

186 Windows® 7 virtual desktops on a single Cisco® UCS B200 M3 blade with Cisco and VMware®



The Cisco UCS B200 M3 Blade Server supported
186 VMware View™ 5 virtual desktops.



When deploying your virtual desktop solution, choosing server hardware that is powerful enough across the compute and memory dimensions to support a large number of virtual desktops is crucial. The more virtual desktops per server you can support, the fewer servers you need to buy to provide virtual desktops to support your desired number of users.

To find the virtual desktop capacity of a single Cisco UCS B200 M3 Blade Server, we used the Login Consultants Virtual Session Indexer (Login VSI) 3.0 benchmark. The Login VSI workload we used performs a range of tasks to simulate a typical knowledge worker. The benchmark results show the maximum number of virtual desktops that a server can support by measuring response times throughout the test.

Testing we conducted in the Principled Technologies lab revealed that a single Cisco UCS B200 M3 Blade Server running VMware vSphere 5 could support up to 186 concurrent VMware View 5 virtual desktops, each running a Login VSI 3.0 Medium workload (with Flash), while still providing an excellent desktop experience for the end-user. This workload only used 3 percent of the available UCS bandwidth, leaving significant headroom for additional blades in the chassis for scalability, demonstrating the extensive bandwidth capacity afforded by the Cisco UCS architecture.

MORE VDI SESSIONS ARE BETTER

Choosing the right combination of hardware and software for your virtual desktop solution can significantly impact your bottom line. A robust hypervisor, top-of-the-line virtual desktop software, and a server built with powerful processors and an expansive memory footprint all work together to ensure you can meet the needs of your employees without your spending money, space, and time on additional hardware. The greater your virtual desktop density, the fewer physical servers you need. This reduces your electricity usage and power costs, and results in a greener datacenter.

We set out to examine such a virtual desktop solution, one that consisted of the following components:

- Cisco Unified Computing System™ (UCS) B200 M3 Blade Server with Intel® Xeon® processor E5-2690s
- VMware vSphere 5
- A VMware View 5 virtual desktop linked clone pool consisting of 193 Microsoft® Windows® 7 x64 VMs
- 193 total virtual desktops used to determine a Login VSI_{max} of 186 desktops with an acceptable response time, all provisioned with 1 vCPU and 1.5 GB of reserved memory
- EMC® VNX 5500 storage array

For details on test settings, see [Appendix B](#).

RESPONSE TIME MATTERS

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 by taking the average response times and dropping the highest and lowest 2 percent. The average response time of the first 15 sessions determines a baseline; the Dynamic VSI_{max} is $\text{baseline} \times 125\% + 3000\text{ms}$. As more sessions begin to consume system resources, response times degrade and the VSI index increases until it is above the Dynamic VSI_{max}. When this condition is met, the benchmark records a Login VSI_{max}, which is the maximum number of sessions that the platform can support. Because the VSI index drops the highest 2 percent of response times, we needed to use 193 virtual desktop sessions to reach the Login VSI_{max} of 186 for the Cisco B200 M3. Figure 1 shows the VSI index average and average response times for all active sessions recorded during the test. The Cisco UCS B200 M3 Blade Server was able to support 186 virtual desktops based on the Login VSI_{max} assigned by the Login VSI benchmark. User response time degraded only when all 16 cores were nearly saturated.

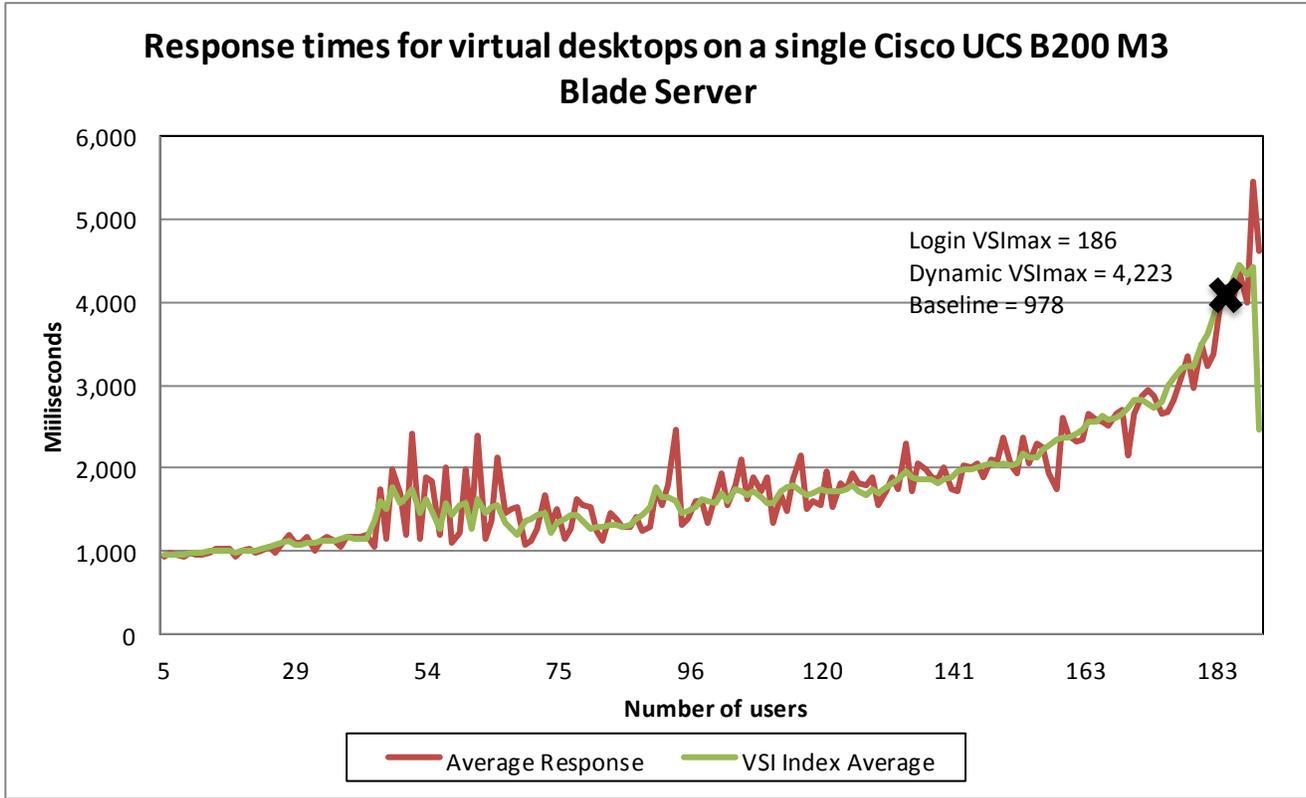


Figure 1: Average virtual desktop response times at various numbers of virtual desktops on the Cisco UCS B200 M3 Blade Server.

To initiate our test, we enabled our VMware View 5 pool to start up all Windows 7 VMs and reach an idle state. We monitored our test bed during the startup and perceived no bottlenecks in server CPU, network, or storage I/O at the VMware View default startup rate of five VMs at a time. When the VMs were idle, we started Login VSI testing. Figure 2 shows the processor utilization throughout the test. With 193 simultaneous users, 186 of which achieved an acceptable response time as determined by the Login VSI 3.0 benchmark, nearly all 16 processor cores were at close to full utilization. The graph line represents the average utilization across all 16 cores (32 threads) throughout the boot, idle, and testing phases. When the test was complete, all virtual desktops began to log off.

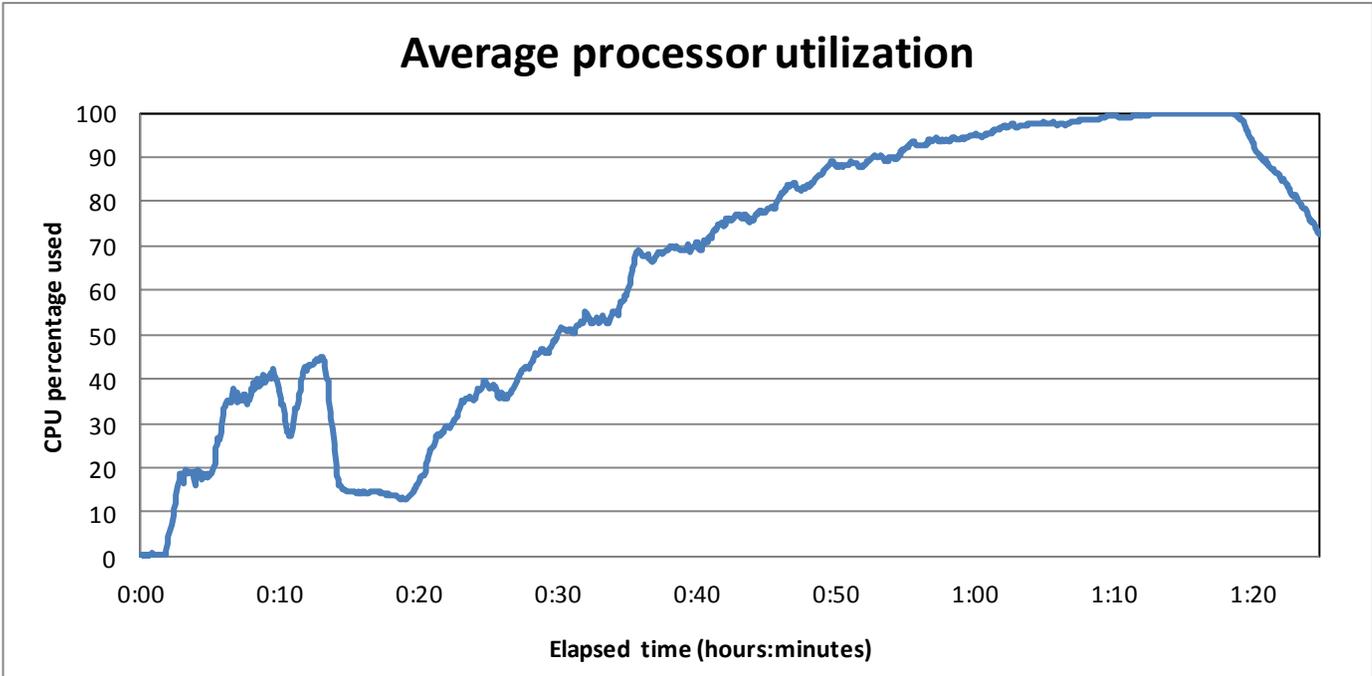


Figure 2: Processor utilization throughout the test.

Figure 3 shows the memory usage throughout the test. The step increase at the beginning of the chart reflects the beginning of the test with the 193 virtual desktops powering on. After boot up, vDTs that were not active conserved memory via page sharing. As sessions became active, the memory conserved by page sharing decreased until all page-sharing savings reached zero.

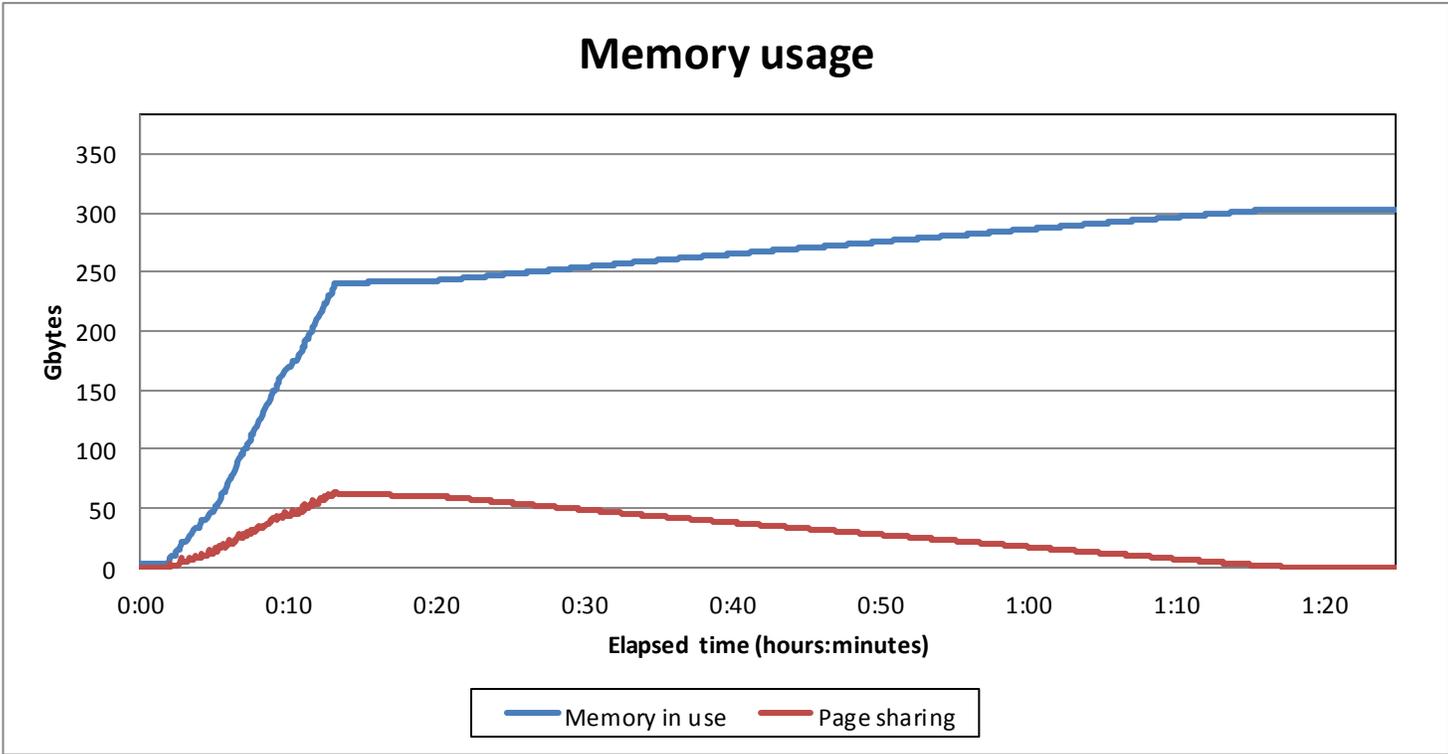


Figure 3: Memory usage throughout the test.

Figure 4 shows the fabric usage throughout the test.

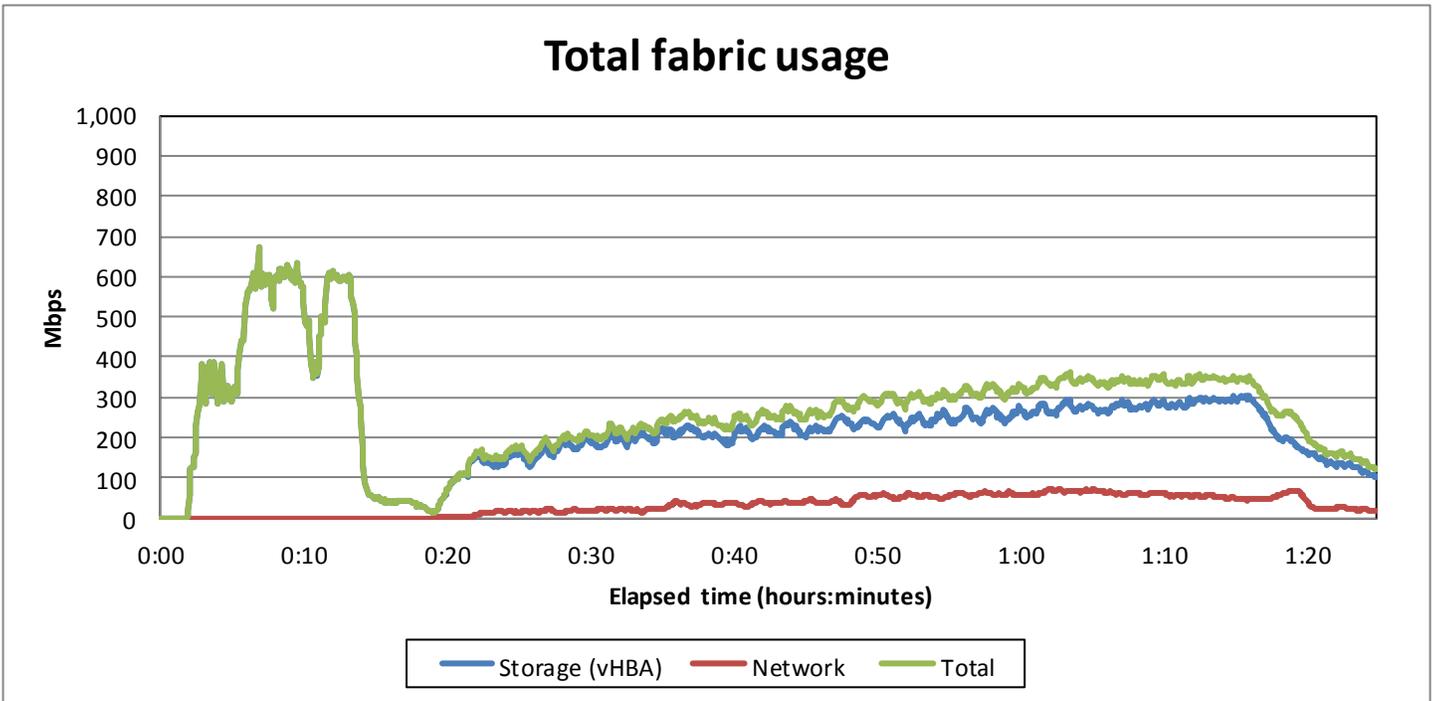


Figure 4: Fabric usage throughout the test.

Figure 5 shows the IOPS recorded throughout the test.

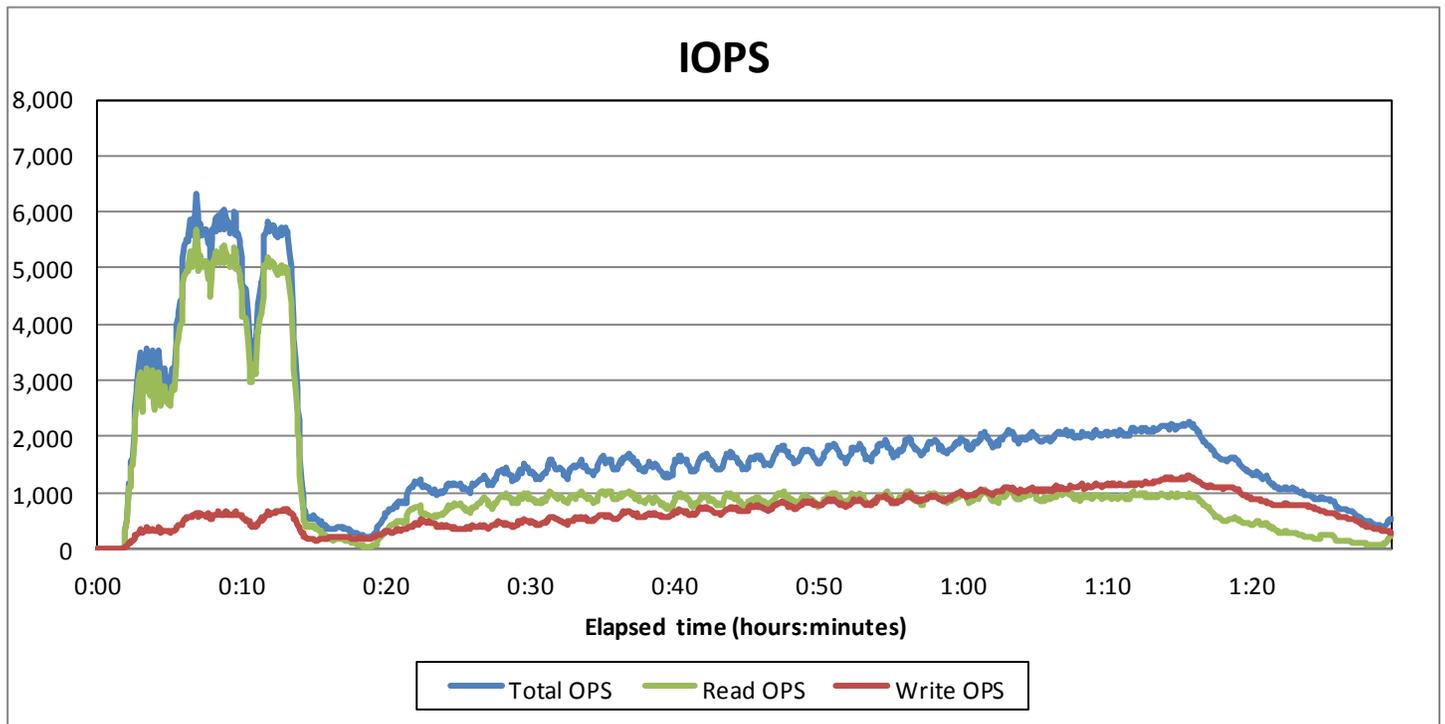


Figure 5: IOPS throughout the test.

GREATER BANDWIDTH HEADROOM PROVIDES EXCELLENT SCALABILITY

Although the Cisco UCS offers scalable bandwidth to each Cisco UCS 5108 Chassis, up to a fully redundant 80 Gb/s (160 Gb/s in an active-active configuration), in our testing we used a single redundant pair of 2 x 10Gb/s connections to the fabric interconnect. The peak bandwidth usage of the test never exceeded 700 megabits per second, or roughly 3 percent of the bandwidth available. See [Appendix D](#) for details. Note that the peak usage includes all storage and virtual desktop traffic. This shows that the chassis capacity far exceeds the required bandwidth for virtual desktop users based on our test results. The bandwidth afforded by the Cisco UCS architecture provides sufficient headroom for excellent scalability as your IT staff adds more Cisco UCS B200 M3 server blades to support larger user populations.

For information about Login VSI and the pieces of the solution we tested, see the [What we tested](#) section below. For server and storage configuration information, see [Appendix A](#). To see the step-by-step process we used for testing, see [Appendix B](#).

WHAT WE TESTED

About the Cisco UCS B200 M3 Blade Server

The Cisco UCS B200 M3 Blade Server is an enterprise-class blade server powered by the new Intel Xeon processor E5-2600 series to deliver high performance and outstanding I/O throughput for your applications. Supporting up to 384 GB of RAM with 24 DIMM slots, the Cisco UCS M200 M3 has expansive memory capabilities to support your heavy workloads. The B200 M3 blade will support a configuration of up to 768 GB when 32GB DIMMs are available later this year.

To learn more, see [Appendix A](#) for more detailed hardware specifications, or visit <http://www.cisco.com/en/US/products/ps12288/index.html>.

About the Cisco UCS Manager

The Cisco UCS Manager enables unified, embedded management that integrates the management of both software and hardware on the Cisco UCS solution. The UCS Manager centralizes server management, making it easier in several key ways. First, role-based management makes it easy to assign unique management roles to different administrators (i.e., server, network, or storage admins) so that each can be assigned his or her own unique policies and permissions, while still being part of an integrated management environment. Policy-based provisioning provides managers with the ability to create service profile templates that they apply to one or 100 servers, making it easy to apply consistent policies. The Cisco USC Manager makes server management less about managing isolated, single hardware components and more about managing many hardware components (supported up to 20 chassis or 160 blades) as a single management domain. The use of service profiles allows system administrators to allocate and reallocate server resources, which the UCS Manager views as “raw computing capacity.” This way, server capacity allocation becomes more dynamic and efficient, with managers able to deploy and reallocate server resources in a matter of minutes.

To learn more about the Cisco UCS Manager, visit <http://www.cisco.com/en/US/products/ps10281/index.html>.

About VMware View 5

VMware designed its View 5 desktop virtualization software to simplify IT management of virtual desktops from within the cloud. A centralized interface allows administrators to manage upwards of tens of thousands of end-users. An administrator can easily manage settings such as policy enforcement, performance monitoring, connection brokering, and provisioning, to name a few. The result includes improved security, less costly management, and faster provisioning and maintenance of desktop images and applications. The end-user enjoys easier access to his or her View desktop from a variety of locations, less downtime, a customizable desktop, and robust multimedia capabilities. In our tests, we implemented a new feature of View 5, that of PCoIP Optimization Controls. This feature helps IT administrators to better

configure bandwidth settings (by user, use case, or network requirements), which can reduce bandwidth by up to 75 percent and improve protocol efficiency.

To learn more about VMware View 5, visit

<http://www.vmware.com/products/view/overview.html>.

About VMware vSphere 5

vSphere 5 is the latest virtualization operating system from VMware. vSphere 5 allows companies to virtualize their server, storage, and networking resources, achieving a consolidation ratio greater than 15:1. Features such as automated management and dynamic resource allocation improve efficiency. The services that vSphere 5 provides fall into two categories: Infrastructure services or application services. The former handle the virtualization of resources and their allocation to application when most needed, while the latter provide service-level controls to applications running on vSphere 5.

To learn more about VMware vSphere 5, visit

<http://www.vmware.com/products/vsphere/overview.html>.

About the Intel Xeon processor E5 family

The new Intel Xeon processor E5 family 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/content/www/us/en/processors/xeon/xeon-processor-5000-sequence.html>.

About Login VSI

Login VSI benchmarks virtual desktop sessions to determine how scalable a particular virtualized system is. Specifically, it benchmarks a virtual desktop solution by simulating Windows-based Office user workloads. The Medium workload of Login VSI, which we tested as indicative of a typical “knowledge worker,” opens and closes the following applications and runs their respective tasks:

- Microsoft Outlook®: Browsing a message
- Microsoft Word® (TimerDoc): Initiating response timer to see how the program responds throughout the workload
- Microsoft Internet Explorer® instance one: Maximizing, scrolling, and minimizing
- Microsoft Internet Explorer instance two: Navigating a Web site, maximizing, and scrolling
- Adobe® Flash® KA movie trailer
- Microsoft Word (UserRead): Reading and typing text, and printing to PDF

- Bullzip: Generating a PDF
- Adobe Reader®: Reading a PDF
- Microsoft PowerPoint®: Watching a presentation and adding a slide
- Microsoft Excel®: Reading and minimizing
- 7-Zip: Saving a ZIP file

Login VSI Version 3.0 (Release 6) benchmarks user experience more effectively than previous versions of Login VSI because its workloads and what the VSI Index measures more accurately reflect the tasks actual users perform on their virtual desktops. Reported response times are higher in Login VSI 3.0 than in Login VSI 2.0 and other previous versions because the benchmark uses this heavier workload. The Login VSI benchmark mandates the minimum acceptable response time for the testing.

The Login VSI 3.0 benchmark uses seven operations to determine the VSI_{max}, the maximum number of users the system can handle before suffering serious degradation in performance. By using seven operations instead of only two, as earlier versions of Login VSI did, Login VSI 3.0 better reflects what a user actually experiences. The seven operations are as follows:

- Copying a new document from the document pool in the home drive
- Starting Microsoft Word
- Starting the File Open dialogue
- Starting the Search and Replace dialogue
- Starting the Print dialogue
- Starting Notepad
- Compressing the document into a ZIP file with 7-zip command line

Login VSI records response times, the time taken to execute a given task, in milliseconds. Login VSI then reports minimum, average, and maximum response times, as well as the VSI Index average while performing the workload. The Login VSI Index average is similar to the average response time, as it averages the maximum and minimum response times, but it removes 2 percent from the maximum and minimum response time before calculating the average. VSI max is then calculated in one of two ways, Classic and Dynamic. When the VSI Index average is higher than the default threshold of 4000ms, Classic VSI_{max} is achieved. Dynamic VSI max calculates a dynamic threshold based on the average response times of the first 15 sessions and applies the formula $\text{Baseline} \times 125\% + 3000$, when the VSI index is higher than the dynamic baseline then dynamic VSI Max is achieved. In our testing, Dynamic VSI Max was calculated to be 186 sessions.

It is important to note that variations in hypervisor, application, guest OS, and VDI settings can have a significant impact on expected user density in these tests. Tuning frames per second, image compression, screen resolution, and other user-experience-specific settings can increase or decrease the number of desktops a system can support. Generally, improving user experience will decrease the number of supported desktops. It is therefore important to

understand and quantify the specific needs of VDI users and create baseline settings to ensure the results are representative of your environment. For more details on the settings used in our testing, see [Appendix B](#).

For more information on Classic and Dynamic VSI max, see <http://www.loginvsi.com/en/admin-guide/analyzing-results#h0-1-calculating-vsimax>

For more information on Login VSI 3.0, see http://www.loginconsultants.com/index.php?option=com_content&task=view&id=390.

SUMMARY

A server that supports greater density of hosted virtual desktops without sacrificing performance will minimize the cost of your infrastructure and improve ROI. In our tests, the Cisco UCS B200 M3 Blade Server running VMware View 5 with VMware vSphere 5 provided impressive virtual desktop hosting density. The Cisco UCS solution delivered 186 concurrent VMware View 5 virtual desktops with acceptable user response times and minimal bandwidth usage.



APPENDIX A – SERVER AND STORAGE CONFIGURATION INFORMATION

Figure 6 provides detailed configuration information about the test servers. Note that we used the Cisco UCS B200 M3 Blade Server for the systems under test and used the Cisco UCS B200 M2 Blade Server for our test bed infrastructure. Figure 7 details the storage we used in our tests.

System	Cisco UCS B200 M3 server	Cisco UCS B200 M2 server
General		
Number of processor packages	2	2
Number of cores per processor	8	6
Number of hardware threads per core	2	2
System power management policy	OS Control	OS Control
CPUs		
Vendor	Intel	Intel
Name	Xeon	Xeon
Model number	E5-2690	X5670
Stepping	6	CO
Socket type	LGA2011	LGA 1366
Core frequency (GHz)	2.90	2.93
Bus frequency	8.0 GT/s	6.4
L1 cache	32 KB + 32 KB	32 KB+ 32 KB (per core)
L2 cache	256 KB (per core)	256 KB (per core)
L3 cache	20 MB	12 MB
Platform		
Vendor and model number	Cisco UCS B200 M3	Cisco UCS B200 M2 Blade Server
Motherboard model number	Cisco FCH153271DA	N20-B6625-1
BIOS name and version	Cisco B200M3.2.0.2a.0.0.22420121123	Cisco S5500.2.0.1d.093030111102
BIOS settings	Default	Default
Memory module(s)		
Total RAM in system (GB)	384	96
Vendor and model number	Samsung M393B2G70BH0-YK0	Samsung M393B5170FH0-YH9
Type	PC3L-12800R	DDR3 PC3-10600
Speed (MHz)	1,600	1,333
Speed running in the system (MHz)	1,066	1,333
Size (GB)	16	8
Number of RAM module(s)	24	12
Chip organization	Double-sided	Double-sided
Rank	Dual	Dual
Hard disk		
Vendor and model number	Seagate ST9146803SS	Seagate ST9146803SS
Number of disks in system	2	2
Size (GB)	146	146
RPM	15,000	10,000
Type	SAS	SAS

System	Cisco UCS B200 M3 server	Cisco UCS B200 M2 server
RAID controller		
Vendor and model	LSI MegaRAID SAS 2004	LSI Logic® SAS 1064E
Controller firmware	20.10.1-0061	01.32.04.00
Operating system		
Name	VMware vSphere 5	VMware vSphere 5
Build number	515841	515841
Language	English	English
Operating system power profile	Maximum Performance	Maximum Performance
I/O Adapters		
Vendor and model number	Cisco UCS-VIC-M82-4P	UCS M71KR-Q QLogic® Converged Network Adapter
Type	M-LOM	Mezzanine

Figure 6: Detailed configuration information for the servers.

System	EMC VNX 5500 storage array
Storage	
Number of 15-disk processor enclosures	1
Power supplies	
Total number	2
Disk array enclosures	
Number of 25-disk array enclosures	1
Number of 15-disk array enclosures	1
Data movers	
Number of VNX 5500 data movers	1
Disks	
Number of 100GB SSDs	8
Number of 300GB SAS drives	20
Number of 2TB NL SAS drives	10
Operating system	
Name	Unisphere™
Network	
Type	4 Gb Fibre Channel

Figure 7: Detailed configuration information for the storage.

APPENDIX B – HOW WE TESTED

To determine the number of virtual desktops the server could support, we ran incremental tests increasing the virtual desktop load until Dynamic VSI Max was reached. The minimum number of sessions required to archive Dynamic VSI max was 193. When testing 193 virtual desktops, we recorded a Dynamic VSI max of 186. At 192 sessions, the benchmark did not achieve Dynamic VSI Max. At the end of the test, the processors on the Cisco UCS B200 M3 Blade Server were nearly saturated. We confirmed that no other factors such as storage bottlenecks or memory constraints were contributing to a loss of performance or decreased response time.

Figure 8 illustrates our test environment: one Cisco UCS 5108 Blade Chassis with one Cisco UCS B200 M3 Blade Server and one Cisco UCS B200 M2 blade server. The Cisco UCS B200 M2 blade server with VMware vSphere 5 hosted all VMware View 5 and Login VSI Infrastructure VMs and the Cisco B200 M3 blade server with VMware vSphere 5 hosted all the VMware View 5 virtual desktops. We connected the Cisco UCS 5108 Blade Chassis to redundant pair of Cisco UCS 6248UP Fabric Interconnects. We connected the Fabric Interconnects to a Cisco Nexus™ 5010 switch. We deployed the two Cisco blade servers via the Cisco UCS Manager. Using Cisco Service Profiles, we assigned a base firmware level of 2.0(2a) for all server components. For the Cisco B200 M3, we assigned two redundant 20Gb vNICs and two redundant 4Gb Fibre Channel HBAs. For the Cisco B200 M2, we assigned two redundant 10Gb vNICs and two redundant 4Gb Fibre Channel HBAs. We hosted all VM storage on an EMC VNX 5500. We set up our VMware View virtual desktops via a linked clone pool. Our master image, a Microsoft Windows 7 x 86 Enterprise VM, had one vCPU and 1.5 GB of reserved memory. We used the VMware View script commands.bat found at <http://www.vmware.com/files/pdf/VMware-View-OptimizationGuideWindows7-EN.pdf>.

We disabled the build to lossless feature and set the maximum frames per second to 15 as discussed at <http://www.vmware.com/files/pdf/view/VMware-View-5-PCoIP-Network-Optimization-Guide.pdf>

All Login VSI launchers were virtual machines. To ensure audio rendering, we installed Virtual audio cable 4.12 on each. All desktop session were at a resolution of 1024x768, 32 bit color.

Note that, for its UCS blade servers, Cisco recommends a stateless boot from SAN configuration to ensure portability. However, for simplicity we installed our vSphere operating system on local disks because it did not affect the performance testing.

Figure 9 illustrates our logical network layout. We created a vSwitch on each vSphere server and created a single port group, tagged as vlan100. We connected all virtual desktops, Login VSI launchers, and VMware View infrastructure to these two vSwitches.

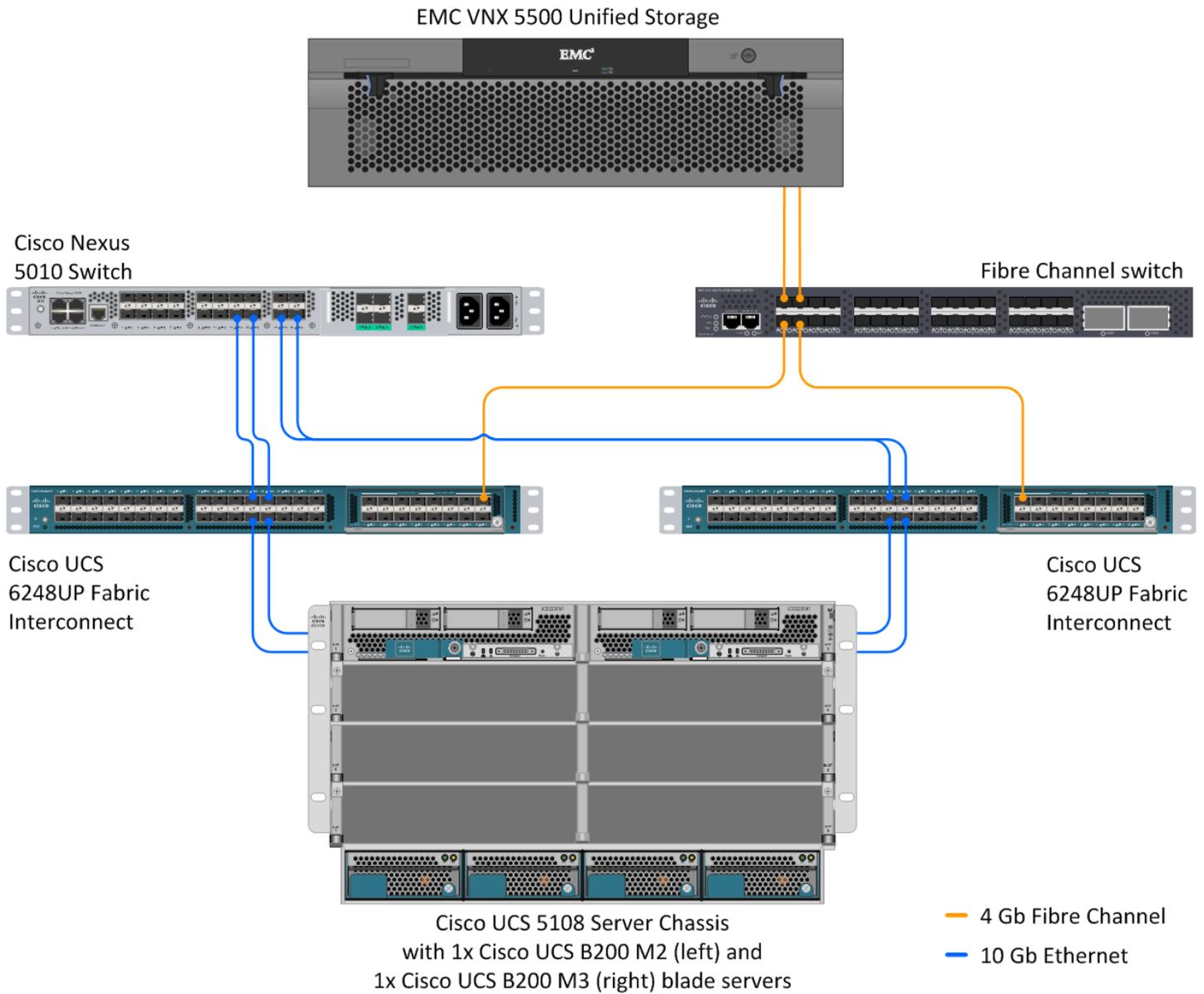


Figure 8: Our test environment.

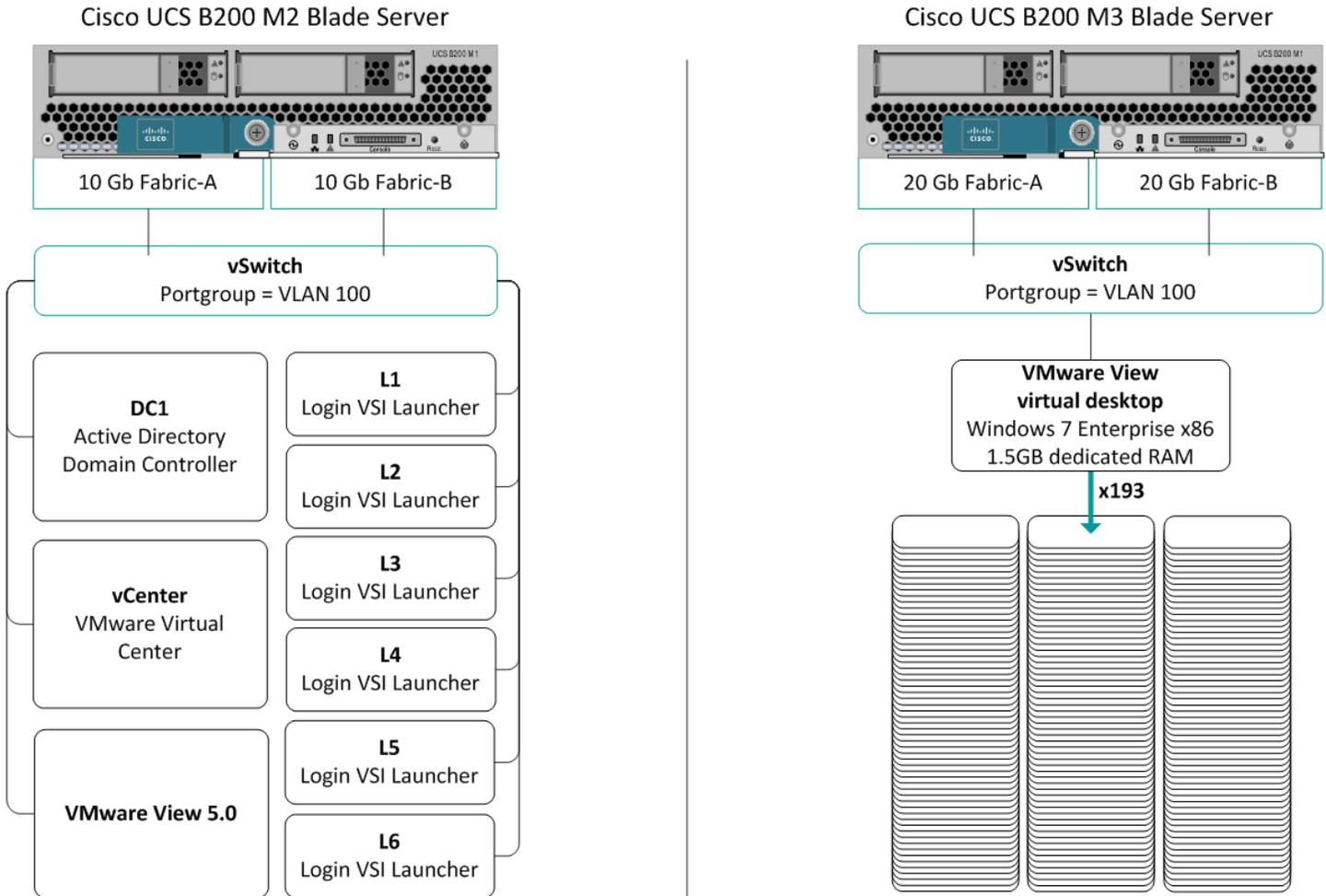


Figure 9: Our logical network layout.

Setting up the storage

To host all testing infrastructure, we installed a Cisco UCS B200 M2 Blade Server. Using UCS Service profiles, we configured the local disks in a RAID 1 configuration to host the ESXi hypervisor.

To host all virtual desktops, we installed a Cisco UCS B200 M3 Blade Server. Using UCS Service profiles, we configured the local disks in a RAID 1 configuration to host the ESXi hypervisor.

EMC VNX 5500 storage array

We configured the EMC VNX 5500 storage array to present a high-performance LUN consisting of a three-disk SSD RAID group to host the Windows® 7 replica disk for VMware View 5.0. We created a FAST Cache enabled storage pool. From the pool, we provisioned a 500 GB LUN to host all infrastructure and Login VSI launchers, and three 500 GB LUNs for all virtual desktop linked clone disks.

Setting up the external storage FAST Cache and RAID groups

1. Open EMC Navisphere.
2. Log in as sysadmin.
3. Click System → System Management → Manage Cache.
4. In the VNX 5500 storage system properties, click the FAST Cache tab, and click Create.

5. Select Enclosure 0, Disk 10 and 11, and click OK.
6. Click Storage→Storage Configuration→Storage Pools.
7. Click RAID Groups, and click Create.
8. Create storage.
9. In the General tab, select RAID 0.
10. In the General tab, for disks, click Manual and select Disk enclosure 0, SSD disks 4, 5 and 6, and click Apply.
11. Click Create.
12. In the General tab, select RAID 5.
13. In the General tab, for disks, click Manual, and select Disk enclosure 0:
 - a. Disk enclosure 0: SSD disks 7, 8, 9
 - b. Disk enclosure 1: SAS disks 0-19
14. In the Advanced tab, select the check box next to FAST Cache Enabled, and click OK.

Provisioning LUNS

1. Open Storage →LUNs.
2. Click Create:
 - a. For Storage pool type, click RAID group.
 - b. For Storage pool for new LUN=, select 0.
 - c. For Capacity, type 271 . 00 GB.
 - d. For LUN ID, select 0.
 - e. For Name, type SSD and click Apply.
3. Click Create:
 - a. For storage pool type, click RAID group.
 - b. For storage pool for new LUN, =select pool0.
 - c. For capacity, type 500 . 00 GB.
 - d. For number of LUNS to create, select 4.
 - e. For Name, type LUN and for starting ID, type 1 and click Apply.

Creating a storage group

1. Click Hosts, and under Storage groups, click Create.
2. For Storage Group Name, type VDI and click OK.
3. Open the storage group VDI.
4. Click the LUNs tab.
5. Expand SPA, and highlight LUN1-4 and SSD. Click Add, and click Apply.
6. Click OK to confirm, and click OK to exit.

Setting up the infrastructure server (infra), and server under test (SUT)

BIOS settings

We used Cisco UCS Firmware Manager to set all UCS firmware to version 2.0(2a).

Installing VMware vSphere 5 (ESXi) on the Cisco UCS B200 M2 (infra)

1. Insert the ESXi 5.0 disk, 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.
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 it 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 (network)

1. On the ESXi 5.0 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. Configure vSwitch0 by clicking Add Networking...
12. Click the Network Adaptors tab.
13. Click Add...
14. Select vmnic1, and click Next.
15. Position vmnic0 as active and vmnic1 as a standby, and click OK.
16. Click the Ports tab, and edit the vSwitch.
17. In the vSwitch0 properties, Click Add...
18. Create a virtual machine network called VDI-NET, with a VLAN ID of 100, click Next, and click Finish.
19. In the vSwitch0 properties, Click Add...

Configuring ESXi after installation (DNS, and NTP)

1. Select the Configuration tab, and click Time configuration.
2. Select Properties, and click Options.
3. In the General settings, select Start automatically if any ports are open, and Stop when all ports are closed.
4. In the NTP settings, add a reliable NTP server, or use DC1.view5.com.
5. Close NTP settings.
6. Select the Configuration tab, and click DNS and routing.
7. Type `infra` for name, and `view5.com` for domain.
8. Enter `172.0.0.10` for preferred DNS.
9. Close DNS.

Installing VMware vSphere 5 (ESXi) on the Cisco UCS B200 M3 (SUT)

1. Insert the ESXi 5.0 disk, 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.
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 it 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 (network)

1. On the ESXi 5.0 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. Configure vSwitch0 by clicking Add Networking...
12. Click the Network Adaptors tab.
13. Click Add...
14. Select vmnic1, and click Next.
15. Position vmnic0 as active and vmnic1 as a standby, and click OK.
16. Click the Ports tab and edit the vSwitch.
17. Change the number of ports to 512, and click OK.
18. In the vSwitch0 properties, click Add...
19. Create a virtual machine network called VDI-NET with a VLAN ID of 100 click Next, and click Finish.

Configuring ESXi after installation (DNS, and NTP)

1. Select the Configuration tab, and click Time configuration.
2. Select Properties, and click Options.
3. In the General settings, select Start automatically if any ports are open, and Stop when all ports are closed.
4. In the NTP settings, add a reliable NTP server, or use DC1.view5.com.
5. Close NTP settings.
6. Select the Configuration tab, and click DNS and routing.
7. Type SUT for name, and view5.com for domain.
8. Enter 172.0.0.10 for preferred DNS.
9. Close DNS.

Adding the ESXi servers to the EMC storage group

1. Open EMC Navisphere.
2. Log in as `sysadmin`
3. Click hosts, and under storage groups, click the VDI storage group, and click Properties.
4. In the Storage Group Properties box, click the Hosts tab.
5. Add infra and SUT, and click OK.
6. Reboot both ESXi servers.

Creating the ESXi datastore (SSD)

1. Log into infra as `root` with the vSphere client.
2. Click Configuration tab→Storage→Add Storage.
3. Select LUN0, and click Next.
4. Select VMFS-5, and click Next.
5. Review the disk layout, and click Next.
6. For Datastore name, type SSD and click Next.
7. For Capacity, select Maximum available space, and click Next.
8. Click Finish to create the datastore.

Creating the ESXi datastore (LUN1-4)

1. Log into infra as `root` with the vSphere client.
2. Click Configuration tab→Storage→Add Storage.
3. Select LUN1, and click Next.
4. Select VMFS-5, and click Next.
5. Review the disk layout, and click Next.
6. For Datastore name, type `LUN1` and click Next.
7. For Capacity, select Maximum Available Space, and click Next.
8. Click Finish to create the datastore.
9. Repeat steps 1 through 8 to create LUN2, 3 and 4.

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

1. Connect to the infra server via the VMware vSphere client.
2. Log in as `root` to the infra server.
3. In the vSphere client, connect to the vCenter™ Server, and browse to the ESXi host.
4. Click the Virtual Machines tab.
5. Right-click, and choose New Virtual Machine.
6. Choose Custom, and click Next.
7. Assign the name `DC1` to the virtual machine, and click Next.
8. Select infra for the host, and click Next.
9. Select LUN1 for the storage, and click Next.
10. Choose Virtual Machine Version 8, and click Next.
11. Choose Windows, choose Microsoft Windows Server® 2008 R2 (64-bit), and click Next.
12. For CPUs, select one virtual processor socket, and 2 cores per virtual socket, and click Next.
13. Choose 4 GB RAM, and click Next.
14. Click 1 for the number of NICs, select VMXNET3, connect to the VDI-NET network, and click Next.
15. Leave the default virtual storage controller, and click Next.
16. Choose to create a new virtual disk, and click Next.
17. Make the OS virtual disk size 40 GB, choose thick-provisioned lazy zeroed, specify the OS datastore on the external storage, and click Next.
18. Keep the default virtual device node (0:0), and click Next.
19. Click Finish.
20. Right-click the VM, and choose Edit Settings.
21. On the Hardware tab, click Add...
22. Click Hard Disk, and click Next.
23. Click Create a new virtual disk, and click Next.
24. Specify 15 GB for the virtual disk size, choose thin provisioning, and specify LUN1.
25. Choose SCSI (0:1) for the device node, and click Next.
26. On the Hardware tab, click Add...
27. Click Create a new virtual disk, and click Next.
28. Specify 50 GB for the virtual disk size, choose thin provisioning, and specify LUN1.
29. Choose SCSI (0:2) for the device node, and click Next.
30. Click Finish, and click OK.
31. Click the Resources tab, and click Memory.
32. Select reserve all guest memory, and click OK.
33. Connect the VM virtual CD-ROM to the Microsoft Windows Server 2008 R2 installation disk.
34. 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 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 `172.0.0.10/255.255.252.0`
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 the server.

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 `View5.com` and click Next.
5. At the NetBIOS name prompt, leave the name View5, 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 `infra` and `SUT`.
15. Open Windows Explorer and create a file called `e:\profiles`
16. Assign permissions of read/write to the `view5\everyone` group.

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 `view5.com` 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.
 - Start IP address=172.0.0.101
 - End IP address=172.0.3.200
 - Subnet mask=255.255.252.0
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. Click Close.
17. Click Start→Run and type `DHCPmgmt.msc`
18. DHCP→dc1.view5.com→IPv4→Server Options.
19. Right-click Server Options, and select Configure options for DNS
20. Add 172.0.0.10 as the DNS server, and 172.0.0.1 for router, Click OK.

Configuring PCoIP GPO for performance

We turned off Build to lossless, and adjusted maximum frame rate for more information. To learn more, please see: <http://www.vmware.com/files/pdf/view/VMware-View-5-PCoIP-Network-Optimization-Guide.pdf>.

1. Log into DC1 as administrator
2. Open the Group Policy editor.
3. Edit the default domain policy.
4. Click Administrative templates, and click Add/remove templates...
5. Browse to the pcoip.adm on the View 5 install DVD, and click Open.

6. In the GPO, browse to Computer Configuration→Administrative Template→Classic Administrative Template (ADM)→PCoIP Session Variables→ Not Overridable Administrative settings, and click Turn off Build-to-lossless feature. Right-click, and click Edit.
7. Select the radio button for Enabled, and tick the box next to I accept to turn off the Build-to-lossless feature.
8. In the GPO, browse to Computer Configuration→Administrative Template→Classic Administrative Template (ADM)→PCoIP Session Variables→ Not Overridable Administrative settings, and click Configure PCoIP image quality levels. Right click, and click Edit.
9. Set the Minimum Image Quality value to 50, Maximum Image Quality to 90, and the Maximum Frame Rate to 15.
10. Click OK.
11. Close the Group Policy editor.

Setting up the Login VSI share and Active Directory users

For Login VSI to work correctly, you must create a CIFS share, Active directory OU, and Active directory. For more information on Login VSI, see <http://www.loginvsi.com/en/admin-guide/installation.html>.

1. Open Windows Explorer, and create a file called f:\share
2. Assign permissions of read/write to the VDI/everyone group.
3. Right-click the f:\share folder, and select Properties.
4. Click the Sharing tab, and click Share...
5. Add everyone to the Read/Write group, and click Share.
6. From the Login VSI media, run the Login VSI AD Setup.
7. Keep the defaults, and click Start.

Creating roaming profiles for users

1. Open Active Directory users and computers.
2. Browse to view5.com→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%
8. Click OK.

Setting up a VM to host the vCenter server

1. Connect to the infra server via the vSphere client.
2. Log into infra with the VMware vSphere client.
3. In the vSphere client, connect to the vCenter Server, and browse to the ESXi host.
4. Click the Virtual Machines tab.
5. Right-click, and choose New Virtual Machine.
6. Choose Custom, and click Next.
7. Assign the name vCenter to the virtual machine, and click Next.
8. Select infra for the host, and click Next.
9. Select LUN1 for the storage, and click Next.
10. Choose Virtual Machine Version 8, and click Next.
11. Choose Windows, choose Microsoft Windows Server 2008 R2 (64-bit), and click Next.
12. For CPUs, select one virtual processor socket, and 2 cores per virtual socket, and click Next.
13. Choose 4GB RAM, and click Next.
14. Click 1 for the number of NICs, select VMXNET3, connect to the VDI-NET portgroup, and click Next.
15. Leave the default virtual storage controller, and click Next.
16. Choose to create a new virtual disk, and click Next.

17. Make the OS virtual disk size 40 GB, choose thick-provisioned lazy zeroed, specify the OS datastore on the data1, and click Next.
18. Keep the default virtual device node (0:0), and click Next.
19. Connect the VM virtual CD-ROM to the Microsoft Windows Server 2008 R2 installation disk.
20. Click Finish.
21. Right-click the vCenter VM, and click Edit settings.
22. Click the Resources tab, click Memory, check the Reserve all guest memory box, and click OK.
23. 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 vCenter5 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 view5 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.

Installing vCenter 5

1. Log onto the vCenter 5 as View5\administrator
2. From the VMware vCenter5 install media, click Autorun.
3. Click Run to start the install wizard.
4. Click the Install button on the VMware vSphere 5.0 wizard.
5. Select the install wizard language as English, and click OK.
6. At the install wizard welcome screen, click Next.
7. Accept the license agreement, and click Next.
8. Enter user information and a license key, and click Next.
9. Select Install the SQL Express instance, and click Next.
10. Select the system account for the vCenter Server service account, and click Next.
11. Keep the installation directory as C:\Program Files\VMware\Infrastructure\, and click Next.
12. Select Create a standalone VMware vCenter Server instance, and click Next.
13. Keep the vCenter default ports, and click Next.
14. Select 1024 MB for the JVM memory, and click Next.

15. Click Install to finish the vCenter Server installation.
16. When the installation completes, restart the server.
17. Using the vSphere client, log into vCenter5 as `view5\administrator`
18. Right-click the root of vCenter5, and click New Data center.
19. Name the New datacenter `datacenter`
20. Add the server named `infra.view5.com` to the datacenter.
21. Add the server named `SUT.view5.com` to the datacenter.

Configuring VMware Composer SQL ODBC

1. From the vCenter desktop, Open Start→All Programs→Microsoft SQL Server 2008 R2→Configuration Tools→SQL Server Configuration Manager.
2. Click SQL Server Network Configuration→Protocols for VIM_SQLEXP.
3. Right-click TCP/IP, and select Enabled.
4. Click SQL Services→right-click SQL server browser, and select Properties.
5. IN the SQL Server Browser properties, select the Services tab, change the Start mode to Automatic, and click OK.
6. Start the SQL server browser service.
7. Select Start→Run→`odbcad32.exe`.
8. Click the system DSN tab.
9. Click Add.
10. Click SQL Server, and click Finish.
11. In the Create a New Data Source to SQL Server text box, enter the connection name type: `composer`
12. For Server, select `vCenter\VIM_SQLEXP`, and click Next.
13. Leave authentication as default, click Next twice, and click Finish.
14. Click OK to create the composer ODBC connection.

Setting up VMware View Composer

1. Open the View5 media folder, and run the file names `VMware-viewcomposer-2.7.0-481620.exe`.
2. At the Welcome and Patents screens, 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, type `composer` for source name, type `View\Administrator` for user name, type the password, and click Next.
6. Leave the default SOAP port, and click Next.
7. Click Install, and click finish.

Setting up a VM to host the VMware View 5 connection server

1. Log into vCenter with the VMware vSphere client.
2. In the vSphere client, browse to the ESXi host named `infra`.
3. Click the Virtual Machines tab.
4. Right-click, and choose New Virtual Machine.
5. Choose Custom, and click Next.
6. Assign the name `View5` to the virtual machine, and click Next.
7. Select `infra` for the host, and click Next.
8. Select LUN1 for the storage, and click Next.
9. Choose Virtual Machine Version 8, and click Next.
10. Choose Windows, choose Microsoft Windows Server 2008 R2 (64-bit), and click Next.
11. For CPUs, select one virtual processor socket, and 2 cores per virtual socket, and click Next.
12. Choose 4GB RAM, and click Next.
13. Click 1 for the number of NICs, select VMXNET 3, connect to the VDI-NET portgroup, 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 40 GB, choose thick-provisioned lazy zeroed, specify the OS datastore on the external storage, and click Next.
16. Keep the default virtual device node (0:0), and click Next.
17. Connect the VM virtual CD-ROM to the Microsoft Windows Server 2008 R2 installation disk.
18. Right-click the View5 VM, and click Edit settings.
19. Click the Resources tab, click Memory, check box Reserve all guest memory, and click OK.
20. Click Finish.
21. Start the VM.

Installing the Microsoft Windows Server2008 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 `view5` 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 View5 domain.
15. Install VMware tools. For more information, see http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=340.
16. Reboot.

Installing the VMware View 5 server

1. Log into the server named View5.
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 5 server.
12. Log out of View 5.

Setting up a Windows 7 Enterprise x86 image for VMware View 5 linked clone “gold image” and a Windows 7 Enterprise x64 image VSI Launchers

Using the vSphere client, we created a Windows 7 Enterprise x64 VM with the Login VSI launcher software, and cloned it to create six Login VSI launchers. We also created a single optimized Windows 7 Enterprise x86 VM on the SUT as the gold image for View 5 linked clone deployment.

Installing the Windows 7 Enterprise (x64) Login VSI launcher

1. Log into the appropriate vCenter.
2. In the vSphere client, connect to the vCenter Server, and browse to the ESXi host named infra.
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 `LUN1`, and click Next.
8. Choose Virtual Machine Version 8, 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 12 GB 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 20 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 View5.com domain, and reboot.

Adjusting page file on the launcher

1. Log in as `view5/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 `2048` for both values, and select Set.

Disabling Windows Firewall

The domain GPO automatically disables the Windows Firewall.

Installing Microsoft Office 2007 Professional on the launcher

1. From the Office 2007 media, run Setup.
2. Enter the product key for Office 2007, and click Continue.
3. Accept the licensing agreement.
4. Select default installs.
5. Click Install.
6. Download and run Office 2007 Service Pack 2.
7. Reboot the system.

Installing Virtual Audio cables

By default, the virtual launchers cannot render audio so we installed Virtual Audio Cables ver 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.

Installing Login VSI target software on the launcher

1. Browse to `\\vsi-install\Target setup`.
2. Run the setup.exe.
3. In the Target Setup wizard, specify the VSI share ([\\dc1\share](http://dc1/share)).
4. Click Start.
5. When prompted with security warnings, click OK.
6. Reboot the system.

Clone the launcher

We created a template from the VM named launcher and deployed six Launchers using 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>.

Installing the Windows 7 Enterprise (x86) VMware View 5 gold image

1. Log into vCenter.
2. In the vSphere client, connect to the vCenter Server, and browse to the ESXi host named SUT.
3. Click the Virtual Machines tab.
4. Right-click, and choose New Virtual Machine.
5. Choose Custom, and click Next.
6. Assign the name `gold_image` to the virtual machine, and click Next.
7. Select `LUN1` and click Next.
8. Choose Virtual Machine Version 8, and click Next.

9. Choose Windows, choose Microsoft Windows 7 (32-bit), and click Next.
10. Choose one virtual processor, and click Next.
11. Choose 1536 GB RAM, and click Next.
12. Click 1 for the number of NICs, select E1000 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 20 GB, choose thin-provisioned, click Next.
16. Keep the default virtual device node (0:0), and click Next.
17. Click Finish, and click OK.
18. Edit the gold_image VM.
19. Remove the virtual floppy, and click OK.
20. In the Options tab→General, deselect Enable logging, and click OK.
21. Click the Resources tab, click Memory, click the box next to Reserve all guest memory, and click OK.
22. Connect the VM virtual CD-ROM to the Microsoft Windows 7 x86 installation disk.
23. Start the VM.
24. When the installation prompts you, press any key to begin setup.
25. Enter your language preferences, and click Next.
26. Click Install.
27. Accept the license terms, and click Next.
28. Select Custom, and select the drive that will contain the OS.
29. Click Install, and the setup begins.
30. Type `user` for the username and change the computer name, and click Next.
31. Enter no password, and click Next.
32. For system protection, select Use recommended settings, and click Next.
33. Enter your time zone, and click Next.
34. Select the Work Network setting, and click Next.
35. Use Windows Update to patch the Windows 7 installation.
36. Install VMware Tools. For more information, see http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=340
37. Reboot.
38. Join the View5.com domain, and reboot.

Installing Windows 7 Enterprise (x86) and optimizing Windows 7

Adjusting page file

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 `1536` for both values, and select Set.

Disabling Windows Firewall

The domain GPO automatically disables the Windows Firewall.

Installing the Login VSI Target software on gold_image

1. Log in as `View5\administrator`
2. Browse to `\\dc1\share\vs1_install\setup\target setup\setup-x86.setup`.
3. In the target setup wizard, type `\\dc1\share`
4. Wait for the install to complete.

Installing the VMware View agent on gold_image

1. Log into the gold_image.
2. Browse to the VMware View agent media.
3. At the Welcome screen and License agreement, accept the terms, and click Next.
4. Accept install defaults, and click Next.
5. Select Do not enable the remote desktop capability on this computer, and click Next.
6. Keep the default install directory, and click Install.
7. Start the Windows Registry Editor, and navigate to the following registry key:
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\vmware-viewcomposer-ga.
8. Navigate to the SkipLicenseActivation registry value. The default value is 0.
9. Set the value to 1.
10. Reboot the VM gold_image.

Cleaning up the VM on Windows 7 virtual desktop

1. Click Start→Run→services.msc.
2. In the Services menu, select Windows Search, and change it from Disabled to Automatic (delayed start).
3. Close the Services menu.
4. Click Start→Control Panel→View Devices and Printers.
5. In the Services and Printers window, delete the XPS printers and document writers.

Optimizing the Windows 7 virtual desktop, and final preparation of the gold image

For our testing, we optimized the Windows 7 gold image for performance using the commands.bat:

<http://www.vmware.com/files/pdf/VMware-View-OptimizationGuideWindows7-EN.pdf>

1. Run commands.bat.
2. Shut down the VM.
3. Log into vCenter with the vSphere client.
4. Take a snapshot of the gold_image VM called view5_ready.

Configuring the View 5 server - creating a pool and adding entitlements for Login VSI users

1. Open the View Administrator.
2. Log in as View5\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 pool for the pool ID and display name, and click Next.
9. Leave the pool settings as defaults, and click Next.
10. Keep the disposable disk size as 4,096, and click Next.
11. Type a naming pattern of View- and type 193 for both max number of desktops, and number of spares.
12. Enter the virtual machine settings as follows:
 - Default image as: gold_image
 - VM folder: /Datastore/vm/pool
 - Host or cluster: /datastore/host/SUT.view5.com
 - Resource pool: /datastore/host/SUT.view5.com/Resources
 - Linked clone Datastores: LUN2, LUN3, LUN4
 - Replica disk Datastore: SSD
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 login_VSI/view5.com, and click OK.
17. Ensure all 193 desktops have a status of ready.

Running the Login VSI benchmark

We used six launchers configured in parallel to run a medium workload of 193 user sessions on the VMware View 5 pool. For more information on how to run a Login VSI test, see: <http://www.loginvsi.com/en/admin-guide/performing-tests>.

APPENDIX C - LOGIN VSI INI FILES USED FOR TESTING

VMware View 5 launcher.ini

```
[Launcher]
Servername=
Username=
Password=
Domain=
ConnectionType="Custom with CSV file"
ConnectionNumber=User
CCL=c:\program files\VMware\VMWare View\Client\bin\wswc.exe -serverURL
http://VIEW5 -username %CSV_User% -password Password1 -domainname View5 -
desktopname pool -Standalone -logInAsCurrentUser False -connectUSBOnStartup False
CSV=\\DC1\Share\csv\view5-user.csv
Launchmode=Sequential
ParallelDelay=10
ParallelTimeframe=3600
InitialStartNumber=1
NumberOfSessions=193
SequentialInterval=30
Fancy_number=1
Autologoff=1
LogoffTimeOut=120
CreateProfile=0
UseLocalLauncher=0
```

View5-user.csv

```
User
login_vsi1
login_vsi2
login_vsi3
login_vsi4
login_vsi5 (*)
```

() continue until login_vsi193*

APPENDIX D – RESOURCE UTILIZATION DETAILS

Figure 10 shows that the server supporting the virtual desktop load never exceeded 3 percent of the bandwidth available, leaving over 97 percent of fabric available for future scaling.

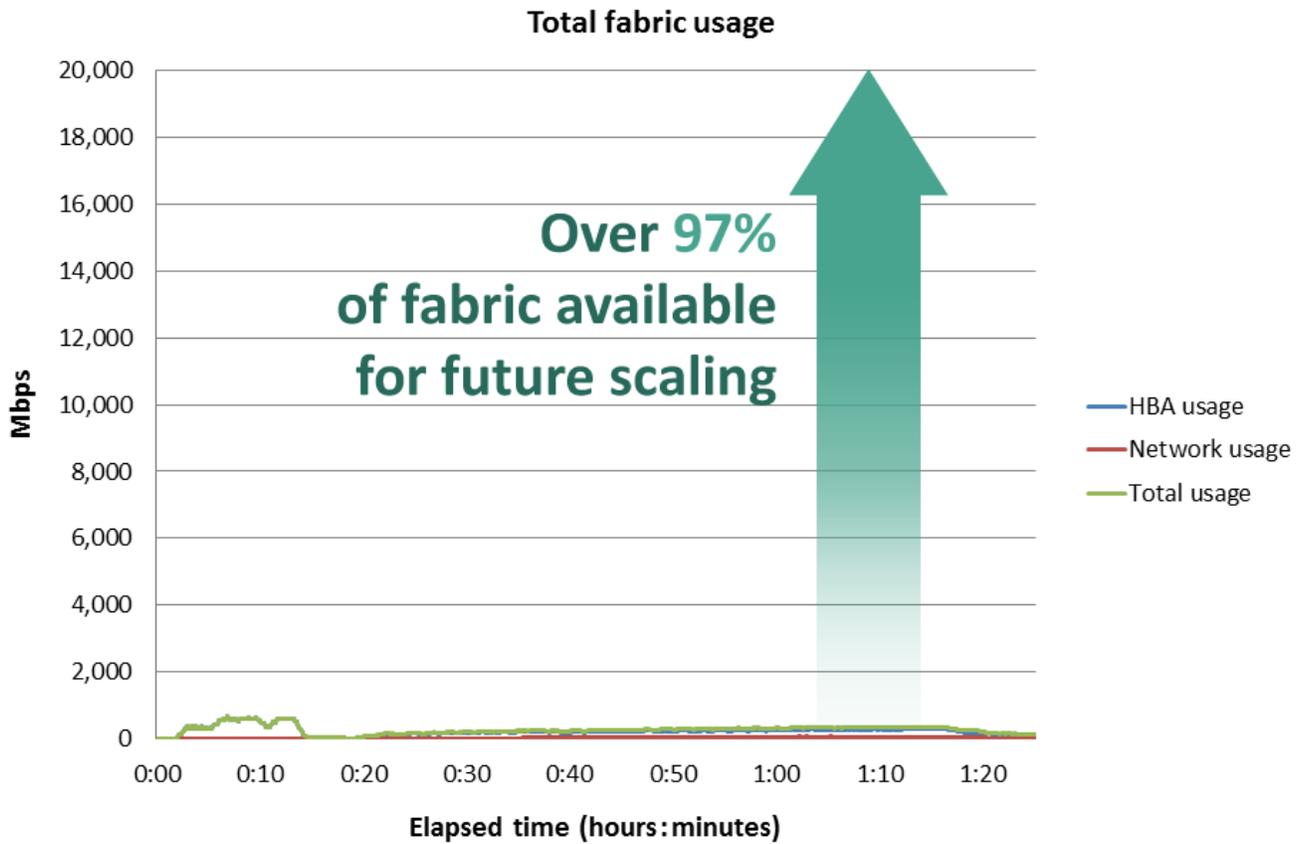


Figure 10: Bandwidth usage for test. In our testing, the aggregate workload never exceeded 3 percent of available compute fabric bandwidth.

ABOUT PRINCIPLED TECHNOLOGIES



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

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

When the assessment is complete, we know how to present the results to a broad range of target audiences. We provide our clients with the materials they need, from market-focused data to use in their own collateral to custom sales aids, such as test reports, performance assessments, and white papers. Every document reflects the results of our trusted independent analysis.

We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to help our clients assess how it will fare against its competition, its performance, its market readiness, and its quality and reliability.

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

Principled Technologies is a registered trademark of Principled Technologies, Inc.
All other product names are the trademarks of their respective owners.

Disclaimer of Warranties; Limitation of Liability:

PRINCIPLED TECHNOLOGIES, INC. HAS MADE REASONABLE EFFORTS TO ENSURE THE ACCURACY AND VALIDITY OF ITS TESTING, HOWEVER, PRINCIPLED TECHNOLOGIES, INC. SPECIFICALLY DISCLAIMS ANY WARRANTY, EXPRESSED OR IMPLIED, RELATING TO THE TEST RESULTS AND ANALYSIS, THEIR ACCURACY, COMPLETENESS OR QUALITY, INCLUDING ANY IMPLIED WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE. ALL PERSONS OR ENTITIES RELYING ON THE RESULTS OF ANY TESTING DO SO AT THEIR OWN RISK, AND AGREE THAT PRINCIPLED TECHNOLOGIES, INC., ITS EMPLOYEES AND ITS SUBCONTRACTORS SHALL HAVE NO LIABILITY WHATSOEVER FROM ANY CLAIM OF LOSS OR DAMAGE ON ACCOUNT OF ANY ALLEGED ERROR OR DEFECT IN ANY TESTING PROCEDURE OR RESULT.

IN NO EVENT SHALL PRINCIPLED TECHNOLOGIES, INC. BE LIABLE FOR INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH ITS TESTING, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT SHALL PRINCIPLED TECHNOLOGIES, INC.'S LIABILITY, INCLUDING FOR DIRECT DAMAGES, EXCEED THE AMOUNTS PAID IN CONNECTION WITH PRINCIPLED TECHNOLOGIES, INC.'S TESTING. CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES ARE AS SET FORTH HEREIN.
