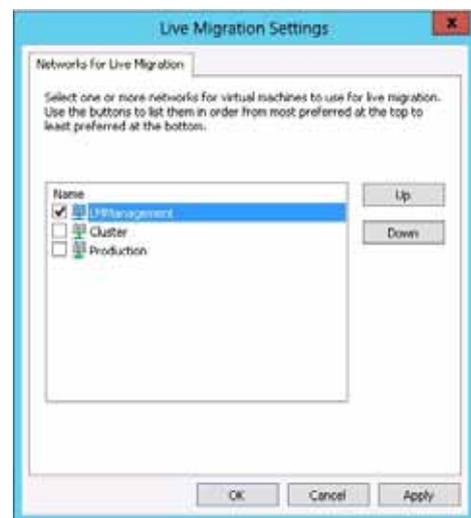
- Repeat step 2 through 5 for the remaining networks. For the Reference Architecture settings refer to the table below. Please note that the network names and specifications may be different for your customer implementation. Refer to Appendix A for your individual settings.

New Name	Allow Cluster Communication	Allow Clients to connect
LMManagement	Yes	No
Production	Yes	Yes
Cluster	Yes	NO

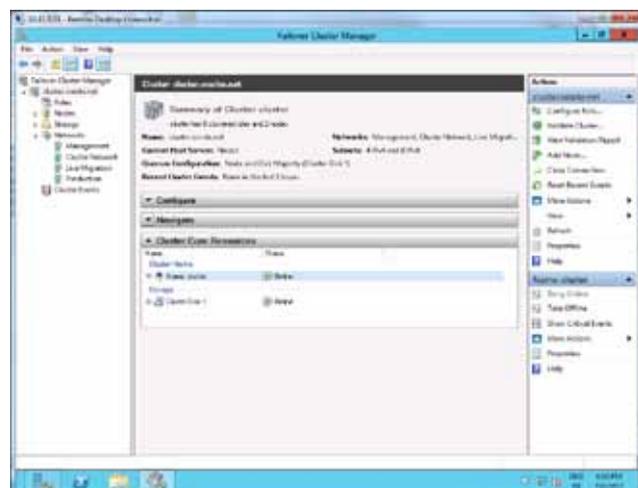
- Then click on the **Networks** node in the left pane.
- On the **Actions** pane on the right, click on **Live Migration Settings**.



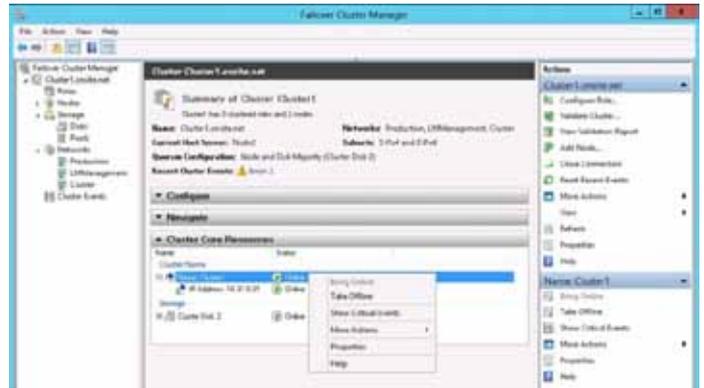
- In the **Live Migration Settings** window you see the list of all available networks.
- Deselect all networks but **LMManagement**. Then click **OK**.
 - If LMManagement is not on top of the list use the up button to move to the top.



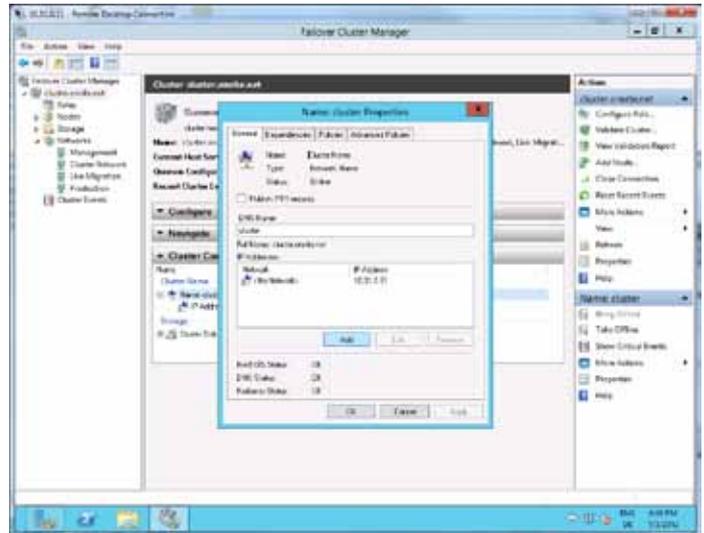
- Then click on the cluster node in the left pane.
- In the center pane locate the section **Cluster Core Resources**.



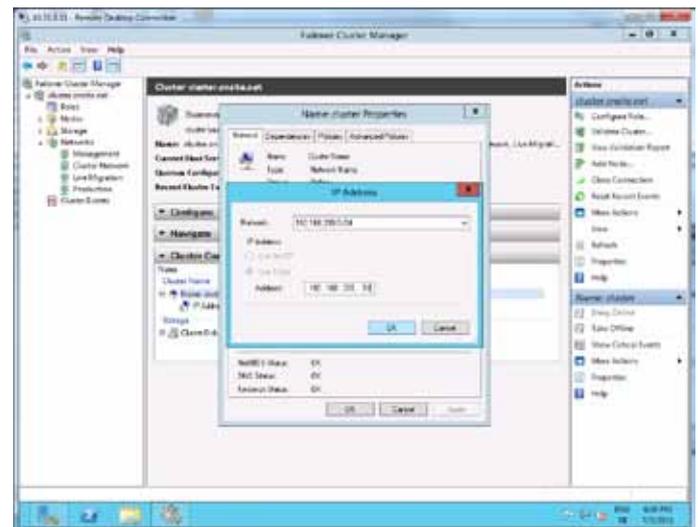
13. Expand the cluster name node. You will see the IP address of the cluster network used to access this cluster.
14. Right click the node **Name: Cluster 1** and click on **Properties**.



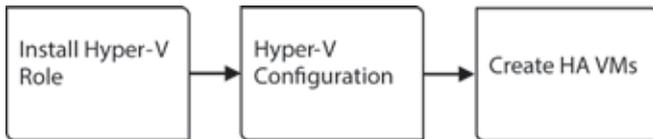
15. On the **General** tab click **Add**.



16. In the **IP Address** window you see the subnet of the Production network in the drop down.
17. Provide the IP address for the cluster on this network.
18. Click **OK** and then **OK** again.



Enable and Configure Hyper-V

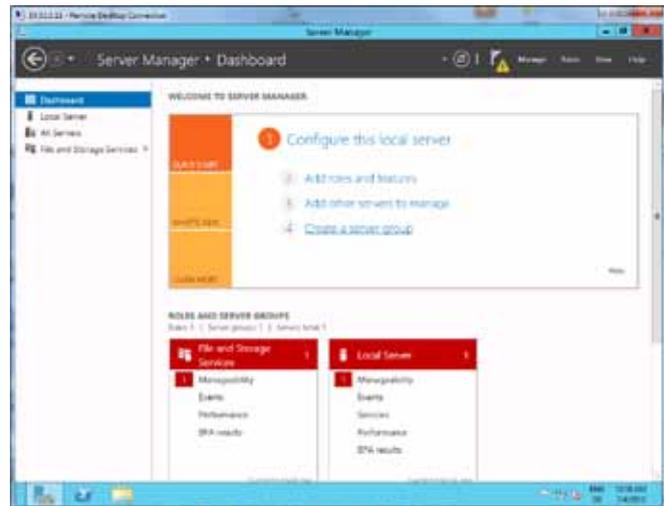


Hyper-V in Windows Server 2012 provides a complete set of virtualization features and is the foundation upon which customers can construct a private cloud. New isolation and multitenant isolation capabilities help to keep virtual machines isolated and can be scaled beyond virtual local area networks by using network virtualization. Management tasks can be fully automated, to reduce administrative overhead and new functionality, such as resource metering, improves Quality of Service (QoS).

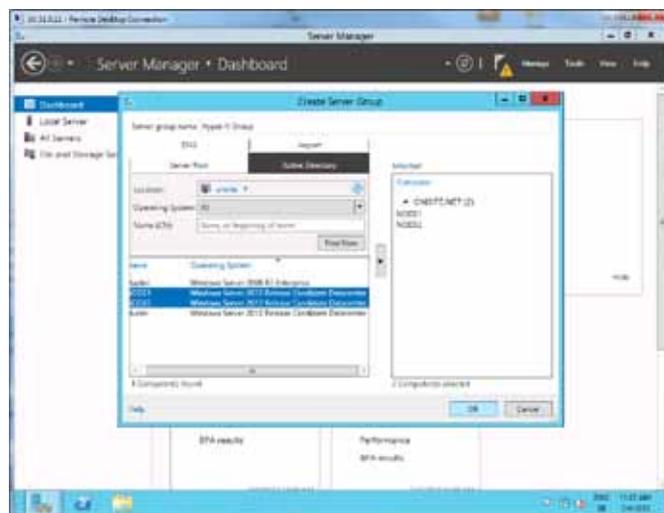
Install Hyper-V Role

The two DL360e servers will both host virtual machines, so you will need to install the Hyper-V role on both servers. Since Windows Server 2012 enables infrastructure management through a single console you first create a server group and then deploy the Hyper-V role.

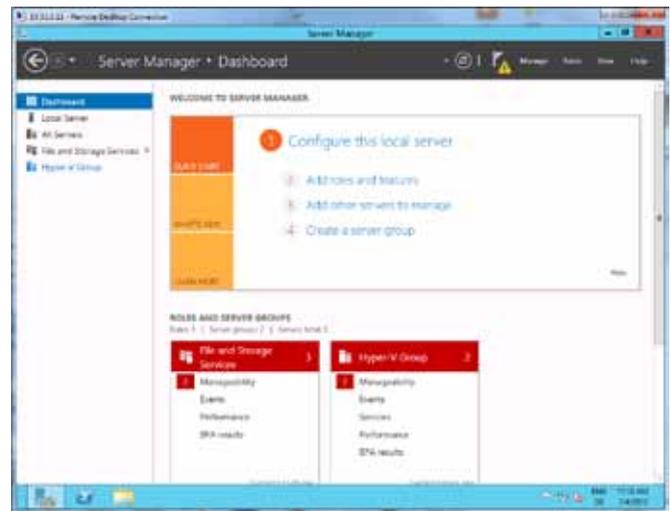
1. Logon to the first node with domain administrative credentials.
2. On the Server Manager Dashboard click on 4 Create a server group.



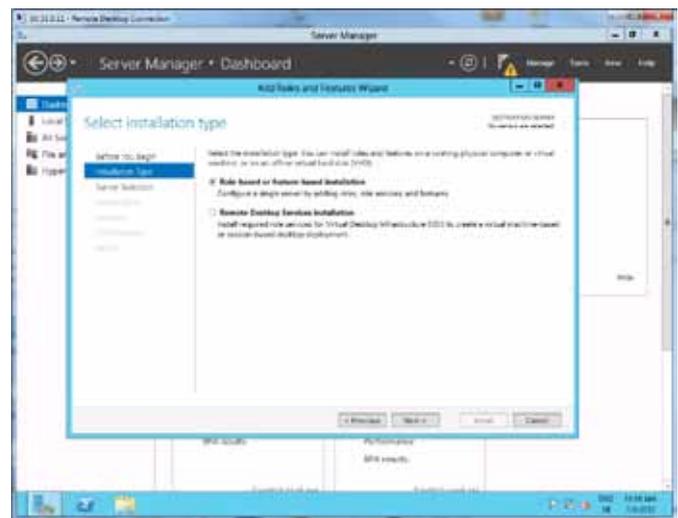
3. In the Create Server Group window click on the tab Active Directory.
4. In the **Server group name** field enter a descriptive name, for example Hyper-V Group.
5. Click on **Find Now**.
6. All computer accounts are listed in the field below. Select the **two servers**, for example Node 1 and Node 2, while clicking the second the second server hold the Shift key, or double click each server you want to add.
7. Click on the ► **button** to add the selected servers and then **OK**.



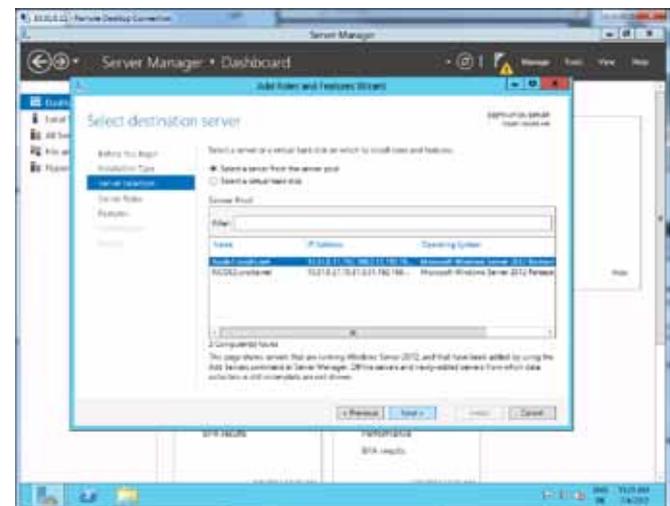
8. In the left pane of the Server Manager a new entry with name you provided will appear.
9. Now click on 2 Add roles and features.
10. In the Add Roles and Features Wizard click Next.



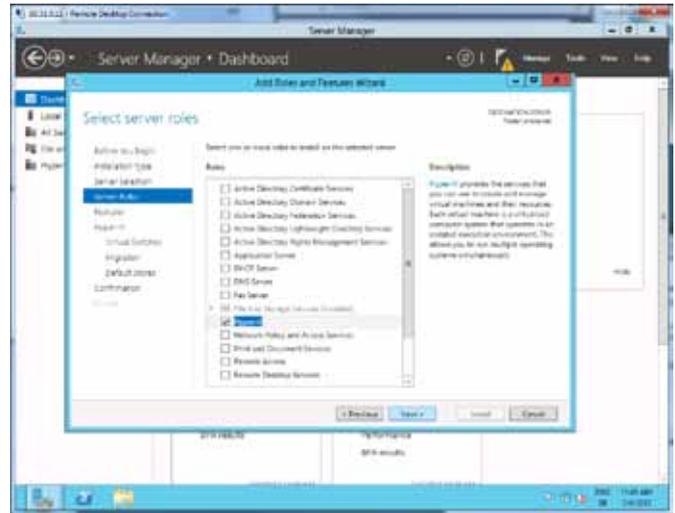
11. Select role-based or feature base installation and click Next.



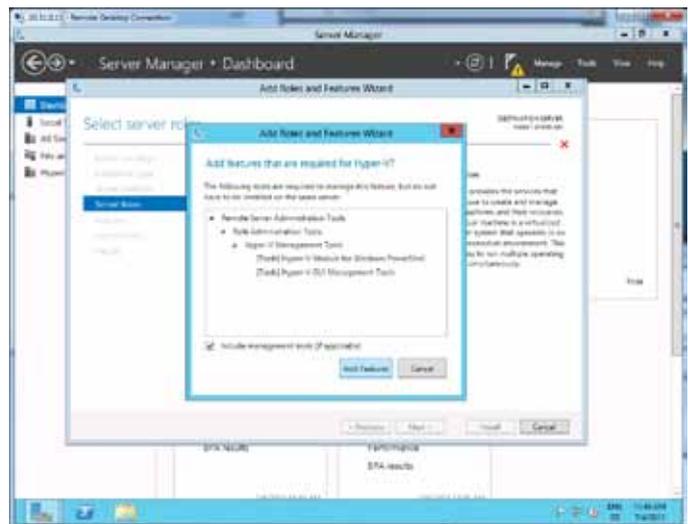
12. On the **Server Selection** screen select the first server, for example Node 1.onsite.net, and click **Next**.



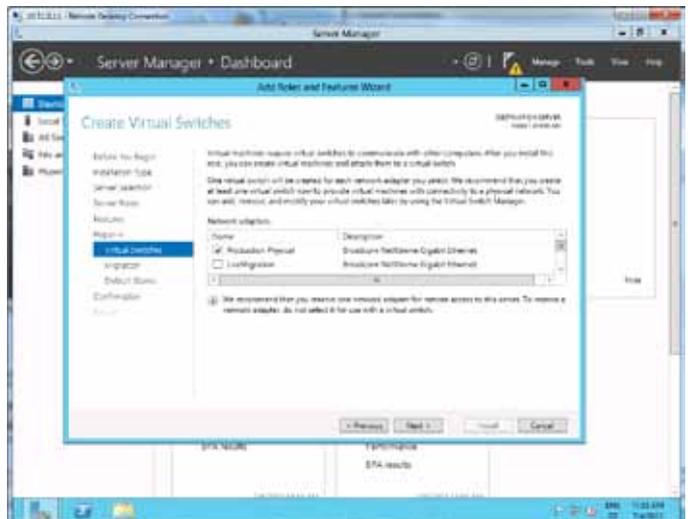
- On the **Server Roles** screen locate the role **Hyper-V** and click the checkbox in front.



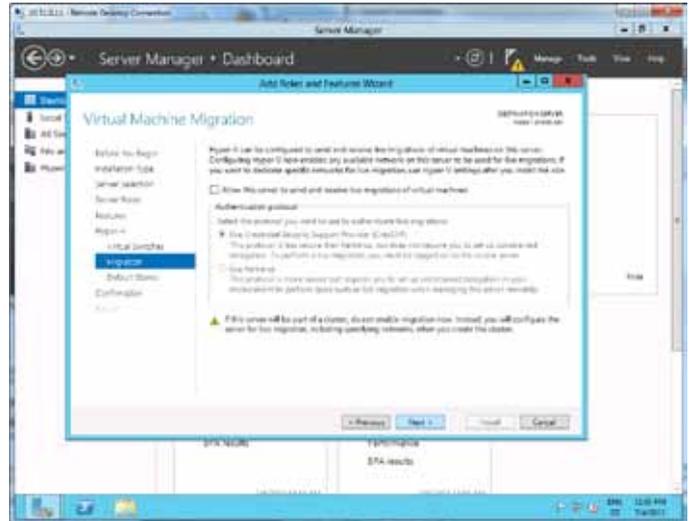
- The Hyper-V role requires certain management tools to be installed. Click **Add Features** to install the necessary components.
- Click **Next** and on the Features screen, too.
- On the **Hyper-V** screen click **Next**.



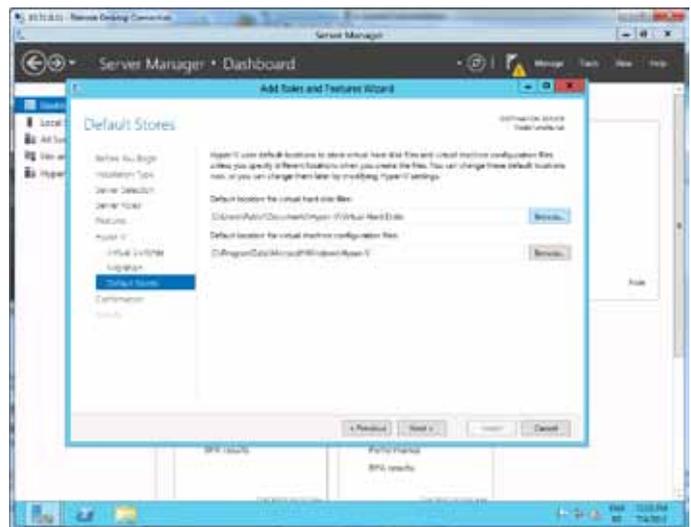
- On the **Virtual Switches** screen select the **Production Team** network.



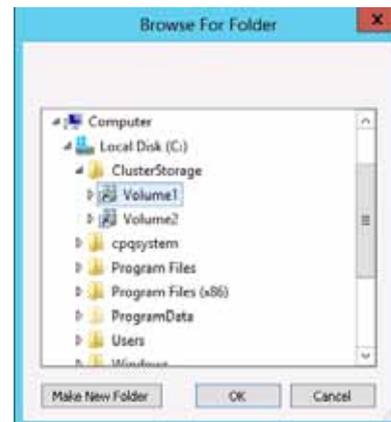
- On the **Migration** screen click **Next**, make sure that the checkbox **Allow this server to send and receive live migrations of virtual machine** is **NOT** checked. It is not needed as the cluster has been configured for live migration already.



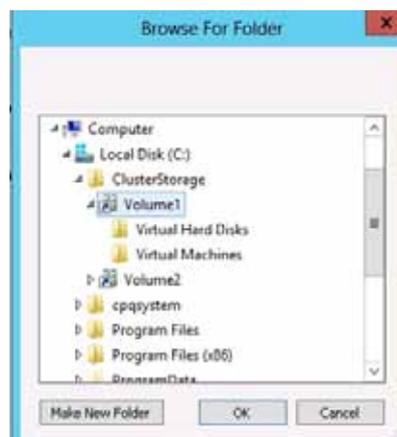
- Specify the default stores for virtual machines and VM configuration files. Click on the first **Browse** button to specify the location for VHDs.



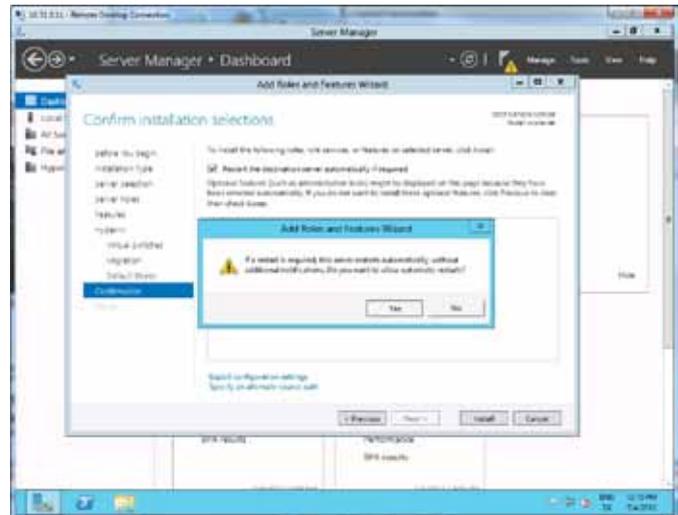
- For Node 1 locate the CSV1 location **C:\ClusterStorage\Volume1** and select it. For Node 2 locate the CSV2 location **C:\ClusterStorage\Volume2** and select it.



- Click **Make New Folder** and named it **Virtual Hard Disks**. Click **OK**.
- Click the second **Browse** button and repeat steps 20 through 21. This time create a new folder named **Virtual Machines**.



23. Click **Next**.
 24. On the Confirmation page select the checkbox Restart the destination server automatically if required.
 25. Confirm the warning message with **Yes**.
26. Then click **Install**.



27. Monitor the progress and wait for the process to finish. The server needs to be restarted.
28. When the server has restarted the Hyper-V installation will continue to finish.
29. Finally click **Close**.

30. Repeat steps 9 through 29 for the second node.
 - a. Remember that you can use the Server Manager of the server you are currently logged on to.
 - b. You may not use the Browse function for default stores if performing a remote installation. Simply enter the locations manually:

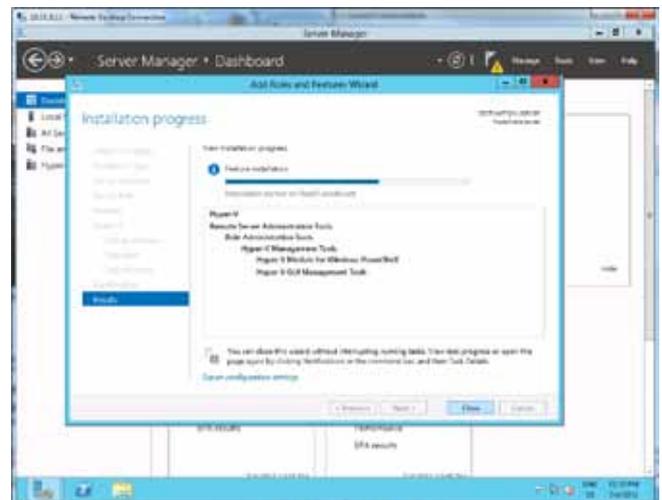
VHD location:

C:\ClusterStorage\Volume2\Virtual Hard Disks

VM Configuration location:

C:\ClusterStorage\Volume2\Virtual Machines

- a. If you performed a remote installation, monitor the progress in the Add Roles and Features Wizard. If you closed the Wizard, you reopen the Wizard by clicking on the Notification icon in the top pane.

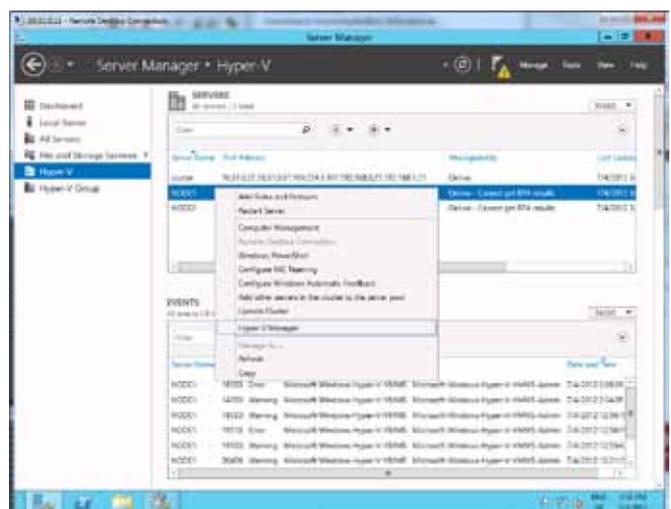


31. On the left a new node Hyper-V will appear.

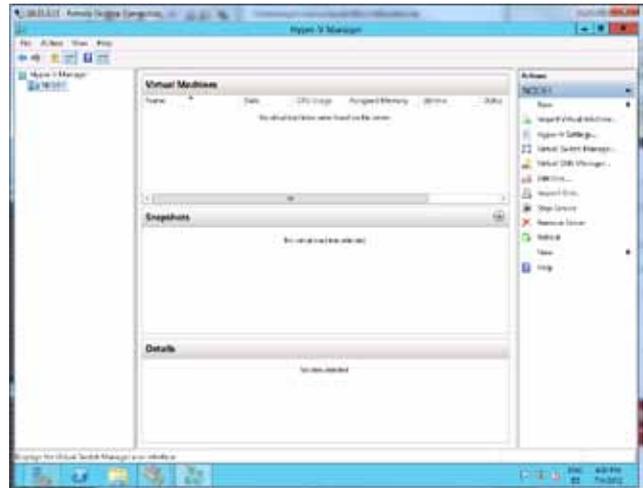
Hyper-V Configuration

There are a few additional steps to configure Hyper-V:

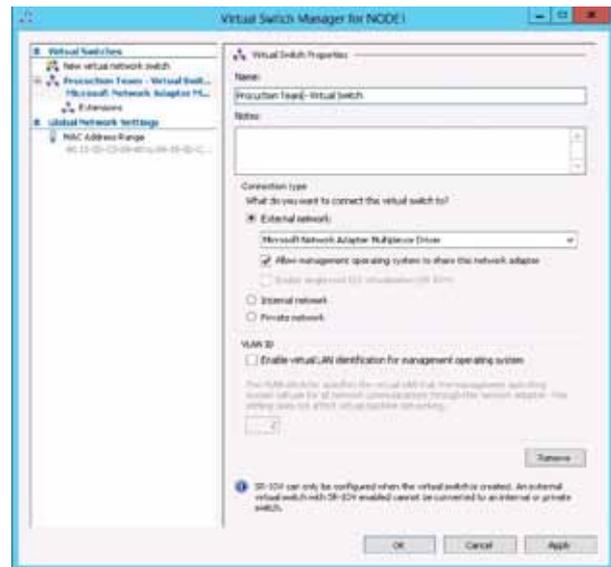
- Configure the virtual switches and associate them to the correct NICs
 - Configure the default locations for the VM configuration files and VM VHD files.
1. Assuming you are still logged on and the **Server Manager** is still opened, click on the node **Hyper-V** in the left pane of the Server Manager.
 2. In the content pane right click the first Hyper-V host and select **Hyper-V Manager**.



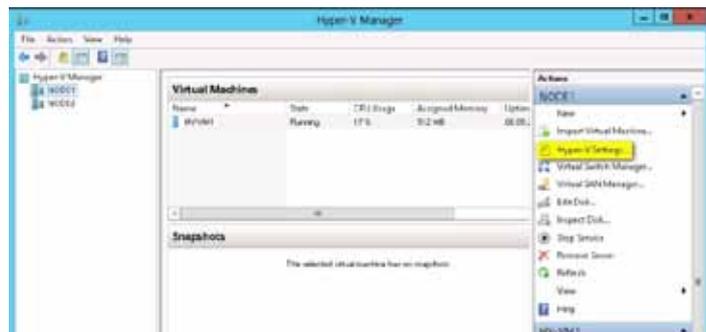
- In the Hyper-V Manager click on Virtual Switch Manager.



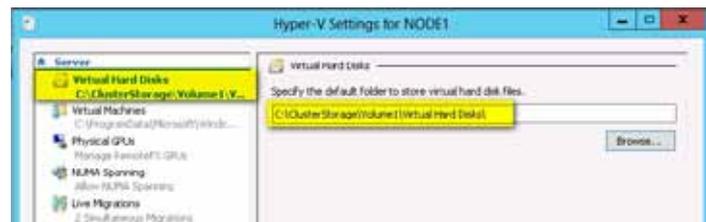
- In the Virtual Switch Manager window click on Microsoft Network Adaptor Multiplexor Driver.
- In the right pane change the name of the virtual switch to **Production Team—Virtual Switch** and click **OK**.



- In the Hyper-V Manager click on Hyper-V Settings.



- Select Virtual Hard Disks and specify the VHD location by browsing to C:\ClusterStorage\Volume1\Virtual Hard Disks\ for Node 1 (C:\ClusterStorage\Volume2\Virtual Hard Disks\ for Node 2)
- Select Virtual Machines and specify the virtual machine file location by browsing to C:\ClusterStorage\Volume1\Virtual Machines\ for Node 1 (C:\ClusterStorage\Volume2\Virtual Machines\ for Node 2)
- Close the Hyper-V Manager.
- You should return to the Server Manager—Hyper-V view.
- Right click the second VM host and repeat steps 2 through 6.
 - The Hyper-V Manager opens again and adds the second host in the left pane for management.



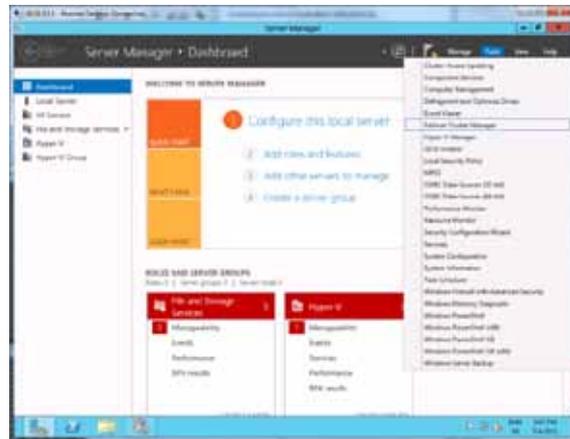
Creating Highly Available Virtual Machines

To create highly available virtual machines, you can either use the Failover Cluster Manager or the Hyper-V Manager. Using the Failover Cluster Manager has the advantage that the VM created will automatically be marked as highly available. If the VM is created via Hyper-V Manager, you need to add the VM service manually to mark the virtual machine as high available.

Create HA Virtual Machine using Failover Cluster Manager

This set of instructions assumes that you have an ISO file ready containing the setup files for a Windows Server 2012 installation.

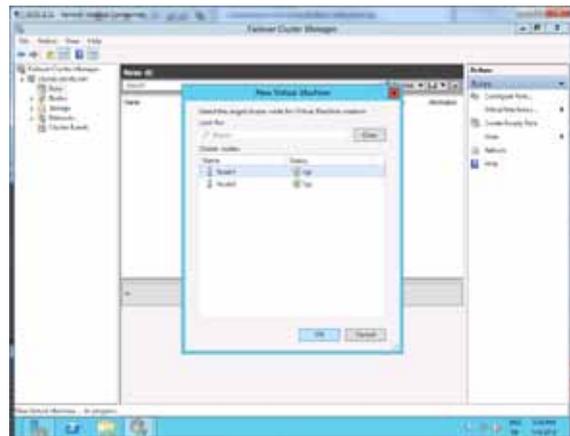
1. Logon to one of the server nodes, with domain administrative credentials.
2. In the **Server Manager** on the top ribbon click on **Tools** and select **Failover Cluster Manager**.



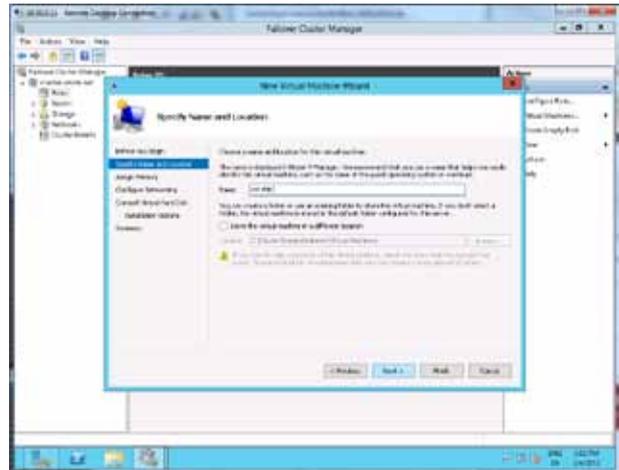
3. In the **Failover Cluster Manager** click on **Roles** in the left pane.
4. On the Actions pane click on Virtual Machines.
5. Click on New Virtual Machine.



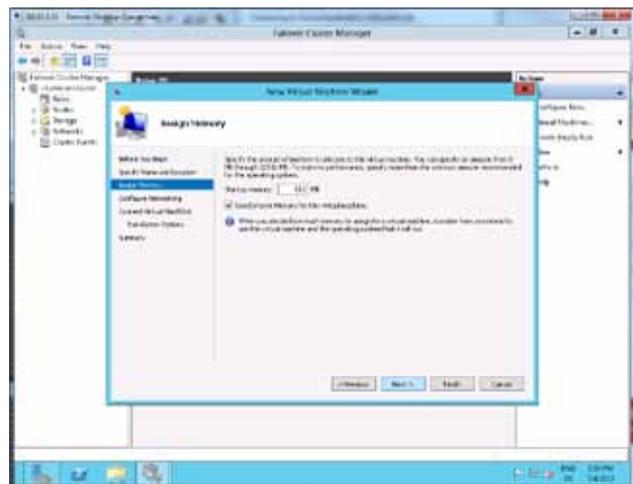
6. In the **New Virtual Machine** window select the node you want to deploy the VM to, and then click **OK**.



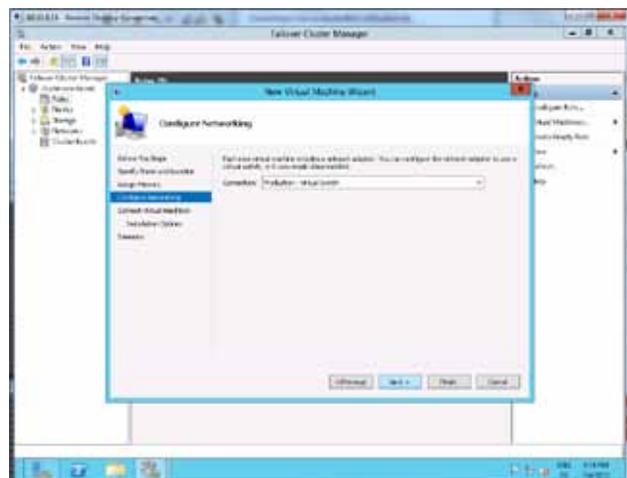
7. In the New Virtual Machine Wizard window click Next.
8. Provide a name for the virtual machine, for example HV-VM1. Select “Store the virtual machine in a different location” and browse to the node’s CSV. (“C:\ClusterStorage\Volume1\Virtual Machines” for Node 1, “C:\ClusterStorage\Volume1\Virtual Machines” for Node 2) and click **Next**.



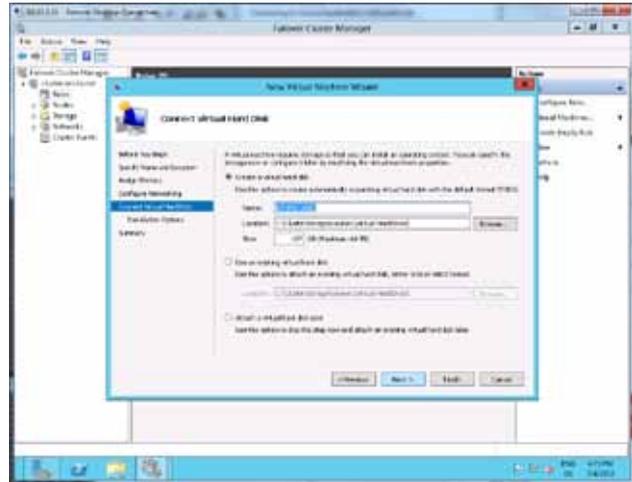
9. On the Assign Memory screen set the Startup memory to 512 MB and select the checkbox Use Dynamic Memory for this virtual machine. Click Next.



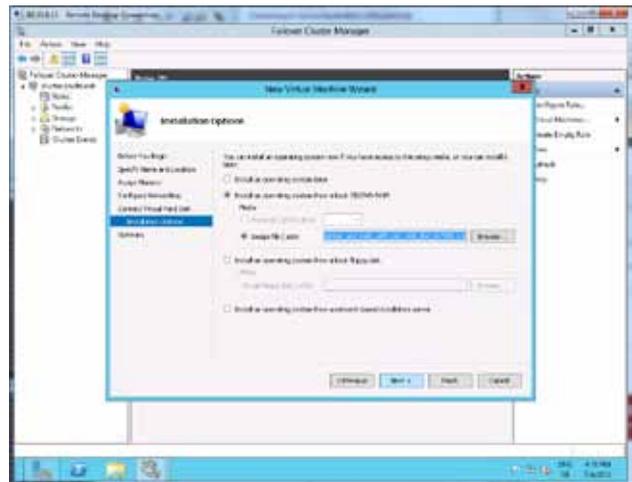
10. On the **Configure Networking** screen select **Production Team—Virtual Switch** as the connection, and then click **Next**.



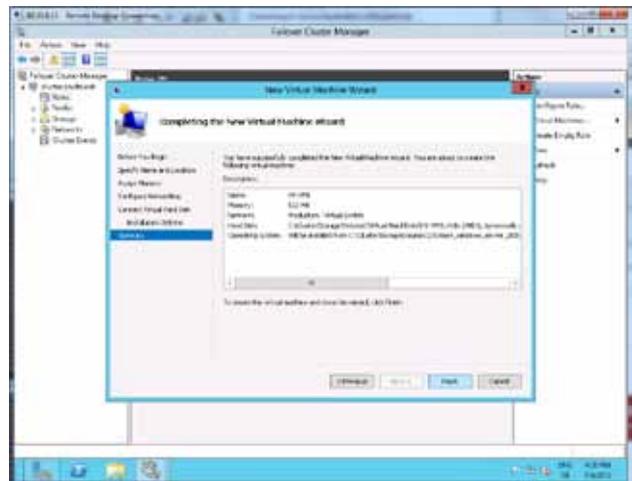
11. On the **Connect Virtual Hard Disk** screen validate that the “C:\ClusterStorage\Volume1\Virtual Hard Disks” for Node 1 (or “C:\ClusterStorage\Volume2\Virtual Hard Disks for Node 2”) folder is selected. Click **Next**.



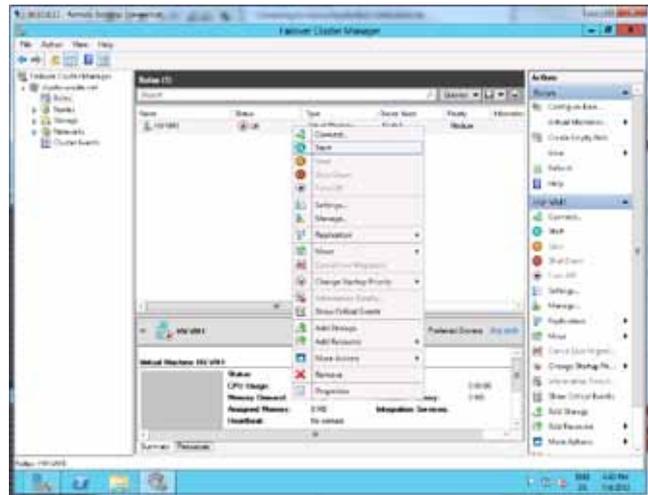
12. Select Install an operating system from a boot CD/DVD-ROM and browse for the ISO file. Click Next.



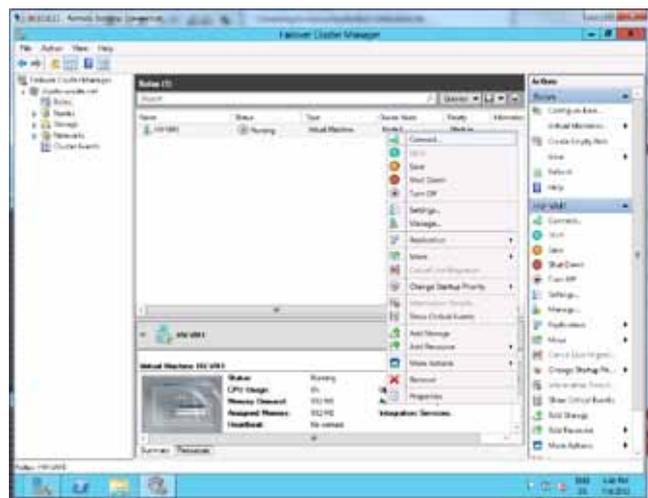
13. Review the **Summary** and click **Finish**.
 - a. The virtual machine data files are created and the VM is automatically configured as highly available.



14. Close the High Availability Wizard by clicking on Finish.
15. Return to the **Failover Cluster Manger**. In the center pane the new VM is listed.
16. Right click the virtual machine and select **Start**.



17. Right click the VM again and select **Connect**.



18. Finish the installation. Once the setup is finished, configure the network inside the virtual machine.



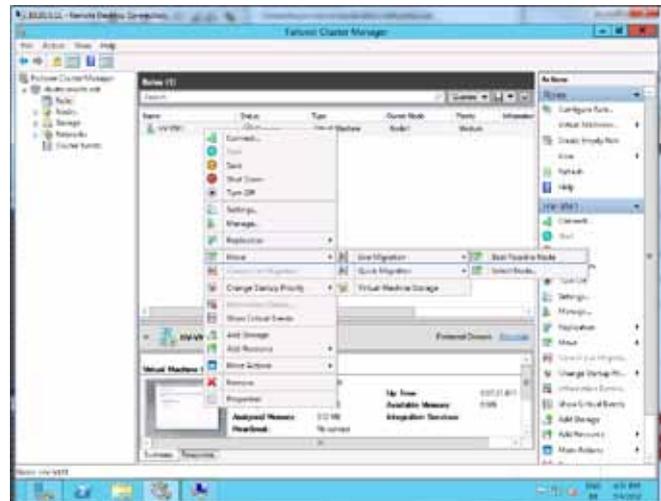
Configure Networking of the Virtual Machine

When the installation has finished, you need to configure the networking of the virtual machine, if there is no DHCP server on the production network available.

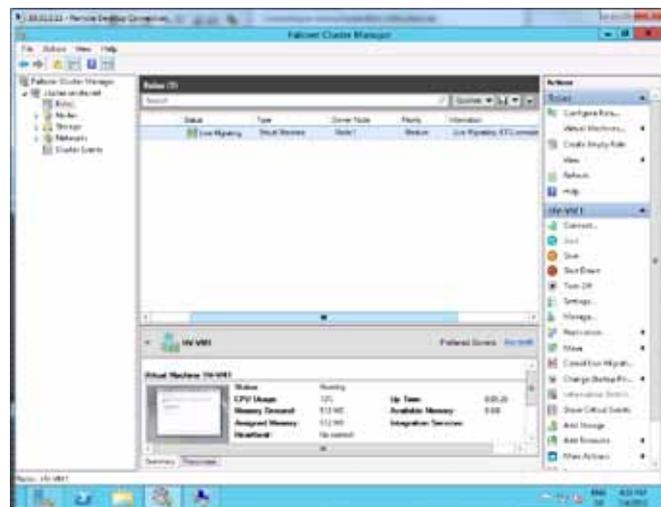
1. Assuming the Virtual Machine Connection viewer is still open, and the installation is finished, provide a password and wait for the desktop to load.
2. After the login the Dashboard window appears. Select Local Server.
3. Click on Configure networking.
4. In the Network Connections window right click the network Local Area Connection and select Properties.
5. Double click Internet Protocol Version 4 (TCP/IPv4).
6. Select Use your IP settings and enter an IP Address for the production network.
7. Click OK (twice) to save the changes.
8. Minimize the virtual machine viewer.
9. On the host you can see the VM is running, its current CPU utilization and memory consumption.
10. Open a command prompt and ping the IP address you have assigned to the VM.
 - a. If you don't get a reply, disable the Windows Firewall inside the virtual machine.

Perform Live Migration of a VM

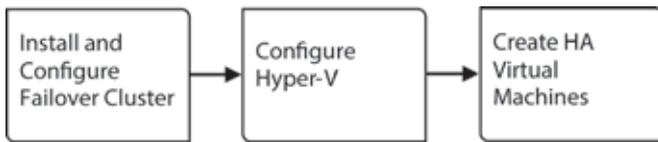
1. Open a PS command line window and submit a continuous ping to the live migration target virtual machine.
2. Return to the Failover Cluster Manager.
3. Locate the **Roles** node in the left pane and click it.
4. Right click the virtual machine and select **Move -> Live Migration -> Best Possible Node**.



5. In the center pane of the Failover Cluster Manager you can monitor the migration progress.
 - a. The virtual machine keeps its connectivity even during the migration process. Clients will not experience any downtime or connection loss to the services provided by this virtual machine.



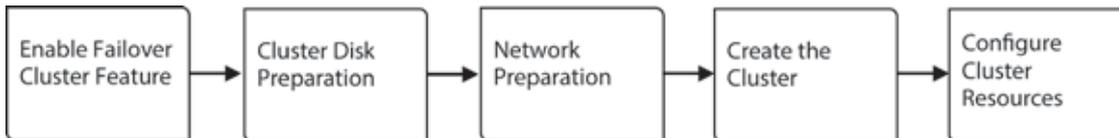
Configure Operating System for Virtual Machine Provisioning on Windows Server 2008 R2



Install and Configure Failover Cluster

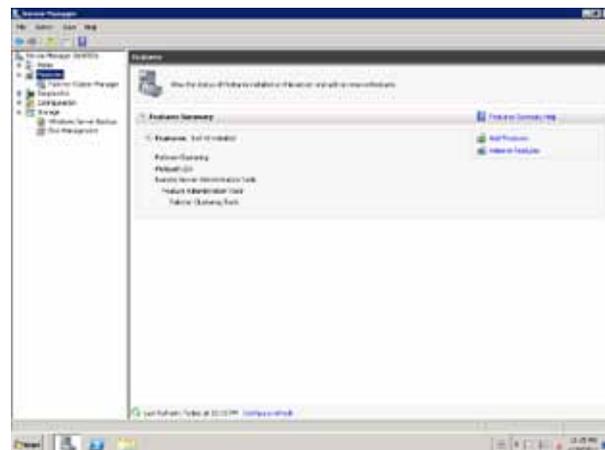
The Failover Cluster feature requires an Active Directory Domain. This document assumes that you have access to an Active Directory and the necessary domain administrative credentials. Before you enable the Failover Cluster feature and create the cluster, make sure that all DL360e servers have joined the domain.

Enable the Failover Cluster Feature



The following steps have to be done on all blades, which will be added as cluster nodes.

1. Open the Server Manager, browse to Start -> Administrative Tools -> Server Manager.
2. In the left pane of the Server Manager click on the node Features.
3. In the content pane click on Add Features.
4. The Add Features Wizard shows up.
5. Locate the entry Failover Clustering and select the checkbox in front. Then click Next.
6. On the Confirm Installation Selections screen click Install.
7. Monitor the progress and wait for the result screen. Then click Close.
8. Return to the Server Manager and expand the Features node. Underneath, you see the new Failover Cluster Manager node.

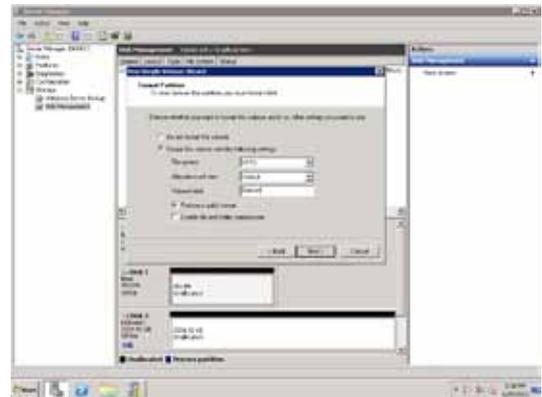


Preparation for Cluster Creation

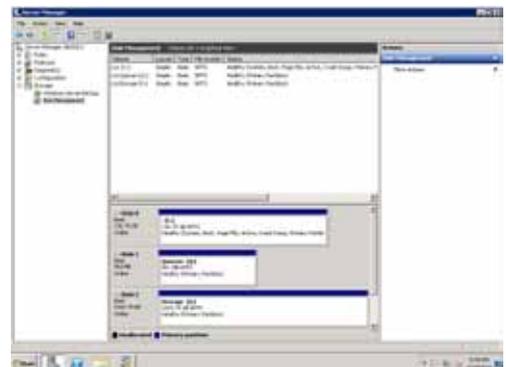
Before you actually create the cluster through the Failover Cluster Manager you need to prepare the cluster disks and the networks used by the cluster. The following steps have to be done on all servers you want to include in the cluster.

Prepare the disks

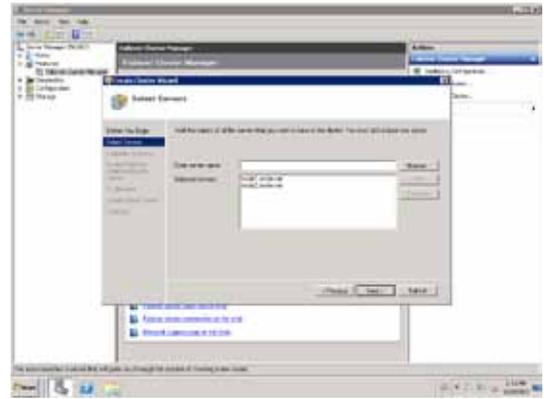
1. Logon to the first server you want to have in the cluster, preferably with domain administrative credentials.
2. Open the **Server Manager**, browse to Start -> Administrative Tools -> Server Manager.
3. Expand the node **Storage** and click on **Disk Management**.
4. The disk manager displays all LUNs that are connected to the current server.
 - a. In addition to the boot disk C:\, the reference architecture has three LUNs dedicated for the cluster, one for the Quorum disk which has 1 GB and two for cluster Shared Volumes.
5. Locate the disk to be used as quorum and right click the properties box, not the graphical depiction of the disk.
6. From the context menu select **Online**.
7. Then right click the properties box again and select **Initialize**.
8. The **Initialize Disk** window pops up. As partition style select **MBR** then click **OK**.
 - a. Disk 0 is now online and marked as Basic.
9. Now right click the disk and select **New simple volume** from the context menu.
10. This opens the New Simple Volume Wizard window. In that window click **Next**.
11. Use all available disk space for the volume size then click **Next**.
 - a. The RA has 951 MB as maximum disk space available so enter 951 in the entry box.
12. On the **Assign Drive Letter or Path** screen select drive letter **Q** for the quorum disk. Then click **Next**.
13. On the Format Partition screen, select Format this volume with the following settings.
 - a. For file system select NTFS
 - b. Use the default allocation unit size
 - c. For volume label enter Quorum
 - d. Perform a quick format
 - e. Ensure that Enable file and folder compression is not selected.
14. Click **Next**.
15. Review the settings on the summary screen and click Finish to create the volume.



16. Repeat steps 5 through 15 for the cluster storage disks. For drive letters use **R** and **S** and for volume labels use **CSV1** and **CSV2**. Format this volume with the same settings as in step 13.
17. Wait until the formatting has finished.
18. You now see four disks in the disk manager.
 - a. Disk 0: The Boot disk of the host
 - b. Disk 1: The Quorum disk for cluster
 - c. Disk 2: CSV1
 - d. Disk 3: CSV2



19. Right click on the disk and set all of them back to offline.
20. Now logon to the second node, preferably with domain administrative credentials.
21. Open the **Server Manager** and expand the **Storage** node.
22. Click on Disk Management.
23. If the disk manager displays the disk as not initialized with unallocated space, right click the node **Disk Management** and select **Refresh**.
 - a. The disks should now display as formatted but offline.
24. Right click the **Disk 1** property box and click **Online**.
25. Right click the disk (named Quorum) and select **Change Drive Letter and Paths** from the context menu.
26. In the Change Drive Letter and Paths window click on Change.
27. Then select the letter **Q** a new drive letter and click **OK**.
28. A warning message appears click **Yes** to confirm the drive letter change.
29. The disk now displays in the disk manager with drive letter Q.
30. Repeat step 23 through 27 for Disk 2 and Disk 3 (CSV1 and CSV2). Change the drive letter to R and S.
31. Set all disks back to offline.



Verify the Networks used by the cluster

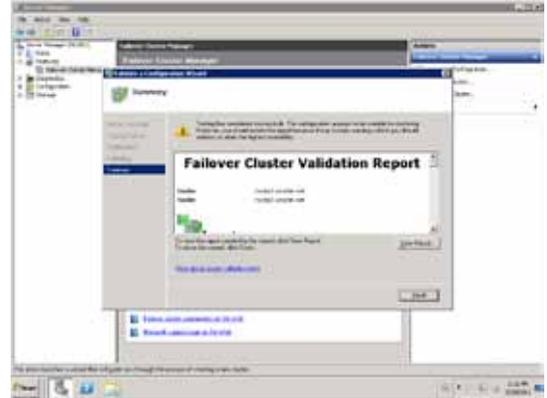
1. Logon to the server with domain administrative credentials.
2. Open the **Control Panel**. Browse to Start -> Control Panel.
3. In the Control Panel click **Network and Internet**.
4. Then click Network and Sharing Center.
5. In one of the previous tasks you configured the available network adapters. Click on the network named Cluster.
6. In the **Cluster Status** window click on **Properties**.
7. Double click the entry Internet Protocol Version 4 (TCP/IPv4).
8. Review the IP Address settings and provide a gateway address if you have not already done so.
 - a. The Failover cluster can only create the cluster if the target network is configured with a gateway, even if no gateway is used on the particular network.
9. Then click **OK** to accept the changes and confirm the warning message by clicking **Yes**.
10. Click **OK** again and then **Close**.
11. Then close the Network and Sharing Center.

Verify the settings on all servers you want to have in the cluster, and make necessary changes as needed.

Create and Configure the Cluster

The next steps can be done on any node that will be part of the cluster.

1. Logon to the node with domain administrative credentials.
2. Open the Server Manager, browse to Start -> Administrative Tools -> Server Manager.
3. In the left pane expand the **Features** node.
4. Click on the **Failover Cluster Manager** node. You now see the Failover Cluster management console.
5. In the **Actions** pane on the right, click **Create a Cluster**.
6. The Create Cluster Wizard opens. Click **Next**.
7. On the **Select Servers** screen enter the FQDN (full qualified domain name, eg. node1.your.domain) of the server you want to have in the cluster, then click **Add**. Repeat this step with all other the servers to be included the cluster.
 - a. Alternatively you can also browse the Active Directory for computers. Clicking on **Browse** opens the **Select Computers** panel. Enter the server names, then click **Check Names** for verification, or use the **Advanced** button to search for servers that meet specific criteria.
8. Once you have added all servers click **Next**.
9. On the **Validation Warning** screen make sure that the radio button **Yes** is selected to run a validation test before the Cluster is being created. Then click **Next**.
 - a. You should perform the configuration validation test to ensure that all requirements are met for cluster creation and operation.
10. When the **Validate a Configuration Wizard** screen is displayed. Click **Next**.
11. Select **Run all tests** and click **Next**.
12. On the confirmation screen, you can review which servers will be tested and which tests will be performed. Click **Next** to start the configuration validation.
13. Monitor the test progress. It will take some time to complete all tests.
14. When all tests are finished, the **Summary** screen appears. Review the test results in the content pane.
 - a. The Wizard also creates a detailed result report. To review the details click on **View Report**. The report displays in the browser.
15. Click **Finish** to close the validation Wizard.
16. The **Access Point for Administering the Cluster** screen appears. Enter a cluster name in the dedicated field.
 - a. For the RA enter **cluster** as name.
17. Specify the cluster IP addresses for the network used by the cluster.
18. Then click **Next**.
19. Review the settings on the **Confirmation** screen. Then click **Next**.
20. The cluster creation will take some time; please wait for the process to finish.
21. Once the process has finished the **Summary** screen displays. Click **Finish** to close the Create Cluster Wizard.
 - a. There is also a detail report available that was created during the cluster creation. Click the **View Report** button to review the detailed report.
22. In the Failover Cluster Manager expand the node **cluster.your.domain** in the left pane and click on **Networks**.
23. In the content pane you see four networks. Right click the first network **Cluster Network 1** and select **Properties**.
24. Provide a name for the network. Refer to your individual network definitions from Chapter 1.



Enable Cluster Shared Volumes (CSV)

Using Cluster Shared Volumes, multiple virtual machines that are distributed across multiple cluster nodes can access their virtual hard disk (VHD) files at the same time, even if the VHD files are on a single LUN in the storage. Additionally, the clustered VMs can all fail over independently of one another. With CSV's you do not need to create a LUN for each Hyper-V virtual machine.

For the RA we use two Cluster Shared Volumes. CSV1 is used by Node 1 to store the VMs, while Node 2 uses CSV2.

1. Open the Failover Cluster Manager, browse to Start -> Administrative Tools -> Failover Cluster Manager
2. Click on the node **cluster.onsite.net**.
3. In the Actions pane on the right click on Enable Cluster Shared Volumes.
4. In the message popup confirm that you have read the notice and click **OK**.
 - a. Wait a few seconds, the snap-in console will not be available for a short time. A small one-way icon appears on the node Failover Cluster Manager.
 - b. When CSV enabling is done you see a new node Cluster Shared Volumes.
5. In the left pane, click on the node **Cluster Shared Volumes**.
6. Then click on **Add storage** in the **Actions** pane, the Add Storage window appears.
 - a. All cluster disks are listed, except the quorum disk.
7. Expand the node Cluster Disk 2 (CSV1) to view details of the corresponding disk.
8. Select the checkbox to use the disk as a CSV.
9. Do the same for Disk 3 (CSV2) to use it also as a CSV.
10. Then click **OK**.
 - a. The selected disk(s) will now be changed to Cluster Shared Volumes.
 - b. The previously assigned drive letter(s) will be removed.
 - c. During the change process a new folder "ClusterStorage" on the system drive (C:) is created.
 - d. Each cluster storage disk will have its own folder representation in this folder;
For example: Storage Disk 2, previously drive letter R, will now be accessible via C:\ClusterStorage\Volume1 on all nodes in the cluster. Storage Disk 3, previously drive letter S, will now be accessible via C:\ClusterStorage\Volume2 on all nodes in the cluster.
11. In the Failover Cluster Manager click on the node Cluster Shared Volumes. The disk(s) added now list in the content pane.
12. Expand the cluster disk nodes in the content pane to review details, such as folder location, File system, and free space.

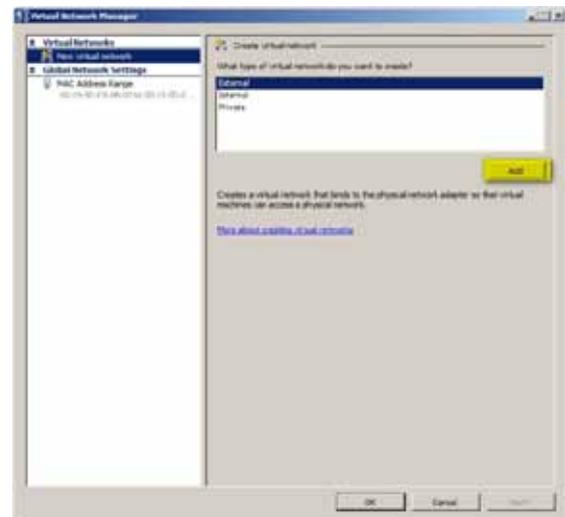
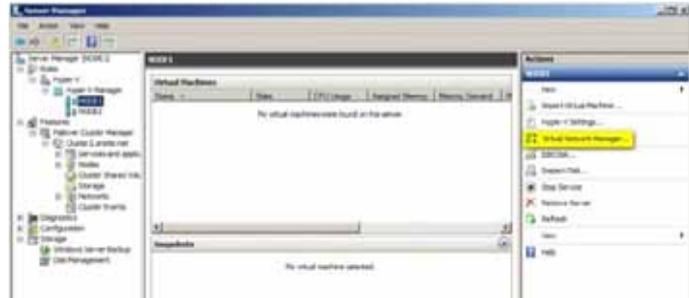
Configure Hyper-V

The Hyper-V role, which was already installed in a previous step, provides the software infrastructure and core management tools with which virtual machines can be created and managed. In combination with the Failover Clustering feature, you are able to provide highly available virtual machines. With the release of Service Pack 1 for Windows Server 2008 R2 VMs can be configured to use dynamic memory allocation.

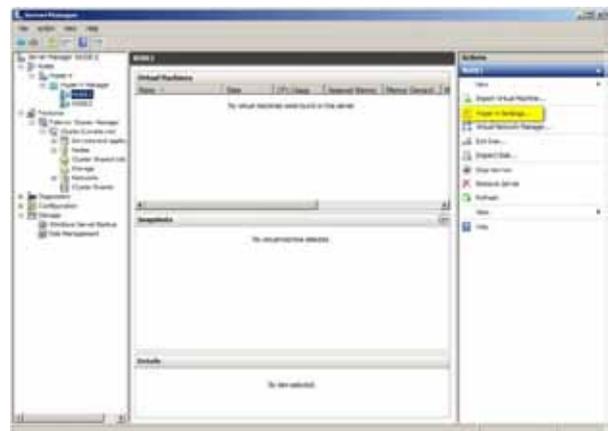
Note: you may have noticed that the installation order for Windows Server 2008 R2 differs from Windows Server 2012. This is intentional and related to differences in NIC teaming procedures for the two versions of the operating system. At this point in the Windows Server 2008 R2 installation, we have already enabled the Hyper-V role.

The following steps must be performed on all nodes in the cluster that will host virtual machines.

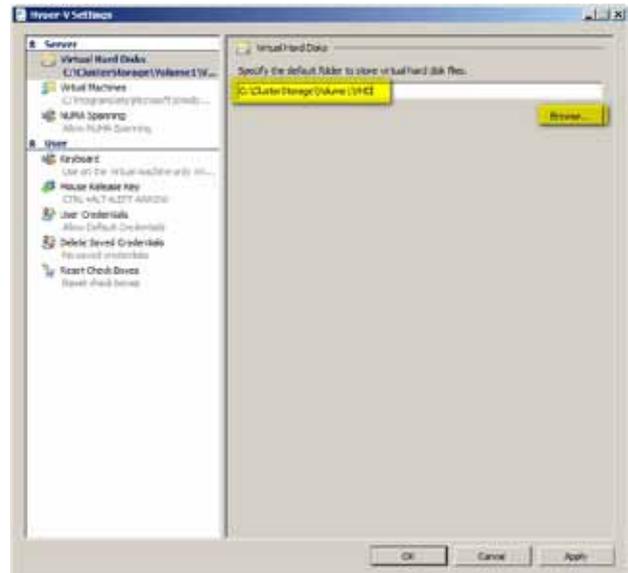
1. Logon to the first node using domain administrative credentials.
2. Open the **Server Manager**, browse to Start -> Administrative Tools -> Server Manager.
3. In the left pane click on **Roles**.
4. Then click on **Hyper-V Manager**, the Hyper-V Manager appears.
5. In the Hyper-V Manager window, click **Virtual Switch Configuration**.
6. Select **add** new virtual Network.
7. Rename the new virtual Network to **Production Virtual Network** and select the **Production Team** in the drop down box. Select **OK**. Select **OK** again on the warning window.



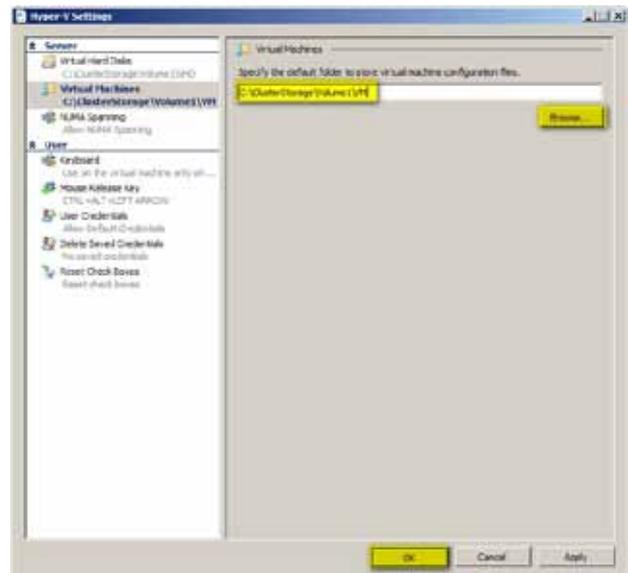
8. On the Hyper-V manager screen, click **Hyper-V settings**.



- To specify the Cluster shared Volume as the default location for the virtual hard disk files, select Virtual Hard Disks and browse to C:\ClusterStorage\. For Node 1 select C:\ClusterStorage\Volume1\VHD and click **Apply**. Use C:\ClusterStorage\Volume2\VHD for Node 2.



- To specify the Cluster shared Volume as the default location for the virtual machine configuration files, select Virtual Machines and browse to C:\ClusterStorage\. For Node 1 select C:\ClusterStorage\Volume2\VM Click **OK**. Use C:\ClusterStorage\Volume2\VM for Node 2.



Create and test highly available Virtual Machines

You will now create a virtual machine and make it highly available using the Hyper-V manager and the Failover Cluster Manager.

- Logon to a cluster node using domain administrative credentials.
- Have a Windows Server 2008 R2 ISO image available.
- Open the **Hyper-V Manager**, browse to Start -> Administrative Tools -> Hyper-V Manager.
- Confirm the UAC warning message, click **Yes**.
- Once the Hyper-V manager has loaded, click on **New** in the **Actions** pane and select **Virtual Machine**.
- On the **New Virtual Machine Wizard**, click **Next**.
- Provide a name for the virtual machine, for example HA-VM1.
- Then click **Next**.
- Leave the default memory at **512 MB** and click **Next**.
 - When creating a virtual machine with the Hyper-V manager, the specified memory will be configured as static. Once the VM has been created you can change the memory using Dynamic Memory allocation.
- On the **Configure Network** screen select the **Production virtual Network** virtual network, click **Next**.

11. If a VM should become highly available, the VHD must reside on a shared storage location. Per default Hyper-V uses the given name (Step 6) for naming the virtual hard disk file. Leave the default settings (name provided and disk size 127 GB) and ensure that the VHD will be placed on **C:\ClusterStorage\Volume1\Virtual Hard Disks**.
12. Click **Next**.
13. On the Installation Options select Install an operating system from a boot CD/DVD-ROM.
14. In the box **Media** click on **Browse** and locate the Windows 2008 R2 ISO image.
15. Click **Next**.
16. Review the summary and click **Finish** to start creating the virtual machine.
17. In the content pane of the Hyper-V Manager you see the newly created virtual machine.
 - a. Note that the VM is in Off state. This enables you to make changes to the VM, such as Dynamic Memory, virtual hard disk size, etc.
18. Select the virtual machine **HA-VM1** and click on **Settings** in the Actions pane underneath the section HA-VM1, or right click the VM and select Settings.
19. On the Settings for HA-VM1 click on **Memory**.
20. Select the option **Dynamic** and set the **Startup RAM** to 512 MB and the **Maximum RAM** to 2048 MB.
 - a. Hyper-V based VMs in a Windows Server 2008 R2 environment can be equipped with up to 64 GB of memory. Please note that the physical host server must have at least the maximum amount of physical memory.
21. Click on Hard Drive underneath IDE Controller 0.
22. Click on **Edit**. Check the available action options Compact, Convert and Expand. Select **Convert** to change the VHD file to a fixed size. Click **Next** and **Finish**.
 - a. By default, Hyper-V creates dynamically expanding virtual hard disk. This type of virtual hard disk uses the space on the storage as needed, and grows up to the maximum size specified.
 - b. In a production environment it is strongly recommended to use fixed virtual hard disks, which reserve the entire hard disk space needed on the storage. When using dynamically expanding VHDs, VMs may stop if the shared storage volume becomes full and the VHD can no longer expand.
23. Then click on **Network Adapter**. Ensure that the Network adapter is connected to the virtual network named **Production Virtual Network**.
24. Click **OK** to accept the changes.
 - a. Options that were changed can be easily identified by the blue bold text in the left pane.
25. Right click the virtual machine **HV-VM1** and select **Connect**.
26. In the Virtual Machine Connection window click the power on button.
27. Install Windows Server 2008 R2.

Configure Networking of the Virtual Machine

When the installation has finished, you need to configure the networking of the virtual machine, if there is no DHCP server on the production network available.

1. Assuming the Virtual Machine Connection viewer is still open, and the installation is finished, provide a password and wait for the desktop to load.
2. After the login the **Initial Configuration Tasks** window appears.
3. Click on Configure networking.
4. In the **Network Connections** window right click the network **Local Area Connection** and select **Properties**.
5. Double click Internet Protocol Version 4 (TCP/IPv4).
6. Select **Use your IP settings** and enter an IP Address for the production network.
7. Click **OK** (twice) to save the changes.
8. Minimize the virtual machine viewer.
9. On the host you can see the VM is running, its current CPU utilization and memory consumption.
10. Open a command prompt and ping the IP address you have assigned to the VM.
 - a. If you don't get a reply, disable the Windows Firewall inside the virtual machine.

11. In the next steps you will make the virtual machine highly available. In order to proceed shutdown the virtual machine, by
 - a. Either using the Hyper-V Manager, there right click the VM and select Shutdown
 - b. Or selecting Shutdown inside the virtual machine.

Create a Virtual Machine Using the Failover Cluster Manager

Once you have ensured that the VM can be contacted from one of the cluster nodes, you will now make this virtual machine highly available. Make sure that the VM(s) you want to make highly available is (are) all in an off state. If not, shut them down.

1. Open the **Failover Cluster Manager** on the VM host you are logged on to.
2. In the left pane, expand the **cluster node** and click on **Services and applications**.
3. Then click on Configure a Service or Application... in the Actions pane on the right.
4. The High Availability Wizard appears, click **Next**.
5. On the Select Service or Application screen scroll down and select Virtual Machine.
6. Click **Next**.

- a. The cluster will now be queried for any virtual machines. Please note that even virtual machines are listed which may not be made highly available, for example, if VHD is stored locally on a host. But you will be notified later, if a VM is not ready for HA.

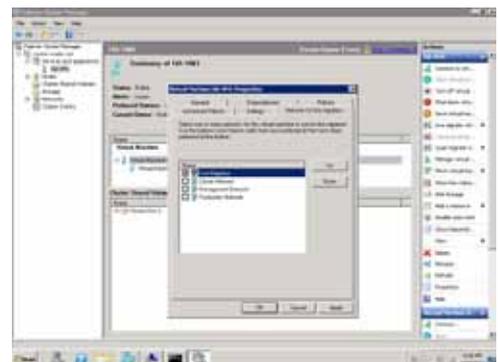
7. Select the virtual machine **HA-VM1** and click **Next**.
8. On the **Confirmation** screen click **Next**. The necessary configuration will now be done.
9. When the **Summary** screen shows, click Finish.
 - a. A detail report will be created. Click on View Report to view the report.



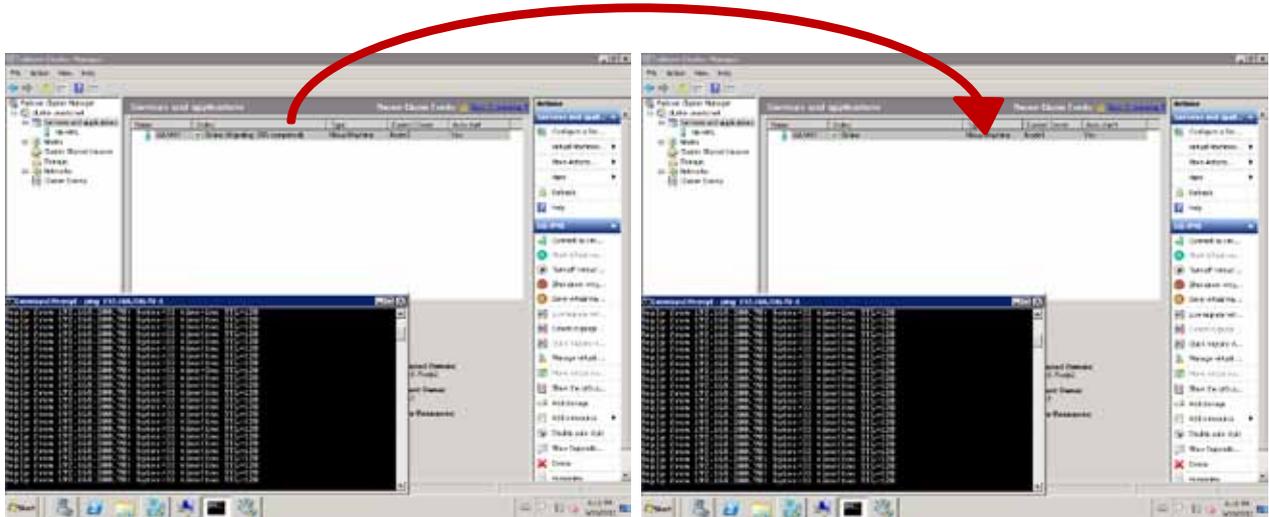
10. The HA virtual machines now appear in the list of **Services and applications**.
11. Since the VM was shut down the status indicates Offline. Certain VM tasks can be performed through the Failover Manager, such as start, shutdown.
12. Right click the virtual machine **HA-VM1** and select **Start virtual machines**.

Specify Live Migration Network and Test High Availability of the VM

1. In the Failover Cluster Manager expand the Service and applications node.
2. Select the VM **HA-VM1**.
3. In the center pane, right click the resource **Virtual Machine HA-VM1** and select **Properties**.
4. In the Properties window click on the tab Network for live migration.
5. Select only the network named **LMManage** and move to the top of the list. Disable all other networks.
 - a. Although you specify a network for live migration for a specific virtual machine, the setting is global and applies to all virtual machines.
 - b. If you have more than one cluster network listed, change the priority order to avoid having live migration and Cluster Shared Volumes use the same network.
6. Click **OK** to save the changes.
7. Assuming the command prompt is still opened, submit a continuous ping to the virtual machine. or connect to another cluster node and submit the ping from there.
8. Return to the Failover Cluster Manager.



9. Click on **Services and applications**, **not** the HA-VM1 node underneath.
10. In the center pane you should see the Services and applications list. The HA-VM1 is online and the current owner is Node 1.
11. Right click the virtual machine **HA-VM1** and select **1—Live migrate to node Node 2**.
12. Monitor the migration progress in the Failover Cluster Manager. You should notice that the ping continues receiving replies from the virtual machine.



Cloud Management using Microsoft System Center

In order to build a fully featured private cloud using the HP Departmental Private Cloud Reference Architecture, many organizations will choose to implement Microsoft System Center. System Center provides all of the functionality necessary to design, deploy and manage cloud services. While this section does not provide specific installation instructions, it does outline System Center capabilities for organizations that may want to consider a System Center deployment.

HP recommends dedicating a management server outside of the HP Departmental Cloud 2-node cluster to host any elements of Microsoft System Center that the customer may choose to deploy.

Note: Microsoft System Center 2012 SP1 is required to manage Windows Server 2012 environments. For more information about System Center 2012 SP1, please contact your Microsoft sales specialist.

System Center 2012—Overview

Microsoft System Center 2012 solutions can help to capture and aggregate knowledge about the infrastructure, policies, processes, and best practices so that the IT staff can build manageable systems and automate operations. With the components included, Microsoft provides a comprehensive management environment from desktop and devices to the data center and the implementation of public and private clouds.



The family of System Center solutions consists of:

App Controller provides a unified console that helps to manage public and private clouds, as well as cloud based virtual machines and services.

Configurations Manager provides a comprehensive solution for change and configuration management for the Microsoft Platform. It allows administrators to deploy and configure operating systems, software applications and software updates; and enables monitoring and remediation of computers for compliance settings.

Data Protection Manager is a backup and recovery solution for Microsoft workloads. It provides protection for Files and Folders, SQL Server, Exchange Server, Virtual Machine Manager, Hyper-V, SharePoint and client computers.

Endpoint Protection is an anti-malware and security solution for the Microsoft platform.

Operations Manager provides a flexible management and monitoring solution for the IT infrastructure. It helps to ensure predictable performance and availability of vital applications and services and offers comprehensive monitoring for the data center and the cloud, private or public.

Orchestrator provides orchestration, integration and automation of IT processes through the creation of runbooks, which enable administrators to define and standardize best practices and improve operational efficiency.

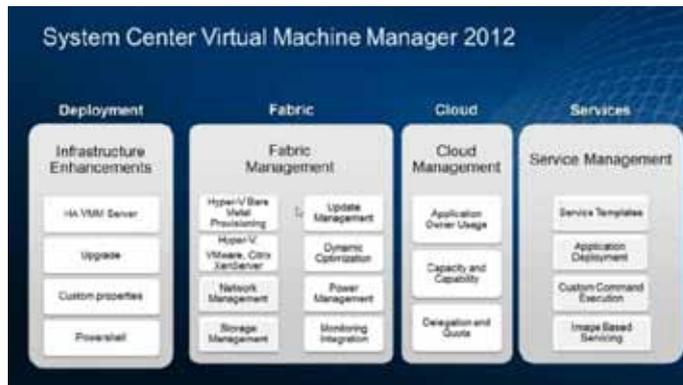
Service Manager is an integrated platform for automating and adapting IT service management best practices, such as Information Technology Infrastructure Library (ITIL) and Microsoft Operations Framework (MOF). It also includes a built-in process for incident and problem resolution, change control and asset lifecycle management.

Virtual Machine Manager (VMM) is the management solution for the virtualized data center. It enables administrators to manage virtual hosts, networking and storage resources and to design and deploy virtualized IT services to private cloud infrastructure created with VMM.

Unified Installer is a tool that enables a single user-interface for the installation of seven System Center 2012 components. It provides a means of distributed installation from a central point using the existing setup program of each component.

System Center 2012—Virtual Machine Manager

System Center VMM is the tool systems administrators will use create and management Hyper-V virtual machines and to design and deploy virtualized IT services. System Center VMM has evolved significantly with the System Center 2012 release and its focus has grown from simply creating and managing virtual machines to designing and deploying complete IT services, including underlying physical hardware. The capabilities of SCVMM 2012 focus on four pillars:



Infrastructure Enhancements—System Center Virtual Machine Manager is the focal point for managing virtualized data centers. With System Center 2012, the VMM server can be deployed in a clustered environment, and users can interact with SC VMM using PowerShell to facilitate the incorporation of VMM functionality into larger workflows.

Fabric Management—With SCVMM 2012 you can manage multiple hypervisors, such as Hyper-V, VMware and Citrix Xen. System Center VMM also supports deploying a Hyper-V host on bare metal through a simple installation Wizard, and with SCVMM 2012 you can create a Hyper-V cluster from the SCVMM console. Network management has been enhanced with integrated load balancing. In addition, it is possible to assign IP and MAC addresses from pools as well as create, present and format LUNs hosted in SMI-S compliant arrays.

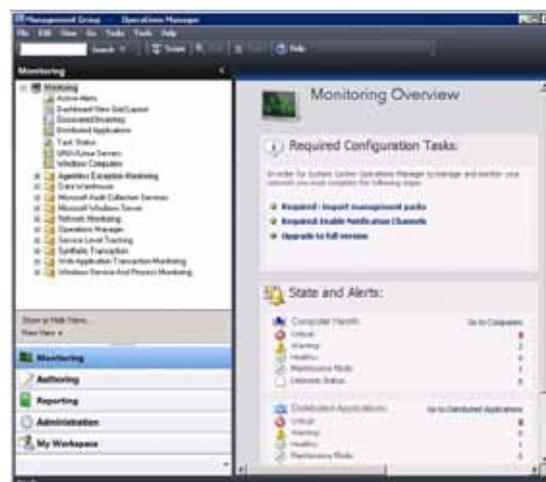
Cloud Management—The most important new feature in SCVMM is the support for Cloud Management. SCVMM enables administrators to abstract server, network and storage resources into private clouds. In addition you can delegate access to private clouds with control of capacity, capabilities and user quotas. Application administrators can author, deploy, manage and decommission applications in the private cloud.

Service Management—A Service is the deployed instance of a collection of virtual machines with applications, OS roles and features that work together for providing a Service to the end customers (e.g. any Web-based application with a database back end, where different parts of the application are installed in multiple machines). Service definition in VMM 2012 includes machine definition as well as the applications. VMM can deploy MSDeploy packages that contain IIS website definitions, Server App-V packages that contain Virtualized Applications and SQL Server DAC packages that contain database definitions. Service Templates contain the definitions for machines, their connectivity, application definitions etc., and are the starting point for a VM or a service.

System Center 2012—Operations Manager

System Center 2012 Operations Manager is the solution component that helps IT administrators monitor services, devices and operations for many computers from a single console. Businesses of any scale depend on the services and applications provided by their computing environment. It is the IT departments' responsibility to ensure high performance and uninterrupted availability of critical services and applications. IT departments need to know when there are problems, identify and locate the problems, and isolate the root cause of these problems.

Using Operations Manager eases monitoring of multiple computers, devices, services and applications. The Operations Manager console enables IT administrators to check for health, performance and availability for all monitored objects in the environment and helps to identify and resolve problems.



System Center Operations Manager Management Packs

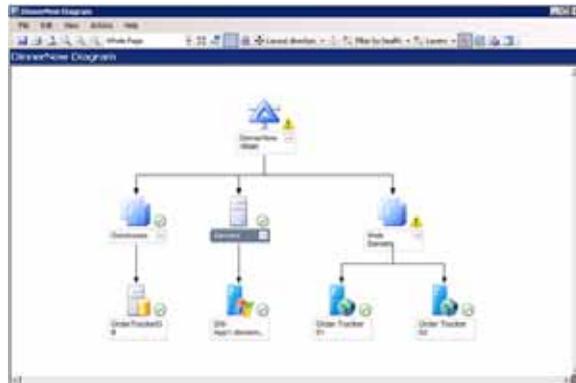
Management packs define the information the System Center Operations Manager agents collect and return to the management server. It defines the types of objects, such as applications and features that will be monitored on computers that were discovered by Operations Manager.

Discovered objects have a health state which is reflected in the Operations console. For easy identification of the health state, a green icon represents a healthy state, a yellow represents a warning state and a red icon indicates a critical state of an object. For example the HP ProLiant Server and BladeSystem and the HP ProLiant PRO Management Packs, detect a fan failure which alerts a critical state. If the faulty server is a VM host, it could trigger a PRO tip which evacuates running virtual machine to another host, before the server goes down completely.

Integrating System Center Virtual Machine Manager and Operations Manager to Enable PRO

Integrating System Center Operation Manager into System Center Virtual Machine Manager enables monitoring of state and availability of the managed virtual machines and their hosts. In addition SCOM also monitors the VMM servers and the components VMM-Database servers, VMM Library servers and Self-Service portal web servers. Although VMM 2012 has an integrated dynamic optimization and power optimization feature, enabling PRO extends these features with hardware monitoring and helps IT administrators to proactively react to hardware failures, for example a system fan failure of a physical host. The PRO feature is only available with SCOM integration into SCVMM.

Another benefit of integrating VMM and Operations Manager is that VMM can keep the service model of a deployed service in the cloud up to date in SCOM, including dynamically updating the service diagram due to scale out (for example, add a SQL server to load balanced SQL tier) or scale in (for example, remove a business logic server from a load balanced middle tier), as well as display the health of the virtual machines, tiers and the overall service in SCOM.



Integrating HP Insight Control for System Center

By integrating the server management features of HP ProLiant and HP BladeSystem into Microsoft System Center consoles, administrators can gain greater control of their technology environments. This provides consistency for software deployment and updates and enables a faster response in the event of server failure, reducing the risk of downtime. The HP Insight Control for Microsoft System Center contains server different integration kits and features. Each of them has its own installation requirements and procedures.

To begin the installation for integrating with SCOM and SCVMM of the HP Control for Microsoft System Center, follow these steps:

SCOM Integration:

1. Insert the DVD
 - a. If the installer does not start automatically, run the Autorun.exe from the DVD.
2. On the **Install** tab click **Install**.
3. From the Installation dialog box choose HP SCOM Management Packs
4. Follow the instructions on the installer screen.

SCVMM Integration:

1. Insert the DVD
 - a. If the installer does not start automatically, run the Autorun.exe from the DVD.
2. On the **Install** tab click **Install**.
3. From the Installation dialog box choose HP SCVMM 2012 Integration Kit
4. Follow the instructions on the installer screen.

Enable the PRO Feature

The PRO Feature requires the integration of System Center Virtual Machine Manager and System Center Operations Manager. To enable response to critical errors reported by HP ProLiant Server used as VM hosts, follow these steps to enable the PRO feature:

1. Open the **Operations Manager** console and verify that the **HP ProLiant PRO Management Pack** has been added.
2. Open the **VMM console** open the **Settings** workspace.
3. In the Settings pane, click System Center Settings.
4. Click on Operations Manager Server.
5. VMM will detect that there is no current integration and will walk you through a simple Wizard to setup the connection.
6. When done click on the **Home** tab in the **Properties** group click **Properties**.
7. In the Details page under Connection Settings, select Enable Performance and Resource Optimization (PRO) and click OK.
8. Return to the **Operations Manager Console** and check if the HP ProLiant VMM hosts appear. It might take up to ten minutes before they appear.
9. To test a PRO tips, click **Test PRO** in the **Operations Manager Settings** dialog box and check the result either in the Jobs workspace in the VMM console or in the Operations console in the Operations Manager.

Conclusion

The move to virtualization and the cloud is inevitable because current IT processes are unsustainable for businesses of all sizes. The HP Departmental Private Cloud Reference Architecture defines best practices and implementation instructions for building a highly available, two-node virtualization or private cloud solution ideally suited for mid-sized businesses and branch office deployments. The reference architecture is built with HP ProLiant DL360e servers, HP P2000 MSA Array System with SAS shared storage, HP E2910 switches, and HP Insight Control management software as well as Microsoft Windows Server 2012, or Windows Server 2008 R2, and Microsoft System Center.

To learn more about the HP Departmental Private Cloud Reference Architecture and other solutions optimized for Windows Server 2012 and Microsoft System Center, visit HP's website at hp.com/learn/ws2012.

Appendix A: Integration of the Reference Architecture into a customer environment

Collecting Information needed from the Customer

When deploying the HP Departmental Private Cloud Reference Architecture, it's critical that you collect the following information:

1. Will the HP Departmental Private Cloud be integrated into an existing infrastructure?
 - a. If yes, collect detailed information about the implementation plan
 - b. Which and how many physical machines will be consolidated?
2. What are the customer specific networking requirements and guidelines?
 - a. Which IP addresses/ranges should be used?
 - b. Should VLANs be configured for the virtual system?
3. What are the customer's guidelines for machine naming?
4. What are the customer's password guidelines?
5. Which tools does your customer already use for management and monitoring?
 - a. Such as Insight Control, System Center Operations Manager,
 - b. If your customer uses any deployment and configuration tools.
 - c. Such as Windows Deployment Service, System Center Configurations Manager, HP Insight Control, etc.

Below is a table that you can use to collect customer-specific information relevant to the installation and configuration of the HP Departmental Private Cloud RA.

Network	IP Address Range	Network Mask	Gateway	DNS Server	VLAN	Domain
LM/Management						
Cluster/CSV						
Production						
ILO Network						

Device	Device Name	iLO address	Host NIC			User	Password
			Host NIC 1/2	Host NIC 3	Host NIC 4		
			Production	Cluster / CSV	LM / Management		
HP E2910-24G al			-----	-----	-----		
HP E2910-24G al			-----	-----	-----		
DL360e Gen8							
DL360e Gen8							
P2000 SAS MSA			-----	-----	-----		
P2000 SAS MSA			-----	-----	-----		

Appendix B: Reference Architecture Components

Essential Rack HA Components

Hardware Components

HP ProLiant servers

HP ProLiant Gen8 servers are intelligent servers delivering high-quality lifecycle experience with same power and space. Next-generation Intel® Virtualization Technology enables superior virtualization performance, superior scalability, enhanced flexibility, and simplified server management. The ProLiant Servers for the Reference Architecture are DL360e Gen 8 with 2 six core CPUs, 24 GB of Memory, two 146 GB internal disks for the OS, four 1 Gb Ethernet NICs and one Dual Port SAS Controller for the connection to the P2000 SAS Disk Array.

HP P2000 G3 MSA Storage

Affordable, direct-attach, external shared storage solution that provides a more efficient balance of scalability, reliability, and cost efficiency for small to midsize environments. It is designed to be easy to deploy and secure, along with low management costs while driving rapid return on investment (ROI) through efficient storage consolidation. All HP P2000 storage arrays ship standard with 64 snapshots and volume copy enabled for increased data protection. The Reference Architecture comes with twelve 300 GB 10k SAS drives.

HP Networking

Reliable networking for a virtualized environment. HP Networking switches provide superior reliability and proven performance, reduce complexity, and total cost of ownership (TCO), and feature an industry-leading warranty—changing the rules of networking. The HA Smart Bundle uses two HP E2910-24G al switches. These switches have 24 1Gb ports and the possibility to add different Expansion Modules:

- 2-port (two fixed CX4 ports) 10 Gigabit per second Ethernet (10GbE) module.
- 2-port 10GbE SFP+ (Small Form Factor Pluggable) module.
- 1-port 10GbE interconnect module.

Software Components

Windows Server 2008 R2 Hyper-V or Windows Server 2012

The next-generation hypervisor-based server virtualization technology is available as an integral feature of the Windows OS. It enables you to implement server virtualization with ease. Hyper-V R2 or R3 lets you make the best use of your server hardware investments by consolidating multiple server roles as separate virtual machines (VMs) running on a single physical machine. Hyper-V in Windows Server 2012 includes improvements in many areas. The following table lists the most significant functionality changes.

Feature/functionality		Description
Client Hyper-V	New	Create and run VMs using a Windows Desktop OS
Module for Windows PowerShell	New	Use Windows PowerShell cmdlets to create and manage your Hyper-V environment.
Hyper-V Replica	New	Replicate virtual machines between storage systems, clusters, and data centers to provide business continuity and disaster recovery.
Live Migration	Updated	Perform live migrations on non-clustered as well as clustered virtual machines, and perform more than one live migration at the same time.
Significantly increased scale and improved resiliency	Updated	Use significantly larger compute and storage resources than was previously possible. Improved handling of hardware errors increases the resiliency and stability of the virtualization environment.
Storage migration	New	Move the virtual hard disks of running virtual machines to different storage locations without downtime.
Virtual Fibre Channel	New	Connect to Fibre Channel storage from within a guest operating system.
Virtual hard disk format	Updated	Create stable, high-performance virtual hard disks up to 64 terabytes.
Virtual switch	Updated	New capabilities such as network virtualization support for multi-tenancy and extensions that Microsoft partners can provide to add functionality for monitoring, forwarding, and filtering packets.

Refer to the “Windows Server 2012 Hyper-V Component Architecture Poster” for further details.
<http://www.microsoft.com/en-us/download/details.aspx?id=29189>

HP Insight Control

HP Insight Control delivers essential management of HP ProLiant infrastructure that includes server deployment, monitoring, control, power and performance management. HP Insight Control, based on HP Systems Insight Manager (HP SIM), provides a unified, secure and extensible platform to centrally manage servers, storage, and other infrastructure devices across heterogeneous operating system environments. For more information about Insight Control refer to the Insight Control QuickSpecs at http://h18013.www1.hp.com/products/quickspecs/12631_div/12631_div.html .

Note: For all these features you need a separate server which acts as the CMS (Central Management Server) with a SIM/Insight Control installation. The Insight Control Licenses must be registered in the License utility of Insight Control.

As part of Insight Control, you get also the Insight Control remote management (iLO Advanced) license. That enables management features which include remote access to server power control and event logs, virtual media for simple deployment and update of remote servers, high-performance virtual keyboard-virtual-mouse (KVM) for routine and emergency remote administration, and single-server power measurement and regulation.

For more information go to:

<http://h20195.www2.hp.com/V2/GetPDF.aspx/4AA0-0100ENW.pdf>
<http://h18004.www1.hp.com/products/solutions/virtualization/virthyper-v.html>
http://h18013.www1.hp.com/products/quickspecs/12631_div/12631_div.html
http://h18000.www1.hp.com/products/quickspecs/14327_na/14327_na.pdf
http://h18000.www1.hp.com/products/quickspecs/13551_div/13551_div.html
http://h18000.www1.hp.com/products/quickspecs/13280_div/13280_div.PDF

Appendix C: 4 Node Cluster Cabling

Network Cabling

Live Migration/Management Network

	Switch A connected to	Switch B connected to
Port 1	Node A iLO	Switch A Port 2 (Trunk 1)
Port 2	Switch B Port 1 (Trunk 1)	Node B iLO
Port 3	Node A NIC 4	Switch A Port 4 (Trunk 1)
Port 4	Switch B Port 3 (Trunk 1)	Node B NIC 4
Port 5	Node C iLO	P2000 Controller B
Port 6	P2000 Controller A	Node D iLO
Port 7	Node C NIC 4	To customer network
Port 8	To customer network	Node D NIC 4

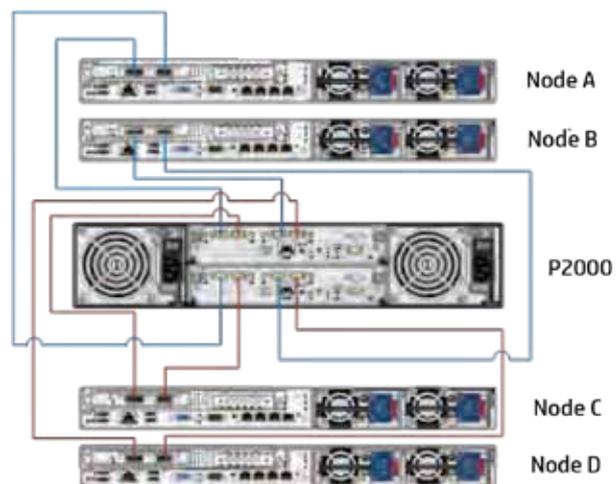
Cluster/CSV Network

	Switch A connected to	Switch B connected to
Port 9	Node A NIC 3	Switch A Port 10 (Trunk 2)
Port 10	Switch B Port 9 (Trunk 2)	Node B NIC 3
Port 11	Node C NIC 3	Switch A Port 12 (Trunk 2)
Port 12	Switch B Port 11 (Trunk 2)	Node D NIC 3

Production Network

	Switch A connected to	Switch B connected to
Port 13	Node A NIC 2	Switch A Port 14 (Trunk 3)
Port 14	Switch B Port 13 (Trunk 3)	Node A NIC 1
Port 15	Node B NIC 2	Switch A Port 16 (Trunk 3)
Port 16	Switch B Port 15 (Trunk 3)	Node B NIC 1
Port 17	Node C NIC 2	To customer network
Port 18	To customer network	Node C NIC 1
Port 19	Node D NIC 2	To customer network
Port 20	To customer network	Node D NIC 1
21–24	To customer network	To customer network

Storage Cabling



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