HP reference configuration for virtualization: HP ProLiant c-Class half-height servers and VMware Infrastructure 3

Executive summary

Virtualization has rapidly changed from an emerging technology to a data center stalwart capable of hosting mission-critical applications and providing levels of redundancy and recovery that were once impossible or cost prohibitive with industry standard platforms. This document graphically represents an enterprise reference configuration for HP BladeSystem c-Class running VMware Infrastructure 3 in the most redundant, rapidly recoverable and highly available configuration. Solutions utilizing HP BladeSystem c-Class can be sized to match any environment.

Target audience: This paper is targeted at data center administrators, infrastructure planners and system/solution architects. An understanding of the function of virtualization is necessary. For an excellent overview of the practice of implementing VMware Infrastructure 3 into a data center environment, read the Planning, Deployment and Operations guides on HP's VMware alliance solutions site at http://www.hp.com/go/VMware .

Reference configuration

HP BladeSystem c-Class features both full- and half-height blades. This paper discusses and diagrams deployment of half-height blade servers in an architecture that follows industry best practices for strict enterprise level data and network redundancy.

Half-height blade servers

HP recommends that a c-Class BladeSystem implementation for VMware Infrastructure 3 on half-height ProLiant c-Class blade servers utilize the components diagrammed in Figures 1-3 and in the bill of materials (BOM) listed later in this document. As with the ProLiant full-height blade servers, the half-height ProLiant BL460c and BL465c servers are excellent platforms for virtualization, offering an integrated, easily managed infrastructure that responds to change and saves money on management, power and cooling.

The ProLiant BL460c and BL465c servers double the amount of computing capacity in the same space versus full-height blades while keeping the same flexibility, power management and system control. With hot-plug hard drives, large memory capacity, multiple expansion slots and the latest generation processors, the ProLiant BL460c and BL465c are optimal choices for virtual infrastructure.

Why blades?

The new HP BladeSystem delivers a best-run IT infrastructure out of the box – unifying server, storage, network, power/cooling and management capabilities to create unlimited possibilities for IT and business.

Cost savvy

HP BladeSystem features a consolidated design that is both more affordable to buy and more efficient to own than conventional infrastructure. Operations are streamlined through standardized components and management interfaces, yielding long term efficiencies unattainable with scattered systems. By pooling and sharing power, cooling, and network; and eliminating the need for other components, the HP BladeSystem can measurably reduce acquisition costs and increase utilization.

Change-ready

HP BladeSystem brings agility to IT. Blade servers, storage, and other modular components can be easily added or removed without having to power down making it easier for IT to respond to business requirements. HP BladeSystem c-Class is an efficiently designed and integrated system that makes the most of every square inch and that can be setup or reconfigured easily. HP provides a common and intuitive interface to monitor and control all HP BladeSystem resources—server, storage, network, power and cooling.

Energy thrifty

HP BladeSystem offers one screen to see and understand the power consumption, heat output, and cooling capacity of your HP BladeSystem environment. The Onboard Administrator monitors the infrastructure, advises repairs, and warns of impending power and cooling issues. Among the many features that make HP BladeSystem the ideal choice for energy conscious environments:

- Cooling-optimized enclosure and blades—Redundant and scalable, HP PARSEC cooling architecture dissipates heat quickly, with lower CFM levels needed, in any configuration, enabling denser configurations.
- HP Active Cool Fans—Patented fans, designed to create tropical-storm winds, automatically deliver required cooling to match changing demands and environmental conditions at power levels far lower than traditional fans.
- HP Modular Cooling System—When added to an HP BladeSystem, this water-cooled rack technology triples the cooling capacity of a standard rack without increasing the heat load of your data center.
- Dynamic Power Saver—Automatically shifts power load for maximum power supply efficiency and reliability.
- Power/Thermal Regulator—Preset power and thermal thresholds ensure that your environment will self-regulate to maintain acceptable consumption output and thermal conditions.
- Future-proof power strategy—Power supplies designed in concert with Intel® and AMD™ processor roadmaps keep pace with the evolution of your computing environment.

Time-smart

If you are connected, HP BladeSystem offers total resource control from anywhere at any time. Simplified provisioning and management in a virtual environment mean transparency when moving server resources between physical and virtual machines. The consolidated nature of HP BladeSystem allows you to make the most of your IT resources. Use HP BladeSystem to centralize your most knowledgeable IT staff, giving them the ability to quickly leverage each other and to monitor, manage and control remote sites from one location.

Why half-height server blades

HP c-Class half-height server blades meet all requirements for data center redundancy in a small, easily expandable platform with capacity for large memory and hot-plug hard drives.

Networking requirements

The half-height blades support up to 6 network interfaces while maintaining dual-port fibre channel connectivity to SAN. No other blade in the industry of this form factor can meet these requirements.

SAN connection

A single fibre channel host bus adapter (HBA) with two ports is acceptable in most environments, which makes SAN connectivity a minor decision point for choosing a blade. Redundant connections to fibre are available in every HP c-Class half-height blade server.

Processor

The HP ProLiant c-Class blade servers feature the latest generation processors including the Intel Xeon® 5000 and 5100 series and AMD Opteron™ 2000 series.

Density

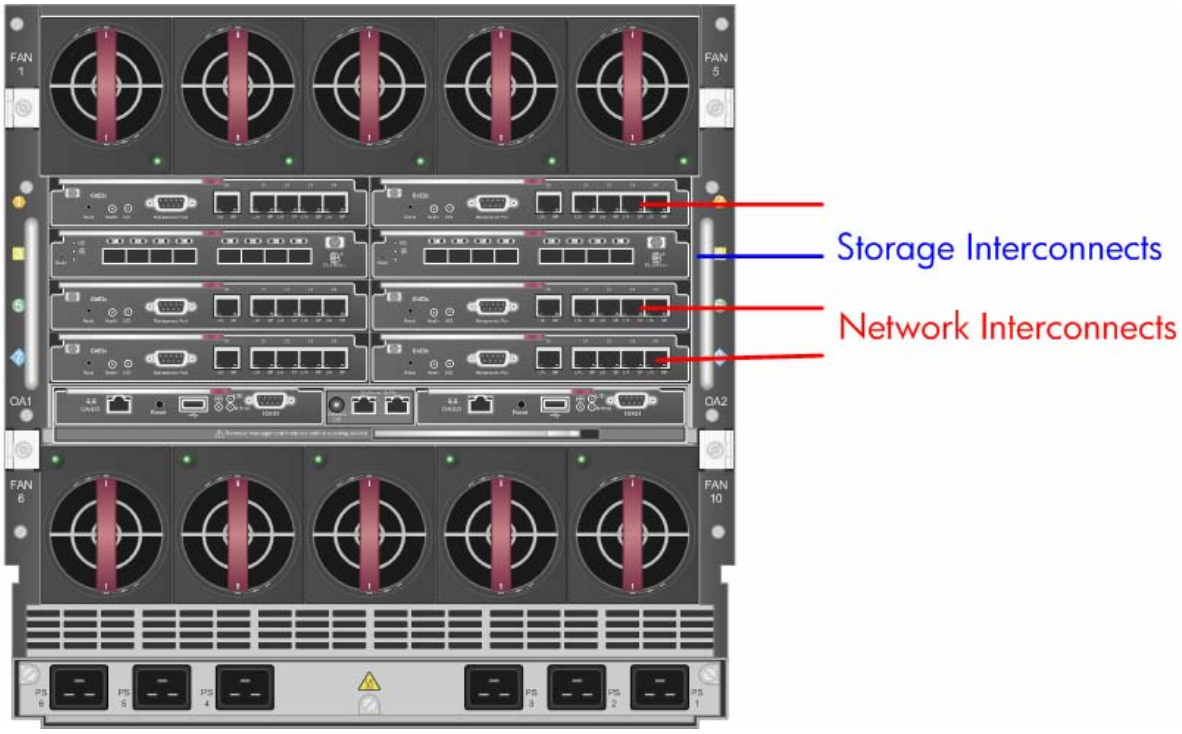
In order to optimize floor space, power efficiency and cooling, half-height blades are an outstanding choice. With no loss in functionality versus a full-height blade and the ability to spread infrastructure costs out over more servers, the half-height blades are an excellent choice for dense environments where power and floor space are at a premium.

Enclosure configuration

This reference configuration recommends the NC325m 4-port network adapter for the ProLiant BL460c or BL465c servers. This adapter allows for 6 individual gigabit network ports. As such, the enclosure should be outfitted with a minimum of 3 network uplinks and a total of 6 network uplinks for redundancy. These network uplinks should be placed in switch slots 1, 5 and 7 in a non-redundant configuration and in slots 1, 2, 5, 6, 7 and 8 for full redundancy.

A fibre channel uplink is required in switch slot 3 for a non-redundant configuration and in slots 3 and 4 for full redundancy. The latter configuration allows for a redundant 4Gb fibre channel connection from each blade within the enclosure. When switches are used internally, the need for external fibre channel switching is greatly reduced, saving costs and reducing cable failure risks and complexity.

Figure 1. HP BladeSystem c7000 enclosure rear-view network, storage and cooling configured to run VMware Infrastructure 3 for this reference configuration



For maximum redundancy at the enclosure level you should configure power supplies for N+N redundancy and utilize at least the minimum number of fans required for redundancy. The enclosure's Onboard Administrator will make recommendations for placement and number of fans based on the number of servers configured and their location within the enclosure.

Note

When more than two power supplies are present, you should configure the enclosure to allow Dynamic Power Savings mode. Dynamic Power Savings is on by default and will insure the most efficient use of power within the enclosure regardless of the number of servers. Dynamic Power Saver can turn power supplies off when they are not needed and increase the utilization of remaining power supplies to reduce wasted power and curb power costs.

The ability to monitor power consumption and plan for resource growth is built into every HP BladeSystem. To learn more about how HP BladeSystem is improving the landscape for power and cooling, see the Control power and cooling for data center efficiency guide at http://h71028.www7.hp.com/ERC/downloads/4AA0-5820ENW.pdf.

Figure 2. HP c7000 enclosure (front-view) with power configured to run VMware Infrastructure 3 for this reference configuration

Figure 3. This graphic shows a redundant network configuration for the suggested reference configuration, including virtual switches. Consult Appendix A of this document to determine your network mapping.

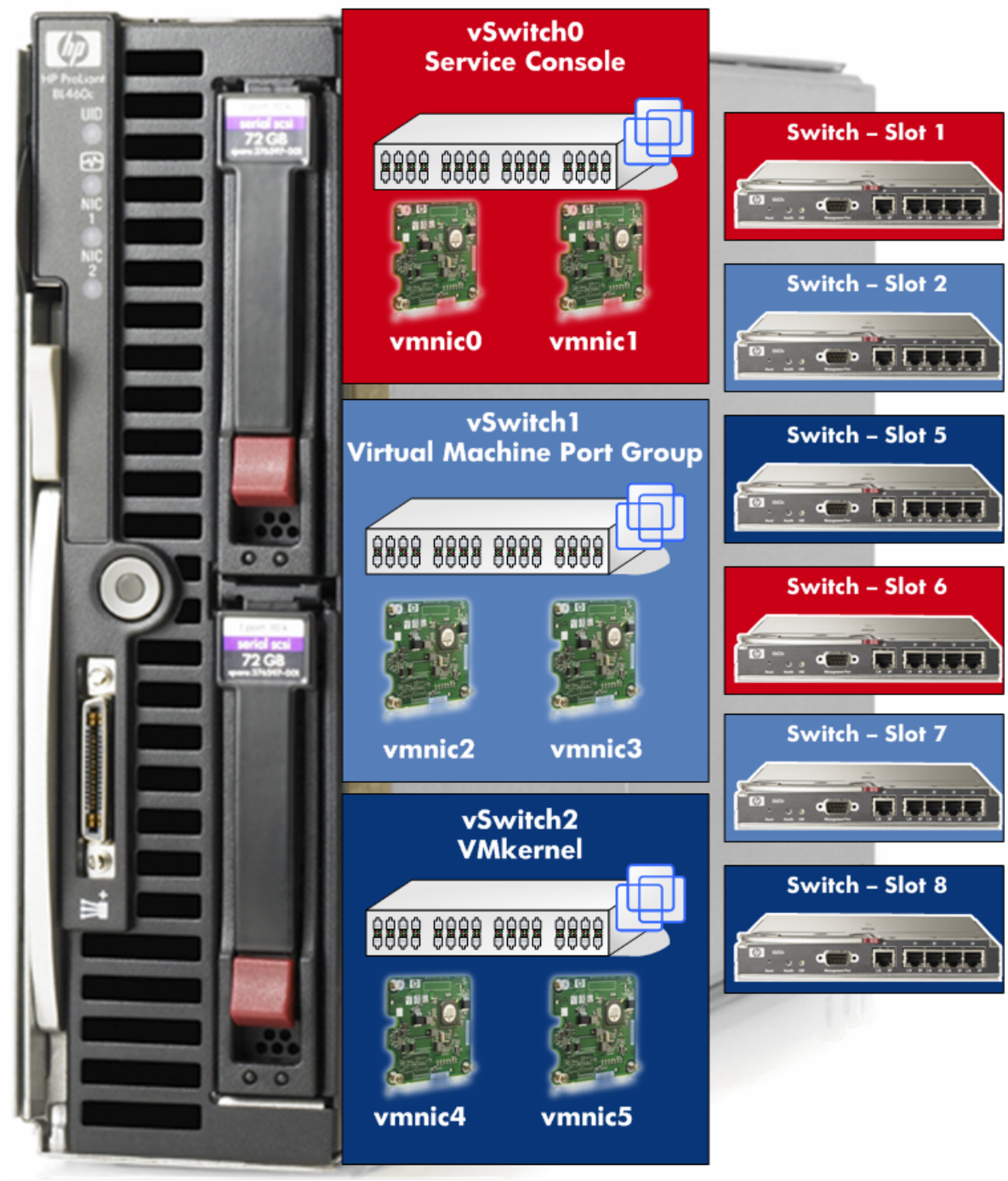


Figure 4. HP Onboard Administrator demonstrating the port mapping of a single BL460c with an HP NC325m mezzanine card running VMware ESX Server.

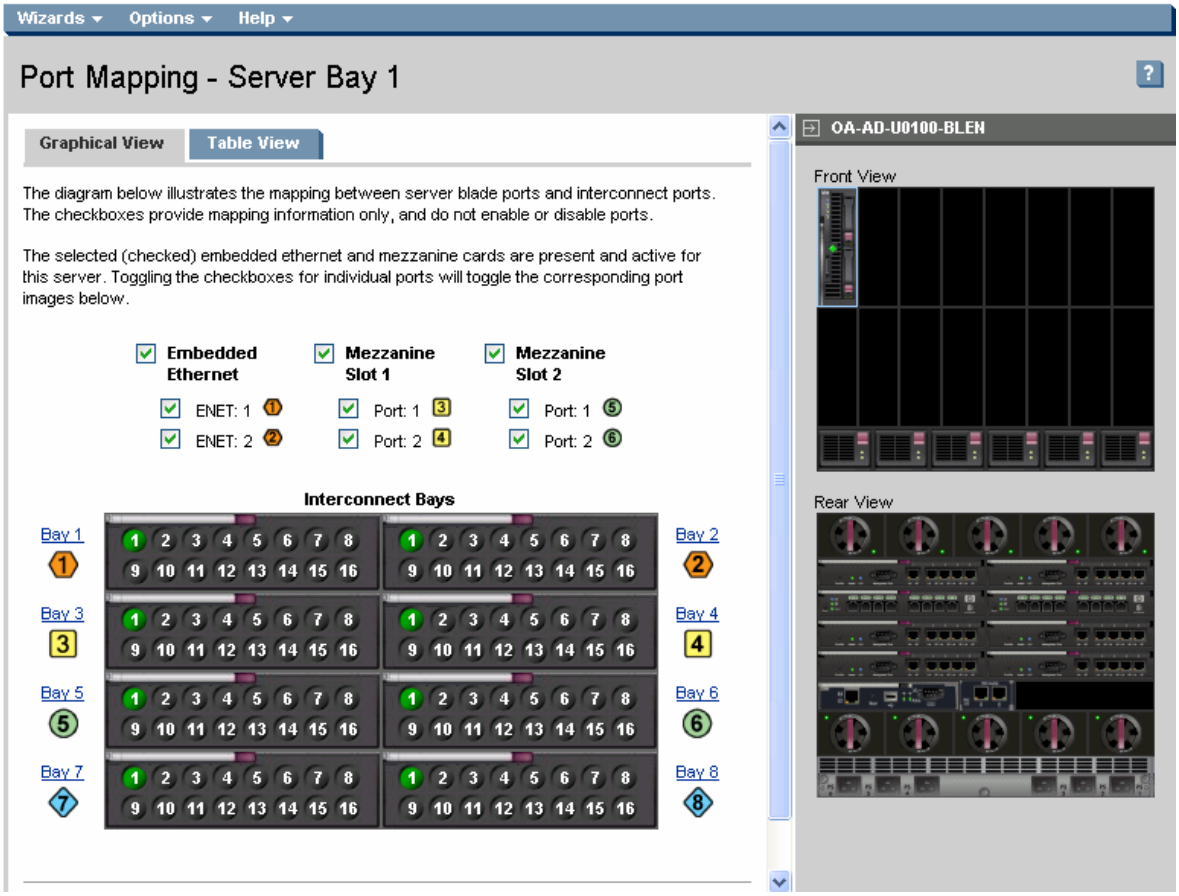
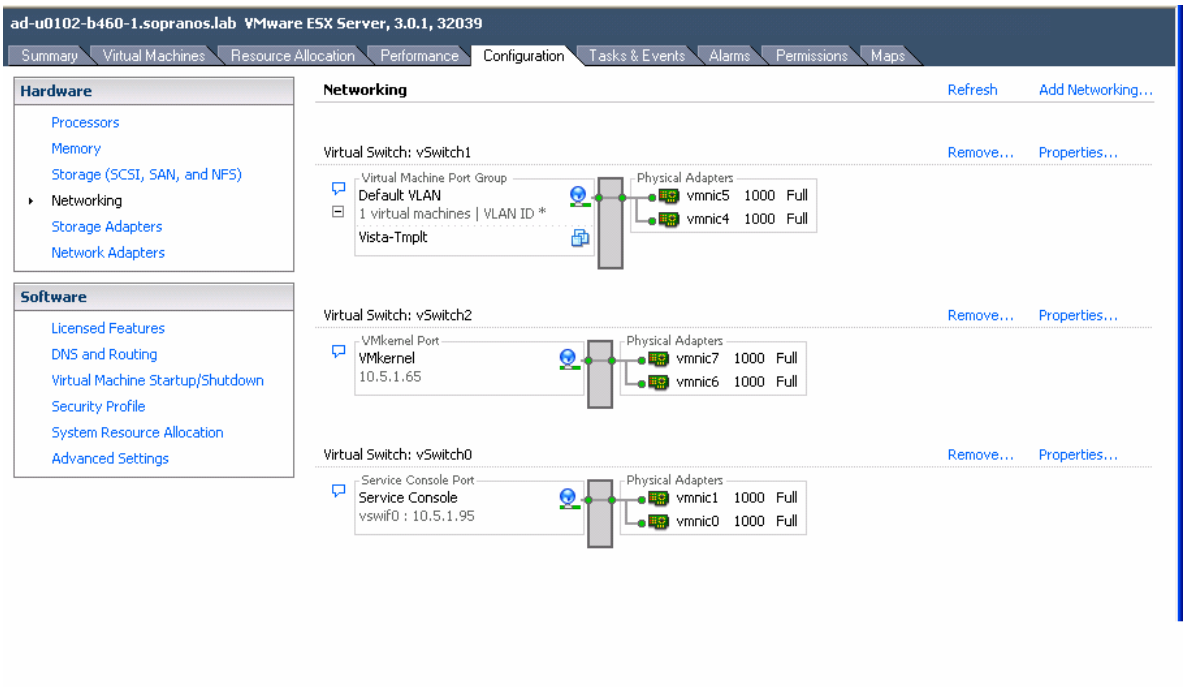


Figure 5. This is the same configuration as Figure 4 as viewed from within VMware VirtualCenter 2. Three virtual switches exist and have network adapters teamed for maximum redundancy at the VMkernel, console and virtual machine network layers. See Appendix A for instructions on determining correct adapter layout.



Server configuration

Each half-height c-Class blade should be configured as follows. Figure 6 highlights component and OS recommendations.

2 Dual-Core Intel Xeon 5000 or 5100 series or 2 Dual-Core AMD Opteron™ 2000 series processors

12 – 32 GB or memory based on planned application load

2 small form factor hot-plug SAS hard disk drives configured for redundancy (36GB or 72GB)

2 onboard gigabit Ethernet adapters (standard)

1 dual-port 4Gb fibre channel host bus adapter (QLogic or Emulex) in mezzanine slot 1

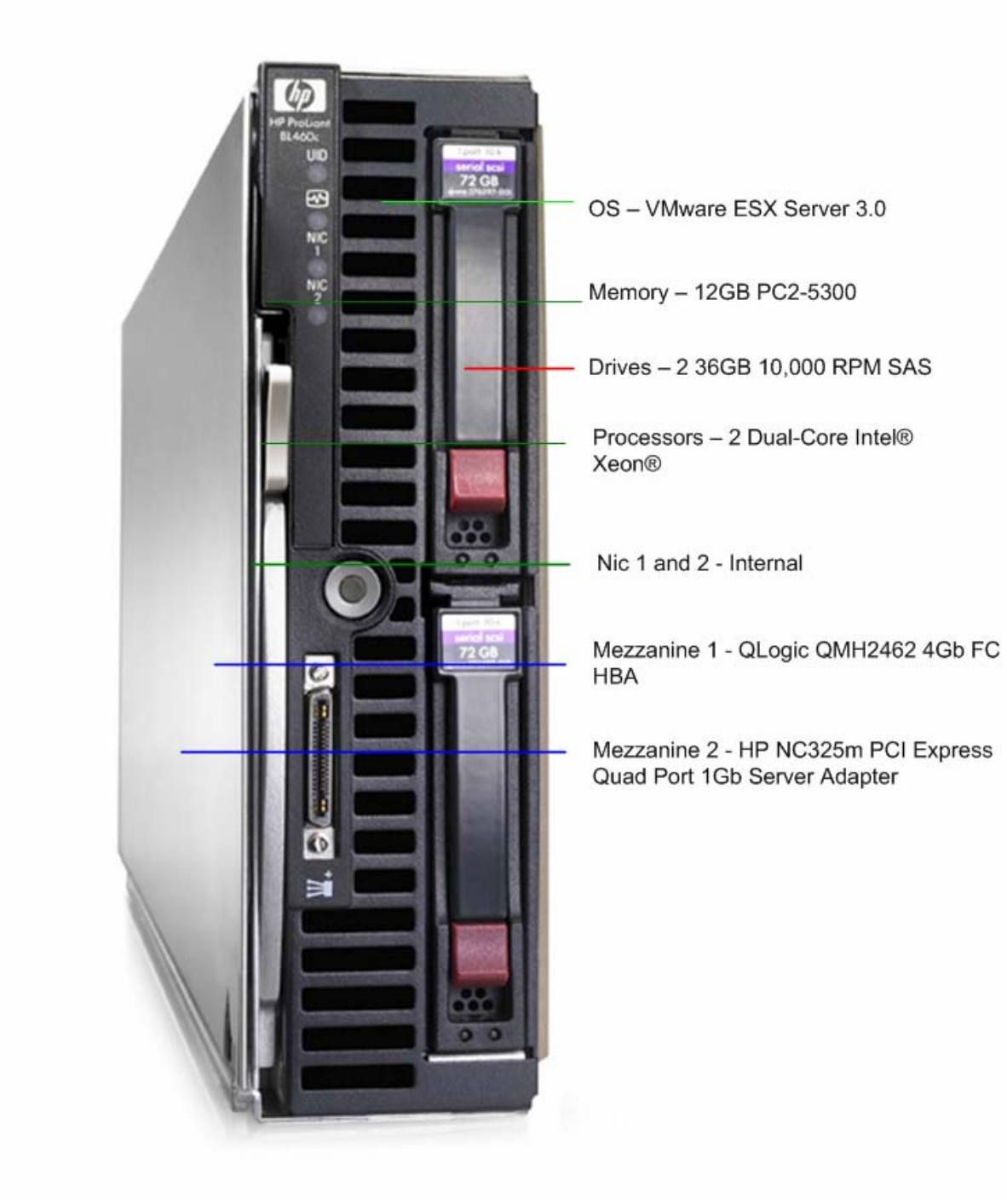
1 quad-port NC325m gigabit network adapter in mezzanine slot 2

VMware ESX Server 3 loaded on the local drives

HP Insight Management (IM) agents for VMware ESX Server

This configuration provides maximum hardware redundancy, system availability, performance and manageability.

Figure 6. HP BL460c configured to run VMware Infrastructure 3 for this reference configuration. Placement of mezzanine boards is critical for proper function.



Storage options

Storage is the backbone of a successful VMware Infrastructure 3 deployment. A sample BOM accompanying this reference configuration recommends the HP StorageWorks 8000 Enterprise Virtual Array (EVA8000) SAN as a back-end storage repository. This reference configuration may also be sized for both the EVA4000 and EVA6000. The storage configuration represented in this reference configuration suggests two separate SANs for the highest availability and greatest disaster recovery capabilities. Consult your HP sales specialist to determine the right storage configuration for you.

Bill of materials

Table 1 presents a bill of materials that will support the configuration listed for half-height servers. The server used for this configuration is the ProLiant BL460c blade server. Configuration of the BL465c differs only in the *Servers* section of the table. To configure a BL465c, consult the QuickSpecs at http://h18004.www1.hp.com/products/quickspecs/12578_na/12578_na.HTML

Table 1. Bill of materials

Infrastructure		
Quantity	**Part Number**	**Description**
1	412133-B21	HP c7000 Three-Phase Enclosure with 6 Power Supplies and 6 Fans with 8 Insight Control Trial Licenses
1	412142-B21	HP Redundant Onboard Administrator Option
6	412140-B21	HP Active Cool Fan Option Kit
6	410917-B21	GbE2c Ethernet Blade Switch for HP c-Class BladeSystem
2	403626-B21	16 port FC Pass-thru Module for c-Class BladeSystem
32	A7446B	4Gb Optical Transceivers
32	221692-B21	StorageWorks LC/LC 2m Cable
Servers		
Quantity	**Part Number**	**Description**
16	404667-B21	HP ProLiant BL460c CTO Blade
16	416660-L21	Dual-Core Intel Xeon Processor 5160 (3.00 GHz, 1333 MHz FSB) Processor Option Kit, FIO Base
16	416660-B21	Dual-Core Intel Xeon Processor 5160 (3.00 GHz, 1333 MHz FSB) Processor Option Kit, FIO Base

48	397413-B21	4 GB FBD PC2-5300 2 x 2 GB Kit
16	403619-B21	QLogic QMH2462 4Gb FC HBA for HP c-Class BladeSystem
16	416585-B21	HP NC325m PCI Express Quad Port 1Gb Server Adapter for c-Class BladeSystem
32	375859-B21	HP 36GB 3G SAS 10K SFF HDD

Storage

Quantity	Part Number	Description
2	AD522B	HP EVA8000 2C12D 60Hz 42U Cabinet
336	293568-B23	FC HDD INT CTO 72G 15K Fact
16	221692-B21	StorageWorks LC/LC 2m Cable
2	T4256D	HP EVA4K/6K/8K 6.0 Controller Media Kit

Software and Support

Quantity	Part Number	Description
1	412808-B21	Insight Control Data Center Edition - 8 Server License
8	430344-B21	HP VMware Infrastructure 3 Enterprise 2P lick + PEVMS w/ 1 year 9x5 unlimited SnS
8	UE837E	3-Yr 24x7 SnS Uplift

Rack and Power Infrastructure

Quantity	Part Number	Description
1	AF002A	10642 G2 (42U) Rack Cabinet – Shock Pallet
1	AF062A	600mm G2 Stabilizer Option Kit (Graphite)
1	AF054A	HP Rack 9000/ 10642 G2 (42U) Side Panels (set of two) (Graphite Metallic)
1	AF074A	HP 10000 G2 Rack Grounding Kit
MISC	AF072A	1U Universal Blanking Panel Kit (10 panels)

Solution criteria

This solution is designed to support an enterprise virtualization environment. Proper sizing is important to a successful deployment of VMware Infrastructure 3. The HP ProLiant server sizer for VMware ESX Server (see www.hp.com/go/vmware) is a free tool provided by HP to assist you with proper sizing. Consult with your HP sales representative to determine the best method for determining your exact requirements.

Why HP for virtualization?

HP gives customers an end-to-end virtualization solution integrated with VMware to save, simplify, and scale across the ProLiant environment. HP is an excellent choice for virtualization for the following reasons:

- HP BladeSystem solutions offer a choice of Intel or AMD processors.
- HP offers comprehensive support with 2-hour response times.
- HP offers support for all components of the virtualization solution: VMware, hardware, and guest/host OS.
- HP has best-in-class management tools: integrated, physical and virtual machine management.
- With HP, you gain unparalleled VMware expertise.
- There is always a single point of contact for expertise, management, and support of a virtualized environment.

Implementing a proof-of-concept

In this paper, HP has presented a functional sample configuration that meets strict data center redundancy requirements and reflects a specific deployment and workload, which may not exactly match a customer's specific situation. HP therefore recommends that readers implement a "proof-of-concept" deployment or engage with HP Services to determine exact solution and deployment details to meet their specific business need.

It is possible with VMware Infrastructure 3 to obtain varying levels of redundancy in networking with fewer network interface cards and switches than outlined in this paper. HP BladeSystem is a flexible infrastructure that is capable of supporting many configurations. Consult with your HP sales advisor to determine how to configure c-Class BladeSystem to best meet your needs.

Appendix A: Determining port mapping for proper redundancy

Determining the proper mapping of network and fibre channel adapters to switches or HP Virtual Connect modules is critical to achieving proper redundancy. This Appendix describes the steps necessary to perform a redundant mapping regardless of c-Class server, software or firmware.

Determining physical uplink mapping

HP BladeSystem c-Class maps all uplinks to the 6 bays in the rear of the c7000 enclosure. The mappings are determined by whether the server inserted is a half-height or full-height server. Regardless of the server selected, it is a best practice in VMware implementations to place the fibre channel HBA in mezzanine 1 on all servers. This necessitates the fibre uplinks (pass-thru, switch or HP Virtual Connect module) being placed in switch bays 3 and 4.

The simplest method to retrieve the mappings of a given setup is to use the Onboard Administrator (OA) for the enclosure itself. Select one server of each type from within your enclosure by clicking on the Device Bays link and then on the server itself. Select the Port Mapping link and then highlight the Table View tab. You will get a listing like the one shown in Figure 7.

Figure 7. Table mappings showing the MAC addresses and WWN of the adapters within that server

Port Mapping - Device Bay 2

Graphical View | Table View

Mezzanine Slot	Mezzanine Device	Mezzanine Device Port	Port Status	Interconnect Bay	Interconnect Bay Port	Device ID
ENET	Embedded Ethernet					
		ENET 1	OK	Bay 1	Port 2	00:18:fe:8a:9e:78
		ENET 2	OK	Bay 2	Port 2	00:18:fe:8a:9e:e8
1	QLogic QMH2462 4Gb FC HBA for HP c-Class BladeSystem					
		Port 1	OK	Bay 3	Port 2	50:06:0b:00:00:6a:67:24
		Port 2	OK	Bay 4	Port 2	50:06:0b:00:00:6a:67:26
2	NC325m Quad Port 1Gb NIC for c-Class BladeSystem					
		Port 1	OK	Bay 5	Port 2	00:18:fe:2f:27:41
		Port 2	OK	Bay 6	Port 2	00:18:fe:2f:27:42
		Port 3	OK	Bay 7	Port 2	00:18:fe:2f:27:43
		Port 4	OK	Bay 8	Port 2	00:18:fe:2f:27:44

Print out one table view for each type of server and set it aside for reference.

Determining mapping in VMware ESX Server 3.0

To determine which adapters correspond to which switches, you will need to retrieve the MAC addresses and vmnic names from within VMware ESX Server 3.0. To do this, issue the following command from the console of each server you used in the previous step:

$> ifconfig

You should receive output similar to that shown in Figure 8.

Figure 8. Output from the ifconfig command on a VMware ESX Server host

Record each MAC address and note which vmnic it is assigned to.

Creating a redundant configuration

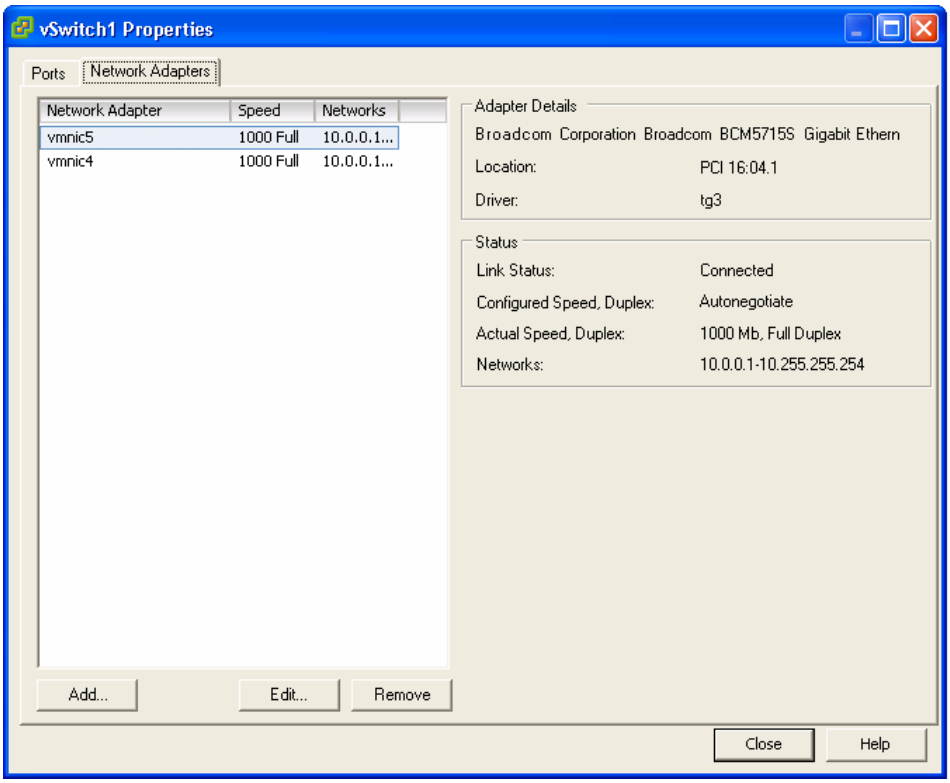
Now that you have your MAC addresses recorded at both the physical and virtual level, fill in Table 2 below for each server type.

Table 2. vmnic mapping

Switch Bay	MAC Address	Vmnic number
1		Vmnic _____
2		Vmnic _____
5		Vmnic _____
6		Vmnic _____
7		Vmnic _____
8		Vmnic _____

Using the table above, create your virtual switches within VirtualCenter or at the console using the ESXCFG-VSWITCH command so that the vmnics combine to map out alternating left and right switch bays. For example, in Figure 9, vSwitch1 has been created using vmnic4 and vmnic5. From the previous diagrams it is clear that these map to switch bays 5 and 6.

Figure 9. Adding the correct adapters to your virtual switches



Create all virtual switches using the same rules. Once you have completed the mapping for a particular server type, all subsequent servers of that type may be mapped identically.

For more information

HP and VMware Alliance at HP.com, http://www.hp.com/go/vmware

HP and VMware Alliance at VMware.com, http://www.vmware.com/partners/alliances/oem/hp.html

HP Business and IT Services, http://www.hp.com/services

BladeSystem Home, http://www.hp.com/go/BladeSystem

ProLiant BL465c QuickSpecs, http://h18004.www1.hp.com/products/quickspecs/12578_na/12578_na.HTML

ProLiant BL460c QuickSpecs, http://h18004.www1.hp.com/products/quickspecs/12518_na/12518_na.HTML

To help us improve our documents, please provide feedback at www.hp.com/solutions/feedback

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