DATABASE PERFORMANCE AND MEMORY CAPACITY WITH THE INTEL XEON PROCESSOR E5-2660V2-POWERED DELL POWEREDGE M620

Dell™ PowerEdge™ M620 server powered by Intel® Xeon® processors E5-2660v2

182.2% greater database performance

92.0% faster average response time

50% more memory capacity

Dell Fault Resilient Memory for additional protection of the hypervisor in a VMware® vSphere® 5.5 environment.

on an OLTP workload versus an HP ProLiant BL460c Gen8 server solution

Memory capacity and speed are key factors for a successful database implementation; more memory and more speed typically contribute to greater workload performance. Innovations in the Dell PowerEdge M620 powered by the Intel Xeon processor E5-2600v2 Series such as Fault Resilient Memory (FRM) provide an additional benefit: resiliency. FRM, a Dell-patented technology made available to VMware vSphere 5.5 virtualized environments, keeps your virtual machines up and running by increasing protection for the hypervisor against memory faults, resulting in a more stable virtualization platform. Blade servers that support the maximum allowable number of memory slots can offer the added security of FRM technology without sacrificing performance compared to servers that by design are unable to support the maximum slot count.

In the Principled Technologies labs, we compared the virtualized database performance of a Dell server and storage solution, powered by the new Intel Xeon processor E5-2660v2, and an HP server and storage solution, powered by the previous generation Intel Xeon processor E5-2640, both running VMware vSphere 5.5 (Release Candidate build 1198610). We found that the Intel Xeon processor E5-2660v2-powered Dell PowerEdge M620 server and Dell storage solution offered 50 percent greater memory capacity, and also offered 182.2 percent greater database performance and a

92.0 percent faster average response time while providing memory error protection with Fault Resilient Memory enabled, when compared to the HP solution with no memory protection enabled. With the Intel Xeon processor E5-2660v2, Dell Fault Resilient Memory, the added memory slots that come standard in the Dell PowerEdge M620, and Dell EqualLogic PS-M4110 storage, you can be sure that your virtualized workloads will keep running strong.

MORE MEMORY AND DATABASE PERFORMANCE

Dell Fault Resilient Memory

Fault-Resilient Memory is a new Dell-patented technology for Dell PowerEdge 12th generation series 6 and higher servers. FRM creates a hardened zone to provide memory resilience for the hypervisor, while only utilizing 25 percent of the available server memory. The VMware vSphere 5.5 hypervisor uses one of its new features, support for Reliable Memory Technology, to place itself in the FRM zone, protecting it from memory faults that could cause the entire hypervisor and VMs running on it to fail and go offline. Dell FRM provides memory error protection comparable to mirroring without sacrificing half of the total available system RAM.

Strong database performance and server resiliency are crucial to how your business operates. The more database performance your blade servers deliver, the more customers you can serve, which means more money in your pocket. Additionally, having fault-resilient technology in your virtual environment can help prevent financial losses resulting from downtime.

With this in mind, we investigated the database performance and memory capabilities of the new Intel Xeon processor E5-2660v2-based Dell PowerEdge M620 blade server with a Dell EqualLogic PS-M4110 storage array (Dell PowerEdge M620 solution) and the previous version Intel Xeon processor E5-2640-based HP ProLiant BL460c Gen8 and an HP StorageWorks D2200sb storage blade (HP ProLiant BL460c Gen8 solution). For our tests, both solutions ran six VMware vSphere 5.5 virtual machines (VMs), each running Microsoft® Windows Server® 2012 and a Microsoft SQL Server® 2012 database. We used the Benchmark Factory® for Databases tool to generate our OLTP workload. Benchmark Factory reports results in transactions per second that a server handled. For more information on the solution we tested, see Appendix A. For step-by-step details on how we tested, see Appendix B.

More database performance

The more transactions per second your VMs can handle, the more customers you can serve. As Figure 1 shows, the Dell PowerEdge M620 server and storage solution running VMware vSphere 5.5 processed an average of 182.2 percent more transactions per second (TPS) while also providing FRM capabilities than the HP ProLiant BL460c Gen8 server and storage solution did without any memory protection. This means that for similar virtualized workloads, you could expect the Dell PowerEdge M620 solution to deliver superior database performance and availability, while also providing memory-error protection.

Transactions per second

Figure 1: The Dell PowerEdge M620 server and storage solution delivered 182.2 percent more transactions per second than the HP solution did.
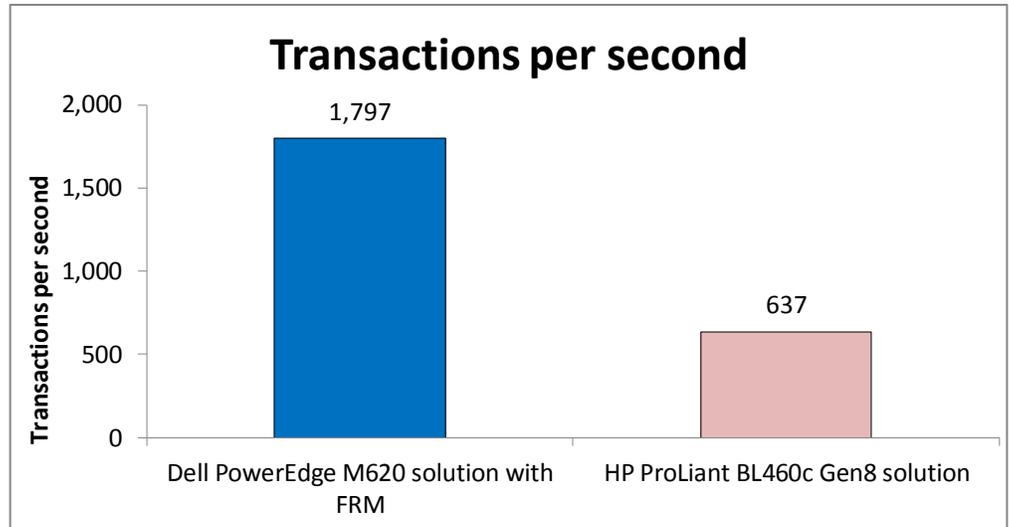
Just because the VMs on a server can handle a certain number of transactions does not mean it is a smooth experience for customers accessing the database. Response times for the transactions can help you assess the level of performance you are getting – the lower the response time, the less a customer has to wait. Figure 2 shows the average response times for the two solutions, in seconds. The Dell PowerEdge M620 server and storage solution had a 92.0 percent faster average response time while providing FRM than the HP ProLiant BL460c Gen8 server and storage solution without memory protection.

Response time (lower is better)

Figure 2: The Dell PowerEdge M620 server and storage solution delivered 92.0 percent faster response times than the HP solution.
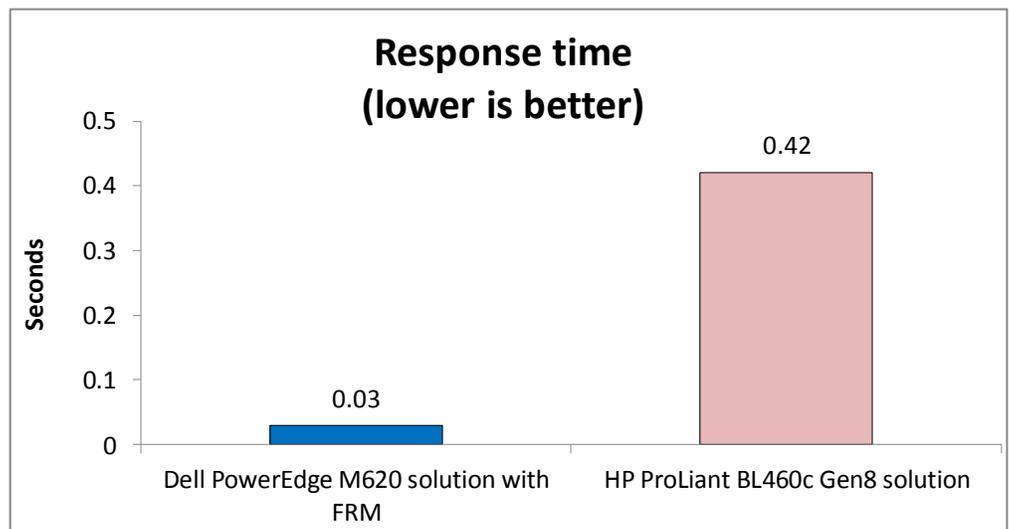
In a complex hardware and software stack, many system components contribute to differences in application performance, and in this case, latency. The increased performance and lower latency of the Dell solution could result from the combination of more powerful processors, greater memory capacity, and the encapsulated blade storage. The Intel Xeon processors E5-2660v2 in the Dell solution

contained more cores than the previous-generation Intel Xeon E5-2640 processors in the HP solution, the added memory capacity allowed more of the database pages to be cached and therefore likely increased buffer hits, and the Dell EqualLogic blade storage better sustained the database workloads while providing dramatically lower disk latency. The Dell solution provided this greater performance while also providing the memory protection benefits of FRM.

More memory

More memory often means you can get more database performance out of your server, as it can help reduce the stress on storage, so memory capacity is an important consideration when selecting a server solution. The Dell PowerEdge M620 supports up to 24 DIMMs offering 50 percent greater memory capacity than the HP ProLiant BL460c Gen8 with only 16 DIMMs. When configured with 4GB memory DIMMs and FRM enabled, the Dell solution provides you with increased hypervisor fault protection and stability for its virtual machines, and still gives you 12.5 percent more memory than the HP solution configured with the same size DIMMs, which does not give you memory fault protection. Figure 3 shows the additional memory capacity of the Dell PowerEdge M620 solution with FRM enabled vs. the HP ProLiant BL460c Gen8 solution without memory protection.

Figure 3: With 4GB DIMMs and FRM enabled, the Dell PowerEdge M620 provides 12.5 percent more memory than the HP server with the same size DIMMs but without memory protection.
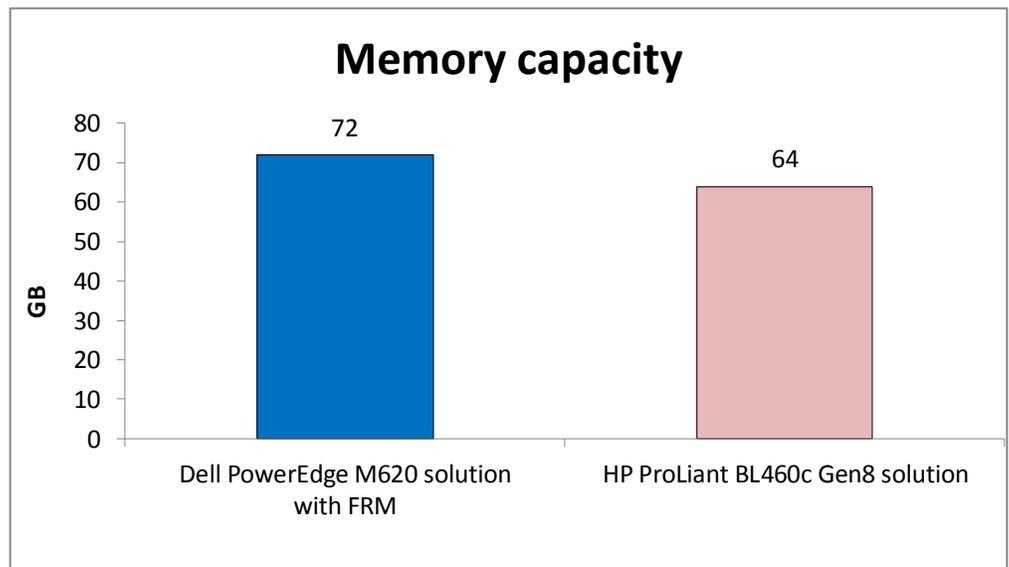
WHAT WE FOUND

Figure 4 details the transactions per second and response times for each database instance while running the OLTP workload, broken down by VM. It also shows the total transactions per second as well as the average response time for each solution. Higher transactions per second and faster response times are better.

	Dell PowerEdge M620 solution with FRM		HP ProLiant BL460c Gen8 solution	
	TPS	Response (s)	TPS	Response (s)
VM 1	281.30	0.04	111.62	0.51
VM 2	289.04	0.04	95.66	0.08
VM 3	339.83	0.01	105.96	0.52
VM 4	296.51	0.04	114.59	0.42
VM 5	286.46	0.04	101.49	0.55
VM 6	303.63	0.03	107.32	0.46
Total/Average	1,796.77	0.03	636.64	0.42

Figure 4: Transactions per second and response times during our tests. Higher TPS are better, and faster response times are better.

WHAT WE TESTED

Both solutions ran VMware vSphere 5.5 Release Candidate. To measure database performance for each solution, we created six VMware vSphere 5.5 VMs (VM version 10). We distributed the number of virtual processors and memory available for each solution among the six VMs to maximize the hardware resources and subsequent performance available on each solution. We created separate VMDKs for the OS, SQL database, and SQL logs and placed them into one of three VMFS5 datastores provided to the host via 10Gb iSCSI (595, 600, and 400GB respectively). Connectivity for iSCSI was provided via 10Gb mezzanine cards with each port on a separate virtual network in a round-robin configuration. Both storage solutions were configured in a 12-drive RAID 10 group for the virtual drives. Each VM ran Microsoft Windows Server 2012 and Microsoft SQL Server 2012.

For the Dell solution, each VM was configured with:

- 6 virtual processors
- 12 GB of RAM
- VMXNET 3 virtual adapter for client traffic
- 3 virtual drives (thick-provisioned eager-zeroed):
  - o 80GB virtual drive for the OS (LSI Logic SAS virtual storage adapter)
  - o 40GB virtual drive for the SQL database (VMware Paravirtual storage adapter)
  - o 30GB virtual drive for the SQL logs (VMware Paravitual storage adapter)

For the HP solution, each VM was configured with:

- 4 virtual processors
- 10 GB of RAM
- VMXNET 3 virtual adapter for client traffic
- 3 virtual drives (thick-provisioned eager-zeroed):

- o 80GB virtual drive for the OS (LSI Logic SAS virtual storage adapter)
- o 40GB virtual drive for the SQL database (VMware Paravirtual storage adapter)
- o 30GB virtual drive for the SQL logs (VMware Paravirtual storage adapter)

About Benchmark Factory for Databases

To measure database performance in each VMware vSphere 5.5 VM, we used the Benchmark Factory for Databases tool, which lets you conduct database workload replay, industry-standard benchmark testing, and scalability testing. It enables you to deploy changes to your database environment with confidence by reducing the risks associated with patches, upgrades, migrations, and adjustments to virtual machine configurations. With this workload replay and scheduling software, you can eliminate slow SQL database performance and dramatically simplify high-performance database management. We used an OLTP database test in Benchmark Factory to run a TPC-E-like workload, and tuned the workload to drive for maximum performance from each solution.

Our Benchmark Factory for Databases workload consisted of a TPC-E, scale 2, 20GB database running on each VM. We set a pre-sampling length of 10 minutes and a sampling length of 30 minutes. We ran the workload on each server three times, and chose the median run based on transactions per second.

For more information on Benchmark Factory, visit www.quest.com/benchmark-factory/.

About Dell Fault-Resilient Memory Technology

Traditional memory protection techniques, such as memory mirroring, use up 50 percent of available server memory. This Dell capability, enabled on both the Intel Xeon E5-2600 and E5-2600v2 series processors, creates a hardened zone within a single socket to provide memory resilience for the hypervisor, while only utilizing half of the socket's memory, or 25 percent of the total system RAM, for the hardened zone. The VMware vSphere 5.5 hypervisor uses one of its new features, support for Reliable Memory Technology, to place itself in the FRM zone, protecting it from memory faults that could cause the entire hypervisor and VMs running on it to fail and go offline.

Fault Resilient Memory provides memory protection to VMware vSphere 5.5 virtual environments in the event of a memory error or even failure while still providing you with 75 percent of the raw capacity of your memory configuration.

About the Dell PowerEdge M1000e blade enclosure

The Dell PowerEdge M1000e blade chassis and its supported fabric interconnects are designed for dense computing situations. Features of the PowerEdge M1000e include:

- **Simplified Management.** Provides a secure centralized management interface for the chassis and blades within, using proven Web (SSL-encrypted) and CLI (SSH/Telnet) technologies.
- **Automated configuration.** The Chassis Management Controller allows administrators to control up to nine enclosures and 144 server blades, including BIOS/firmware change management and updates, thermal monitoring, and power threshold configuration.
- **Flexible I/O.** Six interconnect sockets with the capability to support three fully redundant fabrics, a passive midplane with more than 8 Tbps in I/O bandwidth capacity, and FlexIO support provide a number of connectivity options for your servers.
- **Reliability and efficiency.** Six power supplies and nine fans, all hot-swappable, allowing for no-downtime maintenance of key chassis components. All components are tuned for maximum power efficiency to reduce datacenter power consumption.

For more information about the Dell PowerEdge M1000e Blade Enclosure, visit www.dell.com/us/enterprise/p/poweredge-m1000e/pd.

About the Dell PowerEdge M620 blade server

The Dell PowerEdge M620 has features optimized for performance, density, and energy efficiency.

- **Processors.** The Dell PowerEdge M620 is powered by two Intel® Xeon® E5-2600v2-series processors, which incorporate the very latest in processor technology from Intel. The powerful processors provide the performance you need for your essential mainstream tasks. The Intel Xeon E5-2600v2-series processor gives you up to eight cores per processor or up to 16 cores per server.
- **Memory.** The Dell PowerEdge M620 holds up to 768GB DDR3 RAM (up to 1600 MHz) across 24 DIMM slots per server node. The comparable HP blade we tested only supports a maximum of 16 DIMM slots per server node; significantly impacting overall performance on memory dependent workloads.
- **Management.** The Dell PowerEdge M620, like all late-model Dell servers includes iDRAC with Lifecycle Controller. This embedded management tool simplifies server management by providing a single interface for management functions and by storing critical system information in the system itself. There are no CDs or USB keys required for drivers or firmware.

About the Dell EqualLogic PS-M4110 blade array

The Dell EqualLogic PS-M4110 is an enterprise-class storage array designed to install directly into a blade chassis. Simple integration with Dell PowerEdge M-series servers and switches in the PowerEdge M1000e chassis allows for a full-featured, single-

chassis solution without external dependencies. The PS-M4410 features a full suite of enterprise-class management tools and features, including EqualLogic array firmware, SAN Headquarters, and Host Integration Tools.

About the Intel Xeon processor E5-2600v2 Series

The Intel Xeon processor E5-2600v2 Series, also known as Intel Ivy Bridge, builds on the E5-2600 product family for even stronger processors. The new product family features increased core counts (up to 12 cores/24 threads) and up to 30M cache. Intel Xeon E5-2600v2 processors support larger memory DIMMS, up to 64GB, and faster memory, up to 1,866 MHz.

This processor series also introduce new features to help protect your important data: Intel Secure Key, which provides faster and more secure encryption, and Intel OS Guard, which improves protection against malware. The Intel Xeon processor E5-2600v2 Series also features Advance Programmable Interrupt Controller virtualization (APICv), which can help improve virtualization performance.

For more information on the Intel Xeon processor E5-2600v2 Series, visit www.intel.com.

IN CONCLUSION

The Dell PowerEdge M620 offers 24 memory slots, 50 percent more than the 16 slots offered by the HP ProLiant BL460c Gen8, which, when combined with powerful Intel Xeon E5-2660v2 processors and Dell EqualLogic storage, enables the Dell solution to provide greater performance while delivering memory error protection. We found that the Dell PowerEdge M620 solution, built on the new Intel Xeon processor E5-2600v2 Series, delivered 182.2 percent more database performance and 92.0 percent faster response times than the previous version Intel Xeon E5-2640 processor-based HP ProLiant BL460c Gen 8 solution, while providing 12.5 percent more available memory and error protection. The additional memory capacity of the Dell solution allowed us to engage FRM technologies and still have more overall RAM capacity compared to the 16-slot HP server. The Dell PowerEdge M620 server and storage solution offered maximum memory capacity and protection with Fault Resilient Memory to keep your database workloads running strong and available for your business needs.

APPENDIX A – SERVER AND STORAGE CONFIGURATION INFORMATION

Figure 5 provides detailed configuration information for the test servers. Figure 6 provides information about the test storage, and Figure 7 details configuration information for the blade enclosures.

System	Dell PowerEdge M620	HP ProLiant BL460c Gen8
General		
Number of processor packages	2	2
Number of cores per processor	10	6
Number of hardware threads per core	2	2
CPU		
Vendor	Intel	Intel
Name	Xeon	Xeon
Model number	E5-2660v2	E5-2640
Launch date	Q3 2013	Q1 2012
Socket type	LGA2011	LGA2011
Core frequency (GHz)	2.20	2.50
Bus frequency	8 GT/s	7.2 GT/s
L1 cache	32 + 32 KB (per core)	32 + 32 KB (per core)
L2 cache	256 KB (per core)	256 KB (per core)
L3 cache	25 MB (shared)	15 MB (shared)
Platform		
Vendor and model number	Dell PowerEdge M620	HP ProLiant BL460c Gen8
Motherboard model number	0VHRN7	654609-001
BIOS name and version	2.0.14	I31
BIOS settings	Default	Default
Memory module(s)		
Total RAM in system (GB)	96	64
Vendor and model number	Samsung M393B5170FHD-CH9 Micron MT36JSZF51272PY	Micron MT36JSZF51272PZ
Type	PC3-10600R	PC3-10600R
Speed (MHz)	1,333	1,333
Speed running in the system (MHz)	1,333	1,333
Timing/Latency (tCL-tRCD-tRP-tRASmin)	9-9-9-36	9-9-9-36
Size (GB)	4	4
Number of RAM module(s)	24	16
Chip organization	Double-sided	Double-sided
Rank	Dual	Dual
OS/Hypervisor		
Name	VMware ESXi (Release Candidate)	VMware ESXi (Release Candidate)
Build number	1198610	1198610
File system	VMFS	VMFS
Kernel	5.5.0	5.5.0

System	Dell PowerEdge M620	HP ProLiant BL460c Gen8
Language	English	English
RAID controller		
Vendor and model number	Dell PERC H310 Mini	HP SmartArray P220i
Firmware version	20.11.0-0002 (12/10/2012)	3.54 (2/19/2013)
Driver version	00.00.05.34-9vmw	5.5.0-44vmw
Cache size (MB)	0	512
Hard drives		
Vendor and model number	Hitachi HUC151414CSS600	HP EH0146FAWJB
Number of drives	2	2
Size (GB)	146	146
RPM	15K	15kK
Type	SAS	SAS
Ethernet adapter		
Vendor and model number	Broadcom® BCM57810 NetXtreme® II 10 GigE	Broadcom BCM57810 NetXtreme II 10 GigE
Number of ports	2	2
Type	Integrated	Integrated
Driver version	1.72.56.v55.2	1.72.56.v55.2
Ethernet adapter		
Vendor and model number	Intel 82599EB 10 Gigabit Dual Port	Emulex HP FlexFabric 10Gb 2-port 554M
Number of ports	2	2
Type	Mezzanine	Mezzanine
Driver version	3.7.13.7.14iov-NAPI	10.0.100.0v-1vmw
USB ports		
Number	3	2
Type	2.0	2.0

Figure 5: Detailed configuration information for the servers.

Storage array	Dell EqualLogic PS-M4110XV	HP StorageWorks D2200sb
Arrays	1	2
Number of storage controllers per array	2	1
RAID level	10	10
Firmware revision	6.0.2	6.00
Drive vendor and model number	Dell ST9300653SS	HP EH0300FBQDD
Number of drives	12 drives + 2 spares (14 total)	12 drives (no spares)
Drive size (GB)	300	300
Drive buffer size (MB)	64	64
Drive RPM	15K	15K
Drive type	6Gb SAS	6Gb SAS

Figure 6: Detailed configuration information for the test storage.

Enclosure	Dell PowerEdge M1000e	HP BladeSystem c7000
Number of blades	1	1
Power supplies		
Total number	6	6
Wattage of each	2,360	2,450
Cooling fans		
Total number	9	6
Voltage	12	12
Amps	7.0	16.5
Network module 1		
Total number	2	2
Vendor and model	Dell Ethernet Pass-Through	HP 1Gb Ethernet Pass-Through
Network module 2		
Total number	2	2
Vendor and model	Dell Force10™ MXL 10/40 GbE	HP VC Flex-10 Enet Module

Figure 7: Detailed configuration information for the blade enclosures.

APPENDIX B - HOW WE TESTED

Both solutions ran six VMware vSphere 5.5 Release Candidate virtual machines (VMs), each running Microsoft Windows Server 2012 and a Microsoft SQL Server 2012 database. We used the Benchmark Factory for Databases tool to create our OLTP workload, using the TPC-E benchmark. The Dell solution used default BIOS settings with the Fault Resilient Memory protection technology enabled, and the HP solution used default BIOS settings.

Installing the hypervisors

We installed VMware ESXi 5.5 Release Candidate for each server on local drives in a RAID 10 configuration.

Installing ESXi 5.5 Release Candidate

1. Connect a USB DVD drive with the ESXi 5.5 Release Candidate installation disk, and boot the server.
1. On the Welcome screen, press Enter.
2. On the End User License Agreement (EULA) screen, press F11.
3. On the Select a Disk to Install or Upgrade Screen, select the virtual drive to install ESXi on, and press Enter.
4. On the Please Select a Keyboard Layout screen, press Enter.
5. On the Enter a Root Password Screen, assign a root password and confirm it by entering it again. Press Enter to continue.
6. On the Confirm Install Screen, press F11 to install.
7. On the Installation complete screen, press Enter to reboot.

Configuring ESXi after Installation

1. On the server, press F2, enter the root password, and press Enter.
2. On the System Customization screen, select Troubleshooting Options, and press Enter.
3. On the Troubleshooting Mode Options screen, select Enable ESXi Shell, and press Enter.
4. Select Enable SSH, press Enter, and press Esc.
5. On the System Customization screen, select Configure Management Network.
6. On the Configure Management Network screen, select IP Configuration.
7. On the IP Configuration screen, select set static IP, enter an IP address, subnet mask, and default gateway, and press Enter.
8. On the Configure Management Network screen, press Esc. When asked to apply the changes, press Y.

Configuring the Dell EqualLogic PS-M4110 blade array

We paired the Dell EqualLogic PS-M4110 blade array with the Dell PowerEdge M620 blade server.

Configuring the storage array blade

1. Using a Web browser, log into the Dell PowerEdgeM1000e CMC Web interface.
2. Insert the storage array into the chassis and allow it to power on automatically.
3. Wait for blade to display in the Server Overview screen.
4. At the Server Overview screen, select the corresponding slot for the storage blade.
5. At the Storage Array Status, click Configure Array.

6. At the Configure Array screen, enter a member name, IP information, and create a new group by entering a group name, IP address, and administrator credentials. Select the appropriate network fabric (Fabric B in our case), and click Apply.
7. At the Message from webpage pop-up, click OK.

Configuring the array RAID
1. Enter the EqualLogic storage group IP address into a Web browser and use the administrator credentials to log in.
2. Select the storage group, and expand the members in the left pane.
3. Select the member, which is unconfigured, and click Yes to configure the RAID.
4. At the General Settings screen, leave the default name and storage pool assignment, and click Next.
5. At the RAID configuration screen, select RAID 10, and click Next.

Creating a volume
We created three volumes: OS (595 GB), Data (600 GB) and Logs (400 GB). We added these volumes as ESXi datastores and used them to store our VMDKs.
1. In the left pane, click Volumes, and, in the adjacent pane, click Create volume.
2. Name the first volume, and click Next.
3. Enter the appropriate volume size, and click Next.
4. On the Step 3 – iSCSI Access screen, check the Limit access to iSCSI initiator name checkbox, and enter the appropriate iSCSI initiator name.
5. Click Finish.

Configuring the HP StorageWorks D2000sb blade array
We paired the HP StorageWorks D2000sb blade array with the HP ProLiant BL460c Gen8 blade server. The D2000sb requires a partner blade when in a SAN. For the partner blade, we used another HP ProLiant BL460c Gen8.
1. Install the storage blade in an even-numbered bay.
2. Install the partner blade in the adjacent odd-numbered bay.

Creating the RAID groups
1. Connect a keyboard, monitor, mouse, and DVD-ROM using the adapter, and press the power button on the partner blade.
2. When prompted, press F5 to access the Array Configuration Utility.
3. At the Array Configuration Utility menu, under the Configuration tab, select the HP Smart Array P220i from the drop-down menu.
4. Under Systems and Devices, select the RAID controller, and in the right pane, click Create Array.
5. Select both physical drives, and click OK.
6. Under Systems and Devices, select the array, and click Create Logical Drive.
7. Select RAID 1 under Fault Tolerance, leave the other settings as default, and click Save.
8. In the drop-down menu, select the HP Smart Array P410i.
9. Under Systems and Devices, select the RAID controller, and in the right pane, click Create Array.
10. Select the first eleven physical drives, and click OK.
11. Under Systems and Devices, select the array, and click Create Logical Drive.

12. Under Fault Tolerance, select RAID 1+0, leave the other settings as default, and click Save.
13. Under Systems and Devices, select the logical drive, and click Spare Management.
14. Select the remaining physical drive, and click Save.
15. Click Exit ACU.

Installing ESXi 5.1 on the partner blade
1. Attach an external DVD drive to the partner blade, insert your ESXi 5.1 for HP Gen8 installation media, and reboot the blade.
2. From the boot menu, select ESXi installer,and press Enter. Allow a few minutes to load.
3. At the Welcome screen, press Enter.
4. At the End User License Agreement (EULA) screen, press F11.
5. At the Select a Disk to install or Upgrade screen, select the two-disk RAID 1 volume you created to install ESXi on, and press Enter.
6. On the Please Select a Keyboard Layout screen, press Enter.
7. On the Enter a Root Password screen, assign a root password, and confirm it by entering it again. Press Enter to continue.
8. On the Confirm Install screen, press F11 to install.
9. On the Installation Complete screen, press Enter to reboot.
10. After the server reboots, press F2 to log in, and enter the appropriate credentials.
11. Highlight Configure Management Network, and press Enter.
12. Highlight IP Configuration, and press Enter.
13. Highlight Set static IP address and network configuration and press the space bar to select it, and enter the management IP address. Press Enter.
14. Highlight DNS Configuration, and press Enter.
15. Enter the applicable DNS server information and an appropriate hostname. Press Enter.
16. Press Esc and Y when the installation prompts you to restart the management network.
17. Press Esc to log out.

Creating the ESXi datastores
1. Using the appropriate credentials, log into the partner blade running ESXi with vSphere client. If prompted, select Install this certificate and do not display any security warnings for <0.0.0.0>, and click Ignore, where <0.0.0.0> is the host IP address
2. Click Configuration tab→Storage→Add Storage.
3. Select the appropriate volume, and click Next.
4. Select VMFS-5, and click Next.
5. Review the disk layout, and click Next.
6. For Datastore name, type VSA-1 and click Next.
7. For Capacity, select Maximum available space, and click Next.
8. Click Finish to create the datastore.

Creating the virtual networks
1. From vSphere Client, select the Configuration tab, and select Networking.
2. Click Add Networking.

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3. For Connection Types, select Virtual Machine, and click Next.
4. Deselect vmnic1, select vmnic2 and vmnic3 (the two 10Gb mezzanine adapters), and click Next.
5. Enter an appropriate Network Label, and click Next.
6. Click Finish.
7. Click Properties…
8. Under Ports, select the Virtual Machine Port Group, and click Edit…
9. Under Failover Order, check the Override switch failover order checkbox.
10. Select one of the active adapters, and move it to be a Standby Adapter.
11. Click OK.
12. Click Close twice.

Deploying the VSA VM
1. Using Server Manager, install .NET Framework 3.5 onto the management server.
2. Copy the HP P4000 VSA 10.5 software installer for ESX servers onto your management server.
3. Click autorun.exe.
4. At the EULA screen, click Agree.
5. Click Install VSA for VMware ESX Server.
6. At the Win-zip self-extractor screen, click Unzip.
7. Click OK.
8. At the command prompt, type 2 for the GUI wizard, and press Enter.
9. At the welcome screen, click Next.
10. Accept the EULA by checking the radio button, and click Next.
11. At the Install the Centralized Management Console screen, accept defaults, and click Next.
12. At the ESX Host Discovery screen, enter the IP address of the partner blade and the appropriate login credentials, and click Next.
13. At the Connect to ESX host screen, click Next.
14. At the Type of virtual appliance screen, leave Virtual SAN Appliance (VSA) selected, and click Next.
15. At the Select the datastore screen, select the RAID 1 partition to store the virtual appliance files, and click Next.
16. At the Network settings screen, enter the IP address, subnet, and gateway information, and select the appropriate network interface. Click Next.
17. At the Configuration details screen, enter an appropriate virtual appliance name, and click Next.
18. At the Configuring Virtual SAN Appliance screen, check two VMDK location checkboxes, select the appropriate datastore that corresponds with the attached D2200sb, and enter the desired size of each VMDK. We used all available space. Click Next.
19. At the Configure and install another virtual appliance screen, select the No, I am done radio button, and click Next.
20. At the confirmation pop-up, click Yes.
21. At the summary screen, click Deploy.
22. When the deployment process completes, click Finish.

Customizing and configuring the VSA appliance VMs
Complete the following steps for each partner blade.

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1. Using vSphere client, log into the partner blade.
2. Right-click the VSA VM, and select Power→Shut Down Guest.
3. Click Yes to confirm shutdown.
4. Once the VM has shut down, right-click the VSA VM, and select Edit Settings…
5. Under Memory, set the memory size to 2GB.
6. Under CPUs, set the number of cores per socket to four.
7. Click the Resources tab, and set the CPU reservation to 2000 MHz.
8. Set the memory reservation to 2048MB RAM.
9. Click OK.
10. Right-click the VSA VM, and select Power→Power On.
11. Once the VM has booted, launch the virtual machine console window.
12. Type start and press Enter.
13. To log in, press Enter.
14. Highlight Network TCP/IP Settings, and press Enter.
15. Highlight eth0, and press Enter.
16. Enter an appropriate hostname, select Use the following IP address, enter the appropriate network information, and select OK.
17. When the dialog box pops up, press Enter to confirm.
18. Press Enter to close the pop-up box showing that the network was successfully configured.
19. Select Back, and select Log Out.

Creating a new management group and building a new virtual SAN
1. Click Start→HP StoreVirtual Centralized Management Console.
2. In the right pane, click Management Groups, Clusters, and Volumes Wizard.
3. At the Welcome screen, click Next.
4. At the Choose a Management Group screen, leave New Management Group selected, and click Next.
5. At the Create a Management Group screen, enter an appropriate management group name, and click Next.
6. At the Add Administrative User screen, enter a user name and password, and click Next.
7. At the Management Group Time screen, select either the appropriate NTP server or manually set the time, and click Next.
8. At the DNS information screen, enter the applicable DNS information. For our testing purposes, we did not need to configure email notifications, so we left this blank and clicked Next and Accept Incomplete.
9. At the SMTP settings screen, enter the applicable SMTP server information. For our testing purposes, we did not need to configure email notifications, so we left this blank and clicked Next and Accept Incomplete.
10. At the Create a Cluster screen, leave the default selection of Standard Cluster, and click Next.
11. At the Create Cluster screen, enter a cluster name, and click Next.
12. At the Assign a Virtual IP and Subnet Masks screen, click Add…
13. Enter a virtual IP address and subnet mask, and click OK. Click Next.
14. At the Create Volume screen, enter the appropriate information for the first volume you wish to create, and click Finish.
15. At the licensing warning pop-up, click OK.
16. At the Summary screen, click Close.

17. At the registration reminder pop-up, click OK.

Building the VMs

We used VMware vCenter Server 5.5 Release Candidate to import and configure our storage, and then to create and manage our test VMs.

Setting up vCenter Server

1. Install ESXi 5.5 Release Candidate on a utility server using the instructions above.
2. Import the OVF containing the Linux-based vCenter Server appliance from VMware.
3. Start the vCenter Server VM and perform basic installation steps, such as setting the name, IP, credentials, and so on.
4. Connect to the vCenter Server via the vSphere Web client, create a cluster, and add the Dell PowerEdge M620 or HP ProLiant BL460c Gen8 to the cluster.

Configuring the external volumes in VMware vSphere 5.5

1. In the vSphere Web client, select the host.
2. Click the Configuration tab.
3. Click Storage, and click Add Storage…
4. Choose Disk/LUN.
5. Select the first LUN assigned to ESX, and click Next.
6. Accept the default of VMFS-5 for the file system.
7. Review the disk layout, and click Next.
8. Enter the datastore name, and click Next.
9. Accept the default of using maximum capacity, and click Next.
10. Click Finish.

Creating the base VM

1. In your Web browser, connect to the vCenter Server, and browse to the ESXi host.
2. Right-click the ESXi host, and choose New Virtual Machine.
3. Choose Create a new virtual machine, and click Next.
4. Assign a name to the virtual machine, and click Next.
5. Select the relevant OS datastore on the external storage, and click Next.
6. Select ESX 5.1 and later compatibility, and click Next.
7. Choose Windows, select Microsoft Windows Server 2012, and click Next.
8. Select the VM's virtual hardware options.
9. Click Finish.
10. Start the VM.
11. Attach the installation DVD for Windows Server 2012 Datacenter to the VM.
12. At the Language Selection Screen, click Next.
13. Click Install Now.
14. Select Windows Server 2012 Datacenter (Full Installation), and click Next.
15. Click the I accept the license terms checkbox, and click Next.
16. Click Custom.

17. Click Next.
18. At the User's password must be changed before logging on warning screen, click OK.
19. Enter the desired password for the administrator in both fields, and click the arrow to continue.
20. At the Your password has been changed screen, click OK.

Providing Data and Log storage to the VMs

1. In vCenter, right-click the VM and click Edit Settings.
2. In the drop-down menu, choose SCSI Controller and click Add.
3. Click the arrow next to New SCSI controller to open the controller options.
4. Change the type to VMware Paravirtual.
5. Click OK.
6. Open the Edit Settings menu again.
7. In the drop-down menu, choose New Hard Disk and click Add.
8. Click the arrow next to New Hard disk to open the hard disk options.
9. Choose 40 GB for the size and the Data LUN for the location. We used Thick provision eager zeroed and chose Virtual Device node SCSI(1:0). Click OK.
10. Repeat for a 30 GB hard disk in the Logs LUN, using Virtual Device node SCSI(1:1).
11. Inside the VM, open Disk Management.
12. Bring the disks online and initialize with GPT formatting.

Installing Microsoft SQL Server 2012

1. Navigate to the SQL Server 2012 installation media, and launch SETUP.EXE.
2. In the left pane, click Installation.
3. Click New SQL Server stand-alone installation or add features to an existing installation.
4. At the Setup Support Rules screen, click OK.
5. At the Product Key screen, enter your product key, and click Next.
6. At the License Terms screen, click the checkbox to accept the license terms, and click Next.
7. At the Product Updates screen, click Install to install any available updates.
8. At the Setup Support Rules screen, click Next.
9. At the Setup Role screen, click Next.
10. At the Feature Selection screen, select Database Engine Services, SQL Server Replication, Full-Text and Semantic Extractions for Search, SQL Server Data Tools, Client Tools Connectivity, Client Tools Backwards Compatibility, Management Tools – Basic, and Management Tools – Complete. Click Next.
11. At the Installation Rules screen, click Next.
12. At the Instance Configuration screen, leave the default instance, and click Next.
13. At the Disk Space Requirements screen, click Next.
14. At the Server Configuration screen, click Next.
15. At the Database Engine Configuration screen, select Mixed Mode. Add a local administrator as a SQL Server administrator and specify and confirm a password. Click Next.
16. At the Error Reporting screen, click Next.
17. At the Installation Configuration Rules screen, click Next.
18. At the Ready to Install screen, click Install.

19. After the installation completes, click Close.

Cloning the VMs
1. In your Web browser, connect to the vCenter Server, and browse to the ESXi host.
2. Locate the base VM in the inventory, and shut down the guest OS.
3. Right-click the VM, and select Clone.
4. Follow the on-screen wizard to place the clone in the same datastore as the base.
5. Repeat steps 3 and 4 to make 6 clones from the base VM.
6. In each VM, assign a static IP address.

Running the benchmark

We used two Dell PowerEdge R710 servers running VMware ESXi 5.1 to host Windows Server 2012 client VMs for each solution. We installed SQL Server 2012 Management tools and Benchmark Factory for Databases on each VM.

Creating a blank database on the VMs.
1. In Windows Server 2012, launch Microsoft SQL Server Management Studio.
2. Log into the default instance on the target VM using the appropriate credentials.
3. Right-click Databases, and select New Database.
4. Enter `Testdb` for the database name.
5. Set the Initial Size of the data file to 20,480 MB, and the log file size to 10,240 MB. Place the data file on the data disk and the log file on the log disk.
6. To begin the database creation, click OK.

Installing Benchmark Factory for Databases 6.9.1
1. Navigate to the Benchmark Factory for Databases 6.9.1 installation media and launch the installer.
2. At the first screen of the install wizard, click Next.
3. At the License Agreement screen, accept the license terms, and click Next.
4. At the Destination Folder screen, select an installation path, and click Next.
5. At the Ready to Install the Program screen, click Install.
6. After the wizard completes, click Finish.
7. In Windows, launch Benchmark Factory for Databases.
8. If the User Experience Feedback window pops up, select the No, thank you radio button and click OK.
9. When the Load Scenario Wizard screen pops up, click Next.
10. At the Select Load Scenario screen, select Industry standard benchmarks (TPC-C, TPC-E, TPC-H…), and click Next.
11. At the Select Benchmark screen, select TPC-E, and click Next.
12. At the Select Profile screen, click New.
13. At the Welcome screen, click Next.
14. At the Driver Selection screen, select Microsoft SQL Server (ODBC) from the drop-down menu, and click Next.
15. At the Connection Information screen, click Add DSN.
16. Select System Data Source, and click Next.
17. Select SQL Server Native Client 11.0, and click Next.
18. Click Finish.
19. Enter `Test` for the file data source name.

20. For Which SQL Server do you want to connect to?, enter the name of the database server and click Next.
21. For How should SQL Server verify the authenticity of the login ID? Select With Integrated Windows authentication, and click Next.
22. At the next screen, check the Change the default database to checkbox and select Testdb from the drop-down menu. Click Next.
23. Click Finish.
24. Click Test Data Source…
25. Click OK.
26. Click OK.
27. Select Test from the drop-down menu for the Data Source Name. Enter the login ID and password specified earlier, and click Next.
28. Enter a Profile Name, and click Next.
29. Click Finish.
30. At the Select Profile screen, click Next.
31. At the Benchmark Scale screen, change Benchmark Scale to 2 and click Next.
32. At the Measurement Intervals screen, click Delete All to remove the default selected user loads, enter 100 under Add Single User Load, and click Add. Click Next.
33. At the Select new job to screen, select Create new Benchmark Factory Job, and click Next.
34. At the end of the Load Scenario Wizard, click Finish.
35. Right-click the newly created job, and click Copy.
36. Click the Paste button above the list of jobs. You should see identical copies of the newly created job. Rename the first to TPC-E Job – Create, and the second to TPC-E Job – Test.
37. On TPC-E Job – Create, right-click TPC-E Transaction Mix, and click Remove. Click Yes to confirm.
38. On TPC-E Job – Test, right-click Create Objects for TPC-E, and click Remove. Click Yes to confirm.
39. Right-click TPC-E Job – Create, and click Run Job.

ABOUT PRINCIPLED TECHNOLOGIES

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Principled Technologies, Inc.
1007 Slater Road, Suite 300
Durham, NC, 27703
www.principledtechnologies.com

We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

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Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.