

DELL ACTIVE SYSTEM 800 CONVERGED INFRASTRUCTURE SOLUTION: VDI AND COLLABORATION PERFORMANCE



DELL™ ACTIVE SYSTEM 800 CONVERGED INFRASTRUCTURE SOLUTION

SUPPORTED
UP TO

1,800

SIMULTANEOUS COLLABORATION, OLTP, AND VDI USERS

on **16** Dell PowerEdge™ M620 blade servers and
3 Dell EqualLogic™ PS6110 storage arrays



Businesses require infrastructure that is flexible, rapid to deploy, and predictably scalable, while servicing end users running a wide variety of applications with high performance. Enterprises that consolidate multiple workloads onto a single infrastructure solution face the challenges of resource management and scalability – how well will the system handle the application needs of your users? The new Dell converged infrastructure solution, the Dell Active System 800 featuring Intel® Xeon® processors, provides a pre-configured, pre-integrated, compatibility-tested solution, complete with compute, storage, and networking in a ready-to-deploy package that can run your enterprise's heterogeneous workloads.

In Principled Technologies' lab tests, we found that using just eight Dell PowerEdge M620 servers, the Dell Active System 800 supported up to 900 simultaneous users running five types of applications – VDI, email, Web collaboration, user collaboration, and order processing. We also analyzed the potential for growth in two scenarios; adding two servers and a storage array scaled perfectly to support 1,150 users, and doubling the server count to 16 and adding a third storage array scaled perfectly to support 1,800 users.

These tests demonstrate two fundamental findings. First, the Intel Xeon processor-powered, eight-server configuration of the Dell Active System 800 is ready and capable of supporting enterprises of up to 900 users. Second, the performance scalability of the Dell Active System 800 is predictable and stable. Being able to count on this scalability is a key element in future-proofing your infrastructure.



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A PRINCIPLED TECHNOLOGIES TEST REPORT

Commissioned by Dell Inc.

FLEXIBLE CONVERGENCE WITH POWER

Deploying a successful and efficient blade infrastructure can be a daunting task. That's why Dell created the Dell Active System 800 converged infrastructure solution – a tested, complete, Intel-powered solution that is designed to provide you with the performance you need to support your workloads today and scale to meet your future needs. Dell preconfigures the Dell Active System 800 solution with 2 to 32 Dell PowerEdge M620 blade servers, one or two Dell PowerEdge M1000e blade enclosures, Dell EqualLogic storage arrays, Dell Force10™ switches, and Dell PowerEdge M I/O aggregators. For organizations that require performance on a larger scale, the Active System 800 scales far beyond this base configuration to accommodate a larger number of server nodes and storage arrays. For more information about the solution we tested, see [Appendix B](#).

Power and stability for mixed workloads

In our tests, eight Dell PowerEdge M620 blade servers and two Dell EqualLogic PS6100 series arrays in a Dell Active System 800 configuration supported up to 900 collaboration and order-processing users (Microsoft® Exchange Server 2010, Microsoft SharePoint® Server 2010, Microsoft Lync® Server 2010, and Microsoft SQL Server® 2012), while simultaneously supporting 900 VMware® View™ virtual desktop users. See [Appendix L](#) for more details on the specifics of each test.

Figure 1 provides detailed information on our tests and the results from each benchmark for the 8-blade configuration.

Workload	Metric
Order-processing workload	5,458 orders per minute
Microsoft Exchange	1.78 messages per second
Microsoft SharePoint	8.22 requests per second
Microsoft Lync Server	7.73 IMs per second
VMware View VDI	900 task workers

Figure 1: Eight-blade AS800 configuration test results from running collaboration, order-processing, and virtual desktop workloads.

When our simulated enterprise experienced a 25 percent increase in workload needs, we scaled the environment with no issues. We added two compute nodes and one storage array. In these tests, the 10 Dell PowerEdge M620 blade servers and three Dell EqualLogic PS6100 series arrays in our Dell Active System 800 configuration supported up to 1,150 collaboration and order-processing users while simultaneously supporting 1,150 virtual desktop users. Figure 2 provides detailed information on our tests and the results from each benchmark for the 10- blade configuration.

Workload	Metric
Order-processing workload	6,207 orders per minute
Microsoft Exchange	3.43 messages per second
Microsoft SharePoint	10.51 requests per second
Microsoft Lync Server	8.72 IMs per second
VMware View VDI	1,150 task workers

Figure 2: Ten-blade AS800 configuration test results from running collaboration, order-processing, and virtual desktop workloads.

Even with 100 percent growth from 900 users to 1,800 users, the Dell Active System 800's scalability gave us the flexibility we needed to expand our capacity by adding six more Dell PowerEdge M620 compute nodes to the PowerEdge M1000e chassis. In those tests, our Dell Active System 800 configuration supported up to 1,800 collaboration and order-processing users while simultaneously supporting 1,800 virtual desktop users. Figure 3 provides the detailed information on our tests and the results from each benchmark for the 16-blade configuration.

Workload	Metric
Order-processing workload	9,646 orders per minute
Microsoft Exchange	6.28 messages per second
Microsoft SharePoint	19.15 requests per second
Microsoft Lync Server	14.20 IMs per second
VMware View VDI	1,800 task workers

Figure 3: Sixteen-blade AS800 configuration test results using collaboration, order-processing, and virtual desktop workloads.

- What does this mean for data center managers?** The Dell Active System 800 is designed to support many mixed applications and many users, and our tests confirmed that an Active System 800 configuration with just sixteen servers could support 1,800 users and five mixed applications. The Active System 800 offers data center managers a converged platform to consolidate multi-user multi-application workloads, which has the potential to reduce data center costs as the number of servers, network fabrics, and storage arrays decrease. Platform scalability allows for future expansion for more users and more applications – the Active System 800 supports up to 32 blade servers and multiple storage arrays.
- What does this mean for the end user?** The Dell Active System 800 is designed to support excellent application throughput in a multi-user multi-application environment. Our tests confirmed that an Active System 800 with 8 Dell PowerEdge M620 blade servers can support up to 900 concurrent task workers using three collaboration applications and a typical order-processing application with excellent response times and sufficient headroom. A 25 percent increase in workload required only a 25 percent increase in number of servers; by adding just two servers we increased the number of

supported users to 1,150. We further confirmed the linear performance scalability of Active System 800 by adding six more blades for a total of 16 Dell PowerEdge M620 servers and increasing the supported user count to 1,800 users.

Predictable scalability

In our tests, the Dell Active System 800 configured with eight Dell PowerEdge M620 servers supported 900 mixed-use end users. With the simple addition of two Dell PowerEdge M620 servers and one Dell EqualLogic PS array, the Dell Active System 800 was capable of supporting 1,150 mixed-use end users. With a fully populated blade chassis, the Dell Active System 800 configured with 16 Dell PowerEdge M620 servers and three Dell EqualLogic PS arrays supported a total of 1,800 mixed-use end users. The ability to predictably grow as your business needs increase is a critical factor in budgetary and infrastructure planning.

- **What does this mean for data center managers?** Predictable scalability—adding resources and seeing linear increases in capacity—lets you better plan for infrastructure growth and budgetary needs, even as your business continues to grow. For example, if your Microsoft Exchange or Microsoft SharePoint needs increase, you can add additional virtual compute resources on the Active System 800 nodes on which you have available resources, or add physical servers to the configuration. If you must grow your infrastructure to accommodate demand, you can do so in a predictable, converged manner.
- **What does this mean for the end user?** Resource contention on back-end data center infrastructure should never create response time, throughput, or availability problems for the end user. In our tests, the Active System 800 had the ability to run five simultaneous mixed applications with exceptional output using 8, 10, or 16 servers for 900, 1,150, or 1,800 users. This means that our simulated users could complete daily collaboration tasks and use their virtual desktop sessions without sacrificing performance or resource availability.

Excellent performance even with growth

When adding resources to your infrastructure to accommodate user growth, the performance of existing applications should not suffer. To show that the Active System 800 could easily handle additional users, we added additional application load to our original configuration to simulate a growth in business need. For the 1,150-user scenario, we increased the application demands of each workload by roughly 25 percent. (For the specific application load increase method we used for each benchmark, see the methodology appendices.) Because the simulated increase in users from 900 to 1,150 would require extra compute and storage resources, we added two Dell PowerEdge M620 servers and a single Dell EqualLogic PS6110XS array. We found that there was a corresponding throughput increase for all workloads. To test more intense performance requirements, we increased the servers available to the Active

System 800 to 16, and increased the workload demands to target 1,800 simulated users. We again found that all workloads increased their throughput appropriately to handle the increase in user demand.

Workload	8-blade configuration	10-blade configuration	16-blade configuration	Percentage increase from scaling from 8 blades to 10 blades	Percentage increase from scaling from 8 blades to 16 blades
Order-processing workload	5,458 orders per minute	6,207 orders per minute	9,646 orders per minute	13.7%	76.73%
Microsoft Exchange	1.78 messages per second	3.43 messages per second	6.28 messages per second	92.7%	252.97%
Microsoft SharePoint	8.22 requests per second	10.51 requests per second	19.15 requests per second	27.9%	133.01%
Microsoft Lync Server	7.73 IMs per second	8.72 IMs per second	14.20 IMs per second	12.8%	83.70%
VMware View VDI	900 task workers	1,150 task workers	1,800 task workers	27.8%	100.00%

Figure 4: Results from our testing of collaboration, order-processing, and virtual desktop workloads.

- **What does this mean for data center managers?** These tests show that even under increased application demand, the scalable design of the Active System 800 enabled greater throughput in our applications as we scaled our performance requirements.
- **What does this mean for the end user?** The increased capacity of the solution after servers were added means that as long as additional resources are added, our simulated end users had no performance degradation.

ABOUT THE ACTIVE SYSTEM 800

A member of the Active Infrastructure converged infrastructure framework family, the Active System 800 is designed to be a comprehensive solution for rapid deployment of a pre-integrated enterprise data center solution. Available in a number of configurations, Dell aims for the Active System 800 to be simple to purchase, configure, and maintain, as well as expand to meet additional requirements in the future. The solution features the following:

- Unified management, via Dell Active System Manager software
- Converged LAN/SAN fabrics, using Dell Force10 S4810 top-of-rack switches and Dell M I/O Aggregators
- Industry-standard Data Center Bridging (DCB) protocols for interoperability with third-party infrastructure, which maximizes traffic performance for protocols such as iSCSI
- Flexible scalability using the Dell PowerEdge M1000e blade chassis
- Enhanced top-of-rack (TOR) switch functionality and coordination with Dell PowerEdge M I/O Aggregators

- Dell PowerEdge M620 servers for compute
- Dell EqualLogic PS6110 storage
- Support for VMware®-based enterprise virtualization

Active System 800 base specifications

- Dell PowerEdge M1000e blade chassis (1 or 2)
- Dell PowerEdge M620 blade server (2 to 32)
 - Intel® Xeon® processors E5-2660 (Upgradeable)
 - 128GB RAM (Upgradeable) (256 GB Tested)
- Dell Force10 S4810 TOR switch (2)
- Dell Force10 S55 management switch
- EqualLogic PS6110
- PowerEdge M I/O Aggregator

Active System Manager

Active System Manager aims to provide centralized hardware deployment mechanisms for the solution, through the following:

- Template-based configuration for provisioning and management
- Wizard-based discovery, inventory, and deployment of blade and chassis infrastructure
- Guided user workflows, multi-level views of I/O topology

About the Dell PowerEdge M620 blade server

The Dell PowerEdge M620 is a half-height two-socket blade server powered by the Intel Xeon processor E5-2600 series that can hold up to 768 GB of RAM in 24 DIMM slots. The PowerEdge M620 comes standard with several management features, including iDRAC7 Express with Lifecycle Controller for Blades, which allow administrators to manage environments locally or remotely. Along with other members of the M-series PowerEdge server line, the PowerEdge M620 integrates with the power-efficient Dell PowerEdge M1000e blade enclosure.

About the Intel Xeon processor E5 family

The Intel Xeon processor E5 family, which comes standard in new Dell PowerEdge servers and in the Active System 800, incorporates new technology and features to meet the computing demands of the present and future. The Intel Xeon processor E5 family delivers intelligent and adaptive performance using such features as Intel Turbo Boost Technology 2.0, Intel Advanced Vector Extension, Intel Integrated I/O, and Intel Data Direct I/O Technology. These new processors also feature Intel Trusted Execution Technology (Intel TXT) and utilize Intel Advance Encryption Standard New Instructions (Intel AES-NI) to help keep your data safe.

For more information about the Intel Xeon processor E5 family, visit <http://www.intel.com>.

Features of the PowerEdge M I/O Aggregator

The PowerEdge M I/O Aggregator enables the PowerEdge M1000e blade enclosure to communicate with other devices on your network using fewer physical connections. The PowerEdge M I/O Aggregators also enable administrators to push complex network requirements to the top-of-rack switch.

Features of the Dell EqualLogic PS6110

The Dell EqualLogic PS6110 10GbE iSCSI family provides rack storage, capable of supplying both the I/O and storage needed to run a high-end virtualized data center environment. Its benefits include the following:

- **Reliability.** Potential options include hot-swap, incremental expansion, dual power and network controllers, and port sharing for failover scenarios.
- **Connectivity.** Connect via 10GbE SFP+ module or cost-effective 10GBASE-T copper.
- **Capacity.** Each array supports a variety of drive configurations.
- **Performance.** Each backplane provides top-of-the-line disk I/O, while 10GbE technology maximizes throughput to and from the array.
- **Management.** EqualLogic Host Software and Host Integration Tools provide configuration and monitoring capabilities.

Features of the Dell Force10 S4810P top-of-rack switch

The Dell Force10 S4810P High-Performance 10/40 GbE Switch enables high-bandwidth, low-latency communications for the demanding conditions of a modern performance-driven server environment. Its benefits include the following:

- **Performance.** Capable of 1.28Tbps, full-duplex, L2 and L3 forwarding through a full-duplex, non-blocking, cut-through switching architecture..
- **Capacity.** Occupying only a single rack unit, the S4810 provides 48 dual-speed 1/10GbE (SFP+) ports and 4 x 40GbE (QSFP+) uplink ports. Breakout cables enable the uplink ports to deliver 64 x 10GbE ports.
- **Reliability.** Dell has engineered the modular Dell Force10 operating system for stability, advanced monitoring, and serviceability, while redundant power supplies and fans mitigate risk for single-point-of-failure issues on the hardware.

Features of the PowerEdge M1000e and Fabric

The Dell PowerEdge M1000e blade chassis and its fabric interconnects are designed for large-scale consolidation and enterprise infrastructure. Features of the PowerEdge M1000e include:

- **Management.** Provides a secure centralized management interface for the chassis and blades within, using proven Web (SSL-encrypted) and CLI (SSH/Telnet) technologies.

- **Simplified 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 8Tbps in I/O bandwidth capacity, and FlexIO support provides a number of connectivity options for your servers.
- **Reliability and efficiency.** Six power supplies and nine fans, all hot-swappable, allowing for maintenance of key chassis components. Components have many power-tuning options to allow administrators to adjust for power efficiencies in their data center.

TESTING ENVIRONMENT

Testing virtual desktop performance

Login Virtual Session Indexer (Login VSI) 3.6 is a tool that helps assess the virtual desktop performance, capacity, and scalability of a server. After all desktops are idle, Login VSI incrementally logs users into virtual desktop sessions and begins workloads on each. Login VSI measures the total response times of seven typical office operations from each session and calculates the VSI Index Average by taking the average response times and dropping the highest and lowest 2 percent.

As more sessions begin to consume system resources, response times degrade and the VSI index increases until it is above the Dynamic VSImax. When this condition is met, the benchmark records a Login VSImax, which is the maximum number of sessions that the platform can support.

The newest version of Login VSI, Login VSI 3.6, includes client side performance testing that test character response, large text response, mouse-click feedback, and image quality and loading times on clients to ensure good end-user performance. In our tests, we did not use the client-side testing portion of Login VSI, but instead used the tool to determine how many virtual desktops the servers could support and to run the Medium workload to tax the servers. For more information about Login VSI 3.6, see <http://www.loginvsi.com/product-overview>.

Testing SQL Server performance

SQL Server 2012 is the latest release of Microsoft's database management platform. Microsoft has added new features to enhance performance, security, and management.

We used the DVD Store 2.1 (DS2) benchmark to simulate a heavy load on SQL Server 2012. For each user, we sent an average of six operations per minute, or a database request every 10 seconds. DS2 reports results in the number of orders per minute (OPM) the server was able to process.

Testing Exchange Server performance

Microsoft Exchange Server 2010 SP2 is a communications platform that provides users anywhere access.

To assess performance, we used Microsoft Exchange Load Generator (LoadGen), an industry-standard tool for benchmarking Microsoft Exchange Server 2003, 2007, or 2010 mail servers. LoadGen simulates standard mail activity from a set number of users. When the workload finishes, LoadGen calculates the number of milliseconds necessary to complete its predefined tasks and reports these response times. LoadGen measures the impact that mail clients using the MAPI, OWA, IMAP, POP, and SMTP protocols have on Exchange servers. We can test how effectively a server or guest running Exchange responds to email loads. The simulator, running on a client machine, generates mail load by sending multiple requests from many users to the Exchange server.

Testing SharePoint performance

Microsoft SharePoint Server 2010 SP1 is the latest version of Microsoft's collaboration software, which allows users to create collaborative Web sites and to create and manage their own workspaces.

To simulate the traffic load on SharePoint 2010, we used a customized version of the WSSDW 1.0.0.0 Beta test. This test creates sample data, populates the server with it, and simulates SharePoint Server users completing everyday tasks. We used Visual Studio 2010 to execute the test workload, and generated a realistic user workload where each of the simulated users performed a task approximately every minute.

Testing Lync Server performance

Microsoft Lync Server 2010, the latest in collaborative communication software, brings voice, video, application sharing, instant messaging (IM), and Web conferencing together into a single unified platform.

To measure the performance of this application suite, we used the Microsoft Lync Server 2010 Stress and Performance Tool package, which can be used to prepare, define, and validate performance targets of user scenarios offered by a Lync Server 2010 deployment. The package includes a set of tools that can simulate simultaneous users on one or more Lync Servers and simplifies the capacity planning for Microsoft Lync Server 2010 communications software. For our testing, we chose to utilize three commonly used modules: instant messaging (IM), audio/video conferencing, and address book queries.

IN CONCLUSION

When searching for a converged infrastructure solution to deploy to your data center, choosing a complete solution that can run a variety of simultaneous workloads is a must for

your organization. An easy-to-deploy, predictable, highly scalable solution that has the ability to meet your workload requirements and provides administrators with flexibility is vital to running an efficient data center.

In our tests, the Dell Active System 800 provided ample performance to drive the needs of a 1,800-person organization using multiple collaboration applications, order-processing applications, and virtual desktop infrastructure. Adding more server and storage capacity to the system allows for reliable and predictable scalability that can be tailored to your organization's specific needs. Expand your infrastructure only as much as you need; the Dell Active System 800 is able to perform well for all end-users while providing flexibility for administrators.

APPENDIX A – DETAILED TEST MEASUREMENTS

Below we provide more specific test measurements relating to storage, power usage, and the virtual desktop response times.

Metrics	8-blade configuration	10-blade configuration	16-blade configuration
IOPS - First PS6110XS storage array	6,605	6,671	6,673
IOPS - Second PS6110XS storage array	N/A	3,263	6,605
IOPS - PS6110X storage array	1,989	2,536	3,494
Storage Latency ms - First PS6110XS storage array	1.31	1.48	1.28
Storage Latency ms - Second PS6110XS storage array	N/A	<1.00	1.10
Storage Latency ms - PS6110X storage array	3.14	3.24	2.22

Figure 5: Storage measurements during the test scenarios.

Power (W)	8-blade configuration	10-blade configuration	16-blade configuration
M1000e Chassis	2,857	3,242	5,206
Force10 switches	306	305	306
First PS6110XS storage array	394	389	397
Second PS6110XS storage array	N/A	362	399
PS6110X storage array	388	390	396
Watts - total solution	3,944	4,688	6,705
Watts per user	4.38	4.08	2.89

Figure 6: Power measurements during the test scenarios.

VDI-specific results

Figures 7 through 11 show the VSI index average and average response times for all active sessions recorded during the tests during the 8-blade, 10-blade, and 16-blade tests. For the 10-blade configuration, we added 125 task workers per blade to blades 7 and 8, and that response time is shown in Figure 9. For the 16-blade configuration, we assigned 125 task workers per blade for blades 1 through 7 and 9 through 15 and 25 task workers per blade for blades 8 and 16. As the figures show, the average response time for the active sessions never exceeded the VSI index average, indicating an acceptable score from Login VSI.

Figure 7: VDI response time compared with VSI Index Average, blades 1 through 8, for the 8-blade, 900-task worker scenario.

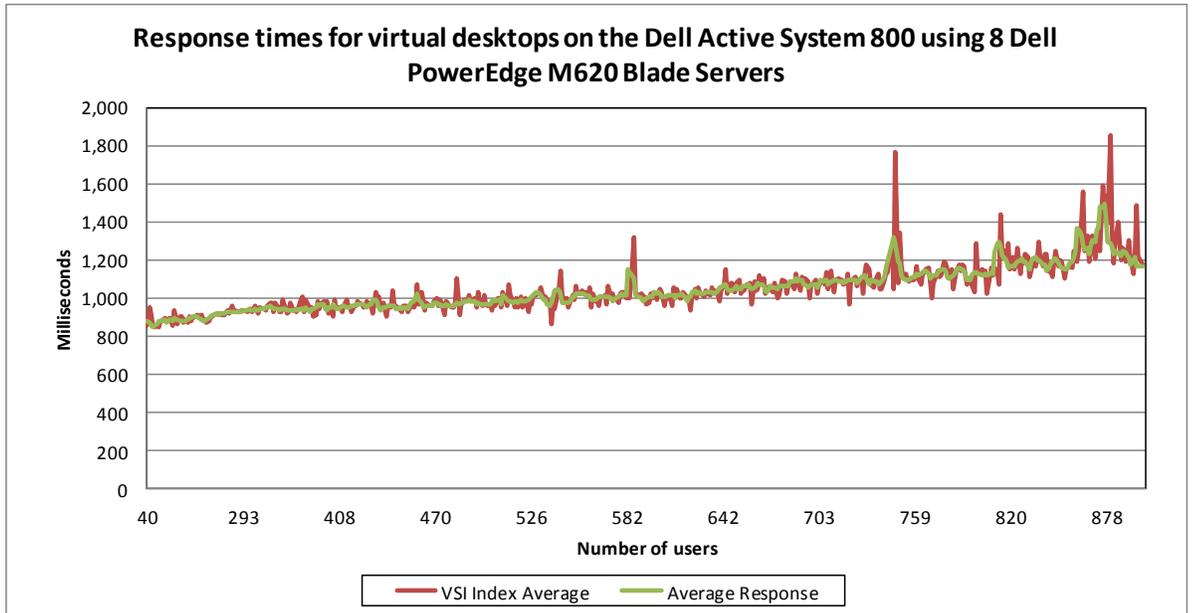


Figure 8: VDI response time compared with VSI Index Average, blades 1 through 8, for the 10-blade, 1,150-task worker scenario.

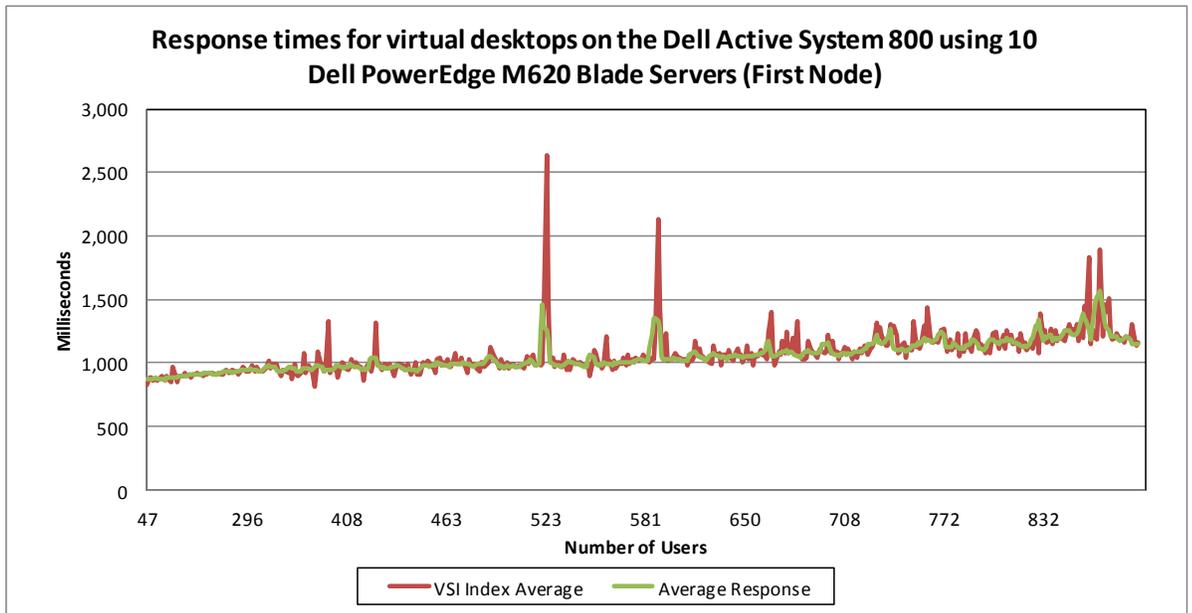


Figure 9: VDI response time compared with VSI Index Average, blades 9 and 10, for the 10-blade, 1,150-task worker scenario.

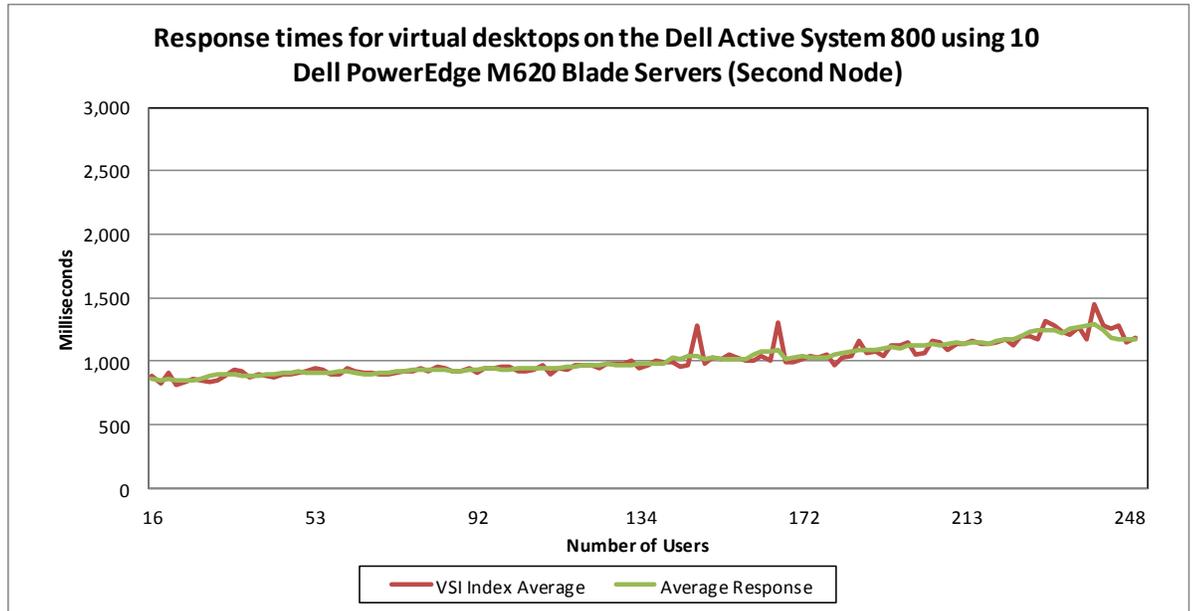


Figure 10: VDI response time compared with VSI Index Average, blades 1 through 8, for the 16-blade, 1,800-task worker scenario.

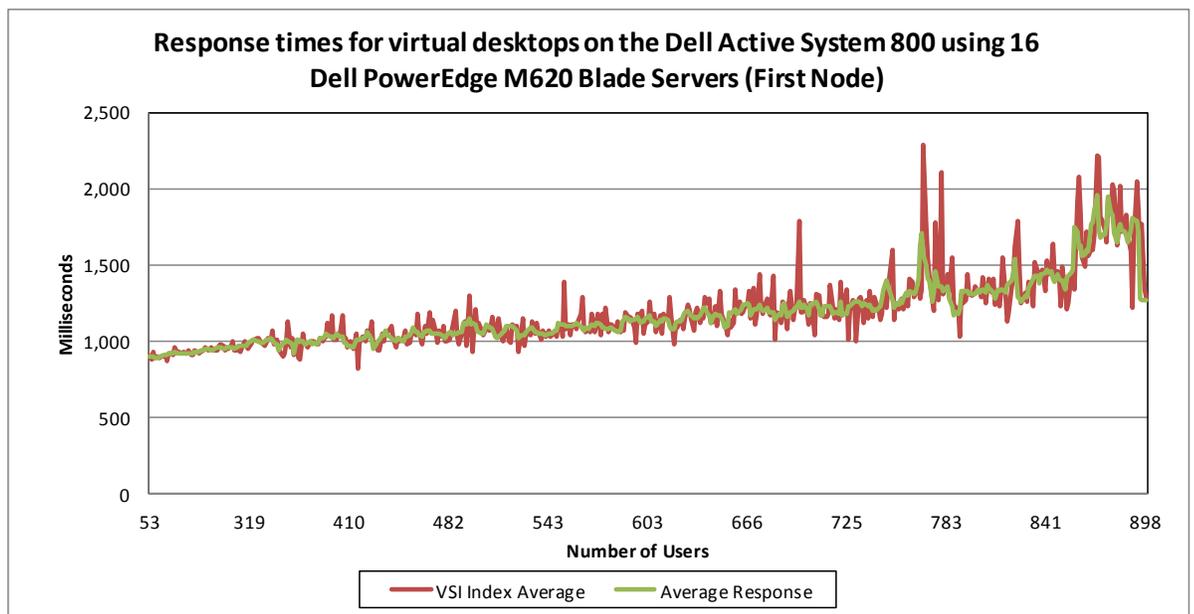
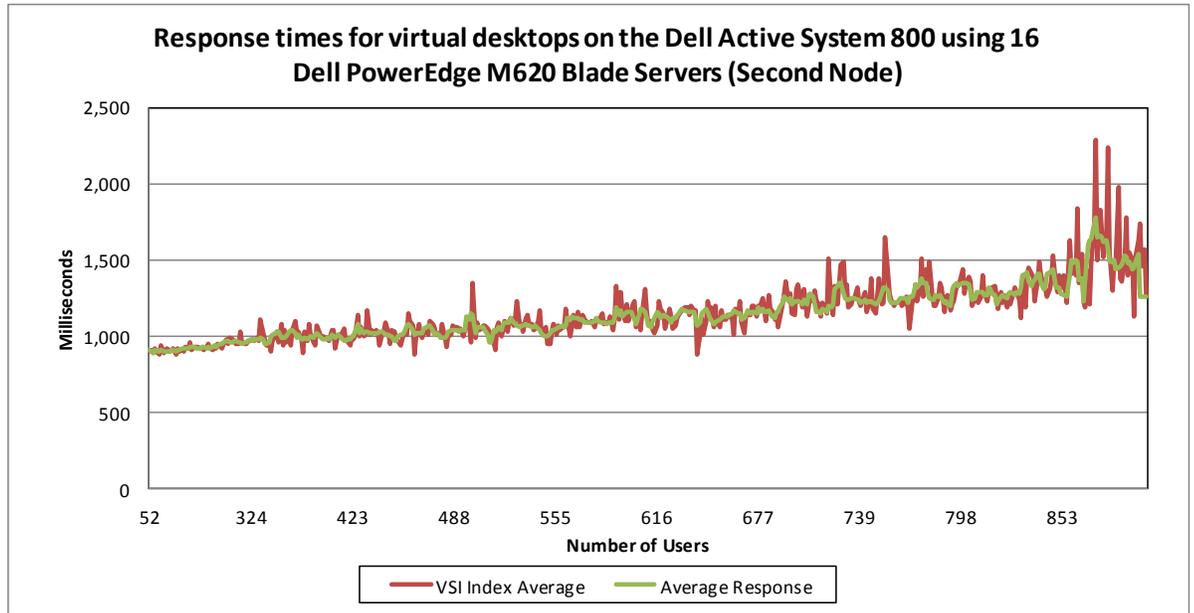


Figure 11: VDI response time compared with VSI Index Average, blades 9 through 16, for the 16-blade, 1,800-task worker scenario.



APPENDIX B - DETAILED CONFIGURATION INFORMATION

Figure 12 provides detailed configuration information about the test server blades and chassis.

Server	Dell PowerEdge M620
Enclosure	
Blade enclosure	Dell PowerEdge M1000e
General dimension information of blade enclosure	
Height (inches)	17.25
Width (inches)	19.00
Depth (inches)	29.50
U size in server rack (U)	10
Power supplies of blade enclosure	
Total number	6
Wattage of each power supply (W)	2,700
Cooling fans of blade enclosure	
Total number	9
Dimensions (h x w) of each	3-1/4" x 3-1/4 "
Voltage (V)	12
Amps (A)	5
General processor setup	
Number of processor packages	2
Number of cores per processor package	8
Number of hardware threads per core	2
System power management policy	Max Performance
CPU	
Vendor	Intel
Name	Xeon E5-2660
Stepping	C2
Socket type	Socket 2011 LGA
Core frequency (GHz)	2.20
Bus frequency	8 GT/s
L1 cache	32 KB + 32 KB (per core)
L2 cache	256 KB (per core)
L3 cache	20 MB (shared)
Platform	
Vendor and model number	Dell PowerEdge M620
Motherboard model number	0GVN4C
Motherboard chipset	Intel ID3C00 Rev. 07
BIOS name and version	Phoenix ROM BIOS PLUS Version 1.10 1.2.6 ¹
BIOS settings	System Profile set to Max Performance

¹ The BIOS for the 1,800-user scenario was 1.4.9.

Server	Dell PowerEdge M620
Memory modules	
Total RAM in system (GB)	256
Vendor and model number	Hynix HMT42GR7MFR4C-PB
Type	PC3-12800
Speed (MHz)	1,600
Speed in the system currently running @ (MHz)	1,066
Timing/latency (tCL-tRCD-iRP-tRASmin)	11-11-11-35
Size (GB)	16
Number of RAM modules	8
Chip organization	Double-sided
RAID controller	
Vendor and model number	PERC H710 Mini
Firmware version	21.0.1-0132
Cache size	1 GB
Hard disk	
Vendor and model number	Seagate ST9146853SS
Number of disks in system	2
Size (GB)	146
Buffer size (MB)	64
RPM	15,000
Type	6Gb SAS
Operating system	
Name	VMware vSphere® 5.1
Build number	799733
File system	VMFS
Language	English
Network card/subsystem	
Vendor and model number	Broadcom® NetXtreme® II 10 Gb Ethernet BCM57810
Type	Onboard

Figure 12: Detailed configuration information for the ten Dell PowerEdge M620 blades we used in our tests.

APPENDIX C - TEST STORAGE INFORMATION

Figures 13 and 14 provide detailed information for the test storage. We used two of each of the storage arrays for the test configuration.

Storage array	Dell EqualLogic PS-6110X
Number of storage controllers per array	2
RAID level	10
Number of drives per array	24 (22 active data drives, 2 spares)
Drive vendor and model number	Seagate ST9900805SS
Drive size (GB)	900
Drive buffer size (MB)	64
Drive RPM	10,000
Drive type	6Gb SAS

Figure 13: Detailed configuration information for the Dell EqualLogic PS-6110X storage array.

Storage array	Dell EqualLogic PS-6110XS (2)
Number of storage controllers per array	2
RAID level	6 (accelerated)
Number of drive types per array	2
First type of drive in array	
Number of drives per array	7
Drive vendor and model number	Pliant LB 400M
Drive size (GB)	400
Drive buffer size (MB)	None
Drive RPM	Not applicable
Drive type	3Gb SAS
Second type of drive in array	
Number of drives per array	17 (16 active data drives, 1 spare)
Drive vendor and model number	Seagate ST9600205SS
Drive size (GB)	900
Drive buffer size (MB)	64
Drive RPM	10,000
Drive type	6Gb SAS

Figure 14: Detailed configuration information for the two Dell EqualLogic PS-6110XS storage arrays.

APPENDIX D - STORAGE CONFIGURATION FOR PERFORMANCE TESTING

We used one Dell EqualLogic PS6110X array and one Dell EqualLogic PS6110XS array for the 8-blade, 900-user scenario, configured in a single group. We added one additional Dell EqualLogic PS6110XS array to support the 10-blade, 1,150-user and 16-blade, 1,800-user scenarios. Each array was cabled to both of the Dell Force10 S4810 TOR switches via 10Gb network cables. On the group, we configured three storage pools (one per array), each containing all volumes responsible for a specific part of the testing infrastructure.

We configured our Storage pools and volumes as follows.

- Storage Pool 1 on the Dell EqualLogic PS6110X storage array held the volumes for our collaboration servers.
 - Lync Server – 100 GB
 - Exchange Data – 2 TB
 - Exchange Log – 50 GB
 - Exchange OS – 100 GB
 - SharePoint Data – 250 GB
 - SharePoint OS – 100 GB
 - SQL Data – 300 GB
 - SQL Logs – 200 GB
 - SQL OS – 200 GB
- Storage Pool 2 on the first Dell EqualLogic PS6110XS storage array held the volumes for our first VMware View pool.
 - VMware View Replica – 100 GB
 - vDT-01 – 600 GB
 - vDT-02 – 600 GB
 - vDT-03 – 600 GB
 - vDT-04 – 600 GB
- To support the 1,150- and 1,800-user scenarios, we added a second Dell EqualLogic PS6110XS array to the group, and added an additional storage pool for this tray to hold the volumes for our second VMware View pool.
 - VMware View Replica – 100 GB
 - vDT2-01 – 600 GB
 - vDT2-02 – 600 GB
 - vDT2-03 – 600 GB
 - vDT2-04 – 600 GB

Setting up the Dell EqualLogic PS6110X storage array

Connect to the storage array using serial port and terminal utility and complete the following steps:

1. Power on the array and enter the login credentials.
2. When prompted to configure the array, type `y`.
3. When asked Do you want to proceed?, type `Yes`.
4. Enter a member name and press Enter. For our testing we chose `tray1`.
5. Press Enter for the eth0 network interface.
6. Enter an IP address, and press Enter. For our testing, we chose `192.10.11.11`.

7. Leave the default netmask, and press Enter.
8. Leave the default gateway, and press Enter.
9. Enter a group name and press Enter. For our testing, we chose `group`.
10. Enter an IP address for the group, and press Enter. For our testing, we chose `192.10.11.1`.
11. Enter a password for this group, and press Enter.
12. Confirm all configurations and finish the group creation.
13. Repeat these steps for both of the PS6110XS storage arrays. Enter applicable IP address information and credentials.

Configuring the EqualLogic arrays

1. Log into EqualLogic Web interface using a Web browser.
2. Enter the EqualLogic storage group IP address into a Web browser and use the administrator credentials to log in to the EqualLogic Group Manager.
3. Select the storage group, and expand the members (arrays) in the left pane.
4. Create two pools in addition to the default pool.
5. Select the first member (tray1, PS6110X), which will show as unconfigured, and click Yes to configure the RAID.
6. At the General Settings screen, change the default name, leave the default storage pool assignment, and click Next.
7. At the RAID configuration screen, select RAID 10, and click Next.
8. At the Summary screen, click Finish.
9. Select the second member (tray2, PS6110XS), which will show as unconfigured, and click Yes to configure the RAID.
10. At the General Settings screen, change the default name, place in the appropriate second pool, and click Next.
11. At the RAID configuration screen, select RAID 6 (accelerated), and click Next.
12. At the Summary screen, click Finish.
13. Select the third member (tray3, PS6110XS), which will show as unconfigured, and click Yes to configure the RAID.
14. At the General Settings screen, change the default name, place in the appropriate third pool, and click Next.
15. At the RAID configuration screen, select RAID 6 (accelerated), and click Next.
16. At the Summary screen, click Finish.

Creating volumes

1. In the left pane, click Volumes, and, in the adjacent pane, click Create volume.
2. Name the volume, select the appropriate storage pool assignment, 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 names.
5. Click Finish.
6. Repeat steps 1 – 5 to create all of the additional volumes as necessary. The replica volumes for VMware View must be created first on storage pools 2 and 3.

APPENDIX E – NETWORK CONFIGURATION FOR PERFORMANCE TESTING

We configured the network cabling of the hardware as shown in Figure 15. We used components in an Active System 800 configuration for our network. Auxiliary machines for testing, such as client machines, Active Directory server, and vCenter Server, ran on the LAN.

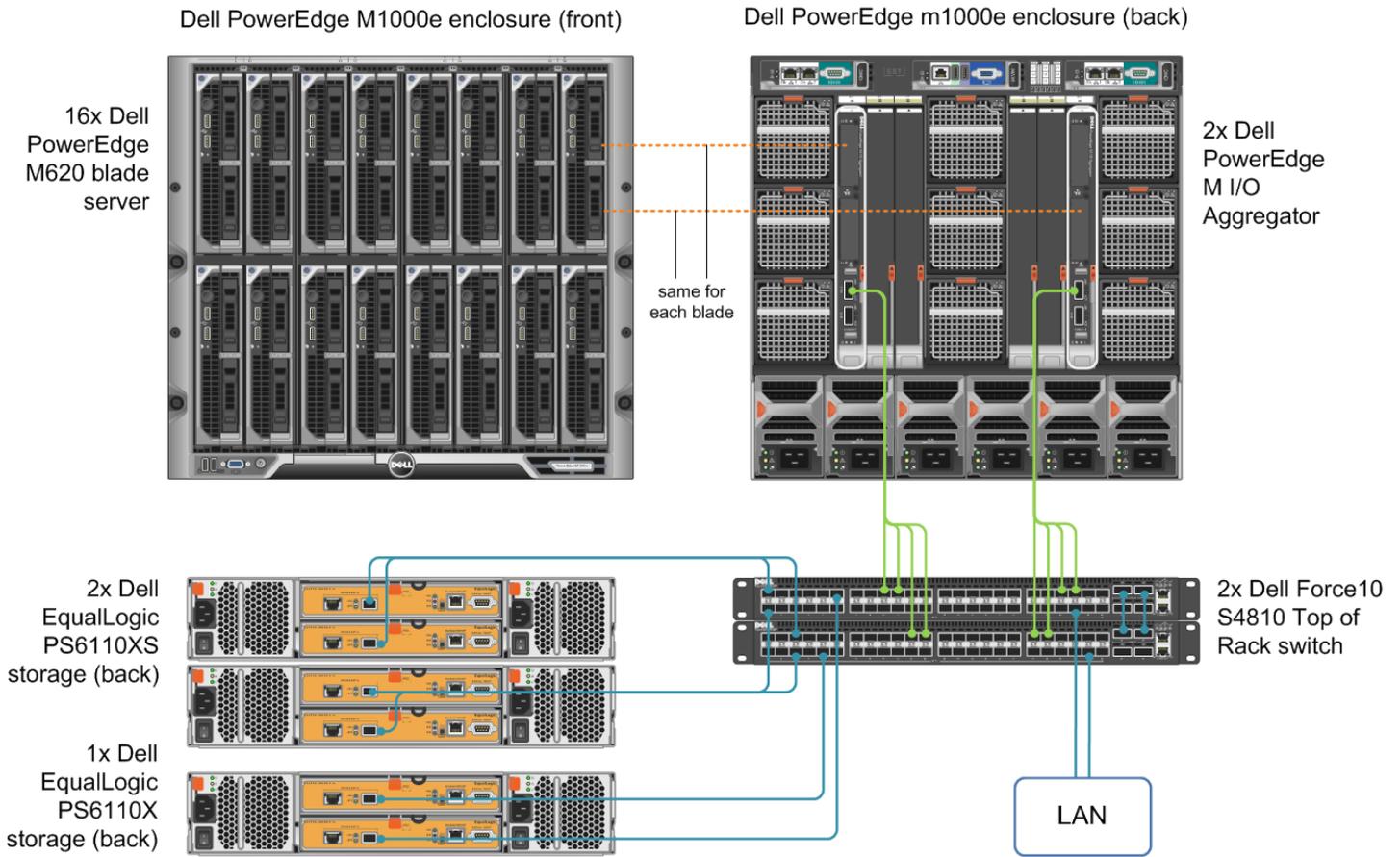


Figure 15: Physical cabling we used in testing. We added a second Dell EqualLogic PS6110XS storage array to support the 10- and 16-blade- scenarios. Note in full Active System 800 configuration, further redundancy would be configured.

Configuring power settings on the Dell M1000e chassis

1. Log into Dell Chassis Management Controller Web interface using a Web browser.
2. Click on the Power tab and select configuration.
3. Set the System Input Power Cap to 100%.
4. Set the Redundancy Policy to AC Redundancy.
5. Enable Dynamic Power Supply Engagement.

Dell Force10 S4810P switch configuration

For our testing, we used switch firmware version 8.3.12.0. Connect to each switch with a serial cable and terminal utility, but do not connect the switches with each other, and complete the steps below:

Setting up the stack configuration

1. Once connected through the terminal to the first switch, which will become the master, type `enable` and press Enter.
2. Type `delete startup-config` and press Enter. When asked to confirm, type `yes` and press Enter.
3. Type `reload` and press Enter, and if asked to save the system configuration, type `no` and press Enter.
4. When asked to proceed with the reload, type `yes` and press Enter.
5. When the switch finishes rebooting, type `enable` and press Enter.
6. Type `config` and press Enter.
7. Type `stack-unit 0 priority 2` and press Enter.
8. Type `exit` and press Enter.
9. Type `stack-unit 0 stack-group 14` and press Enter.
10. Type `stack-unit 0 stack-group 15` and press Enter.
11. Type `copy run start` and press Enter.
12. Connect to the second switch in the terminal.
13. Type `enable` and press Enter.
14. Type `delete startup-config` and press Enter. When asked to confirm, type `yes` and press Enter.
15. Type `reload` and press Enter, and if asked to save the system configuration, type `no` and press Enter.
16. When asked to proceed with the reload, type `yes` and press Enter.
17. When the switch finishes rebooting, type `enable` and press Enter.
18. Type `stack-unit 0 renumber 1` and press Enter.
19. Type `config` and press Enter.
20. Type `stack-unit 1 priority 1` and press Enter.
21. Type `exit` and press Enter.
22. Type `stack-unit 1 stack-group 14` and press Enter.
23. Type `stack-unit 1 stack-group 15` and press Enter.
24. Type `copy run start` and press Enter.
25. Connect the switches with QSFP cables, from ports 56 and 60 in the first switch to the opposite ports in the second switch (port 56 in the first switch to port 60 in the second, etc.).
26. Connect to the first switch through the terminal, type `reload` and press Enter. Type `yes` and press Enter when asked to proceed with the reload.
27. Wait for the first switch to finish rebooting.
28. Connect to the second switch through the terminal.
29. Type `reload` and press Enter. Type `yes` and press Enter when asked to proceed with the reload.
30. Wait for the second switch to finish rebooting.
31. Connect to the first switch through the terminal.
32. To ensure that the stack has been set up, type `show redundancy` and press Enter.
33. If configuration was successful, the LED labeled MASTER will have a steady green light for the master switch (the first switch) and will show blinking green light for the standby switch (the second switch).

Configuring the out-of-band management port

1. In the first switch's terminal, type `enable` and press Enter.

2. Type `config` and press Enter.
3. Type `interface ManagementEthernet 0/0` and press Enter.
4. Type `shutdown` and press Enter.
5. Type IP address `192.168.11.254 255.255.255.0` and press Enter.
6. Type `no shutdown` and press Enter.
7. Type `exit` and press Enter.

Configuring login credentials

1. Type `username admin privilege 15 password 0 password` and press Enter, where *password* is the password you wish to set.
2. Type `enable password level 15 0 password` and press Enter.

Configuring the remaining ports

1. Type `interface range tengigabitethernet 0/0 - 47 , tengigabitethernet 1/0 - 47` and press Enter.
2. Type `no ip address` and press Enter.
3. Type `mtu 12000` and press Enter.
4. Type `portmode hybrid` and press Enter.
5. Type `switchport` and press Enter.
6. Type `no flowcontrol rx on tx off` and press Enter.
7. Type `no shutdown` and press Enter.
8. Type `exit` and press Enter.

Configuring port channels for LAG

1. Type `interface port-channel 1` and press Enter.
2. Type `no ip address` and press Enter.
3. Type `mtu 12000` and press Enter.
4. Type `portmode hybrid` and press Enter.
5. Type `switchport` and press Enter.
6. Type `no shutdown` and press Enter.
7. Type `exit` and press Enter.
8. Type `interface port-channel 2` and press Enter.
9. Type `no ip address` and press Enter.
10. Type `mtu 12000` and press Enter.
11. Type `portmode hybrid` and press Enter.
12. Type `switchport` and press Enter.
13. Type `no shutdown` and press Enter.
14. Type `exit` and press Enter.
15. Type `interface range tengigabitethernet 0/0 - 1 , tengigabitethernet 1/0 - 1` and press Enter.
16. Type `no ip address` and press Enter.
17. Type `no switchport` and press Enter.
18. Type `shutdown` and press Enter.

19. Type `port-channel-protocol lacp` and press Enter.
20. Type `port-channel 1 mode active` and press Enter.
21. Type `no shutdown` and press Enter.
22. Type `exit` and press Enter.
23. Type `interface range tengigabitethernet 0/2 - 3 , tengigabitethernet 1/2 - 3` and press Enter.
24. Type `no ip address` and press Enter.
25. Type `no switchport` and press Enter.
26. Type `shutdown` and press Enter.
27. Type `port-channel-protocol lacp` and press Enter.
28. Type `port-channel 2 mode active` and press Enter.
29. Type `no shutdown` and press Enter.
30. Type `exit` and press Enter.

Configuring iSCSI optimization

1. Type `iscsi enable` and press Enter.

Configuring Data Center Bridging (DCB)

1. Type `dcb-input pfc` and press Enter.
2. Type `pfc priority 4` and press Enter.
3. Type `exit` and press Enter.
4. Type `priority-group iSCSI` and press Enter.
5. Type `priority-list 4` and press Enter.
6. Type `set-pgid 1` and press Enter.
7. Type `exit` and press Enter.
8. Type `priority-group OTHER` and press Enter.
9. Type `priority-list 0-3,5-7` and press Enter.
10. Type `set-pgid 2` and press Enter.
11. Type `exit` and press Enter.
12. Type `dcb-output ets` and press Enter.
13. Type `priority-group iSCSI qos-policy iSCSI` and press Enter.
14. Type `priority-group OTHER qos-policy OTHER` and press Enter.
15. Type `exit` and press Enter.
16. Type `service-class dynamic dot1p` and press Enter.
17. Type `interface range tengigabitethernet 0/0 - 47 , tengigabitethernet 1/0 - 47` and press Enter.
18. Type `dcb-policy input pfc` and press Enter.
19. Type `dcb-policy output ets` and press Enter.
20. Type `protocol lldp` and press Enter.
21. Type `exit` and press Enter.
22. Type `exit` and press Enter.
23. Type `qos-policy-output iSCSI ets` and press Enter.

24. Type `bandwidth-percentage 50` and press Enter.
25. Type `exit` and press Enter.
26. Type `qos-policy-output OTHER ets` and press Enter.
27. Type `bandwidth-percentage 50` and press Enter.
28. Type `exit` and press Enter.
29. Type `dcb-policy input stack-unit all stack-ports all pfc` and press Enter.
30. Type `dcb-policy output stack-unit all stack-ports all ets` and press Enter.
31. Type `dcb enable` and press Enter.
32. Type `exit` and press Enter.
33. To save these settings, type `copy run start` and press Enter.
34. To apply these settings, type `reload` and press Enter. When asked if you want to proceed with the reload, type `yes` and press Enter. After the switches reboot, the settings will have all taken effect.

APPENDIX F – SERVER INSTALLATION, GENERAL CONFIGURATION, AND GUEST OPERATING SYSTEM INSTALLATION

We installed all PowerEdge M620 servers with VMware vSphere 5.1 build 799733 from the Dell Recovery CD, available from Dell at <http://www.dell.com/support/drivers/us/en/04/DriverDetails/Product/poweredge-m620?driverId=XWYR5&osCode=XI51&fileId=3005015335>. We installed vSphere to each server's internal SD card. We configured these servers to host virtual desktops for VMware View 5.1 in addition to hosting the Lync, Exchange, SharePoint, and SQL Server applications.

We configured a Dell PowerEdge R620 server with VMware vSphere™ (ESXi) 5.1 to host all VMware View infrastructure components for VMware View 5.1, the Active Directory server, and the VMware vCenter Server.

Setting up the infrastructure server (infra) and the virtual desktop hosts (vDT-hosts)

BIOS settings

We used the latest BIOS updates. We adjusted the default BIOS settings to ensure Virtualization Technology was enabled, and set the performance profile to maximum performance.

Installing VMware vSphere 5.1 (ESXi) on the PowerEdge R620 (infra) and all PowerEdge M620s (vDT-Hosts)

1. Insert the ESXi 5.1 7disk, and select Boot from disk.
2. On the Welcome screen, press Enter.
3. On the End User License Agreement (EULA) screen, press F11.
4. On the Select a Disk to install or Upgrade Screen, select the relevant volume to install ESXi on, and press Enter. On the Dell PowerEdge M620 servers we installed to the internal SD card, while on the Dell PowerEdge R620 server we installed to internal storage.
5. On the Please Select a Keyboard Layout screen, press Enter.
6. On the Enter a Root Password Screen, assign a root password, and confirm the password by entering it again. Press Enter to continue.
7. On the Confirm Install Screen, press F11 to install.
8. On the Installation complete screen, press Enter to reboot.

Configuring ESXi after installation

1. On the ESXi 5.1 screen, 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 if you want to apply the changes, press Y.
9. Log into infra as `root` with the vSphere client.

10. Select the Configuration tab, and click Networking.
11. Click Add Networking...
12. Create a virtual machine network called `PRIV-NET` and select the appropriate adapters.
13. Click OK.
14. Select the Configuration tab, and click Time configuration.
15. Select Properties, and click Options.
16. In the General settings, select Start automatically if any ports are open, and Stop when all ports are closed.
17. In the NTP settings, add a reliable NTP server. We used the Active Directory domain controller.
18. Close NTP settings.
19. Select the Configuration tab, and click DNS and routing.
20. Type `infra` for name, and `test.local` for domain.
21. Enter the IP of `172.0.0.10` for preferred DNS.
22. Close DNS.

Creating the ESXi datastores

1. Log into `infra` as `root` with the vSphere client.
2. Click Configuration tab → Storage Adapters → Add...
3. Select Add Software iSCSI Adapter, and click OK.
4. Select the iSCSI adapter and click on Properties...
5. Select the Dynamic Discovery tab and click on Add...
6. Enter the iSCSI Server IP and click OK.
7. Select Rescan All...
8. Select the newly discovered volume.
9. For Datastore name, type `LUN1` and click Next.
10. For Capacity, select Maximum Available Space, and click Next.
11. Click Finish to create the datastore.
12. Repeat steps 8 through 11 to create additional datastores as necessary.

Setting up a VM to host Microsoft Windows Active Directory® server (DC1) on (infra) server

1. In your Web browser, connect to the vCenter Server, and browse to the ESXi host hosting the management VMs.
2. Right-click on the ESXi host, and choose New Virtual Machine.
3. Choose Create a new virtual machine, and click Next.
4. Assign the name `DC1` to the virtual machine, and click Next.
5. Select `infra LUN` for the storage, and click Next.
6. Select ESX 5.1 and later compatibility and click Next.
7. Choose Windows, and choose Microsoft Windows Server 2008 R2, and click Next.
8. Choose the VM's virtual hardware options, and click Next (see each VM's section below for additional VM configuration data).
 - Select one virtual processor socket, and 2 cores per virtual socket
 - 4GB RAM
 - Select VMXNET3 for the NIC interface, connect to the `PRIV-NET` network

9. Choose to create a new virtual disk, and click Next.
10. Make the OS virtual disk size 100 GB, choose thin-provisioned, specify external storage, and click Next.
11. Keep the default virtual device node (0:0), and click Next.
12. Click Finish.
13. Right-click the VM, and choose Edit Settings.
14. Click the Resources tab, and click Memory.
15. Select Reserve all guest memory, and click OK.
16. Connect the VM virtual CD-ROM to the Microsoft Windows Server 2008 R2 installation disk.
17. Start the VM.

Installing the Microsoft Windows Server 2008 R2 operating system on the domain controller VM

1. Choose the language, time and currency, and keyboard input. Click Next.
2. Click Install Now.
3. Choose Windows Server 2008 R2 Enterprise (Full Installation), and click Next.
4. Accept the license terms, and click Next.
5. Click Custom.
6. Click the Disk, and click Drive options (advanced).
7. Click New→Apply→Format, and click Next.
8. After the installation completes, click OK to set the Administrator password.
9. Enter the administrator password twice, and click OK.
10. Connect the machine to the Internet, and install all available Windows updates. Restart as necessary.
11. Enable remote desktop access.
12. Change the hostname to DC1 and reboot when prompted.
13. Run `diskmgmt.msc`.
14. Select the 15 GB secondary volume, name it `profiles` format it NTFS, and assign it drive letter E.
15. Select the 50 GB secondary volume, name it `share` format it NTFS, and assign it drive letter F.
16. Set up networking for the data network:
 - a. Click Start→Control Panel, right-click Network Connections, and choose Open.
 - b. Right-click the VM traffic NIC, and choose Properties.
 - c. Uncheck TCP/IP (v6).
 - d. Select TCP/IP (v4), and choose Properties.
 - e. Set the IP address as `172.0.1.10/255.255.252.0`
17. Install VMware Tools. For more information, see http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=340
18. Reboot.

Installing Active Directory and DNS services on DC1

1. Click Start→Run, type `dcpromo` and click OK.
2. At the Active Directory Domain Services Installation Wizard welcome screen, check the Use advanced mode installation option, and click Next.
3. In the Choose a Deployment Configuration dialog box, select Create a new domain in a new forest, and click Next.

4. At the FQDN page, type `test.local` and click Next.
5. At the NetBIOS name prompt, change the name to `test`, and click Next.
6. At the Forest Functionality level, select Windows Server 2008 R2, and click Next.
7. At the additional Domain Controller Options, leave DNS server selected, and click Next.
8. At the System Folder Location screen, change to `E:\` leave the default options, and click Next.
9. Assign a Directory Services Restore Mode Administrator account password, and click Next.
10. At the Summary screen, review your selections, and click Next.
11. Once Active Directory Domain Services finishes installing, click Finish, and restart the system.
12. Run `dnsmgmt.msc`.
13. Create a reverse lookup zone for DC1.
14. Create static entries for all vSphere hosts.
15. Close DNS manager.
16. Open Windows Explorer, and create a folder called `C:\profiles`.
17. Right click and create a folder called `share`.
18. Right click the folder and select properties.
19. Click sharing tab and click Advanced Sharing...
20. Check the box next to Share this folder, and type `share`, and click permissions.
21. Click on the box for Full control for the Everyone group, click add.
22. Type `system` and click OK.
23. Click Full control and click add.
24. Type `administrators` and click OK.
25. Click Full control and click OK.
26. In the Advanced sharing box, click Caching.
27. Click the button next to No files or programs from the share are available offline, and click OK.
28. Open Explorer and browse to `C:\`.
29. Repeat steps 16-30 to create three more shares called `share2`, `profiles`, and `folders` on `C:\`.

Configuring the Windows time service on DC1

To ensure reliable time, we pointed our Active Directory server to a physical NTP server.

1. Open a command prompt.
2. Type the following:

```
W32tm /config /syncfromflags:manual /manualpeerlist:"<IP address of a NTP server>"
W32tm /config /reliable:yes
W32tm /config /update
W32tm /resync
Net stop w32time
Net start w32time
```

Setting up DHCP services on DC1

1. Click Start→Administrative Tools→Server Manager→Add Roles.
2. Select DHCP Server, and click Next.
3. At the Introduction to DHCP Server screen, click Next.
4. At the Specify IPv4 DNS Settings screen, type `test.local` for the parent domain.
5. Type the preferred DNS server IPv4 address, and click Next.
6. At the Specify IPv4 WINS Server Settings screen, select WINS is not required for applications on the network, and click Next.
7. At the Add or Edit DHCP Scopes screen, click Add.
8. At the Add Scope screen, enter the Name DHCP Scope name.
9. In the next box, set the following values, and click OK.
 - a. Start IP address=192.168.151.1
 - b. End IP address=192.168.254.254
 - c. Subnet mask=255.255.128.0
10. Check the Activate This Scope box.
11. At the Add or Edit DHCP Scopes screen, click Next.
12. Click the Enable DHCP v6 Stateless Mode radio button, and click Next.
13. Leave the default IPv6 DNS Settings, and click Next.
14. At the Authorize DHCP server dialog box, select Use current credentials.
15. At the Confirm Installation Selections screen, click Next. If the installation is set up correctly, a screen displays saying that DHCP server install succeeded.
16. Open DHCP→dc1.test.local→IPv4→Server Options.
17. Right-click Server Options, and select Configure options for DNS
18. Add the DNS server and router information, Click OK.
19. Click Close.

Prepping Active Directory for Lync Server testing

A number of steps must be performed on the Active Directory server for Lync Server testing. We cover these in detail below.

Prepping Schema

1. Insert the installation DVD for Lync Server 2010 into the DVD drive.
2. Double-click the CD-DVD drive in Windows to start the installation wizard.
3. Click Yes on the prompt to install the Visual C++ Redistributable Package.
4. When prompted, click Install to start the Deployment Wizard.
5. Accept the terms in the license agreement, and click OK.
6. Click Prepare Active Directory.
7. Click Run for Step 1: Prep Schema.
8. Click Next on the wizard welcome screen.
9. Click Finish.

Prepping Forest

1. On the Active Directory Preparation window, click Run for Step 3: Prep Forest.
2. Click Next on the Wizard welcome window.
3. Leave the local domain selected on the Universal Group Location window, and click Next.
4. Click Finish.

Verifying Replication

1. On the domain controller, click Start→Administrative Tools→Active Directory Users and Computers.
2. Expand the domain name and click Users.
3. In the right pane, confirm that there are nine CS groups (shown below) within the Users to verify that the replication of the Forest Preparation was successful.
 - CSAdministrator
 - CSArchivingAdministrator
 - CSHelpDesk
 - CSLocationAdministrator
 - CSResponseGroupAdministrator
 - CSServerAdministrator
 - CSUserAdministrator
 - CSViewOnlyAdministrator
 - CSVoiceAdministrator

Prepping the current domain

1. Back on the Active Directory Preparation window, click Run for Step 5: Prep Current Domain.
2. Click Next on the Wizard welcome window.
3. Click Finish.

Providing administrative access to the Lync Server Control Panel

1. Click Start→Administrative Tools→Active Directory Users and Computers.
2. Expand Forest, and select Users.
3. Right-click CSAdministrator, and select Properties.
4. Select the Members tab and add user from Domain that needs rights to make changes on the Lync Server. (i.e., administrator). Click OK.
5. Click OK and close the window.

Modifying password complexity

1. Click Start→Run.
2. Type `gpmc.msc` and click OK.
3. Expand the Forest and Domain Tabs.
4. Click your domain.
5. In the right pane, under the Linked Group Policy Objects, right-click the Default Domain Policy, and click Edit.
6. Expand Policies→Windows Settings→Security Settings, and click Account Policies.
7. Right-click Password Policy, and click Open.

8. Right-click Password must meet complexity requirements, and click Properties.
9. Change the properties to Disabled, and click OK.
10. Close the Management Editor.

Installing IIS on Active Directory server

1. Click Start→Administrative Tools→Server Manager.
2. Click Roles→Add Roles.
3. At the Before You Begin screen, click Next.
4. Check Web Server (IIS), click Next.
5. At the Introduction screen, click Next.
6. At the Select Role Services screen, click Next.
7. Click Install.
8. Click Close.

Installing Certificate Services on Active Directory server

1. Click Start→Administrative Tools→Server Manager.
2. Click Roles→Add Roles.
3. Click Next on the Before You Begin window.
4. Check Active Directory Certificate Services, and click Next.
5. Click Next on the Introduction window.
6. Check Certification Authority and Certification Authority Web Enrollment, and click Add Required Role Services on the pop-up window. Click Next.
7. Choose Enterprise, and click Next.
8. Choose Root CA, and click Next.
9. Choose Create a new private key, and click Next.
10. Leave defaults on the Configure Cryptography for CA window, and click Next.
11. Leave defaults on the Configure CA Name window, and click Next.
12. Leave defaults on the Set Validity Period, and click Next.
13. Leave defaults on the Configure Certificate Database window, and click Next.
14. Click Next on the Web Server (IIS) window.
15. Leave defaults on the Select Role Services window, and click Next.
16. Click Install.
17. Click Close.

Preparing Active Directory for VDI testing

To run VDI testing, we created 1,150 users, enabled folder redirection via GPO, and AD roaming profiles.

Create Login VSI users, OUs and GPOs

1. Log on to DC1 as Administrator
2. Open the login VSI install media and run ADSetup.exe
3. Change the number of users to 1,150 and click Start.

Creating roaming profiles for users

1. Open Active Directory Users and Computers.

2. Browse to test.local→Login_VSI→Users→Target.
3. Select all Login VSI users, and right-click Properties.
4. Click the Profiles tab.
5. Check the Profile path box, and type \\dc1\profiles\%username%
6. Click OK.

Configuring folder redirection

1. Log into DC1 as administrator
2. Open the Group Policy editor.
3. Open forest→domains→test.local→right click group Policy Objects, and select new.
4. Type folder redirection, leave source starter GPO as none and click OK.
5. Right-click the folder redirection GPO and click edit.
6. Browse user Configuration→Policies→Windows Settings→Folder Redirection, right click AppData(roaming)
7. In the AppData (roaming) Properties, target tab select the following:
 - a. Setting= "select Basic- Redirect everyone's folders to the same location "
 - b. Target folder location= *Create a folder for each user under the root path*
 - c. Root Path= \\DC1\folders
8. In the AppData (roaming) Properties setting tab, remove the checkbox for Grant the user exclusive right to AppData (Roaming) and click OK.
9. Repeat steps 6-8 for all subfolders in the folder redirection tree.
10. Close the folder redirection group policy.
11. In the group policy editor, right-click the folder redirection policy and select →GPO status→Computer Configuration Settings Disabled.
12. In the group policy editor, drag the folder redirect GPO to Forest→Domains→test.local→Login_VSI→Users→Target
13. Logout of DC1.

APPENDIX G – VDI INFRASTRUCTURE INSTALLATION AND CONFIGURATION

We installed and configured a VMware vCenter Server VM and a VMware View 5 connection server. We installed VMware View Composer to deploy linked clone virtual desktop pools. We created a Microsoft Windows 7 Enterprise (x86) gold image and deployed two virtual desktop pools for testing. We created a Microsoft Windows 7 Enterprise (x64) Login VSI launcher template and deployed 50 launcher VMs from template. We deployed virtual desktop VMs to blades one through eight for our 8-blade, 900-user scenario, additional desktop VMs to blades nine and ten for our 10-blade, 1,150-user scenario.

Setting up a VM to host the vCenter server

1. Using vSphere client logon to the infra host
2. Right-click on the ESXi host, and choose New Virtual Machine.
3. Choose Create a new virtual machine, and click Next.
4. Assign the name `vCenter` to the virtual machine, and click Next.
5. Select infra LUN for the storage, and click Next.
6. Select ESX 5.0 and later compatibility, and click Next.
7. Choose Windows, and choose Microsoft Windows Server 2008 R2, and click Next.
8. Choose the VM's virtual hardware options, and click Next (see each VM's section below for additional VM configuration data).
 - Select one virtual processor socket, and 4 cores per virtual socket
 - 4GB RAM
 - Select VMXNET3 for the NIC interface, connect to the testing network
9. Choose to create a new virtual disk, and click Next.
10. Make the OS virtual disk size 100 GB, choose thin provisioned, specify the OS datastore on the external storage, and click Next.
11. Keep the default virtual device node (0:0), and click Next.
12. Connect the VM virtual CD-ROM to the Microsoft Windows 2008 R2 installation disk.
13. Click Finish.
14. Right-click the vCenter VM, and click Edit settings.
15. Click the Resources tab, click Memory, check the Reserve all guest memory checkbox, and click OK.
16. Start the VM.

Installing the Microsoft Windows Server 2008 R2 operating system on the VM

1. Choose the language, time and currency, and keyboard input. Click Next.
2. Click Install Now.
3. Choose Windows Server 2008 R2 Enterprise (Full Installation), and click Next.
4. Accept the license terms, and click Next.
5. Click Custom.
6. Click the Disk, and click Drive options (advanced).
7. Click New→Apply→Format, and click Next.
8. After the installation completes, click OK to set the Administrator password.
9. Enter the Administrator password twice, and click OK.

10. Connect the machine to the Internet, and install all available Windows updates. Restart as necessary.
11. Enable remote desktop access.
12. Change the hostname to `vCenter` and reboot when prompted.
13. Set up networking for the data network:
 - a. Click Start, Control Panel, right-click Network Connections, and choose Open.
 - b. Right-click the VM traffic NIC, and choose Properties.
 - c. Uncheck TCP/IP (v6).
 - d. Select TCP/IP (v4), and choose Properties.
 - e. Set the IP address, subnet, gateway, and DNS server.
14. Join the test.local domain.
15. Reboot the system.
16. Install VMware Tools. For more information, see http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=340.
17. Reboot.

Install SQL Server on the vCenter VM

1. Log into the vCenter VM as `test\administrator`.
2. On the Microsoft SQL server 2008 R2 media Click Run SETUP.EXE
3. If the installer prompts you with a .NET installation dialog, click Yes to enable the .NET Framework Core role.
4. In the left pane, click Installation.
5. Click New installation or add features to an existing installation.
6. At the Setup Support Rules screen, wait for the check to complete. If there are no failures or relevant warnings, click OK.
7. Select the Enter the product key radio button, and enter the product key. Click Next.
8. Click the checkbox to accept the license terms, and click Next.
9. Click Install to install the setup support files.
10. If no failures are displayed, click Next. If you see a Computer domain controller warning and a Windows Firewall warning, ignore them for now.
11. At the Setup Role screen, choose SQL Server Feature Installation.
12. At the Feature Selection screen, select Database Engine Services, Full-Text Search, Client Tools Connectivity, Client Tools Backwards Compatibility, Management Tools –Basic, and Management Tools – Complete. Click Next.
13. At the Installation Rules screen, click Next when the check completes.
14. At the Instance configuration screen, leave the default selection of default instance, and click Next.
15. At the Disk space requirements screen, click Next.
16. At the Server configuration screen, choose NT AUTHORITY\SYSTEM for SQL Server Agent, and choose NT AUTHORITY\SYSTEM for SQL Server Database Engine. Click Next.
17. At the Database Engine Configuration screen, select Mixed Mode.
18. Enter and confirm a password for the system administrator account.
19. Click Add Current user. This may take several seconds.

20. Click Next.
21. At the Error and usage reporting screen, click Next.
22. At the Installation Configuration rules screen, check that there are no failures or relevant warnings, and click Next.
23. At the Ready to Install screen, click Install.
24. After installation completes, click Next.
25. Click Close.
26. Click Start→All Programs→Microsoft SQL Server 2008 R2→Configuration Tools, and click SQL Server Configuration Manager.
27. Expand SQL Server Network Configuration, and click Protocols for MSSQLSERVER.
28. Right-click TCP/IP, and select Enable.
29. Close the SQL Server Configuration Manager.
30. Click Start→All Programs→Microsoft SQL Server 2008 R2→SQL Server Management Studio. Choose to connect to the instance.
31. Right-click Databases, click new Database.
32. Type vCenter.
33. Right click vCenter database and click properties.
34. Click files and change owner to `test.local\administrator`
35. Click OK.
36. Repeat steps 32-35 to create a composer database.

Configuring SQL ODBC data source for vCenter and composer

1. Log into the vCenter Server as `view5/administrator`
2. Select Start→Run→`odbcad32.exe`.
3. Click the system DSN tab.
4. Click Add.
5. Click SQL Server native client 10.0, and click Finish.
6. In the Create a New Data Source to SQL Server text box, enter the connection name type: vCenter
7. For Server, select vCenter, and click Next.
8. Leave authentication as default, click next twice, and click Finish.
9. Click OK to create the vCenter ODBC connection.
10. Repeat steps 2-8 to create a composer ODBC connection.

Installing VMware vCenter Server 5.1

1. Log onto the vCenter as `test\administrator`
2. From the VMware vCenter 5.1 install media, click Autorun.
3. Select VMware vCenter Simple Install, and click install.
4. At the Install wizard welcome screen, click Next.
5. Agree to the license agreement, and click Next.
6. Enter a vCenter Single Sign on Password for `admin@system-Domain`, and click Next.
7. Select the option to use an existing SQL Server instance, and click Next.

8. Leave the default FQDN, and click Next.
9. Select the system account for the vCenter Server service account, and click Next.
10. Keep the installation directory as C:\Program Files\VMware\Infrastructure\, and click Next.
11. Keep the default port for single sign-on (7444), and click Next.
12. Click Next to complete the Single sign-on install.
13. Enter user information and a license key, and click Next.
14. Select Exiting SQL database, and browse to vCenter, vCenter Database, Next.
15. Use the SYSTEM account, and click Next.
16. Leave ports at defaults, and click Next.
17. Select 2048 MB for the JVM memory, and click Next.
18. Click Install.
19. When the vCenter install is complete, select the VMware vSphere Web client, and click Install.
20. Click Next.
21. Click I agree to the terms of the license agreement, and click Next.
22. Leave the install directory as default, and click Next.
23. Leave the default ports, and click Next.
24. Enter the single sign-on credentials, and click Next.
25. Click Install to finish the Web client installation.
26. When the installation completes, restart the server.
27. Using the vSphere Web client, log in to vCenter as `test\administrator`
28. Right-click the root of vCenter, and click New Data center.
29. Name the New datacenter `DataCenter`.
30. Right-click the root Datacenter, and select new cluster
31. Name the cluster `vDT1`, do not enable HA or DRS. Click OK.
32. Right-click the root Datacenter, and select new cluster.
33. Name the cluster `vDT2`, do not enable HA or DRS. Click OK.
34. Add `esxi1→8` to `vDT1`.
35. Add `esxi9` and `esxi10` to `vDT2` for the 1,150-user configuration.

Setting up VMware View Composer

1. Open the View5 media folder, and run the file names `VMware-viewcomposer-.3.0.0-691993.exe`.
2. At the Welcome screen and the Patents screen, click Next.
3. Accept the VMware end user license agreement, and click Next.
4. Leave the Destination folder as default, and click Next.
5. In the Database information box, for the source name, type `composer`, for user name type `test\Administrator`, type the password, and click Next.
6. Leave the default SOAP port, and click Next.
7. Click Install, and click Finish.

Installing the VMware View 5 connection server

1. Log into the server named View-CS as `test\administrator`.
2. Click Install Media for View Connection Server.
3. To begin the install wizard, click Next.

4. Agree to the license agreement, and click Next.
5. Keep the destination directory as C:\Program Files\VMware View\Server\, and click Next.
6. Select View Standard Server, and click Next.
7. Allow View Server to configure the firewall, and click Next.
8. Click Next.
9. Click Finish.
10. Open a command window, and type `gpupdate /force`
11. Reboot the View-CS server.

Configuring the VMware View Connection Server

1. Open a Web browser to `<the view server ipaddress>/admin`.
2. Log in as `administrator`
3. Open View Configuration→Servers.
4. In the vCenter Servers tab, click Add...
5. In the Add vCenter Server settings, add vCenter, and enable View Composer. Click OK.
6. Set the Host Cache setting to 2048MB.
7. Open View Configuration→Product Licensing and Usage.
8. Click Edit license...
9. Enter a valid license serial number, and click OK.
10. Close the View Administrator.

Installing the Windows 7 Enterprise (x86) base image VM

We also created a single optimized Windows 7 Enterprise x86 VM on the vDT1 cluster as the gold image for VMware View 5 linked clone deployment.

1. Log into the vCenter.
2. In the vSphere client, connect to the vCenter Server, and browse to the infra host.
3. Click the Virtual Machines tab.
4. Right-click, and choose New Virtual Machine.
5. Choose Custom, and click Next.
6. Assign the name as `win7_gold` and click Next.
7. Select `infra` for the host, and click Next.
8. Select `vDT1`.
9. Choose the default virtual machine version, and click Next.
10. Choose Windows, choose Microsoft Windows 7 (32-bit), and click Next.
11. For CPUs, select one virtual processor socket and one core per virtual socket, and click Next.
12. Choose 1GB RAM, and click Next.
13. Click 1 for the number of NICs, select VMX, and click Next.
14. Leave the default virtual storage controller, and click Next.
15. Choose to create a new virtual disk, and click Next.
16. Make the OS virtual disk size 20 GB, choose thick-provisioned lazy-zeroed, specify the OS datastore on the external storage, and click Next.
17. Keep the default virtual device node (0:0), and click Next.

18. Click Finish.
19. Click Finish, and click OK.
20. Right-click the win7-temp VM, and click Edit settings.
21. Click the Resources tab, click Memory, and check the Reserve all guest memory checkbox.
22. Click the Hardware tab, CD/DVD Drive, and Connect the VM virtual CD-ROM to the Microsoft Windows 7 x86 installation disk.
23. Click OK.

Installing the Windows 7 Enterprise (x86) on the base image VM

1. When the installation prompts you, press any key to begin setup.
2. Enter your language preferences, and click Next.
3. Click Install.
4. Accept the license terms, and click Next.
5. Select Custom, and select the drive that will contain the OS.
6. Click Install, and the setup begins.
7. Type `user` for the username and change the computer name, and click Next.
8. Enter no password, and click Next.
9. For system protection, select Use recommended settings, and click Next.
10. Enter your time zone, and click Next.
11. Select the Work Network setting, and click Next.
12. Use Windows Update to patch the Windows 7 installation.
13. Install VMware Tools from http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=340.
14. Reboot.
15. Join the test.local domain.
16. Reboot.

Installing Windows 7 Enterprise (x86), optimizing Windows 7

Adjusting page file

1. Log in as `test\administrator`
2. Right-click Computer→Properties→Change settings→Advanced→Performance→Settings.
3. In Performance settings, select the Advanced tab, and select Change for Virtual Memory.
4. Deselect automatically manage page file.
5. Select Custom size, type `1024` for both values, and select Set.

Disabling Windows Firewall

The domain GPO automatically disables the Windows Firewall.

Installing Office 2010 Professional

1. From the Office 2010 media, run Setup.
2. Enter the product key for Office 2010, and click Continue.
3. Accept the licensing agreement.

4. Select Install Now.
5. Reboot the system.

Installing Login VSI target software on win7_gold

1. Log into the win7_gold VM as `test\administrator`
2. Browse to `\vsi-install\Target setup`.
3. Run `setup.exe`.
4. In the Target Setup wizard, specify the VSI share `\\dc1\share`
5. Click Start.
6. At the security warnings, click OK.
7. Reboot the system.

Installing the View 5 agent on win7_gold

1. Browse to the VMware View 5 media, and run the `VMware-viewagent-x86_64-5.1.0-704644.exe` file.
2. Click Run.
3. At the Welcome screen, click Next.
4. Accept the VMware end user license agreement, and click Next.
5. Select defaults, and click Next.
6. Enter the server name of the View Connection Server, and click Next.
7. Click Install.

Configuring Regedit for Quick prep (kb.vmware.com/kb/1026556)

1. Click Start→Run, and type `regedit`
2. Browse to `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\vmware-viewcomposer-ga`.
3. Right-click `SkipLicenseActivation`, and click `Modify...`
4. Change the value from 0 to 1.

Installing the VMware View client

1. Browse to the VMware View 5.1 media, and run the `VMware-viewclient-x86_64-5.1.0-704644.exe` file.
2. Click Run.
3. At the Welcome screen, click Next.
4. At the Patents screen, click Next.
5. Accept the VMware end user license agreement, and click Next.
6. Select defaults, and click Next.
7. Click Install.
8. Shutdown the VM.

Creating two virtual desktop pools and adding entitlements for Login VSI users

We set up a VMware pool of 900 users on cluster vDT1, and 250 more on vDT2 for the 1,150-user configuration. After deployment, we moved desktop VMs and ensured that each vSphere server hosted no more than 125 vDTs.

Create the desktop pools

1. Open the View Administrator.

2. Log in as `test\administrator`
3. Click Pools, and in the right window, click Add...
4. Select Automatic pool, and click Next.
5. Select Floating, and click Next.
6. Select View Composer Linked clones, and click Next.
7. Use the vCenter(administrator) as the source, and click Next.
8. Type `pool1` for the pool ID and display name, and click Next.
9. Leave the pool settings as defaults, and click Next.
10. Edit the disposable disk size as 2048, and click Next.
11. Type a naming pattern of `vDT- {n:fixed=3}` and type 900 for both max number of desktops, and number of spares.
12. Enter the virtual machine settings as follows:
 - a. Default image as: `win7_gold`
 - b. VM folder: `/Datastore/`
 - c. Host or cluster: `/datastore/vDT1`
 - d. Resource pool: `/datastore/vDT1`
 - e. Linked clone Datastores: `EQL_vDT1` → 4
 - f. Replica disk Datastore: `EQL_replica1`
13. Choose the AD container `OU=Computers,OU=Login_VSI`, and use quickprep.
14. Click Finish to create the pool.
15. Highlight the pool named Pool, and click Entitlements.
16. Click Add, select `test\login_VSI_TS`, and click OK.
17. Ensure all 900 desktops have a status of ready.

Moving to the 10-blade, 1,150-user configuration

We created a second VMware View desktop pool on cluster vDT2.

1. Open the View Administrator.
2. Log in as `test\administrator`
3. Click Pools, and in the right window, click Add...
4. Select Automatic pool, and click Next.
5. Select Floating, and click Next.
6. Select View Composer Linked clones, and click Next.
7. Use the vCenter(administrator) as the source, and click Next.
8. Type `pool2` for the pool ID and display name, and click Next.
9. Leave the pool settings as defaults, and click Next.
10. Edit the disposable disk size as 2048, and click Next.
11. Type a naming pattern of `VDT2- {n:fixed=4}` and type 250 for both max number of desktops, and number of spares.
12. Enter the virtual machine settings as follows:
 - a. Default image as: `win7_gold`
 - b. VM folder: `/Datastore/`

- c. Host or cluster: /datastore/vDT2
 - d. Resource pool: /datastore/vDT2
 - e. Linked clone Datastores: EQL_vDT21→vDT22
 - f. Replica disk Datastore: EQL_replica2
13. Choose the AD container OU=Computers,OU=Login_VSI, and use quickprep.
 14. Click Finish to create the pool.
 15. Highlight the pool named Pool, and click Entitlements.
 16. Click Add, select test\login_VSI_TS, and click OK.
 17. Ensure all 250 desktops have a status of ready.

Setting up Windows 7 Enterprise x64 image VSI Launchers

On three enterprise-class, two-socket servers and two arrays of external storage, we hosted 50 launcher VMs for testing. Using the vSphere client, we created a Windows 7 Enterprise x64 VM with the Login VSI launcher software, and cloned it to create 50 Login VSI launchers. We evenly distributed the launcher VMs so each vSphere host in the launcher cluster hosted no more than 18 launchers.

Installing the Windows 7 Enterprise (x64) Login VSI launcher

1. Log into the vCenter.
2. In the vSphere client, connect to vCenter, and browse to the ESXi host named Launcher.
3. Click the Virtual Machines tab.
4. Right-click, and choose New Virtual Machine.
5. Choose Custom, and click Next.
6. Assign the name `Launcher` to the virtual machine, and click Next.
7. Select the `launchers` datastore, and click Next.
8. Choose the default virtual machine version, and click Next.
9. Choose Windows, choose Microsoft Windows 7 (64-bit), and click Next.
10. Choose two virtual processors, and click Next.
11. Choose 10GB RAM, and click Next.
12. Click 1 for the number of NICs, select E1000 and VDI-NET, and click Next.
13. Leave the default virtual storage controller, and click Next.
14. Choose to create a new virtual disk, and click Next.
15. Make the OS virtual disk size 24 GB, choose thick-provisioned lazy zeroed, and click Next.
16. Keep the default virtual device node (0:0), and click Next.
17. Click Finish.
18. Click Finish, and click OK.
19. Click the Resources tab, and click Memory.
20. Connect the VM virtual CD-ROM to the Microsoft Windows 7 x64 installation disk.
21. Start the VM.
22. When the installation prompts you, press any key to begin setup.
23. Enter your language preferences, and click Next.
24. Click Install.
25. Accept the license terms, and click Next.

26. Select Custom, and select the drive that will contain the OS.
27. Click Install, and the setup begins.
28. Type `user` for the username and change the computer name, and click Next.
29. Enter a password, and click Next.
30. For system protection, select Use recommended settings, and click Next.
31. Enter your time zone, and click Next.
32. Select the Work Network setting, and click Next.
33. Use Windows Update to patch the Windows 7 installation.
34. Install VMware Tools. For more information, see http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=340
35. Reboot.
36. Join the test.local domain, and reboot.

Adjusting page file on the launcher VMs

1. Log in as administrator.
2. Right-click Computer→Properties→Change settings→Advanced→Performance→Settings.
3. In Performance settings, select the Advanced tab, and select Change for Virtual Memory.
4. Deselect Automatically manage page file.
5. Select Custom size, type 10480 for both values, and select Set.

Disabling Windows Firewall

The domain GPO automatically disables the Windows Firewall.

Installing Login VSI target software on the launcher

1. Browse to VSIinstall media\setups\Launcher\
2. Run the setup.exe.
3. In the Target Setup wizard, specify the VSI share (<\\dc1\share>).
4. Click Start.
5. Reboot the system.

Installing Virtual Audio Cables

By default, the virtual launchers cannot render audio so we installed Virtual Audio Cables version 4.10. The software can be downloaded from <http://software.muzychenko.net/eng/vac.htm>

1. Download and extract the media.
2. Click Setup.
3. Click Yes to begin the install.
4. Click I accept to accept the software license agreement.
5. Click Install.

Clone the launcher

We created a template from the VM named launcher and deployed 50 launchers with the sysprep functionality built into vCenter. For more information on how to clone virtual machines in VMware vCenter, please read <http://www.vmware.com/support/pubs/vsphere-esxi-vcenter-server-pubs.html>.

Moving to the 16-blade, 1,800-user configuration

For the 16-blade, 1,800-user scenario we deployed virtual desktop VMs to all 16 blades, with 125 per blade on blades 1-7 and 9-15, and 25 per blade on blades 8 and 16. In addition, we deployed an additional enterprise-class, two-socket server to the launcher cluster to host 18 additional Login VSI launchers.

We reconfigured our user data shares and login VSI log shares to support the large increase to the number of users. The following changes were made to our existing VDI deployment :

To host the VDI user data, we created two new Windows 2008 R2 VMs named file-1 and file-2.

- Two new shares called `folders` and `profiles` were created on both VMs.
- A new Login VSI OU called `target2` was created.
- Login_VSI0901 → Login_VSI1800 from the OU named `target` were moved into this new OU.
- A new GPO was created on the OU `target` to redirect folders [\\file-1\folders](#).
- A new GPO was created on the OU `target2` to redirect folders [\\file-2\folders](#).
- In Active Directory users and computers, roaming profiles for login_VSI0001 → login_VSI0900 were changed to [\\file-1\profiles\%username%](#), and for login_VSI0901 → login_VSI1800 they were changed to [\\file-2\profiles\%username%](#)

To host the Login VSI activity logs, we created two new Windows 2008 R2 VMs named file-3 and file-4.

- A new share called `share` was created on both VMs.
- The Login VSI target software was reconfigured for all desktops in cluster 1 to use [\\file-3\share](#) and in cluster 2 to use [\\file-4\share](#).
- The corresponding launchers for cluster 1 and 2 were reconfigured to use [\\file-3\share](#) and [\\file4-share](#) respectively.

APPENDIX H – MICROSOFT LYNC SERVER INSTALLATION AND CONFIGURATION

We installed Microsoft Lync Server 2010 on VM residing on blade number 7 for the 8- and 10-blade configurations and on blade number 16 for the 16-blade configuration.

Configuring the Lync Server VM

After cloning, modify the Lync Server VM to contain the following settings:

- Memory: 8GB
- Virtual processors: 4

Joining the domain

1. Power on the VM.
2. Click Start→Control Panel→Network Connections→Local Area Connection.
3. Click Properties.
4. Highlight Internet Protocol (TCP/IP), and click Properties.
5. Select the Use the following IP address radio button, and enter the desired IP for your VM.
6. Select the Use the following DNS server addresses radio button, and enter the IP of the DNS server in the Preferred DNS server field. Click OK.
7. Right-click My Computer, and select Properties.
8. Under the Computer Name tab, click Change.
9. In the Computer Name Changes screen, under Computer name, type `exchange` as your computer name.
10. In the Computer Name Changes screen, under the Member of section, select the Domain radio button, and type `test.local`
11. Select OK to start joining the domain.
12. When the screen appears asking for a person qualified on the domain, type `administrator` as the username and `Password1` as the password.
13. At the Welcome pop-up window and the window warning that you must reset the computer for the changes to take effect, click OK.
14. At the System Properties screen, click OK.
15. When a pop-up appears asking if you want to restart now, click Yes to restart your VM.

Installing Web Server (IIS)

1. Click Start→Administrative Tools→Server Manager.
2. Click Roles, scroll to Web Server (IIS), and click Add Role Services
3. Select the following:
 - Windows Authentication
 - IIS 6 Management Compatibility
 - ASP.NET
 - Client Certificate Mapping Authentication
 - IIS Management Scripts and Tools with any required services they need, and Click Next.
4. Click Install.
5. Click Close.

Adding Desktop Experience

1. Click Start→Administrative Tools→Server Manager.
2. Click Features→Add Features.
3. Select Desktop Experience, add the required role services, and click Next.
4. Click Install.
5. Reboot when prompted
6. Click Close after rebooting.

Adding Directory Service Integration

1. Click Start→Administrative Tools→Server Manager.
2. Click Features→Add Features.
3. Expand Message Queuing, expand Message Queuing Services, and check Directory Service Integration and HTTP Support.
4. Click Add Required Features on the pop-up windows.
5. Click Next.
6. Click Next on the IIS introduction window.
7. Click Next on the Role selection window.
8. Click Install.
9. Reboot when prompted.
10. Close Server Manager.

Installing .NET Framework 3.5.1 Features

1. Click Start→Administrative Tools→Server Manager.
2. Click Features.
3. Click Add Features.
4. At the Select Features screen, select .NET Framework 3.5.1 Features, and add the required features when prompted. Click Next.
5. Click Install.
6. Click Close.

Starting the Lync Server Pre-installation menu

1. Mount the Microsoft Lync Server 2010 ISO to the VM.
2. Double-click the CD-DVD drive in Windows to start the installation wizard.
3. Click Yes on the prompt to install the Visual C++ Redistributable Package.
4. Leave the default Installation Location, and click Install.
5. Accept the terms of the License Agreement, and click OK.

Preparing the single Standard Edition Server

1. In the Lync Server 2010 Deployment Wizard menu, click Prepare first Standard Edition server.
2. Click Next to start installation.
3. Click Finish.

Creating a share for the topology

1. Go to My Computer→C:
2. Right-click and select New→Folder.

3. Name the folder `share`.
4. Right-click the newly created folder, and select Share with → Specific people...
5. Enter `Everyone`, and click Add.
6. Change the permission level for Everyone to Read/Write.
7. Click Share.
8. Click Done.

Installing the Topology Builder and preparing the topology

1. Install Topology Builder, and click Next.
2. Click Start → All Programs → Microsoft Lync Server 2010, and launch Lync Server Topology Builder.
3. Select New Topology, and click OK.
4. Name file, and choose location to save file.
5. Enter primary SIP domain, and click Next.
6. At the Specify additional supported domains screen, click Next.
7. In Define First site, enter site name, and click Next.
8. At the Specify site details screen, click Next.
9. Click Finish, leaving the Open the New Front End Wizard when this wizard closes box checked.
10. At the Define the New Front End pool, click Next.
11. Enter FQDN, select Standard Edition Server, and click Next.
12. At the Select Features screen, Check Conferencing, which includes audio, video and application sharing.
13. Click Next.
14. At the Select co-located server roles screen, accept the default selection, and click Next.
15. At the Associate server roles with this Front End pool screen accept defaults, and click Next.
16. At the Define the SQL store screen, click Next.
17. At the Define the file share screen, leave the defaults, and click Next.
18. At the Specify the Web Services URL, leave the default, and click Finish.
19. Right-click Lync Server 2010 and select Edit Properties.
20. Enter URL for administrative access, select the Central Management Server, and click OK.
21. Right-click Lync Server 2010 and select Publish Topology.
22. Click Next on Publish the topology screen.
23. On the Select Central Management Server screen, click Next.
24. When publishing is completed, click Finish, and close the Lync Server Topology builder application.

Installing Lync Server

1. Back in the Deployment wizard, click Install or Update Lync Server System to launch the Lync Server deployment wizard.
2. Click Run on Step 1 – Install Local Configuration Store.
3. On Configure Local Replica or Central Management Store screen, keep defaults and click Next.
4. When installation is complete, click Finish.
5. Click Run on Step 2 – Setup or Remove Lync Server Components.
6. Click Next.
7. When installation is complete, click Finish.

8. Click Run on Step 3 – Request, Install, or Assign Certificates.
9. Keep defaults, and click Request.
10. At the Certificate Request screen, click Next.
11. On Delayed or Immediate Request screen, accept the default and click Next.
12. Leave the default selection in the Choose a Certification Authority (CA) screen, and click Next.
13. At the Certification Authority Account, click Next.
14. At the Specify Alternate Certificate Template screen, click Next.
15. Enter a name for your certificate, and click Next.
16. On the Organization Information screen enter organizational information, and click Next.
17. Enter Geographical information on Geographical Information screen, and click Next.
18. Accept defaults on Subject Name/Subject Alternate Names screen, and click Next.
19. At the SIP Domain setting on Subject Alternate Names (SANs) screen, select the SIP domain, and click Next.
20. At the Configure additional Subject Alternate Names screen, click Next.
21. On the Certificate Request Summary screen, click Next.
22. When request for certificates has completed, click Next.
23. Click Finish.
24. At the Certificate Assignment screen, click Next.
25. At the Certificate Assignment Summary screen, click Next.
26. Click Finish.
27. At the Certificate Wizard screen, click Close.
28. Click Run on Step 4 – Start Services.
29. At the Start Services screen, click Next.
30. After services are started, click Finish.
31. Click Exit to close the Deployment Wizard.

Configuring Web Component certificate

1. Click Start→Administrative Tools→Server Manager.
2. Expand Roles, expand Web Server (IIS) and click Internet Information Services.
3. Expand your server list and the sites folder, and click Default Web Site.
4. Under IIS, click Authentication.
5. Under the actions menu on the right, choose Bindings...
6. Click Add...
7. Change the Type to HTTPS.
8. Choose the certificate you made in the last section from the SSL certificate drop-down menu, and click OK.
9. Click Close.
10. Close the Server Manager window.

Installing Lync Stress and Performance tool

1. Download the stress and performance tool here
<http://www.microsoft.com/download/en/details.aspx?id=25005>
2. Double-click the .msi file, and click Run.
3. Click Next on the Welcome window.
4. Accept the license agreement, and click Next.

5. Keep the default location, and click Next.
6. Leave defaults to install all features, and click Next.
7. Click Next on the Confirmation window.
8. Click Close.

Running the stress configuration

1. Navigate to C:\Program Files\Microsoft Lync Server2010\LyncStressAndPerfTool\StressConfig.
2. Double-click the StressConfig application.
3. Click Load Configuration File.
4. Choose the SampleData files, and click Open.
5. On the Server tab, enter your FQDN, and your Lync server name in the SQL BE Machine field.
6. On the General Settings tab, change the number of users to 1,000. We chose this number because it matched the Exchange database user size and was over 900. For the 1,150-user configuration, see the “Moving to the 1,150-user configuration” section below. For the 1,800-user configuration, see the “Moving to the 1,800-user configuration” section below.
7. On the General Settings tab, enter your domain in the SIPDomain for users’ URI and User account domain fields.
8. On the General Settings tab, change the Max number of contacts per user to 500.
9. On the VoIP tab, enter your Area Code, and change the UC Policy to Default Policy.
10. On the Users Tab, click Create Users.
11. On the Contacts Tab, click Create Contacts.
12. Click OK.
13. On the distribution list, type 2,000 in the DistributionListNumber field, MyDL in the DistributionListPrefix field, and OCSUsers in the DistributionListOU field.
14. Click Create Distribution Lists.
15. Click Save & Exit.

Generating test scripts

1. Navigate to C:\Program Files\Microsoft Lync Server2010\LyncStressAndPerfTool\LyncStress.
2. Double-click User Profile Generator.
3. Make the following changes on the Common Configuration tab:
4. Set Client Machine Settings to 1.
5. Type OCSUser in the Prefix for User Names field.
6. Change Number of users to 1000. We chose this number because it matched the Exchange database user size and was over 900. For the 1,150-user configuration, see the “Moving to the 1,150-user configuration” section below. For the 1,800-user configuration, see the “Moving to the 1,800-user configuration” section below.
7. Enter your domain in the User and Account domain fields.
8. Enter the FQDN of your server in the Access Proxy or Pool FQDN field.
9. On the General Scenarios tab, change the following fields from None to High:
 - a. Instant Messaging
 - b. Audio Conferencing
 - c. Address Book Web Query

10. Leave defaults on the Voice Scenarios tab.
11. Click Generate Files on the Summary tab.
12. Choose where the generated files should be saved, and click OK.
13. Click OK.
14. Click Exit, and click Yes on the prompt to save the form.
15. Enter a name, and click Save.
16. Copy the generated files to the appropriate client machine.

Moving to the 10-blade, 1,150-user configuration

Before doing the following to change to this configuration, connect to your Active Directory VM and delete the entire sub-tree for OCSUsers in Users and Computers under your testing domain.

Running the stress configuration

1. Navigate to C:\Program Files\Microsoft Lync Server2010\LyncStressAndPerfTool\StressConfig.
2. Double-click the StressConfig application.
3. Click Load Configuration File.
4. Choose the SampleData files, and click Open.
5. On the Server tab, enter your FQDN, and your Lync server name in the SQL BE Machine field.
6. On the General Settings tab, change the number of users to 1,150.
7. On the General Settings tab, enter your domain in the SIPDomain for users' URI and User account domain fields.
8. On the General Settings tab, change the Max number of contacts per user to 500.
9. On the VoIP tab, enter your Area Code, and change the UC Policy to Default Policy.
10. On the Users Tab, click Delete Users and wait for it to finish.
11. On the Users Tab, click Create Users.
12. On the Contacts Tab, click Delete Contacts and wait for it to finish.
13. On the Contacts Tab, click Create Contacts.
14. Click OK.
15. On the distribution list, type 2,000 in the DistributionListNumber field, MyDL in the DistributionListPrefix field, and OCSUsers in the DistributionListOU field.
16. Click Delete Distribution Lists and wait for it to finish.
17. Click Create Distribution Lists.
18. Click Save & Exit.

Generating test scripts

1. Navigate to C:\Program Files\Microsoft Lync Server2010\LyncStressAndPerfTool\LyncStress.
2. Double-click User Profile Generator.
3. Make the following changes on the Common Configuration tab:
4. Set Client Machine Settings to 1.
5. Type OCSUser in the Prefix for User Names field.
6. Change Number of users to 1,150.
7. Enter your domain in the User and Account domain fields.
8. Enter the FQDN of your server in the Access Proxy or Pool FQDN field.

9. On the General Scenarios tab, change the following fields from None to High:
 - a. Instant Messaging
 - b. Audio Conferencing
 - c. Address Book Web Query
10. Leave defaults on the Voice Scenarios tab.
11. Click Generate Files on the Summary tab.
12. Choose where the generated files should be saved, and click OK.
13. Click OK.
14. Click Exit, and click Yes on the prompt to save the form.
15. Enter a name, and click Save.
16. Copy the generated files to the appropriate client machine.

Moving to the 16-blade, 1,800-user configuration

Before doing the following to change to this configuration, connect to your Active Directory VM and delete the entire sub-tree for OCSUsers in Users and Computers under your testing domain.

Running the stress configuration

19. Navigate to C:\Program Files\Microsoft Lync Server2010\LyncStressAndPerfTool\StressConfig.
20. Double-click the StressConfig application.
21. Click Load Configuration File.
22. Choose the SampleData files, and click Open.
23. On the Server tab, enter your FQDN, and your Lync server name in the SQL BE Machine field.
24. On the General Settings tab, change the number of users to 1,800.
25. On the General Settings tab, enter your domain in the SIPDomain for users' URI and User account domain fields.
26. On the General Settings tab, change the Max number of contacts per user to 500.
27. On the VoIP tab, enter your Area Code, and change the UC Policy to Default Policy.
28. On the Users Tab, click Delete Users and wait for it to finish.
29. On the Users Tab, click Create Users.
30. On the Contacts Tab, click Delete Contacts and wait for it to finish.
31. On the Contacts Tab, click Create Contacts.
32. Click OK.
33. On the distribution list, type 2,000 in the DistributionListNumber field, MyDL in the DistributionListPrefix field, and OCSUsers in the DistributionListOU field.
34. Click Delete Distribution Lists and wait for it to finish.
35. Click Create Distribution Lists.
36. Click Save & Exit.

Generating test scripts

17. Navigate to C:\Program Files\Microsoft Lync Server2010\LyncStressAndPerfTool\LyncStress.
18. Double-click User Profile Generator.
19. Make the following changes on the Common Configuration tab:
20. Set Client Machine Settings to 1.

21. Type `OCSUser` in the Prefix for User Names field.
22. Change Number of users to 1,800.
23. Enter your domain in the User and Account domain fields.
24. Enter the FQDN of your server in the Access Proxy or Pool FQDN field.
25. On the General Scenarios tab, change the following fields from None to High:
 - a. Instant Messaging
 - b. Audio Conferencing
 - c. Address Book Web Query
26. Leave defaults on the Voice Scenarios tab.
27. Click Generate Files on the Summary tab.
28. Choose where the generated files should be saved, and click OK.
29. Click OK.
30. Click Exit, and click Yes on the prompt to save the form.
31. Enter a name, and click Save.
32. Copy the generated files to the appropriate client machine.

Configuring Microsoft Lync Client

For our testing, we used one physical client machine for the Microsoft Lync Server client. To create this client, we installed Windows Server 2008 R2 SP1 and several other software components. We followed this process for the configuration:

Joining the domain

1. Select Start→Control Panel→Network Connections→Local Area Connection.
2. Click Properties.
3. Highlight Internet Protocol (TCP/IP), and click Properties.
4. Select the Use the following IP address radio button, and enter the desired IP for your VM.
5. Select the Use the following DNS server addresses radio button, and enter the IP of the DNS server in the Preferred DNS server field. Click OK.
6. Right-click My Computer, and select Properties.
7. Under the Computer Name tab, click Change.
8. In the Computer Name Changes screen, under Computer name, type `lyncclient` as your computer name.
9. In the Computer Name Changes screen, under the Member of section, select the Domain radio button, and type `test.local`
10. Select OK to start joining the domain.
11. When the screen appears asking for a person qualified on the domain, type `administrator` as the username and `Password1` as the password.
12. At the Welcome pop-up window, and the window warning that you must reset the computer for the changes to take effect, click OK.
13. At the System Properties screen, click OK.
14. When a pop-up appears asking if you want to restart now, click Yes to restart your computer.

Installing .NET

1. Open Server Manager.
2. Click Features→Add Features.
3. Check .NET 3.5 and accept the required features. Click Next.
4. Click Next on the welcome window.
5. Click Next on Select Role Services.
6. Click Install.
7. Click Close.

Enabling Desktop Experience

1. Open Server Manager.
2. Click Features→Add Features.
3. Check Desktop Experience, and click Next.
4. Click Install.
5. Click Close.
6. Click Yes on the prompt to reboot.
7. When the installation finishes, click Close.

Installing Microsoft Visual C++ Redistributable Package

1. Download the Microsoft Visual C++ Redistributable Package here:
<http://www.microsoft.com/download/en/confirmation.aspx?id=15336>
2. Double-click the application to start the install.
3. Click Run.
4. Click Next on the Welcome window.
5. Accept the license agreement, and click Install.
6. Click Finish.

Installing Lync Server Stress and Performance Tool

1. Download the stress and performance tool here
<http://www.microsoft.com/download/en/details.aspx?id=25005>
2. Double-click the .msi file, and click Run.
3. Click Next on the Welcome window.
4. Accept the license agreement, and click Next.
5. Keep the default location, and click Next.
6. Leave defaults to install all features, and click Next.
7. Click Next on the Confirmation window.
8. Click Close.

Running MaxUserPorts

1. Navigate to Microsoft Lync Server 2010→LyncStressAndPerfTool→LyncStress.
2. Double-click MaxUserPorts.
3. Click Yes on the Registry Editor warning.
4. Click OK.

Registering the perfmom counters

1. Open a command window, and navigate to the LyncStress folder.
2. Type `regsvr32 /i /n LyncPerfToolPerf.dll`, and press Enter.
3. Click OK on the confirmation popup window.
4. Type `regsvr32 /i /n S4Perf.dll`, and press Enter.
5. Click OK on the confirmation popup window.
6. Close the command window.

APPENDIX I – MICROSOFT EXCHANGE INSTALLATION AND CONFIGURATION

We installed Microsoft Exchange 2010 SP2 on a VM residing on blade number 8 for all user configurations.

Configuring the Exchange 2010 VM

After cloning, modify the Exchange 2010 VM to contain the following settings:

- Memory: 32GB
- Virtual Processors: 4
- Additional virtual disks:
 - 1 x 2 TB virtual disk for mailbox storage (Thick-provision, lazy-zeroed)
 - 1 x 30 GB virtual disk for mailbox logs (Thick-provision, lazy-zeroed)

Joining the domain

1. Power-on the VM.
2. Select Start→Control Panel→Network Connections→Local Area Connection.
3. Click Properties.
4. Highlight Internet Protocol (TCP/IP), and click Properties.
5. Select the Use the following IP address radio button, and enter the desired IP for your VM.
6. Select the Use the following DNS server addresses radio button, and enter the IP of the DNS server in the Preferred DNS server field. Click OK.
7. Right-click My Computer, and select Properties.
8. Under the Computer Name tab, click Change.
9. In the Computer Name Changes screen, under Computer name, type `exchange` as your computer name.
10. In the Computer Name Changes screen, under the Member of section, select the Domain radio button, and type `test.local`
11. Select OK to start joining the domain.
12. When the screen appears asking for a person qualified on the domain, type `administrator` as the username and `Password1` as the password.
13. At the Welcome pop-up window and the window warning that you must restart the computer for the changes to take effect, click OK.
14. At the System Properties screen, click OK.
15. When a pop-up appears asking if you want to restart now, click Yes to restart your VM.

Installing .NET Framework 3.5.1 Features and Internet Information Services

1. Select Start→Administrative Tools→Server Manager.
2. Click Features.
3. Click Add Features.
4. Select .NET Framework 3.5.1 Features
5. Click Add Required Role Services.
6. Click Next.
7. Click Next.

8. At the Select Role Services screen, select the IIS 6 Metabase Compatibility, IIS 6 Management Console, Basic Authentication, Windows Authentication, Digest Authentication, Static content compression, and Dynamic content Compression checkboxes, and click Next.
9. At the Confirm Installation Selections screen, click Install.
10. At the Installation Results screen, click Close.

Installing Microsoft Filter Pack 2.0

1. Download the Microsoft Filter Pack 2.0.
(<http://www.microsoft.com/downloads/en/details.aspx?FamilyID=5cd4dcd7-d3e6-4970-875e-aba93459fbee>)
2. Run FilterPackx64.EXE.
3. Click Next.
4. Click I accept the terms in the License Agreement, and click Next.
5. When the installation is complete, click OK.

Installing Exchange Server 2010

1. Click Start, type `services.msc` and press Enter.
2. Right-click the Net.Tcp Port Sharing service, and click Properties.
3. Change the Net.Tcp Port Sharing startup type to Automatic, and click OK.
4. Open command prompt and type `ServerManagerCmd -i RSAT-ADDS`, and press Enter.
5. Reboot the VM.
6. Mount the installation ISO to the VM and click Setup.EXE when prompted.
7. The installer should consider steps 1 and 2 complete, and gray them out.
8. Click the link for Step 3: Choose Exchange Language Option.
9. Click Install only languages from the DVD.
10. Click the link for Step 4: Install Microsoft Exchange Server 2010 SP1.
11. Click Next to go past the introduction screen.
12. Accept the license agreement, and click Next.
13. Select No for error reporting, and click Next.
14. Select Typical Exchange Server Installation, and click Next.
15. Leave the organization name at default (First Organization), and click Next.
16. At the question about client computers running Outlook 2003 and earlier, select Yes, and click Next.
17. Click Next to accept defaults for Configure Client Access server external domain.
18. At the Customer Experience Improvement Program screen, select I don't want to join the program at this time, and click Next.
19. If a warning about a lack of SMTP appears after the check finishes, ignore it.
20. Click Install to start the installation process.
21. Once installation is complete, click Finish.
22. Click OK when prompted to reboot.
23. Click Close.
24. Click Yes to confirm exit.
25. Reboot the VM.

Installing SP2 for Microsoft Exchange 2010

1. Download Service Pack 2 for Microsoft Exchange 2010 (Exchange2010-SP2-x64.exe) from <http://www.microsoft.com/download/en/details.aspx?id=28190> to c:\SP2 on the VM.
2. Double-click the downloaded file to extract the installation files.
3. Click OK to accept the destination directory for the extracted files.
4. Double-click setup.exe to launch the installer.
5. Click Install Microsoft Exchange Server upgrade.
6. At the Introduction screen, click Next.
7. Accept the terms in the license agreement, and click Next. The Readiness Checks will now run.
8. Install any roles in Server Manager that the Readiness Checks prompt you to install.
9. When the checks successfully complete, click Upgrade.
10. Click Finish, and reboot the VM.

Configuring Exchange Server 2010 connector

1. In the VM, Select Start→All Programs→Microsoft Exchange Server 2010→Exchange Management Console.
2. In the left pane, click Microsoft Exchange On-Premises.
3. In the left pane, expand Organization Configuration, and select Hub Transport.
4. In the action pane on the far right, select New Send Connector.
5. Name the send connector SMTP, select the intended use as Internet, and click Next.
6. In the Address space screen, click Add.
7. In the SMTP Address Space screen, type * as the address, ensure that the installer has checked Include all subdomains, and click OK.
8. Click Next.
9. Accept defaults for the next two pages by clicking Next.
10. At the New Connector page, click New to create the connector.
11. Click Finish to close the New SMTP Send Connector wizard.

Configuring the Exchange Server 2010 Mailbox role

1. Select Start→All Programs→Microsoft Exchange Server 2010→Exchange Management Console.
2. In the left pane, expand Organization Configuration, and click Mailbox.
3. Click the Database Management tab.
4. Right-click Mailbox Database, and select Properties.
5. Select the Maintenance tab.
6. Check the Enable circular logging box.
7. Check the box beside This database can be overwritten by a restore.
8. Next to Maintenance interval, click Customize.
9. Remove all blue from the boxes so the system will not perform maintenance, and click OK.
10. Click OK.
11. Click OK to any warnings about circular logging being applied after the database is remounted.
12. On the far right panel, click Move Databases.
13. Change the Database file and Log folder path locations to point to the two additional attached virtual disks, and click Move.
14. If the application prompts you to dismount, click Yes.

15. Click Finish.
16. Right-click Public Folder Database, and select Properties.
17. Check the Enable circular logging checkbox and uncheck the ESE scanning checkbox.
18. Click Customize next to Maintenance interval.
19. Remove all blue from the boxes so the system will not perform maintenance, and click OK.
20. Click OK.
21. On any warnings about circular logging being applied after the database is remounted, click OK.
22. Click Move Database on the far right panel.
23. Change the Database file and Log folder path locations to point to the two additional attached virtual disks respectively, and click Move.
24. If the application prompts you to dismount, click Yes.
25. Click Finish.

Installing and configuring the Exchange 2010 mail test client (LoadGen)

For our testing, we used one physical client machine for the LoadGen workload. To create this client, we installed Windows Server 2008 R2 SP1 and several other software components. We followed this process for the configuration:

Joining the domain

1. Select Start→Control Panel→Network Connections→Local Area Connection.
2. Click Properties.
3. Highlight Internet Protocol (TCP/IP), and click Properties.
4. Select the Use the following IP address radio button, and enter the desired IP for your VM.
5. Select the Use the following DNS server addresses radio button, and enter the IP of the DNS server in the Preferred DNS server field. Click OK.
6. Right-click My Computer, and select Properties.
7. Under the Computer Name tab, click Change.
8. In the Computer Name Changes screen, under Computer name, type `loadgen` as your computer name.
9. In the Computer Name Changes screen, under the Member of section, select the Domain radio button, and type `test.local`.
10. Select OK to start joining the domain.
11. When the screen appears asking for a person qualified on the domain, type `administrator` as the username and `Password1` as the password.
12. At the Welcome pop-up window and the window warning that you must reset the computer for the changes to take effect, click OK.
13. At the System Properties screen, click OK.
14. When a pop-up appears asking if you want to restart now, click Yes to restart your computer.

Installing Internet Information Services

1. Click Start→Administrative Tools→Server Manager.
2. On the left pane, click Roles.
3. Click Add Roles.
4. Click the Application Server checkbox.

5. When the Add features required for Application Server? screen appears, click Add Required Features.
6. Click Next.
7. Click Next.
8. At the Select Role Services page for Application Server, click the Web Server (IIS) Support checkbox.
9. Click Add Required Support Role Services.
10. Click Next.
11. Click Next.
12. At the Select Role Services page for Web Server (IIS), click IIS 6 Management Compatibility, ASP, and CGI checkboxes; and click Next.
13. Click Install.
14. Click Close.

Installing Load Generator 2010

Download and install Load Generator 2010 using all defaults.

Preparing Load Generator

1. Log into the mail client using the tester account.
2. Select Start→All Programs→Microsoft Exchange→Exchange Load Generator 2010.
3. When the Load Generator screen appears, select Start a new test.
4. Select Create a new test configuration, and click Continue.
5. Change the total length of simulation to 1 hour.
6. In the Specify test settings screen, type `Password1` as the Directory Access Password and Mailbox Account Master Password, and click Continue with recipient management.
7. Make 1,000 users in the Mailbox Database, and click Continue. For the 900-user configuration we chose to use 1,000 users “Average” profile.
8. To accept defaults for Advanced recipient settings, click Continue.
9. In the Specify test user groups screen, select the plus sign to add a user group.
10. Change the Client Type to Outlook 2007 Cached, the Action Profile to Average, and the Mailbox size to 250 MB.
11. In Remote configurations, click Continue.
12. Click Save the configuration file as, and name it `testcfg.xml`
13. After saving the configuration file and click Start the initialization phase (recommended before running the test).

Moving to the 10-blade, 1,150-user configuration

For the 10-blade, 1,150-user configuration we chose to use the existing 1,000-user Exchange database, but instead of the “Average” profile, we increased the workload by modifying the profile to “Heavy.”

Moving to the 16-blade, 1,800-user configuration

For the 16-blade, 1,800-user configuration we chose to add users to the existing 1,000-user Exchange database and the “heavy” workload profile. We used the following steps.

1. Log into the mail client using the tester account.

2. Select Start→All Programs→Microsoft Exchange→Exchange Load Generator 2010.
3. When the Load Generator screen appears, select Start a new test.
4. Select User the following saved configuration profile:, browse to the previously created `testcfg.xml`, and click Continue..
5. In the Specify test settings screen, keep the existing values, and click Continue with recipient management.
6. Make 1,800 users in the Mailbox Database, and click Continue.
7. Accept the existing values for Advanced recipient settings, click Continue.
8. In the Specify test user groups screen, click Continue.
9. In Remote configurations, click Continue.
10. Click Save the configuration file as, and name it `testcfg-1800.xml`
11. After saving the configuration file click Start the initialization phase (recommended before running the test).

APPENDIX J – MICROSOFT SHAREPOINT INSTALLATION AND CONFIGURATION

We installed Microsoft SharePoint 2010 on a VM residing on blade number 7 for the 900- and 1,150-user configurations and on blade number 16 for the 1,800-user configuration.

Configuring the SharePoint VM

After cloning, modify the SharePoint VM to contain the following settings:

- Memory: 8GB
- Virtual Processors: 4
- Additional virtual disks:
 - 1 x 250GB virtual disks for database storage (Thick provision lazy zeroed)

Joining the domain

1. Select Start→Control Panel→Network Connections→Local Area Connection.
2. Click Properties.
3. Highlight Internet Protocol (TCP/IP), and click Properties.
4. Select the Use the following IP address radio button, and enter the desired IP for your VM.
5. Select the Use the following DNS server addresses radio button, and enter the IP of the DNS server in the Preferred DNS server field. Click OK.
6. Right-click My Computer, and select Properties.
7. Under the Computer Name tab, click Change.
8. In the Computer Name Changes screen, under Computer name, type `sharepointvm` as your computer name.
9. In the Computer Name Changes screen, under the Member of section, select the Domain radio button, and type `test.local`.
10. Select OK to start joining the domain.
11. When the screen appears asking for a person qualified on the domain, type `administrator` as the username and `Password1` as the password.
12. At the Welcome pop-up window and the window warning that you must reset the computer for the changes to take effect, click OK.
13. At the System Properties screen, click OK.
14. When a pop-up appears asking if you want to restart now, click Yes to restart your computer.

Installing Microsoft SQL Server 2012

1. Mount the installation ISO to the VM.
2. Click Run SETUP.EXE. If Autoplay does not begin the installation, navigate to the SQL Server 2012 DVD, and double-click.
3. If the installer prompts you with a .NET installation prompt, click Yes to enable the .NET Framework Core role.
4. In the left pane, click Installation.
5. Click New SQL Server stand-alone installation or add features to an existing installation.
6. At the Setup Support Rules screen, wait for the rule check to complete. If there are no failures or relevant warnings, click OK.

7. Select the Specify a free edition and select Evaluation from the drop-down menu. Click Next.
8. Click the checkbox to accept the license terms, and click Next.
9. If no failures are displayed after the setup support files are installed, click Next.
10. At the Setup Role screen, choose SQL Server Feature Installation.
11. At the Feature Selection screen, select Database Engine Services, Full-Text and Semantic Extractions for Search, Client Tools Connectivity, Client Tools Backwards Compatibility, Management Tools – Basic, and Management Tools – Complete. Click Next.
12. At the Installation Rules screen, click Next after the check completes.
13. At the Instance configuration screen, leave the default selection of default instance, and click Next.
14. At the Disk Space Requirements screen, click Next.
15. At the Server Configuration screen, check that NT AUTHORITY\SYSTEM is selected for SQL Server Agent and SQL Server Database Engine. Click Next.
16. Assuming there are no failures, click Next.
17. At the Database Engine Configuration screen, select Mixed Mode.
18. Enter and confirm a password for the system administrator account.
19. Click Add Current user. This may take several seconds.
20. Click the Data Directories tab and enter the appropriate drive and folder to which you eventually deploy the SharePoint databases.
21. Click Next.
22. At the Error and usage reporting screen, click Next.
23. At the Installation Configuration Rules screen, check that there are no failures or relevant warnings, and click Next.
24. At the Ready to Install screen, click Install.
25. After installation completes, click Close.
26. Close the installation window.

Installing Microsoft SharePoint Server 2010

1. Mount the installation media to the VM.
2. Launch setup.exe, and click Install software prerequisites.
3. Review the list of software, and click Next.
4. Accept the EULA, and click Next.
5. When the prerequisites finish installing, click Finish.
6. On the main SharePoint installation menu, click Install SharePoint Server.
7. Enter your product license key, and click Continue.
8. Accept the EULA, and click Continue.
9. Choose the Complete server type, and click Install.
10. When the installation finishes, check the box for Run the SharePoint Products Configuration Wizard now, and click Close.
11. On the Welcome to SharePoint Products screen, click Next.
12. On the pop-up warning about services that will need to be restarted during the configuration, click Yes.
13. Choose Create a new server farm, and click Next.
14. Enter the name of your existing database instance on the same application server.

15. Specify a username and password, and click Next.
16. Enter a passphrase into the Passphrase and Confirm Passphrase fields, and click Next.
17. Leave the default settings on the Configure SharePoint Central Administration Web Application screen, and click Next.
18. Verify your settings, and click Next.
19. When the wizard has completed the configuration, click Finish.
20. Choose Run the farm configuration wizard on the Central Administration site.
21. Choose the services you wish to include in your server farm, and click Next.
22. Enter the specifications for the new site, and click OK.
23. Click Finish.

Preparing the SharePoint test client

For our testing, we used one physical client machine for the SharePoint client. To create this client, we installed Windows Server 2008 R2 SP1, joined the client to the domain, and installed several other software components. We followed this process for the configuration:

Installing Microsoft Visual Studio 2010 Ultimate Edition

1. Download vs_ultimateweb.exe from www.microsoft.com/download/en/details.aspx?id=12752
2. Double-click vs_ultimateweb.exe to run the installer.
3. Uncheck the box beside Yes, send information about my computer, and click Next.
4. If you see a pop-up requiring a Windows Imaging component, click the Windows Imaging Component is Required link.
5. Click Download on the appropriate Imaging component, and choose Run.
6. Accept the EULA, and click Next.
7. Close the pop-up window.
8. Click Next.
9. Accept the EULA, review the components to be installed, and click Next.
10. Choose the Full installation and location for the install, and click Install.
11. Click Finish.
12. Reboot the machine.
13. Click Start→All Programs→Microsoft Visual Studio 2010→Microsoft Visual Studio 2010.
14. When prompted, select General Development Settings and click Start Visual Studio.

Setting up and running WSSDW 1.0.0.0 Beta

1. Complete the following steps on the Domain Controller machine:
 - a. Click Start→Administrative Tools→Active Directory Users and Computers.
 - b. Right-click the domain name and select New→Group.
 - c. Enter `testdomaingroup1` for the group name.
 - d. Repeat steps a through c and create another group named `testdomaingroup2`
2. Download the following from <http://sptdatapop.codeplex.com/releases/view/1141>
 - To the SharePoint 2010 VM
 - WSS Data Population Tool RunTime.zip

- WSS Data Population Tool.chm
- WSS Data Population Tool Sample.zip
- To the SharePoint 2010 test client
 - WSS Performance Load Tests
- 3. Perform the following steps on the SharePoint 2010 VM:
 - a. Extract the contents of WSS Data Population Tool RunTime.zip and WSS Data Population Tool Sample.zip.
 - b. Copy the contents of both extracted .zip folders (WSS Data Population Tool Run Time and WSS Data Population Tool Sample) into the root of C:
- 4. Download SharePtServerDeployment.doc from:
 - <http://www.microsoft.com/en-us/download/details.aspx?id=10009> and place it into the c:\wssdw folder.
 - a. Rename WSS Data Population Sample File.xml to WSS_Data_Population_Sample_File.xml so that there are no spaces in the name. This allows the script to execute from the command prompt.
 - b. Right-click WSS_Data_Population_Sample_File.xml and click Edit to open the document in Notepad. Scroll down to line 55 and remove “.txt” from the document name in the destfile parameter. Then, change any applicable parameters to match the following:

```

<setproperty NumberOfSiteCollections="100" />
<setproperty SiteNameBase="testsite" />
<setproperty NumberOfGroups="2" />
<setproperty GroupNameBase="testgroup" />
<setproperty TargetDomain="test.local" />
<setproperty DomainGroupRoot="testdomaingroup" />
<setproperty DomainUserName="administrator" />
<setproperty DomainUserPassword="Password1" />
<setproperty DesignerGroup="design" AdminGroup="full control" />
<setproperty NumberOfDocumentLibraries="5" />
<setproperty DocumentLibraryNameBase1="testdoclib_A" />
<setproperty NumberOfDocuments="10" />
<setproperty SourceFileLocation="c:\wssdw\SharePtServerDeployment.doc" />
<setproperty DestFile="test" />
<setproperty NumberOfFileVersions="3" />
<setproperty DocumentLibraryNameBase2="testdoclib_B" />
<setproperty NumberOfLists="10" />
<setproperty ListNameBase="testlist" />
<setproperty NumberOfListItems="20" />
<setproperty webpartpath="webpartpagesfolder" />

```

- c. Open the command prompt and execute the script:

```
C:\>WSSDW.exe WSS_Data_Population_Sample_File.xml
```

5. Complete the following steps on the SharePoint 2010 test client:

- a. Extract the contents of WSS Performance Load Test to C: drive on the SharePoint test client.
- b. On the SharePoint test client, open the WSSTransactions folder, right-click→Edit, and modify the following files as follows:

users.csv

Under `username,password` enter `test.local\administrator,Password1` and remove the remaining entries.

serverUrl.csv

Under `serverUrl` replace `http://server` with `http://spserver` to match the server name of the SharePoint 2010 VM.

HierarchyManagerUsers.csv

Under `username,password` replace `domain\username,password` with `test.local\administrator,Password1`

- c. Open the `WssTestProject.sln` file in Visual Studio 2010 Ultimate.
- d. When prompted, click Next.
- e. Click Finish.
- f. When prompted, leave the Retarget the project to .NET Framework 4. After the project opens, you can retarget it to another Framework or Profile radio button selected, and click OK.
- g. Click Close.
- h. In the Solution Explorer pane, scroll to `WSSDispForm`, and double-click it.
- i. Expand the top menu under `WSSDispForm` in the left pane, expand Validation rules, and delete the `FindText` entry that references `mysite.aspx`.
- j. Click Save.
- k. Repeat steps h through j for `WSSHomePage` and `WSSSmallDocLibAllItems`.
- l. Click Project→Add Load Test.
- m. At the Welcome to the Create New Load Test Wizard, click Next.
- n. Enter Test for the load test scenario name, change the think time between test iterations to 8 seconds, and click Next.
- o. At the Load pattern settings for a load test scenario screen, select Constant load, enter 67 for the User Count, and click Next.
- p. Click Next at the Select a test mix model for the load test.
- q. At the Add test to a load test scenario and edit the test mix, click Add and select the following tests from the list below. Additionally, modify the distribution as follows:
 - `WSSDispForm 10%`
 - `WSSDocHTTPFetch 30%`
 - `WSSHomePage 20%`
 - `WSSSmallDocLibAllItems 30%`
 - `WSSPutDocumentCoded 10%`
- r. Click OK.
- s. At the Network types screen, select LAN, and click Next.
- t. At the Browser screen, click Next.

- u. At the Specify computers to monitor with counters sets during load test run screen, click Next.
 - v. At the Review and edit run settings for load test screen, enter 15 minutes for the Warm-up duration, enter 30 minutes for Run duration, 15 minutes for the Cool down duration, and click Finish.
6. To ensure that the WSSDW workload evenly selects different SharePoint sites at random, create .csv lists of a number of categories within each test and add the following parameters to each:

WSSD WSSDispForm: Site name, list name, and list IDs.

WSSDocHTTPFetch: Site name, doc revision, document library name, and document name.

WSSHomePage: Site name

WSSSmallDocLibAllItems: Site name, and document library name

WSSPutDocumentCoded: Site name

Add the following lines of code to the WSSPutDocumentCoded test:

```
[DeploymentItem("officeservertransactions\\siteNames.csv",
"officeservertransactions")]
```

```
[DataSource("Sites", "Microsoft.VisualStudio.TestTools.DataSource.CSV",
"|DataDirectory|\\officeservertransactions\\siteNames.csv",
Microsoft.VisualStudio.TestTools.WebTesting.DataBindingAccessMethod.Random,
Microsoft.VisualStudio.TestTools.WebTesting.DataBindingSelectColumns.SelectO
nlyBoundColumns, "siteNames#csv")]
```

```
[DataBinding("Sites", "siteNames#csv", "siteName",
"Sites.siteNames#csv.siteName")]
```

7. At the "WebTestRequest request1" line, add:

```
+ this.Context["Sites.siteNames#csv.siteName"].ToString() +
```

Moving to the 10-blade, 1,150-user configuration

1. Open the WssTestProject.sln file in Visual Studio 2010 Ultimate.
2. In the Solution Explorer pane, scroll to LoadTest1.loadtest, and double-click it.
3. In the main window pane titled LoadTest1.loadtest, select Test under the Scenarios branch.
4. In the Properties pane under the Explorer Pane, expand the Options branch, and change Think Time Between Test Iterations from 8 to 6.
5. Save the project and exit Visual Studio 2010 Ultimate.

Moving to the 16-blade, 1,800-user configuration

1. Open the WssTestProject.sln file in Visual Studio 2010 Ultimate.
2. In the Solution Explorer pane, scroll to LoadTest1.loadtest, and double-click it.

3. In the main window pane titled LoadTest1.loadtest, select Test under the Scenarios branch.
4. In the Properties pane under the Explorer Pane, expand the Options branch, and change Think Time Between Test Iterations from 6 to 3.
5. Save the project and exit Visual Studio 2010 Ultimate.

APPENDIX K – INSTALLING AND CONFIGURING THE DATABASE WORKLOAD

We installed Microsoft SQL Server 2012 on a VM residing on blade number 7 for the 8- and 10-blade configurations and on blade number 16 for the 16-blade configuration.

Configuring the SQL Server VM

After cloning, modify the SQL VM to contain the following settings:

- Memory: 48GB
- Virtual Processors: 8
- Additional virtual disks:
 - 1 x 295GB virtual disks for SQL database data (Thick provision lazy zeroed)
 - 1 x 195GB virtual disks for SQL log data (Thick provision lazy zeroed)

Installing SQL Server 2012

1. Open the console for the VM or connect to the VM with RDP.
2. Mount the installation ISO to the VM.
3. Click Run SETUP.EXE. If Autoplay does not begin the installation, navigate to the SQL Server 2012 DVD, and double-click.
4. If the installer prompts you with a .NET installation prompt, click Yes to enable the .NET Framework Core role.
5. In the left pane, click Installation.
6. Click New SQL Server stand-alone installation or add features to an existing installation.
7. At the Setup Support Rules screen, wait for the rule check to complete. If there are no failures or relevant warnings, click OK.
8. Select the Specify a free edition and select Evaluation from the drop-down menu. Click Next.
9. Click the checkbox to accept the license terms, and click Next.
10. If no failures are displayed after the setup support files are installed, click Next.
11. At the Setup Role screen, choose SQL Server Feature Installation.
12. At the Feature Selection screen, select Database Engine Services, Full-Text and Semantic Extractions for Search, Client Tools Connectivity, Client Tools Backwards Compatibility, Management Tools – Basic, and Management Tools – Complete. Click Next.
13. At the Installation Rules screen, click Next after the check completes.
14. At the Instance configuration screen, leave the default selection of default instance, and click Next.
15. At the Disk Space Requirements screen, click Next.
16. At the Server Configuration screen, check that NT AUTHORITY\SYSTEM is selected for SQL Server Agent and SQL Server Database Engine. Click Next.
17. Assuming there are no failures, click Next.
18. At the Database Engine Configuration screen, select Mixed Mode.
19. Enter and confirm a password for the system administrator account.
20. Click Add Current user. This may take several seconds.
21. Click the Data Directories tab and enter the appropriate drive and folders for database and logs.
22. Click Next.

23. At the Error and usage reporting screen, click Next.
24. At the Installation Configuration Rules screen, check that there are no failures or relevant warnings, and click Next.
25. At the Ready to Install screen, click Install.
26. After installation completes, click Close.
27. Create a SQL Server login for the ds2user (see the [Configuring the database \(Data generation overview\)](#) section for the specific script to use).
28. Copy the pre-created DVD Store backup to the specified backup volume.
29. Download and install any available updates for Microsoft SQL Server 2012.

Configuring database workload client

For our testing, we used client machines for the Microsoft SQL Server client. To create these clients, we installed Windows Server 2008 R2 SP1, assigned a static IP address, and installed .NET 3.5.

Configuring the database

Data generation overview

We generated the data using the Install.pl script included with DVD Store version 2.1 (DS2), providing the parameters for our 40GB database size and the database platform on which we ran: Microsoft SQL Server. We ran the Install.pl script on a utility system running Linux. The database schema was also generated by the Install.pl script.

After processing the data generation, we transferred the data files and schema creation files to a Windows-based system running SQL Server 2012. We built the 40GB database in SQL Server 2012, and then performed a full backup, storing the backup file on the C: drive for quick access. We used that backup file to restore the server between test runs.

The only modification we made to the schema creation scripts were the specified file sizes for our database. We explicitly set the file sizes higher than necessary to ensure that no file-growth activity would affect the outputs of the test. Besides this file size modification, the database schema was created and loaded according to the DVD Store documentation. Specifically, we followed the steps below:

1. We generated the data and created the database and file structure using database creation scripts in the DS2 download. We made size modifications specific to our 40GB database and the appropriate changes to drive letters.
2. We transferred the files from our Linux data generation system to a Windows system running SQL Server.
3. We created database tables, stored procedures, and objects using the provided DVD Store scripts.
4. We set the database recovery model to bulk-logged to prevent excess logging.
5. We loaded the data we generated into the database. For data loading, we used the import wizard in SQL Server Management Studio. Where necessary, we retained options from the original scripts, such as Enable Identity Insert.
6. We created indices, full-text catalogs, primary keys, and foreign keys using the database-creation scripts.
7. We updated statistics on each table according to database-creation scripts, which sample 18 percent of the table data.

8. On the SQL Server instance, we created a ds2user SQL Server login using the following Transact SQL (TSQL) script:

```
USE [master]
GO
CREATE LOGIN [ds2user] WITH PASSWORD=N'',
    DEFAULT_DATABASE=[master],
    DEFAULT_LANGUAGE=[us_english],
    CHECK_EXPIRATION=OFF,
    CHECK_POLICY=OFF
GO
```

9. We set the database recovery model back to full.
 10. We created the necessary full text index using SQL Server Management Studio.
 11. We created a database user and mapped this user to the SQL Server login.
 12. We then performed a full backup of the database. This backup allowed us to restore the databases to a pristine state relatively quickly between tests.

Figure 16 shows our initial file size modifications.

Logical name	Filegroup	Initial size (MB)
Database files		
primary	PRIMARY	2
cust1	DS_CUST_FG	12,288
cust2	DS_CUST_FG	12,288
cust3	DS_CUST_FG	12,288
cust4	DS_CUST_FG	12,288
ind1	DS_IND_FG	5,355
ind2	DS_IND_FG	5,355
ind3	DS_IND_FG	5,355
ind4	DS_IND_FG	5,355
ds_misc	DS_MISC_FG	200
orders1	DS_ORDERS	6,144
orders2	DS_ORDERS	6,144
orders3	DS_ORDERS	6,144
orders4	DS_ORDERS	6,144
Log files		
ds_log	Not Applicable	20,480

Figure 16: Our initial file size modifications.

APPENDIX L – RUNNING THE TEST

To run the test, we configured a 30 minute test window, allowing each benchmark 15 minutes to warm up prior to this measurement window for performance and latency on each of the solutions.

1. Shut down all VMs, and using the EqualLogic management interface, create a snapshot of each volume. These snapshots were used to restore to a pre-test state so additional identical runs could be performed.
2. Start the Login VSI Benchmark testing. We set Login VSI to a 30 minute login storm, 30 minute peak time, and 15 minute logout time.
3. Begin running the LoadGen benchmark 15 minutes into the Login VSI login storm. LoadGen was set to run for 1 hour, with a 15-minute allotted warm-up period, 30-minute performance measurement window, and 15-minute cool-down period.
4. Immediately after beginning the LoadGen benchmark, start the WSSDW workload. This workload was set to run for 1 hour, with a 15-minute warm up period, 30-minute run period and measurement window, and 15-minute cool-down period.
5. Immediately after beginning the WSSDW workload, start the three LyncPerfTool workloads using the generated script. These workloads were set to have a 15 minute warmup time and then run for 30 minutes of recorded performance.
6. Immediately after beginning all three LyncPerfTool workloads, start the DVD Store benchmark. DVD Store was set to warm up for 15 minutes, and then run for 30 minutes of recorded performance.
7. On completion of all of the test loads, collect the test results for each test and shut down all of the VMs.
8. Using the EqualLogic management interface, revert to the snapshot of each volume taken before the test started to restore all databases and workloads to an initial state.

About running the Login VSI benchmark

We used up to 68 launchers configured in parallel to run a light workload of 900 task workers, 1,150 task workers, and 1,800 task workers on two VMware View 5 pools. For more information on how to run a Login VSI test, see: <http://www.loginvsi.com/en/admin-guide/performing-tests>.

Launcher.ini (for pool1)

```
[Launcher]
Servername=
Username=
Password=
Domain=
CommandPassword=
ConnectionType="Custom with CSV file"
ConnectionNumber=User
CCL=c:\program files\VMware\VMWare View\Client\bin\wswc.exe -serverURL
http://view -username %CSV_User% -password Password1 -domainname test -
desktopname pool -Standalone -logInAsCurrentUser False -connectUSBOnStartup False
```

```
CSV=\\ad-server\share\csv\user.csv
Launchmode=Parallel
PreTestScript=
PostTestScript=
ParallelDelay=10
ParallelTimeframe=1800
InitialStartNumber=1
NumberOfSessions=900
SequentialInterval=20
Fancy_number=1
Autologoff=1
LogoffTimeOut=1200
CreateProfile=0
UseLocalLauncher=0
```

Launcher.ini (for pool2) used for the 10-blade, 1,150-user configuration

```
[Launcher]
Servername=
Username=
Password=
Domain=
CommandPassword=
ConnectionType="Custom with CSV file"
ConnectionNumber=User
CCL=c:\program files\VMware\VMWare View\Client\bin\wswc.exe -serverURL
http://view -username %CSV_User% -password Password1 -domainname test -
desktopname pool2 -Standalone -logInAsCurrentUser False -connectUSBOnStartup
False
CSV=\\ad-server\share\csv\user.csv
Launchmode=Parallel
PreTestScript=
PostTestScript=
ParallelDelay=10
ParallelTimeframe=1800
InitialStartNumber=1
NumberOfSessions=250
SequentialInterval=20
Fancy_number=1
Autologoff=1
LogoffTimeOut=1200
CreateProfile=0
UseLocalLauncher=0
```

Launcher.ini (for pool2) used for the 16-blade, 1,800-user configuration

```
[Launcher]
Servername=
Username=
Password=
Domain=
CommandPassword=
ConnectionType="Custom with CSV file"
ConnectionNumber=User
CCL=c:\program files\VMware\VMWare View\Client\bin\wswc.exe -serverURL
http://view -username %CSV_User% -password Password1 -domainname test -
desktopname pool2 -Standalone -logInAsCurrentUser False -connectUSBOnStartup
False
CSV=\\ad-server\share\csv\user.csv
Launchmode=Parallel
PreTestScript=
PostTestScript=
ParallelDelay=10
ParallelTimeframe=1800
InitialStartNumber=1
NumberOfSessions=900
SequentialInterval=20
Fancy_number=1
Autologoff=1
LogoffTimeOut=1200
CreateProfile=0
UseLocalLauncher=0
```

Worklaod_Global.ini

```
[VSI]
Office_Version=14
```

View5-user.csv

```
User
login_vsi1
login_vsi2
login_vsi3 (*)
```

() continue until you reach target user count*

About running the LoadGen test

For the 8-blade, 900-user scenario, to run the test, we installed the LoadGen client and server components and simulated 1,000 Exchange users targeting the Exchange VM using LoadGen's **Average** Workload profile. To simulate the increase to 1,150 Exchange users, we switched to using LoadGen's **Heavy** Workload profile. For the 16-blade, 1,800-user scenario, we created a new mailbox database with 1,800 users using LoadGen's Heavy Workload profile. We ran the LoadGen benchmark for 60 minutes, and beginning at the 15 minute mark, we used a 30 minute measurement window for performance monitoring.

For more details about LoadGen, see

<http://www.microsoft.com/download/en/details.aspx?displaylang=en&id=14060>.

About running the SharePoint Server test

To simulate the traffic of 900, 1,150, and 1,800 SharePoint Server 2010 users, we set the number of simulated users for the WSSDW 1.0.0.0 Beta to 90, and modified the think time, or time between operations, for each scenario. Our initial think time for 900 users was set to 8 seconds, we moved to 6 seconds to simulate 1,150 users, and finally we set the think time to 3 to simulate the load from 1,800 users. The load test was 45 minutes long, consisting of a 15-minute warm-up time and a 30-minute measurement window. While the test was running, we recorded CPU utilization and total requests per second on our SharePoint server using Windows Performance Monitor. We also recorded latency using the Web Page Response Time counter in Visual Studio load test parameters.

About running the Lync Server test

We ran a load test composed of three commonly used tasks that Lync provides: IM messaging, Audio/Video conferencing, and Address Book Search functionality. We ran with 1,000, 1,150, and 1,800 users with 96 percent of users dedicated to instant messaging, 3 percent of users dedicated to Audio/Video conferencing, and 1 percent of users dedicated to searching. This was the default user allocation by the Lync Server Stress and Performance Tool generator. We ran the test for 45 minutes and calculated the total number of actions completed for each task using the 30-minute block of time coinciding with the other tests. We used Windows Performance Monitor to record results using the Lync counters provided by the testing software. Where appropriate, we divided the number of tasks by the 1,800-second run time to get a task/second score.

About running the DVD Store tests

We created a series of batch files, SQL scripts, and shell scripts to automate the complete test cycle. DVD Store outputs an orders-per-minute metric, which is a running average calculated through the test. In this report, we report the last OPM reported by each client/target pair.

Each complete test cycle consisted of the general steps listed below.

1. Clean up prior outputs from the host system and all client driver systems.
2. Drop all databases from all target VMs.
3. Restore all databases on all target VMs.
4. Shut down all VMs.

5. Reboot the host system and all client systems.
6. Wait for a ping response from the server under test (the hypervisor system), all client systems, and all VMs.
7. Let the test server idle for 20 minutes.
8. Start the DVD Store driver on all respective clients.

We used the following DVD Store parameters for testing the virtual machine in this 900-user scenario:

```
ds2sqlserverdriver.exe --target=<target_IP> --ramp_rate=10 --run_time=30 --  
n_threads=30 --db_size=40GB --think_time=0.3 --detailed_view=Y --  
warmup_time=15
```

To change to the 1,150-user configuration, we changed the starting parameters to the following :

```
ds2sqlserverdriver.exe --target=<target_IP> --ramp_rate=10 --run_time=30 --  
n_threads=35 --db_size=40GB --think_time=0.3 --detailed_view=Y --  
warmup_time=15
```

To change to the 1,800-user configuration, we changed the starting parameters to the following :

```
ds2sqlserverdriver.exe --target=<target_IP> --ramp_rate=10 --run_time=30 --  
n_threads=55 --db_size=40GB --think_time=0.3 --detailed_view=Y --  
warmup_time=15
```

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