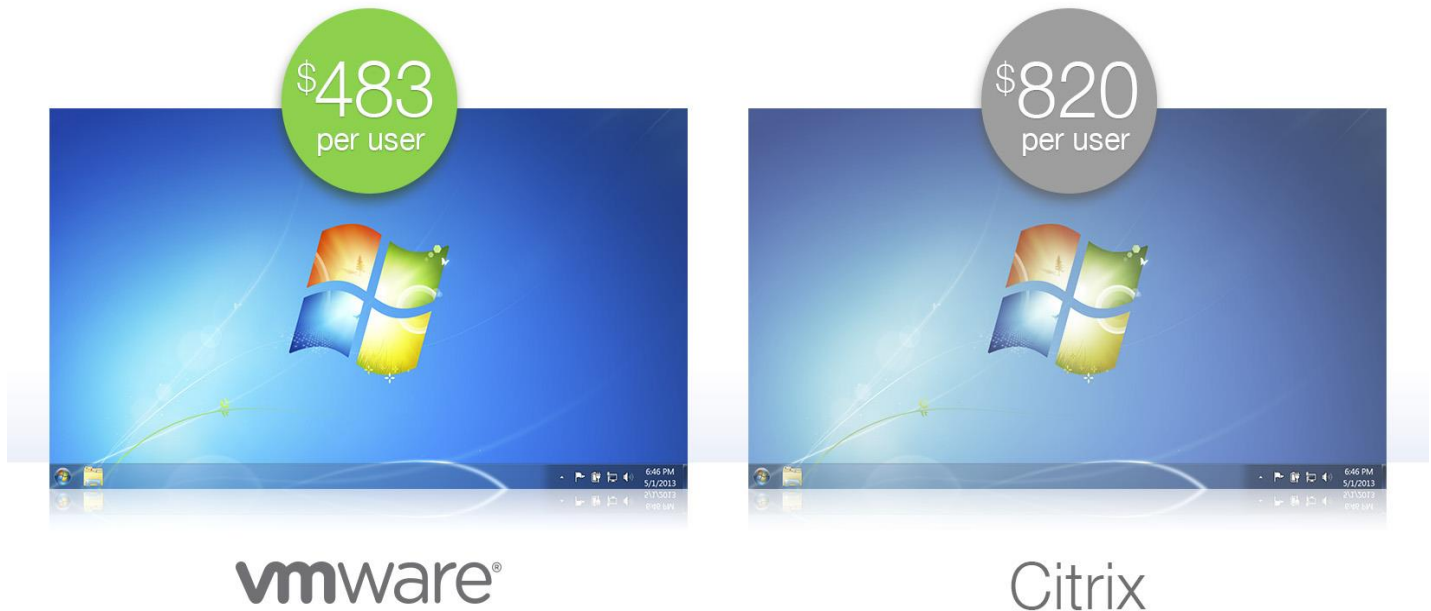


SCALE TESTING AND COST ANALYSIS STUDY: VMWARE HORIZON VIEW 5.2 VS. CITRIX XENDESKTOP 5.6

VMware® Horizon View™ 5.2

41.1% lower cost per user compared to Citrix® XenDesktop™ 5.6 Enterprise Edition



Companies looking for advantages of virtual desktop infrastructure (VDI) must look carefully at cost. Here in the labs of Principled Technologies, we compared Microsoft® Windows® 7 virtual desktops hosted on VMware® Horizon View™ 5.2 and Citrix® XenDesktop™ 5.6.

Hosted on the same physical hardware resources and using similar image rendering settings, we conducted scale testing with the Login VSI medium workload. We found that VMware Horizon View 5.2 supported 174 Microsoft Windows 7 virtual desktop sessions at a cost per user of \$483.¹ Citrix XenDesktop 5.6 supported 175 sessions at a cost of \$820 per user. These findings mean that VMware Horizon View 5.2 delivered comparable density at a 41.1 percent lower cost per user, making it an excellent choice for a company that wants to deliver a high-quality experience to users at an excellent price.

¹ See [Appendix D](#) for cost analysis. We used publicly available pricing as of May 2013 for server hardware and software.



Comparable density, much lower cost

As Figure 1 shows, in our testing, VMware Horizon View 5.2 delivered dramatically lower software cost compared to Citrix XenDesktop 5.6 with settings that most closely match the VMware Horizon View solution. With both platforms running at a similar density, the cost per user came out to be over \$300 less expensive for VMware Horizon View 5.2. It is important to note that VMware includes around-the-clock telephone support to Horizon View users, whereas Citrix offers additional Premier support for each concurrent user at an additional cost.

	VMware Horizon View 5.2	Citrix XenDesktop 5.6 with lossless settings	VMware Horizon View 5.2 provided...
Number of users supported	174	175	Comparable density
Total licensing cost	\$72,210.00	\$131,667.36	45.2% lower total cost
Hardware cost	\$11,845.00	\$11,845.00	Equal hardware cost
Total cost	\$84,055.00	\$143,512.36	41.4% lower total licensing plus hardware cost
Cost per user	\$483	\$820	41.1% lower cost per user

Figure 1: Cost and density comparison for the two solutions.

We provide detailed system configuration information in [Appendix A](#), details of our testing in [Appendix B](#) and [Appendix C](#), and the details of our cost analysis in [Appendix D](#).

Horizon View 5.2 virtual desktops vs. Citrix XenDesktop 5.6 virtual desktops

We loaded our server under test, an HP DL380p Gen8, with VMware vSphere® 5.1 and connected it to six iSCSI LUNS on a Dell™ EqualLogic™ PS 6110X storage array. We hosted all Microsoft Windows 7 virtual desktops for both VMware Horizon View 5.2 and Citrix Desktop 5.6 on the server under test. We hosted all infrastructure VMs on separate server resources. See [Appendix B](#) for detailed information.

We used Login VSI to generate a reproducible, real-world test case that simulated the execution of various applications including Microsoft® Internet Explorer®, Adobe® Flash® video, and Microsoft Office® applications to determine how many virtual desktop users, or sessions, each solution could support.

We configured Login VSI to run a medium workload against a Horizon View pool of virtual desktops and against a Citrix XenDesktop pool of virtual desktops, and set up both tests to incrementally log users into virtual desktops every 20 seconds for the duration of each test.

Login VSI measured the total response time of all the applications from each session and calculated 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 determined a baseline. As more sessions begin to consume system resources, response

time degrades and the VSI index increases until it is above the VSI_{max} (VSI_{max} is baseline x 125% +3000ms). When this condition is met, the benchmark records a Login VSI_{max}, which is the maximum number of sessions that platform could support. Once logged in, each session remained active for the duration of the test, and for at least 15 minutes. Not reaching VSI_{max} is an indication of satisfactory user response at the predetermined user count.

VMware Horizon View 5.2 results

We created a Windows 7 x64 Enterprise Edition master image, and accepted all default settings during the Windows 7 installation. We used standard Login VSI installation instructions and best practices in preparing the Windows 7 master image. We installed Microsoft Office 2010, Login VSI target software, and the VMware Horizon View 5.2 agent on the Windows 7 VM. We deployed a pool of linked clone virtual desktops from the master image, housing the replicas and virtual desktops on three iSCSI LUNs presented to the server under test.

Figure 2 shows the response times, in milliseconds, as sessions increased for the VMware Horizon View 5.2 desktop pool with 174 active desktops.

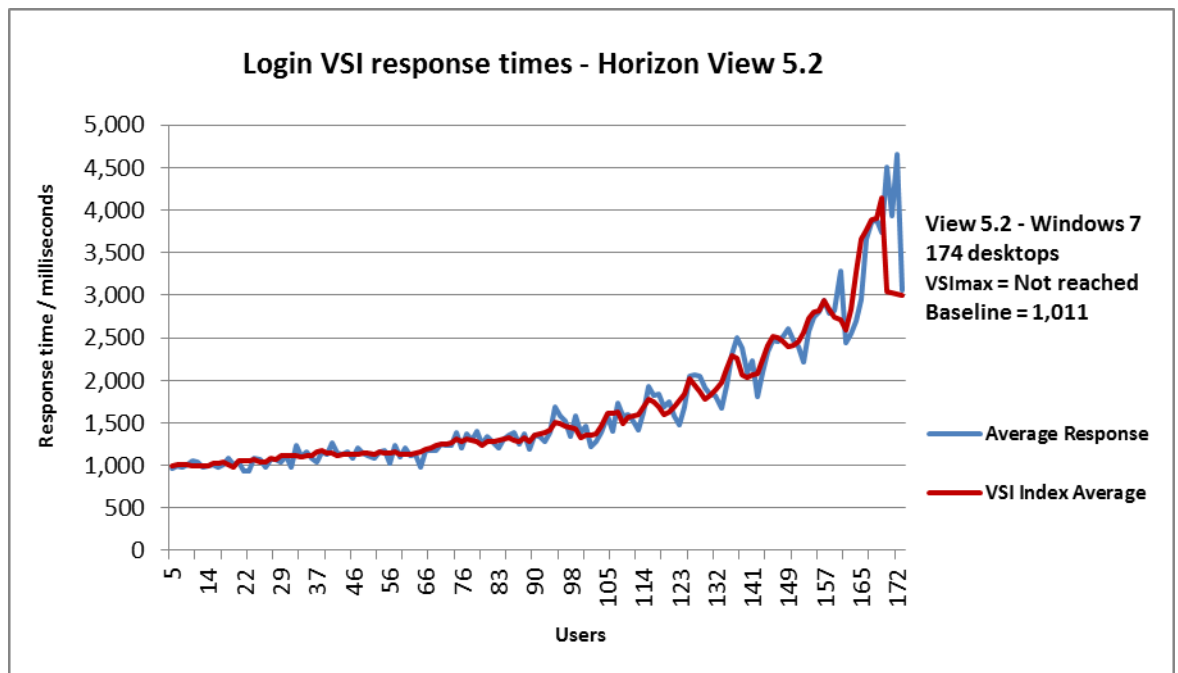
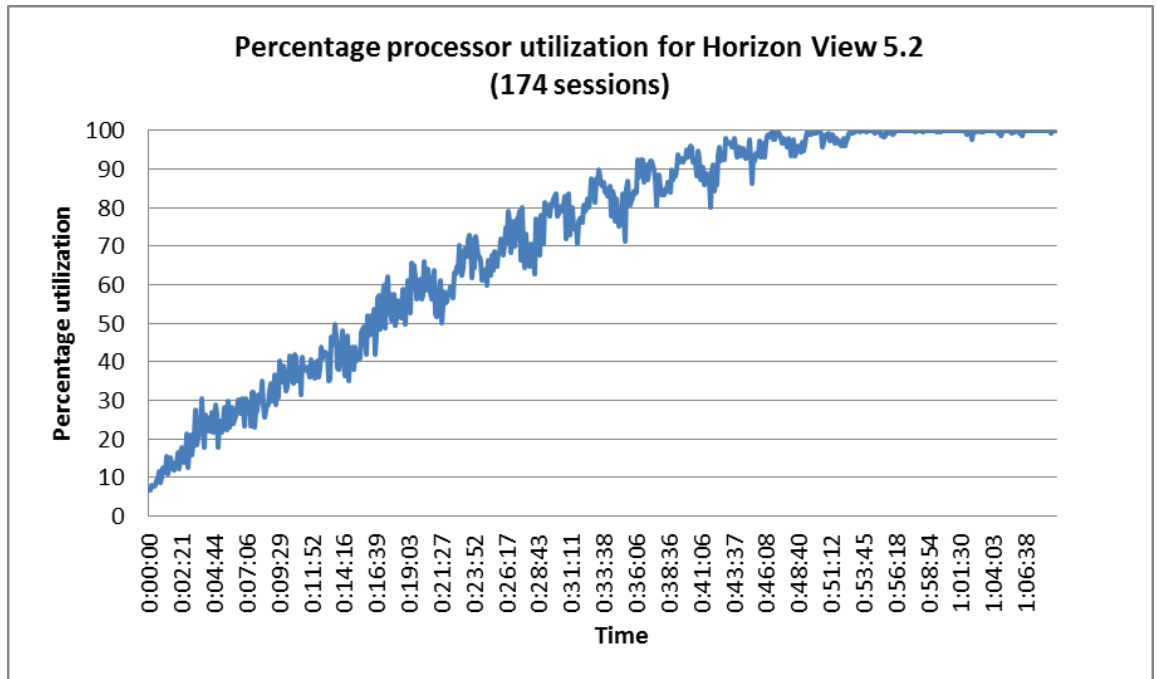


Figure 2: The test server was able to run 174 Horizon View 5.2 Windows 7 virtual desktop sessions without generating a VSI max.

We collected performance data with ESXTOP and Figure 3 shows the percentage CPU utilization throughout our VMware Horizon View 5.2 test with 174 active desktops. Additional sessions exceed the VSI_{max} for the server under test due to CPU utilization.

Figure 3: CPU utilization for our server under test: CPU utilization throughout the Horizon View 5.2 test.²



Citrix XenDesktop 5.6 lossless results

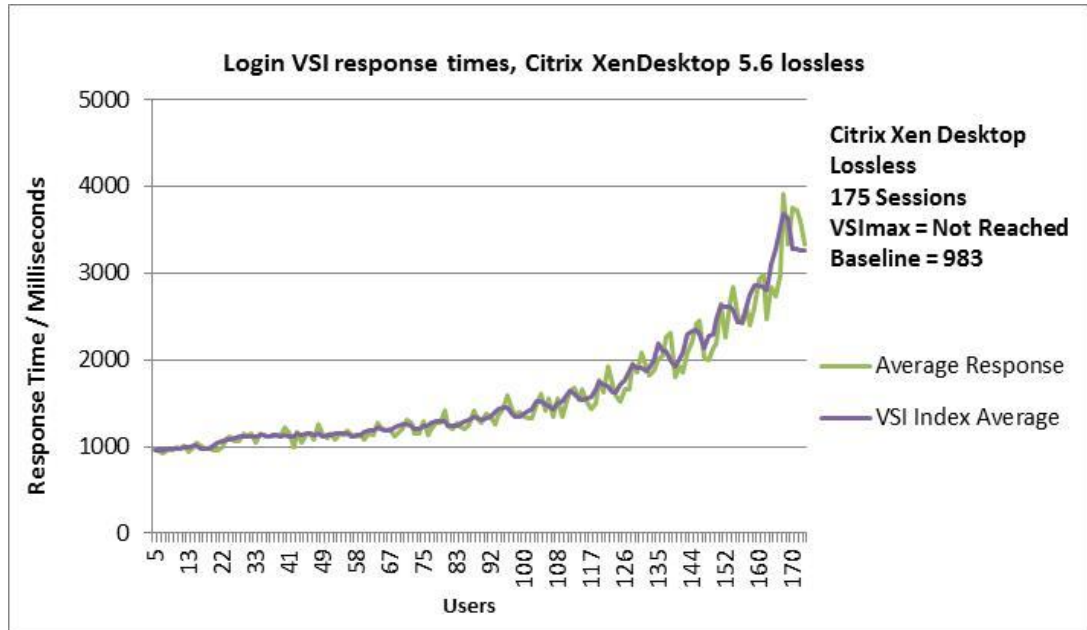
For the testing we report on below, we disabled Citrix XenDesktop 5.6’s default lossy compression and increased the moving image rendering to 30 FPS so that the resulting lossless settings would most closely match the superior lossless image quality of the VMware Horizon View solution. (Note: We also conducted our tests with the default lossy compression at 24 FPS. The results appear in [Appendix E](#).)

For our Citrix XenDesktop 5.6 lossless testing, we created a master image similar to the VMware Horizon View master image. Using the Citrix master image, we created a Citrix Provisioning Services vDisk and deployed 175 Microsoft Windows 7 VMs via Citrix Provisioning Services. We ensured that the VMs were load balanced across three iSCSI LUNS.

Figure 4 shows the response times, in milliseconds, as the sessions increased in our Citrix XenDesktop 5.6 lossless tests with 175 active sessions.

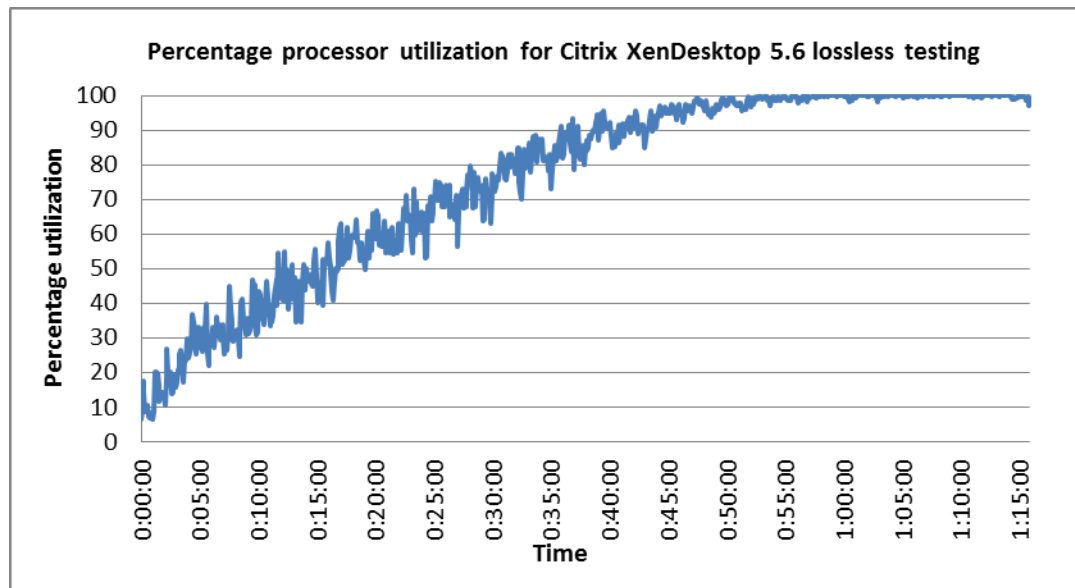
² This test is a VDI simulation that exercises the hardware components in the server. We ran the workload to fully utilize the processors within the system. However, each potential environment varies in hardware topology, SLA requirements, and hardware vendor best practices, so evaluate your environment and size your workloads with caution.

Figure 4: In our lossless test, Citrix XenDesktop 5.6 was able to run 175 sessions without generating a VSImax.



We collected performance data with ESXTOP and Figure 5 shows the percentage CPU utilization throughout our Citrix XenDesktop 5.6 lossless tests. Additional sessions exceed the VSImax for the server under test due to CPU utilization.

Figure 5: CPU utilization for our server under test throughout the Citrix XenDesktop 5.6 lossless test period.³



³ This test is a VDI simulation that exercises the hardware components in the server. We ran the workload to fully utilize the processors within the system. However, each potential environment varies in hardware topology, SLA requirements, and hardware vendor best practices, so evaluate your environment and size your workloads with caution.

CONCLUSION

In our scale testing with the Login VSI 3.7 medium workload, we compared VMware Horizon View 5.2 and Citrix XenDesktop 5.6, and discovered that both enterprise solutions delivered a rich Microsoft Windows 7 desktop experience and supported a comparable number of concurrent users. However, VMware Horizon View 5.2 costs 41.1 percent less than Citrix XenDesktop 5.6. Included in the \$483 per-user cost of VMware Horizon View 5.2 is around-the-clock telephone support, while the \$820 per-user cost of Citrix XenDesktop requires additional fees for telephone support. For companies that want to deliver a high-quality experience with advantages like continuous customer service to users at a competitive price, VMware Horizon View 5.2 is an excellent choice.

APPENDIX A – SYSTEM CONFIGURATION INFORMATION

Figure 6 details the configuration information for the system we tested. Figure 7 shows configuration information for the storage array we used.

System	HP ProLiant DL380p Gen8
General	
Number of processor packages	2
Number of cores per processor	8
Number of hardware threads per core	2
CPU	
Vendor	Intel®
Name	Xeon®
Model number	E5-2680
Socket type	FCLGA2011
Core frequency (GHz)	2.7
Bus frequency	8 GT/s
L1 cache	8 x 32 KB instruction 8 x 32 KB data
L2 cache	8 x 256 KB
L3 cache	20 MB (shared)
Platform	
Vendor and model number	HP ProLiant DL380p Gen8
Motherboard model number	346920-001
BIOS name and version	HP P77 12/14/2012
BIOS settings	Maximum performance
Memory module(s)	
Total RAM in system (GB)	256
Vendor and model number	Kingston KVR13LL9Q4/32
Type	PC3L-10600R
Speed (MHz)	1,333
Speed running in the system (MHz)	1,333
Timing/Latency (tCL-tRCD-tRP-tRASmin)	9-9-9-36
Size (GB)	32
Number of RAM module(s)	8
Chip organization	Double-sided
Rank	Quad
OS/hypervisor	
Name	VMware ESXi 5.1.0
Build number	914609
File system	VMFS
Kernel	ACPI x64-based PC
Language	English

System	HP ProLiant DL380p Gen8
RAID controller	
Vendor and model number	HP Smart Array P420i
Firmware version	3.22
Cache size (MB)	0
Ethernet adapter	
Vendor and model number	Broadcom® BCM5719 Gigabit Ethernet
Number of ports	4
Type	Integrated
USB ports	
Number	4
Type	2.0

Figure 6: System configuration information for our test server.

Storage array	Dell™ EqualLogic™ PS-6110X
Number of storage arrays	1
Number of storage controllers per array	2
RAID level	10
Firmware version	6.0.0
Number of drives	24
Model number	ST9900805SS
Drive size (GB)	900GB
Drive buffer size (MB)	16MB
Drive RPM	10K
Drive type	6Gb SAS 2.5"
Number of spare disks	2

Figure 7: Detailed configuration information for the Dell EqualLogic PS-6110X storage array.

APPENDIX B – HOW WE TESTED

Figure 8 details our tested infrastructure configuration for VMware Horizon View, while Figure 9 details our tested infrastructure configuration for Citrix XenDesktop.

VM name	Hosted OS	Role (s)	Server	Memory	No. of vCPUs
AD01	Win 2008 R2 x64 Enterprise	AD Domain controller VSI Share, DHCP, DNS, NTP	Infra	4 GB	2
VMW-View	Windows 2008 R2 Enterprise	VMware View connection server	Infra	4 GB	4
vCenter	Win 2008 R2 x64 Enterprise	VMware Virtual Center, VMware Composer, SQL server	Infra	8 GB	4
Launcher	Windows 7 x 64 Enterprise	8x Login VSI launchers	Infra	4 GB	2

Figure 8: Layout of the VMware Horizon View infrastructure.

VM name	Hosted OS	Role (s)	Server	Memory	# of vCPUs
AD01	Win 2008 R2 x64 Enterprise	AD Domain controller VSI Share, DHCP, DNS, NTP	Infra	4 GB	2
XenDesktop	Win 2008 R2 x64 Enterprise	XenDesktop Delivery Controller, Licensing Services	Infra	4 GB	4
PVS	Win 2008 R2 x64 Enterprise	XenDesktop Provisioning Services	Infra	4 GB	4
vCenter	Win 2008 R2 x64 Enterprise	VMware Virtual Center, SQL server	Infra	8 GB	4
Launcher	Windows 7 x 64 Enterprise	8x Login VSI launchers	Infra	4 GB	2

Figure 9: Layout of the Citrix XenDesktop infrastructure environment.

We used generic NAS for the infrastructure VMs and a Dell EqualLogic PS6110X drive array for the server under test storage. We configured the Dell EqualLogic PS6110X drive array in a single member group with the RAID policy set at RAID 10. The PS6110X array contained 24 SAS disks with two reserved as spares. We cabled the PS6110X array directly to the HP DL380p Gen8. Using the default storage pool, we created six LUNs that distributed the virtual machines used for testing. For the internal storage, we configured a RAID 1 mirrored pair of disks for the operating system.

INSTALLING AND CONFIGURING INFRASTRUCTURE

We installed Microsoft Server 2008 R2 on three virtual machines housed on an ESXi host (infra) that was not under test. We configured one as an Active Directory® domain controller, DNS server, DHCP server, file server, and NTP server, one as a vCenter server, and one as a Horizon View connection server. Additionally, we deployed two more Microsoft Server 2008 R2 virtual machines, the first one to server as Citrix Desktop Delivery Controller and licensing server and the second one as a Citrix Provisioning Services server. We also configured AD roaming profiles and folder redirection for all Login VSI users.

Configuring power settings on HP DL380p Gen8

1. Power on the server, and press F9 to enter Setup.
2. Select Power Management Options, and press Enter.
3. Select HP Power Profile, and press Enter.
4. Select Maximum Performance. Press F10 to save changes, and exit utility.

Installing VMware ESXi 5.1 on servers under test and infrastructure server

1. Insert the installation media, and select Boot from disk.
2. At the VMware Installer screen, press Enter.
3. At the EULA screen, press F11 to Accept and Continue.
4. Under Storage Devices, select the appropriate virtual disk, and press Enter.
5. Select US as the keyboard layout, and press Enter.
6. Enter the Root password twice, and press Enter.
7. Press F11 to start installation.
8. After the server reboots, press F2 to configure the network settings.
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 adapter.
13. Click OK.

Setting up a VM to host Microsoft Windows Active Directory® server (AD01) on (infrastructure server)

1. Connect to the `infrastructure` server via the VMware vSphere client.
2. Log in as `root`.
3. In the vSphere client, under Basic Tasks, select Create a new virtual machine.
4. Choose Custom, and click Next.
5. Assign the name `AD01` to the virtual machine, and click Next.
6. Select `infrastructure` as the host, and click Next.
7. Select the appropriate storage, and click Next.
8. Choose Virtual Machine Version 8, and click Next.

9. Choose Windows, choose Microsoft Windows Server® 2008 R2 (64-bit), and click Next.
10. For CPUs, select one virtual processor socket, and 2 cores per virtual socket, and click Next.
11. Choose 4 GB RAM, and click Next.
12. Click 1 for the number of NICs, select VMXNET3, connect to the PRIV-NET network, 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 external storage, and click Next.
16. Keep the default virtual device node (0:0), and click Next.
17. Click Finish.
18. Right-click the VM, and choose Edit Settings.
19. On the Hardware tab, click Add...
20. Click Hard Disk, and click Next.
21. Click Create a new virtual disk, and click Next.
22. Specify 40 GB for the virtual disk size, choose thick-provisioned lazy zeroed, specify external storage, and click Next.
23. Choose SCSI (0:1) for the device node, and click Next.
24. On the Hardware tab, click Add...
25. Click Create a new virtual disk, and click Next.
26. Specify 40 GB for the virtual disk size, choose thick-provisioned lazy zeroed, specify external storage, and click Next.
27. Choose SCSI (0:2) for the device node, and click Next.
28. On the Hardware tab, click Add...
29. Click Create a new virtual disk, and click Next.
30. Specify 40 GB for the virtual disk size, choose thick-provisioned lazy zeroed, specify external storage, and click Next.
31. Choose SCSI (0:3) for the device node, and click Next.
32. Click Finish, and click OK.
33. Click the Resources tab, and click Memory.
34. Select Reserve all guest memory, and click OK.
35. Connect the VM virtual CD-ROM to the Microsoft Windows Server 2008 R2 installation disk.
36. Start the VM.

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

1. Open a virtual machine console on AD01.
2. Choose the language, time and currency, and keyboard input. Click Next.
3. Click Install Now.
4. Choose Windows Server 2008 R2 Enterprise (Full Installation), and click Next.

5. Accept the license terms, and click Next.
6. Click Custom.
7. Click the Disk, and click Drive options (advanced).
8. Click New→Apply→Format, and click Next.
9. After the installation completes, click OK to set the Administrator password.
10. Enter the administrator password twice, and click OK.
11. Install VMware Tools. For more information, see kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=340.
12. Reboot the server.
13. Connect the machine to the Internet, and install all available Windows updates. Restart as necessary.
14. Enable remote desktop access.
15. Change the hostname to AD01 and reboot when the installation prompts you.
16. Click Start→Run, type `diskmgmt.msc`.
17. Select a 40 GB volume, name it `profiles` format it NTFS, and assign it drive letter E.
18. Select another 40 GB volume, name it `share` format it NTFS, and assign it drive letter F.
19. Select the last 40 GB volume, name it `folders` format it NTFS, and assign it drive letter G.
20. 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 `172.0.0.10/255.255.0.0`

Installing Active Directory and DNS services on AD01

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 `vdi.local`, and click Next.
5. At the NetBIOS name prompt, leave the name `VDI`, 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. Click Start→Run, type `dnsmgmt.msc`.
13. Create a reverse lookup zone for AD01.
14. Create static entries for the `infrastructure server` and the `servers` under `test`.

Configuring the Windows time service on AD01

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 AD01

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 `vdi.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.
 - Start IP address=172.0.0.20
 - 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 that the DHCP server install succeeded.
16. Click Close.
17. Click Start→Run and type `DHCPmgmt.msc`.

18. DHCP→AD01.vdi.local→IPv4→Server Options.
19. Right-click Server Options, and select Configure options.
20. Activate option 66 Boot Server Host Name.
 - String value= <ip of the Provisioning server>
21. Activate option 67 Boot file Name.
 - String value= ARDBP32.BIN
22. Click OK.

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 www.loginvsi.com/en/admin-guide/installation.html. Open Windows Explorer, and create the following folders: `f:\share`, `e:\profiles` and `g:\folderredirect`

1. Assign permissions of read/write to the vdi/everyone group.
2. Right-click the `f:\share`, `e:\profiles` and `g:\folderredirect` folders, and select Properties.
3. Click the Sharing tab, and click Share....
4. Add everyone, system and administrators to the Read/Write group, and click Share.
5. Right-click the `g:\folderredirect` folder and select Properties→Sharing→Advanced Sharing→Caching, and select No files or programs from the Share Folder are available offline.
6. Click OK, Apply, OK, and Close.
7. From the Login VSI 3.7 media, run the Login VSI AD Setup.
8. Keep the default settings, and click Start.

Setting up roaming profiles for users

1. Open Active Directory Users and Computers.
2. Browse to vdi.local→Login_VSI→Users→Target.
3. Select all Login VSI users, and right-click Properties.
4. Click the Profiles tab.
5. Check box Profile path, and type `e:\profiles\%username%`.
6. Click OK.

Configuring folder redirection

1. Log into DC1 as administrator
2. Open the Group Policy Editor.
3. Open Forest→Domains→vdi.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, and right-click AppData (roaming).

7. In the AppData (roaming) Properties, target-tab select the following:
 - Setting = select Basic = Redirect everyone's folders to the same location
 - Target folder location = Create a folder for each user under the root path
 - Root Path = \\DC1\folderredirection
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 through 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 → vdi.local → Login_VSI → Users → Target.

Setting up a VM to host the vCenter server (vCenter)

1. Log into the `infrastructure` server with the VMware vSphere client.
2. In the vSphere client, under Basic Tasks, select Create a new virtual machine.
3. Choose Custom, and click Next.
4. Assign the name `vCenter` to the virtual machine, and click Next.
5. Select `infrastructure` as the host, and click Next.
6. Select the appropriate storage, and click Next.
7. Choose Virtual Machine Version 8, and click Next.
8. Choose Windows, choose Microsoft Windows Server 2008 R2 (64-bit), and click Next.
9. For CPUs, select one virtual processor socket, and 4 cores per virtual socket, and click Next.
10. Choose 4GB RAM, and click Next.
11. Click 1 for the number of NICs, select VMXNET3, connect to the `PRIV-NET` port group, and click Next.
12. Leave the default virtual storage controller, and click Next.
13. Keep the default virtual device node (0:0), and click Next.
14. Connect the VM virtual CD-ROM to the Microsoft Windows 2008 R2 installation disk.
15. Click Finish.
16. Right-click the vCenter VM, and click Edit settings.
17. Click the Resources tab, click Memory, check the Reserve all guest memory checkbox, and click OK.
18. Start the VM.

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

1. Open a virtual machine console on `vCenter`.
2. Choose the language, time and currency, and keyboard input. Click Next.
3. Click Install Now.

4. Choose Windows Server 2008 R2 Enterprise (Full Installation), and click Next.
5. Accept the license terms, and click Next.
6. Click Custom.
7. Click the Disk, and click Drive options (advanced).
8. Click New→Apply→Format, and click Next.
9. After the installation completes, click OK to set the Administrator password.
10. Enter the administrator password twice, and click OK.
11. Install VMware Tools. For more information, see kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=340.
12. Reboot.
13. Connect the machine to the Internet, and install all available Windows updates. Restart as necessary.
14. Enable remote desktop access.
15. Change the hostname to vCenter and reboot when the installation prompts you.
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, subnet, gateway, and DNS server.
17. Join the VDI domain.
18. Reboot the system.

Installing Microsoft SQL Server 2008 R2

1. Insert installation media, and click OK to install .NET framework.
2. Wait for the SQL Installer to launch. On the left menu, click Installation.
3. Click New installation or add features to an existing installation. Click OK.
4. Enter the Product Key, and click Next.
5. Check the I accept the license terms checkbox, and click Next.
6. Click Install to install the Setup Support Files (required).
7. Resolve any issues displayed in the setup wizard, and click Next.
8. At the Setup Role screen select SQL Server Feature Installation and click Next.
9. Select the Database Engine Services, Full-Text Search, Client tools Backwards Compatibility, Management Tools Basic and Complete, and click Next twice.
10. Accept instance configuration defaults, and click Next.
11. Accept defaults for disk space requirements, and click Next.

12. Click Use the same account for all SQL Server services, select NT Authority\System, and click OK. Click Next.
13. Select Mixed Mode and enter a password for the SA account. Click Add Current User, and click Next.
14. Accept defaults for error reporting, and click Next.
15. Review installation configuration rules check, and click Next.
16. To begin installation, click Install.
17. At completion screen, click Close.
18. Run Windows Update to receive all updates and security patches.

Setting up a database and ODBC DSN for vCenter

1. From the server desktop, open Start→All Programs→Microsoft SQL Server 2008 R2→Configuration Tools→SQL Server Configuration Manager.
2. Click SQL Server Network Configuration→Protocols for MSSQLSERVER.
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. Repeat this step for the SQL Server Agent service.
6. Start the SQL Server browser service and the SQL Server Agent service.
7. From the SQL server desktop, open Start→All Programs→Microsoft SQL Server 2008 R2→Configuration Tools→SQL Server Management Studio.
8. Click Connect.
9. Select the Databases folder, right-click, and select New Database.
10. Provide the name `vcenter` for the new database.
11. Click Options and change the recovery model from full to simple, and click OK.
12. From the desktop of the vCenter server, select Start→Run→`odbcad32.exe`.
13. Click the system DSN tab.
14. Click Add.
15. Click SQL Server Native Client 10.0, and click Finish.
16. In the Create a New Data Source to SQL Server text box, enter the connection name type: `vcenter`.
17. For Server, select SQL, and click Next.
18. Change authentication to With SQL Server authentication using a login ID and password entered by the user, enter `sa` as the Login ID, use the password you defined in SQL server setup for the SA account, and click Next.
19. Select the Change the default database to checkbox, choose `vCenter` from the pull-down menu, and click Next.
20. Click Finish.

21. Click Test Data Source... to confirm correct configuration.
22. Click OK to create the vCenter ODBC connection.

Installing VMware vCenter 5.1

1. Log onto the vCenter as `VDI\administrator`.
2. From the VMware vCenter 5.1 install media, click Autorun.
3. Click Run to start the install wizard.
4. Click the Install button on the VMware vSphere 5.1 Simple Install wizard.
5. Select the Install wizard language as English, and click OK.
6. At the Install wizard welcome screen, click Next.
7. At the End User Patent Agreement, click Next.
8. Agree to the License Agreement, and click Next.
9. Enter and confirm the password you wish to use with the Administrator account for vCenter Single Sign On, and click Next.
10. Select Install a local Microsoft SQL Server 2008 R2 Express Instance and click Next.
11. Enter and confirm the passwords for the DBA and SQL user accounts and click Next.
12. Confirm the Fully Qualified Domain Name or IP address is correct and click Next.
13. Check the Use network service account checkbox and click Next.
14. Accept the default installation path and click Next.
15. Accept the default https port and click Next.
16. Click Install.
17. After Single Sign On completes, and vCenter Server installation begins, enter user information and a license key, and click Next.
18. Select "Use an existing supported database" and select the Data Source Name (DSN) for the connection to the SQL Server: `vcenter`.
19. Enter `sa` as the database username, provide the password for the SA account, and click Next.
20. Select the system account for the vCenter Server service account, and click Next.
21. Keep the vCenter default ports, and click Next.
22. Select 1024 MB for the JVM memory, and click Next.
23. Click Install to finish the vCenter server installation.
24. Click Finish to exit the wizard.
25. Click OK to confirm completion.
26. Click Exit on the installer.
27. Restart the server.
28. Using the vSphere client, log into the vCenter server as `VDI\administrator`.
29. Right-click the root of vCenter, and click New Data center.
30. Name the New datacenter `vdi`.
31. Add the `infrastructure` server to the datacenter.
32. Add the `server` under `test` to the datacenter.

Editing the vCenter prox.xml file to allow http access

1. Open a console to the vCenter Server, and log in as VDI\administrator.
2. Open Wordpad, and edit the file C:\Users\All Users\VMware\VMware VirtualCenter\proxy.xml.
3. Find the /sdk entry.
4. Change httpsWithRedirect to httpAndHttps.
5. Save the proxy.xml file, and reboot the vCenter.

Setting up a VM to host the VMware View connection server

1. Log into vCenter with the VMware vSphere client.
2. In the vSphere client, browse to the ESXi host named `infrastructure`.
3. Click the Virtual Machines tab.
4. Right-click, and choose New Virtual Machine.
5. Choose Custom, and click Next.
6. Assign the name `View Connection` to the virtual machine, and click Next.
7. Select `infrastructure` for the host, and click Next.
8. Select the appropriate 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 `PRIV-NET` port group, and click Next.
13. Leave the default virtual storage controller, and click Next.
14. Choose to create a new virtual disk, and click Next.
14. Make the OS virtual disk size 40 GB, choose thick-provisioned lazy zeroed, specify the OS datastore on the external storage, and click Next.
15. Keep the default virtual device node (0:0), and click Next.
16. Connect the VM virtual CD-ROM to the Microsoft Windows Server 2008 R2 installation disk.
17. Right-click the `View Connection` VM, and click Edit settings.
18. Click the Resources tab, click Memory, check the Reserve all guest memory checkbox, and click OK.
19. Click Finish.
20. Start the VM.

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

1. Open a virtual machine console on `View Connection`.
2. Choose the language, time and currency, and keyboard input. Click Next.
3. Click Install Now.
4. Choose Windows Server 2008 R2 Enterprise (Full Installation), and click Next.

5. Accept the license terms, and click Next.
6. Click Custom.
7. Click the Disk, and click Drive options (advanced).
8. Click New→Apply→Format, and click Next.
9. After the installation completes, click OK to set the Administrator password.
10. Enter the administrator password twice, and click OK.
11. Install VMware Tools. For more information, see kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=340.
12. Reboot.
13. Connect the machine to the Internet, and install all available Windows updates. Restart as necessary.
14. Enable remote desktop access.
15. Change the hostname to `ViewConnection` and reboot when the installation prompts you.
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, subnet, gateway, and DNS server.
17. Join the VDI domain.
18. Reboot the system.

Installing the VMware View Connection Server 5.2

1. Log into the server named `View Connection`.
2. Browse to VMware View installation media, and click VMware-viewconnectionserver-x86_64-5.2.0.
3. Click Run.
4. At the Welcome screen, click Next.
5. Agree to the End User License Agreement, and click Next.
6. Keep the default installation directory, and click Next.
7. Select View Standard Server, and click Next.
8. At the Data Recovery screen enter a backup password, and click Next
9. Allow View Server to configure the Windows firewall automatically, and click Next.
10. Authorize the local administrator to administer View, and click Next.
11. Choose whether to participate in the customer experience improvement program, and click Next.
12. Complete the installation wizard to finish installing View Connection Server.
13. Click Finish.

14. Reboot server.

Configuring the VMware View Connection Server

1. Open a Web browser to <view connection server ip address>/admin.
2. Log in as administrator.
3. Under Licensing, click Edit License...
4. Enter a valid license serial number, and click OK.
5. Open View Configuration → Servers.
6. In the vCenter Servers tab, click Add...
7. Enter vCenter server credentials, and click Next.
8. At the View composer screen, select View Composer co-installed with vCenter Server, and click Next.
9. At the View composer domains screen, click Add...
10. Enter full domain name and user credentials.
11. At the storage screen, select Reclaim VM disk space and Enable View Storage Accelerator.
12. Change the Default host cache size to 2048 MB, and click Next.
13. At the ready to complete screen, click Finish.

Installing the Windows 7 Enterprise (x64) base image VM for VMware Horizon View 5.2

We created a single Windows 8 Enterprise x64 VM as the gold image for VMware Horizon View 5.2 linked clone deployment.

Installing the Windows 7 Enterprise (x64) VMware Horizon View 5.2 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 `view_infra_datastore`, 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 1024 MB RAM, and click Next.
12. Click 1 for the number of NICs, select VMXNET 3, 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 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.

Installing Windows 7 Enterprise (x64)

1. Connect the VM virtual CD-ROM to the Microsoft Windows 7 x64 installation disk.
2. Start the VM.
3. When the installation prompts you, press any key to begin setup.
4. Enter your language preferences, and click Next.
5. Click Install.
6. Accept the license terms, and click Next.
7. Select Custom, and select the drive that will contain the OS.
8. Click Install, and the setup begins.
9. Type `user` for the username and change the computer name, and click Next.
10. Enter no password, and click Next.
11. For system protection, select Use recommended settings, and click Next.
12. Enter your time zone, and click Next.
13. Select the Work Network setting, and click Next.
14. Use Windows Update to patch the Windows 7 installation.
15. Install VMware Tools. For more information, see kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=340.
16. Reboot.
17. Join the vdi.local domain, and reboot.

Adjusting page file

1. Log in as `vdi\administrator`.
2. In the Metro UI, right-click Computer→Properties→Advanced system 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.

Installing Office 2010 Professional

1. Log in as `vdi\administrator`.
2. From the Office 2010 media, run Setup.

3. Enter the product key for Office 2010, and click Continue.
4. Accept the licensing agreement.
5. Select Install Now.
6. Reboot the system.

Installing the Login VSI Target software on gold_image

1. Log in as vdi\administrator.
2. Browse to `\\dc1\share\vsi_install\setup\target_setup\setup-x64.setup`.
3. In the target setup wizard, type `\\dc1\share`.
4. Wait for the install to complete.

Installing the VMware Horizon View 5.2 agent on gold_image

1. Log in to gold_image.
2. Browse to VMware Horizon View 5.2 agent media and open `VMware-viewagent-x86_64-5.2.0.exe`.
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.

Removing XPS printers

1. Click Start→Control Panel→View Devices and Printers.
2. In the Services and Printers window, delete the XPS printers and document writers.
3. Power off the VM and take a snapshot.

Disabling Windows auto-recovery and Java update scheduler

1. Open CMD prompt.
2. Type the following:
`bcdedit /set {default} recoveryenabled No <enter>`
`bcdedit /set {default} bootstatuspolicy ignoreallfailures <enter>`
3. Type `regedit`, and press Enter.
4. Browse to `HKEY_LOCAL_MACHINE\SOFTWARE\JavaSoft\Java Update\Policy\`.
5. Create a DWORD key named `EnableAutoUpdateCheck` and set the value to 0.

6. Prevent the Java update scheduler from running. Browse to `HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Run\` and delete the key named `SunJavaUpdateSched`.
7. Power off the VM and take a snapshot.

Creating the desktop pool and adding entitlements for Login VSI users

We set up a VMware Horizon View 5.2 pool of 174 desktops on three LUNs housed on the Dell EqualLogic PS 6110X array. We created 174 LoginVSI users for use within this pool and added the group as entitled users of the View pool.

Creating the Dell EqualLogic linked clone desktop pool

1. Open the View Administrator.
2. Log in as `vdi\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 `View-pool` 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 `4096`, and click Next.
11. Type a naming pattern of `View-{n:fixed=003}` and type `174` for both max number of desktops, and number of spares.
12. Enter the virtual machine settings as follows:
 - Parent VM: `/New Datacenter/vm/gold_image`
 - Snapshot: `/snap_v1`
 - VM folder: `/New Datacenter/vm/View Pool/WIN8`
 - Host or cluster: `/New Datacenter/host/hp-sut.vdi.local`
 - Resource pool: `/New Datacenter/host/hp-sut.vdi.local`,
 - Linked clone Datastores: `EQL1, EQL2, EQL3`
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_TS/vdi.local`, and click OK.
17. Ensure all 174 desktops have a status of ready.

Setting up a VM to host Citrix XenDesktop

1. Log into the infrastructure server with the VMware vSphere client.
2. In the vSphere client, under Basic Tasks, select Create a new virtual machine.

3. Choose Custom, and click Next.
4. Assign the name `XenDesktop` to the virtual machine, and click Next.
5. Select `infrastructure` as the host, and click Next.
6. Select the appropriate storage, and click Next.
7. Choose Virtual Machine Version 8, and click Next.
8. Choose Windows, choose Microsoft Windows Server 2008 R2 (64-bit), and click Next.
9. For CPUs, select one virtual processor socket, and two cores per virtual socket, and click Next.
10. Choose 4GB RAM, and click Next.
11. Click 1 for the number of NICs, select VMXNET3, connect to the `PRIV-NET` port group, and click Next.
12. Leave the default virtual storage controller, and click Next.
13. Keep the default virtual device node (0:0), and click Next.
14. Connect the VM virtual CD-ROM to the Microsoft Windows 2008 R2 installation disk.
15. Click Finish.
16. Right-click the vCenter VM, and click Edit settings.
17. Click the Resources tab, click Memory, check the Reserve all guest memory checkbox, and click OK.
18. Start the VM.

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

1. Open a virtual machine console on `XenDesktop`.
2. Choose the language, time and currency, and keyboard input. Click Next.
3. Click Install Now.
4. Choose Windows Server 2008 R2 Enterprise (Full Installation), and click Next.
5. Accept the license terms, and click Next.
6. Click Custom.
7. Click the Disk, and click Drive options (advanced).
8. Click New→Apply→Format, and click Next.
9. After the installation completes, click OK to set the Administrator password.
10. Enter the administrator password twice, and click OK.
11. Install VMware Tools. For more information, see kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=340.
12. Reboot.
13. Connect the machine to the Internet, and install all available Windows updates. Restart as necessary.
14. Enable remote desktop access.
15. Change the hostname to `XenDesktop` and reboot when the installation prompts you.
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, subnet, gateway, and DNS server.
17. Join the VDI domain.
 18. Reboot the system.

Installing Citrix XenDesktop 5.6

1. Insert XenDesktop 5.6 media.
2. Click on Install XenDesktop and prerequisites.
3. Click I accept the terms in the license agreement, and click Next.
4. At the Select Components screen, select all the components and select Install the SQL Express, click Next.
5. Check the Enable these ports option, and click Next.
6. Click Install.
7. At the Installation Successful screen, select Configure XenDesktop after closing and click Close.
8. In Citrix Desktop Studio, click Desktop deployment.
9. Type XD-site for site name, use the default database option, and click Next. Click OK to create the database automatically.
10. At the Licensing screen, choose Select from existing licenses and click on Add license file...
11. Browse to the location of the license, and click Open.
12. Select Citrix XenDesktop Platinum, and click Next.
13. At the Connection screen select VMware virtualization and fill out the following fields:
14. Enter the host address as `http://vcenter.vdi.local/sdk`.
15. Enter the username as `administrator`.
16. Enter the administrator password.
17. Enter the connection name as `vCenter`.
18. Select Manually create virtual machines.
19. Click Next.
20. Click Finish to create the site.
21. Open the Citrix Desktop Studio.
22. Select Browser → Desktop Studio → Configuration → Hosts, and click Add Host.
23. In Add Host Wizard, ensure vCenter is selected, and click Next.
24. For cluster, select the server under test cluster. For guest network, select PRIV-NET. For storage, select Vol1 – Vol4, and click Next.
25. Name the Host, and click Finish.

Setting up a VM to host the Citrix Provisioning Server

1. Log into the `infrastructure` server with the VMware vSphere client.
2. In the vSphere client, under Basic Tasks, select Create a new virtual machine.
3. Choose Custom, and click Next.
4. Assign the name `PVS` to the virtual machine, and click Next.
5. Select `infrastructure` as the host, and click Next.
6. Select the appropriate storage, and click Next.
7. Choose Virtual Machine Version 8, and click Next.
8. Choose Windows, choose Microsoft Windows Server 2008 R2 (64-bit), and click Next.
9. For CPUs, select one virtual processor socket, and two cores per virtual socket, and click Next.
10. Choose 4GB RAM, and click Next.
11. Click 1 for the number of NICs, select VMXNET3, connect to the `PRIV-NET` port group, and click Next.
12. Leave the default virtual storage controller, and click Next.
13. Keep the default virtual device node (0:0), and click Next.
14. Connect the VM virtual CD-ROM to the Microsoft Windows 2008 R2 installation disk.
15. Click Finish.
16. Right-click the vCenter VM, and click Edit settings.
17. Click the Resources tab, click Memory, check the Reserve all guest memory checkbox, and click OK.
18. Start the VM.

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

1. Open a virtual machine console on `PVS`.
2. Choose the language, time and currency, and keyboard input. Click Next.
3. Click Install Now.
4. Choose Windows Server 2008 R2 Enterprise (Full Installation), and click Next.
5. Accept the license terms, and click Next.
6. Click Custom.
7. Click the Disk, and click Drive options (advanced).
8. Click New→Apply→Format, and click Next.
9. After the installation completes, click OK to set the Administrator password.
10. Enter the administrator password twice, and click OK.
11. Install VMware Tools. For more information, see kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=340.
12. Reboot.
13. Connect the machine to the Internet, and install all available Windows updates. Restart as necessary.

14. Enable remote desktop access.
15. Change the hostname to *PVS*, and reboot when the installation prompts you.
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, subnet, gateway, and DNS server.
17. Join the VDI domain.
18. Reboot the system.

Installing SQL Express on Provisioning Services server

A SQL database is required for Provisioning Services; we used the included SQL express installation files on the Citrix Provisioning Service media to create a database on the Provisioning server.

1. Insert the media for Citrix Provisioning services 6.1
2. Browse to the SQL Express 2005 Express directory, and run `SQLEXPR.exe`.
3. Accept the End user agreement, and click Next.
4. Click Install to install prerequisites.
5. At the Welcome screen, click Next.
6. Verify the system passes the system configuration check, and click Next.
7. Enter a name and organization, and click Next.
8. Select the default features, and click Next.
9. Select Windows authentication, and click Next.
10. Check both boxes to Enable user instances, add user to the SQL Server administrator Role, and click Next.
11. Click Next for error usage reporting.
12. Click Install.
13. When completed, click Next, and Finish.
14. Open Start → All Programs → Microsoft SQL Server 2005 → Configuration Tools → SQL Server Configuration Manager.
15. Click SQL Server Network Configuration → Protocols for SQLEXPRESS.
16. Right-click TCP/IP, and select Enabled.
17. Click SQL server 2005 Services → right-click SQL server browser, and select Properties.
18. In the SQL Server Browser properties, select the services tab, change the start mode to Automatic, and click OK.
19. Start the SQL server browser service.

Installing Citrix Provisioning Services

1. Click on Start → Administrative Tools → Server Manager → Features → Add Features.

2. Select .NET Framework 3.5.1 Features and click Add Required Role Services.
3. Click Next on the Web Server (ISS) screen.
4. Click Next on the Select Role Services screen, and then click Install.
5. Click Close on the successful installation screen.
6. Execute Citrix `PVS_Server_x64.exe`.
7. Click Install to install the required items.
8. At the Welcome Screen, click Next.
9. Click I accept the terms in the license agreement and click Next.
10. Enter a user name and organization, select all users, and click Next.
11. Select a destination folder, and click Next.
12. On the Setup Type screen, select Complete and click Next, and click Install
13. Click Finish on the Installation completed screen.
14. Click OK on the PVS Console warning.
15. Click Next on the Provisioning Services Configuration Wizard.
16. At the DHCP Services screen, select The service that runs on another computer.
17. At the PXE Services screen, select The services that run on this computer.
18. At the Farm Configuration screen, select Create a farm, and click Next.
19. At the Database Server screen, click Browse..., select the local SQLEXPRESS instance, and click Next.
20. At the New Farm screen, enter the following, and click Next:
 - a. Database name= `ProvisioningServices`
 - b. Farm= `farm`
 - c. Site= `site`
 - d. Collection name= `XD_Test`
 - e. Farm Administrator group= `vdi.local/Builtin/Administrators`
21. At the New Store screen, enter Store name= `Store`. For Path, browse to the root of `e:\`, and click Next.
22. Enter the License Server name and click Next.
23. At the User account screen select Specified user account, enter administrator, `vdi.local` and Password twice, click the checkbox next to Configure the database for the account, and click Next.
24. Keep the default number of days between password updates, and click Next.
25. Keep the primary interface and communication ports, and click Next.
26. Select Use the Provisioning Services TFTP service, and click Next.
27. Leave the stream service at default, and click Next.
28. Click Finish, and click Done.

Installing Citrix Provisioning Services Administrative Console

1. Execute Citrix `PVS_Console_x64.exe`.

2. At the welcome screen, click Next.
3. Accept the licensing agreement, and click Next.
4. Enter a user name and organization name, and click Next.
5. Accept the default install path, and click Next.
6. Accept the default install type, and click Next.
7. Click Install and Finish.

Setting up a Windows 7 Enterprise x64 gold image for Citrix XenDesktop 5.6

Using the vSphere client, we created a Windows Enterprise X64 VM base image. We later used that image to create desktop pools for testing.

On the base image, we installed Microsoft Office 2010, installed the Login VSI target software, added it to the vdi domain, added it to the Login VSI OU, and installed the respective Citrix XenDesktop agent.

Setting up a Windows 7 Enterprise (x64) base image VM

1. In the vSphere client, connect to the vCenter Server, and browse to the `infrastructure` host.
2. Click the Virtual Machines tab.
3. Right-click, and choose New Virtual Machine.
4. Choose Custom, and click Next.
5. Assign the name as `XD_gold`, and click Next.
6. Select the `infrastructure` host, and click Next.
7. Select the appropriate storage.
8. Choose Virtual Machine Version 8, and click Next.
9. Choose Windows, choose Microsoft Windows 7 (32-bit), and click Next.
10. For CPUs, select one virtual processor socket and one core per virtual socket, and click Next.
11. Choose 1GB RAM, and click Next.
12. Click 1 for the number of NICs, select VMXNET 3, 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 Provision, specify the OS datastore on the external storage, and click Next.
16. Keep the default virtual device node (0:0), and click Next.
17. Select Edit the virtual machine settings before completion.
18. Click Continue.
19. Click Add..., select Hard Disk, and click Next.
20. Select Create a new virtual disk, and click Next.
21. Select 4GB, Thin Provision, and click Next.
22. Keep the default virtual device node (0:1), and click Next.
23. Click Finish.

24. Click the Resources tab, click Memory, and check the Reserve all guest memory checkbox.
25. Click the Hardware tab, CD/DVD Drive, and Connect the VM virtual CD-ROM to the Microsoft Windows 7 x64 installation disk.
26. Click OK.

Installing Windows 7 Enterprise (X64) 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.
7. Type `user` for the username, and click Next.
8. Enter no password, and click Next.
9. At the system protection screen, 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. Install VMware Tools. For more information, see kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=340.
13. Reboot.
14. Connect the machine to the Internet, and install all available Windows updates. Restart as necessary.
15. Join the domain and restart the VM.

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 `2048` for both values, and select Set.
6. Restart the VM.

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

1. Log into the XD_gold VM as vdi\administrator.
2. Browse to \vsi-install\Target setup.
3. Run the setup.exe
4. In the Target Setup wizard, specify the VSI share \\AD01\share.
5. Click Start.
6. At the security warnings, click OK.
7. When the installation is complete, reboot the system.

Installing the XenDesktop agent

1. Browse to the Citrix XenDesktop media, and run the XdAgent_64.msi file.
2. Click the checkbox next to I accept the terms in the license agreement.
3. Click Install.
4. Click Finish.

Creating a ListOfDDCs entry in the registry on XD_gold

1. Click Start→Run, and type regedit.
2. Browse to HKEY_LOCAL_MACHINE\Software\Citrix\VirtualDesktopAgent.
3. Create a string value called ListOfDDCs.
4. Right-click the ListOfDDCs string, and click Modify...
5. Type XenDesktop.vdi.local and click OK.
6. Close the registry editor.

Installing Device Identity Manager

1. Log into XD_gold as VDI\Administrator.
2. Browse to the Provisioning services media.
3. Execute the autorun.exe.
4. Click Target Device Installation.
5. Click Install DIM (Device Identity Management).
6. To Being the DIM wizard, click Next.
7. Accept the License agreement, and click Next.
8. Click Install, and Finish when completed.
9. Click Yes to reboot.

Installing Provisioning Services Target Device on XD_gold and creating a vDisk

1. Browse to the Citrix XenDesktop media, and run the PVS Target Device_32.msi file.
2. At the welcome screen for Provisioning Service Target Device Wizard, click Next.
3. Accept the License agreement, and click Next.
4. Enter user name and organization name, and click Next.
5. Accept the default path, and click Next.

6. Click Install.
7. Select Launch Imaging Wizard, and click Finish
8. At the Welcome screen, click Next.
9. For server, type PVS, and click Next.
10. Select Create new vDisk, and click Next.
11. Name the vDisk XD_gold_vdisk and click Next.
12. For Microsoft Volume Licensing, click None, and click Next.
13. Under Source Volume, ensure the Capacity is 20 GB for the C:Boot disk and the free space is greater than 30%.
14. Change the E: (new Volume) to None. Click Next.
15. For target device name, type PVS_XD_gold and click Next.
16. Click on Optimize for Provisioning Services. Click OK.
17. Click Finish to begin creating the empty vDisk.
18. When the vDisk completes, click No to Reboot the XD_gold VM and shutdown instead.

Creating a VM template for Provisioning Services

1. Shut down the XD_gold virtual machine.
2. On vCenter, clone the virtual machine, and name it GoldTemplate.
3. Select the appropriate server under test to host the new template.
4. Before cloning, edit the virtual hardware, and click Continue.
5. Select Hard disk 1, and click Remove.
6. Select Remove from virtual machine and delete files from disk, and click OK.
7. Right click on GoldTemplate, and select Template→Covert to template.

Enabling XD_Gold to boot from Network

1. In vCenter, right-click XD_gold, and click Edit settings.
2. Click Options tab→Boot options, check the box to force BIOS Setup, and click OK.
3. In the VM BIOS, tab to the Boot menu, and change the boot order to:
 - a. Network boot from VMware VMXNET3
 - b. Removable Devices
 - c. Hard Drive
 - d. CD-ROM Drive
4. Tab to Exit, and select Exit Saving Changes.
5. When the VM boots, it will boot from PXE and Provisioning services will stream the vDisk to the device.
6. Log in as VDI\administrator.
7. Provisioning services will now copy XD_gold to the vDisk.
8. Click Finish.
9. Shutdown XD_gold.

Enabling the 4GB local disk as cache

1. Open Provisioning Services→Farm→Site→Device Collections→Collections, and right-click PVS_XD_gold.
2. Change mode from private mode to standard image mode.
3. Change the Cache type to Cache on device hard drive.
4. Click OK.

Deploying a XenDesktop pool with the XenDesktop Setup wizard

1. Open the Provisioning services console →Farm→Sites→Site, right click and select XenDesktop Setup Wizard.
2. At the welcome, screen click Next.
3. Type XenDesktop for the XenDesktop Controller, and click Next.
4. Click the host server under test, and click Set Template
5. Type the administrator Password, and click Get templates.
6. Click VM_gold_template,click OK, and click Next.
7. Select the Provisioning services collection as collection and XD_gold_vdisk as the assigned vDisk, and click Next.
8. Select Create a new catalog, enter the following, and click Next:
 - Machine type= Streamed
 - Catalog name=XD-Catalog-01
9. Enter the following, and click Next:
 - Number of virtual machines= 65
 - vCPUs=1
 - Memory=1024 MB
 - Active Directory= Create New accounts
10. For Active directory location, click Vdi.local→Login_VSI→computers.
11. For Base name, type XD-0#, and click Next.
12. Click Finish.
13. Repeat steps 1-12 for LUN 2 and LUN 3.

Creating Desktop group and adding the XD-01 VM

1. Log into XenDesktop.
2. Open the Citrix Desktop Studio→assignments, and click Create Desktop Group.
3. Select the catalog and add all machines. Click Next.
4. For users, add the VDI\Login_VSI_TS group, and select one desktop per user. Click Next.
5. Leave delegations as default, and click Next.
6. Enter a pool name, display name and desktop group name. Click Finish.

Configuring the power policy for the pool desktop group

1. Right-click pool, and click Edit Desktop Group.

2. Click Power management, for weekdays select all hours, no action, and position the power on machines line to be uniform across all hours on the graph.
3. Click Weekends and select all hours, no action, and position the power on machines line to be uniform across all hours on the graph, and click OK.

Configuring XenDesktop for lossless video quality

You only need this policy for lossless video testing. Be sure to disable this policy if you are performing lossy testing.

1. Go to HDX Policy and click Users.
2. Click New.
3. Set the Lossy compression level (ICA\Visual Display\Still Images) to None and set Max Frames Per Second (ICA\Visual Display) to 30 FPS.

Configuring Citrix XenDesktop

1. Open the Citrix Desktop Studio.
2. Click Desktop studio, select the PowerShell tab, and click Launch PowerShell.
3. In PowerShell, type `Set-BrokerDesktopGroup -Name "pool" -ShutdownDesktopsAfterUse $False`.
4. Browse Desktop Studio→Assignments, and verify that there is one desktop available.

Creating 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 Login VSI launchers on the infrastructure server.

Installing the Windows 7 Enterprise (x64) Login VSI launcher

1. Log into the vCenter.
2. In the vSphere client, connect to the vCenter Server, and browse to the `infrastructure` server.
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 appropriate datastore, 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 1 virtual socket, 2 cores per virtual socket, and click Next.
11. Choose 6 GB RAM, and click Next.
12. Click 1 for the number of NICs, select VMXNET3, 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 32 GB, choose thin provision, 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. Click Reserve all guest memory.
21. Click the Hardware tab.
22. Connect the VM virtual CD-ROM to the Microsoft Windows 7 x64 installation disk.

Installing Windows 7 Enterprise (x64)

1. Start the VM.
2. When the installation prompts you, press any key to begin setup.
3. Enter your language preferences, and click Next.
4. Click Install.
5. Accept the license terms, and click Next.
6. Select Custom, and select the drive that will contain the OS.
7. Click Install, and the setup begins.
8. Type `user` for the username, change the computer name, and click Next.
9. Enter a password, and click Next.
10. For system protection, select Use recommended settings, and click Next.
11. Enter your time zone, and click Next.
12. Select the Work Network setting, and click Next.
13. Use Windows Update to patch the Windows 7 installation.
14. Install VMware Tools. For more information, see kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=340.
15. Reboot.
16. Join the vdi.local domain, and reboot.

Disabling Windows Firewall

The domain GPO automatically disables the Windows Firewall.

Installing the Citrix Receiver 13.0.0

1. Download the latest Citrix Receiver from www.citrix.com/receiver.
2. Double click on CitrixReceiverWeb.
3. At the welcome screen, click on Install.

Installing Virtual Audio Cables

By default, the virtual launchers cannot render audio, so we installed Virtual Audio Cables version 4.10 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 `VSIinstall media\setups\Launcher\`.
2. Run `setup.exe`.
3. In the Target Setup wizard, specify the VSI share.
4. Click Start.
5. Reboot the system.
6. Shut down the launcher VM.

Converting the launcher VM to a template

1. In vSphere Client, right-click `launcher` VM, and select `Template` → `Convert to Template`.

Deploying the launchers VM from launcher template

1. In vSphere Client, browse to `Home` → `VMs and Templates`.
2. Right-click `launcher` to deploy a virtual machine from template.
3. Type `launcher_1` as the new VM name, and click `Next`.
4. Click `Datacenter`, and click `Next`.
5. Click on the launcher server, and click `Next`.
6. Select the appropriate storage, and click `Next`.
7. Select customization using existing customization specifications, select the appropriate file, and click `Next`.
8. Click `Finish` to deploy the new VM.
9. Repeat steps 1 through 8 to deploy more launchers.

Login VSI testing pre-configuration

Before running the tests, we created 200 roaming profiles on the `\\dc1\profiles` share, and 200 redirected folders the `\\dc1\folders` share.

Running the Login VSI benchmark

We used eight launchers, configured in parallel, to run a medium workload with a launch interval of 20 seconds. For more information on how to run a Login VSI test, see www.loginvsi.com/en/admin-guide/performing-tests.

APPENDIX C - LOGIN VSI INI AND CSV FILES USED FOR TESTING

launcher.ini for XenDesktop testing

```
[Launcher]
Servername=
Username=
Password=
Domain=
CommandPassword=
ConnectionType="Custom with CSV file"
ConnectionNumber=User
CCL="\\dc12008\Share\CTXConnector\CTXConnector.exe" -s
http://XenDesktop.vdi.local -u %CSV_user% -p Password1 -d vdi.local -r XD_Pool -
t1 5 -t2 7
CSV=Z:\csv\XD_User.csv
Launchmode=Parallel
PreTestScript=
PostTestScript=
ParallelDelay=10
ParallelTimeframe=3700
InitialStartNumber=1
NumberOfSessions=185
SequentialInterval=30
Fancy_number=1
Autologoff=1
LogoffTimeOut=900
CreateProfile=0
UseLocalLauncher=1
```

Workload_Global.ini

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

XD_User.csv

```
User
XD_login_vsi1
XD_login_vsi2
XD_login_vsi3
XD_login_vsi4
XD_login_vsi5
...
XD_login_vsi199
XD_login_vsi200
```

launcher.ini for View testing

```
[Launcher]
Servername=
```

```
Username>Login_vsi
Password=enc:2D41B9D4A3779F1C48:enc
Domain=vdi.local
CommandPassword=
ConnectionType="Custom with CSV file"
ConnectionNumber=User
CCL=c:\program files\VMware\VMWare View\Client\bin\wswc.exe -serverURL
http://view.vdi.local -username %CSV_User% -password Password1 -domainname VDI -
desktopname pool -Standalone -logInAsCurrentUser False -connectUSBOnStartup False
CSV=z:\csv\user.csv
Launchmode=Parallel
PreTestScript=
PostTestScript=
ParallelDelay=10
ParallelTimeframe=3680
InitialStartNumber=1
NumberOfSessions=184
SequentialInterval=15
Fancy_number=1
Autologoff=1
LogoffTimeOut=900
CreateProfile=0
UseLocalLauncher=0
```

Workload_Global.ini

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

User.csv

```
User
login_vsi1
login_vsi2
login_vsi3
login_vsi4
login_vsi5
...
login_vsi199
login_vsi200
```

APPENDIX D – COST ANALYSIS

We base our cost analysis on the following assumptions:

- Number users = number connections.
- The server has two processors.
- Costs include software licenses plus 3 years of support.
- Costs do not include Windows 7 or desktop software such as Microsoft Office.
- For software that comes in bundles or packs, we use the average cost per item in the pack and multiply that by the number of units.
- We believe that the Citrix XenDesktop Enterprise edition is comparable to the Horizon View bundle (see Figure 10).

Component function	VMware Horizon View bundle	Citrix XenDesktop Enterprise edition
Broker and single point of management	VMware View connection server	Desktop delivery controller
User customizations	Persona management	Profile management
Deployment tool	Linked clone composer	Provisioning services
Virtualized applications	Thin App	XenApp®
Hypervisor	vSphere desktop edition	XenServer®
Hypervisor manager	vCenter™ desktop edition	XenCenter®
Advanced graphics functionality	GPU offload/PCI pass through	HDX 3D for professional Graphics
Anti-virus and security enchantment	vShield Endpoint	None

Figure 10: Feature comparison of VMware Horizon View bundle and Citrix XenDesktop Enterprise edition.

Software Cost Analysis

Figures 11 through 13 show software cost estimates for the configurations and user counts we discuss in this report.

VMware Horizon View 5.2 Enterprise Edition for 174 users

	Unit	Cost per unit	No. of units	Total	Source
VMware Horizon View (10 Pack) + Production Support/Subscription for 3 years - \$4,150.00 (averages \$415 per desktop)	Concurrent User	\$415.00	174	\$72,210.00	store.vmware.com/store/vmware/en_US/DisplayProductDetailsPage/productID.265434800
Total				\$72,210.00	
Cost per user for 174 users		\$415.00			

Figure 11: Cost analysis for VMware Horizon View 5.2.

Citrix XenDesktop 5.6 Enterprise Edition (VDI) - Lossless, 30 FPS - 175 users

	Unit	Cost per unit	No. of units	Total	Source
Citrix XenDesktop 5.6, Enterprise Edition	Concurrent user	\$500.00	175	\$87,500.00	Easy XenDesktop Enterprise Edition, Concurrent User License with one-year Subscription Advantage. www.lscwarehouse.com/software-other.html and www.citrix.com/wsdm/restServe/skb/attachments/RDY7219/XenDesktop%20Licensing%20and%20Pricing%20Overview%20Jul-2012.ppt *
Citrix XenDesktop Two-Year Subscription, Enterprise Edition Add-On	Concurrent user	\$140.00	175	\$24,500.00	Two-year Subscription Advantage add-on. www.citrix.com/content/dam/citrix/en_us/documents/support/Subscription_Advantage_Price_Schedule.pdf *
VMware vSphere Desktop (\$6,500 per 100 desktops or an average of \$65 per desktop)	Desktop	\$65.00	175	\$11,375.00	store.vmware.com/store/vmware/en_US/DisplayProductDetailsPage/productID.233862800 *
VMware vCenter Server Standard for vSphere (Per Instance) and production support for three years	Instance	\$8,292.36	1	\$8,292.36	store.vmware.com/store/vmware/en_US/DisplayProductDetailsPage/productID.233870300 *
Total				\$131,667.36	
Cost per user for 175 users				\$752.38	

Figure 12: Cost analysis for Citrix XenDesktop 5.6 with lossless settings.

* This URL was valid at the time of report publishing (May 2013). We revised the report August 2014 to note the URL is no longer valid.

Citrix XenDesktop 5.6 Enterprise Edition (VDI) - Lossy, 24 FPS - 185 users

	Unit	Cost per unit	No. of units	Total	Source
Citrix XenDesktop 5.6 Enterprise Edition	Concurrent user	\$500.00	185	\$92,500.00	Easy XenDesktop Enterprise Edition, Concurrent User License with one-year Subscription Advantage. www.lscwarehouse.com/software-other.html and www.citrix.com/wsdm/restService/skb/attachments/RDY7219/XenDesktop%20Licensing%20and%20Pricing%20Overview%20Jul-2012.ppt *
Citrix XenDesktop Two-Year Subscription, Enterprise Edition Add-On	Concurrent user	\$140.00	185	\$25,900.00	Two-year Subscription Advantage add-on. www.citrix.com/wsdm/restService/skb/attachments/RDY7219/XenDesktop%20Licensing%20and%20Pricing%20Overview%20Jul-2012.ppt * and www.citrix.com/content/dam/citrix/en_us/documents/support/Subscription_Advantage_Price_Schedule.pdf *
VMware vSphere Desktop (\$6,500 per 100 desktops or an average of \$65 per desktop)	Desktop	\$65.00	185	\$12,025.00	store.vmware.com/store/vmware/en_US/DisplayProductDetailsPage/productID.233862800 *
VMware vCenter Server Standard for vSphere (Per Instance) and production support for three years	Instance	\$8,292.36	1	\$8,292.36	store.vmware.com/store/vmware/en_US/DisplayProductDetailsPage/productID.233870300 *
Total				\$138,717.36	
Cost per user for 185 users		\$749.82			

Figure 13: Cost analysis for Citrix XenDesktop 5.6 with lossy settings.

* This URL was valid at the time of report publishing (May 2013). We revised the report August 2014 to note the URL is no longer valid.

Hardware Cost Analysis

Figure 13 shows detailed hardware costs for the system used in both configurations.

HP ProLiant DL380p Gen8

Item	Cost per unit	No. of units	Total
HP ProLiant DL380p G8	\$2,190.72	1	\$2,190.72
Intel Xeon E5-2680 Processor	\$2,224.50	2	\$4,449.00
HP 8GB PC3L-10600 RDIMM	\$157.13	24	\$3,771.00
HP 750W Common Slot Platinum Plus Hot Plug Power Supply Kit	\$234.50	2	\$469.00
HP 2U Small Form Factor Ball Bearing Gen8 Rail Kit with CMA	\$140.00	1	\$140.00
HP C13 - AS3112-3 AU 250V 10Amp 2.5m Power Cord	\$10.00	2	\$20.00
Intel X520 Dual Port 10Gbe SFP+ Adapter	\$528.00	1	\$528.00
Total (incl. tax)			\$11,845.00

Figure 14: Cost analysis for HP ProLiant DL380p Gen8 hardware.

Totals of Software and Hardware

Figures 15-17 combine the software and hardware costs from the previous figures to present a total cost for each tested configuration.

	Total
VMware Horizon View 5.2 Enterprise Edition for 174 users	\$72,210.00
HP ProLiant DL380p Gen8	\$11,845.00
Total	\$84,055.00
Average cost per user	\$483.07

Figure 15: Cost analysis for VMware Horizon View 5.2.

	Total
Citrix XenDesktop 5.6 Enterprise Edition (VDI) - Lossless, 30 FPS - 175 users	\$131,667.36
HP ProLiant DL380p Gen8	\$11,845.00
Total	\$143,512.36
Average cost per user	\$820.07

Figure 16: Cost analysis for Citrix XenDesktop 5.6 with lossless settings.

	Total
Citrix XenDesktop 5.6 Enterprise Edition (VDI) - Lossy, 24 FPS - 185 users	\$138,717.36
HP ProLiant DL380p Gen8	\$11,845.00
Total	\$150,562.36
Average cost per user	\$813.85

Figure 17: Cost analysis for Citrix XenDesktop 5.6 with lossy settings.

APPENDIX E – CITRIX XENDESKTOP 5.6 LOSSY RESULTS

In addition to our lossless testing, we also tested Citrix Desktop 5.6 with out-of-box defaults, 24 frames per second with lossy compression. Figure 18 shows the response times, in milliseconds, as the sessions increased in our Citrix XenDesktop 5.6 lossy tests. Lossy 24 FPS is an inferior image rendering and as such we chose lossless 30 FPS for our testing.

Figure 18: In our lossy test, Citrix XenDesktop 5.6 was able to run 185 sessions without generating a VSImax.

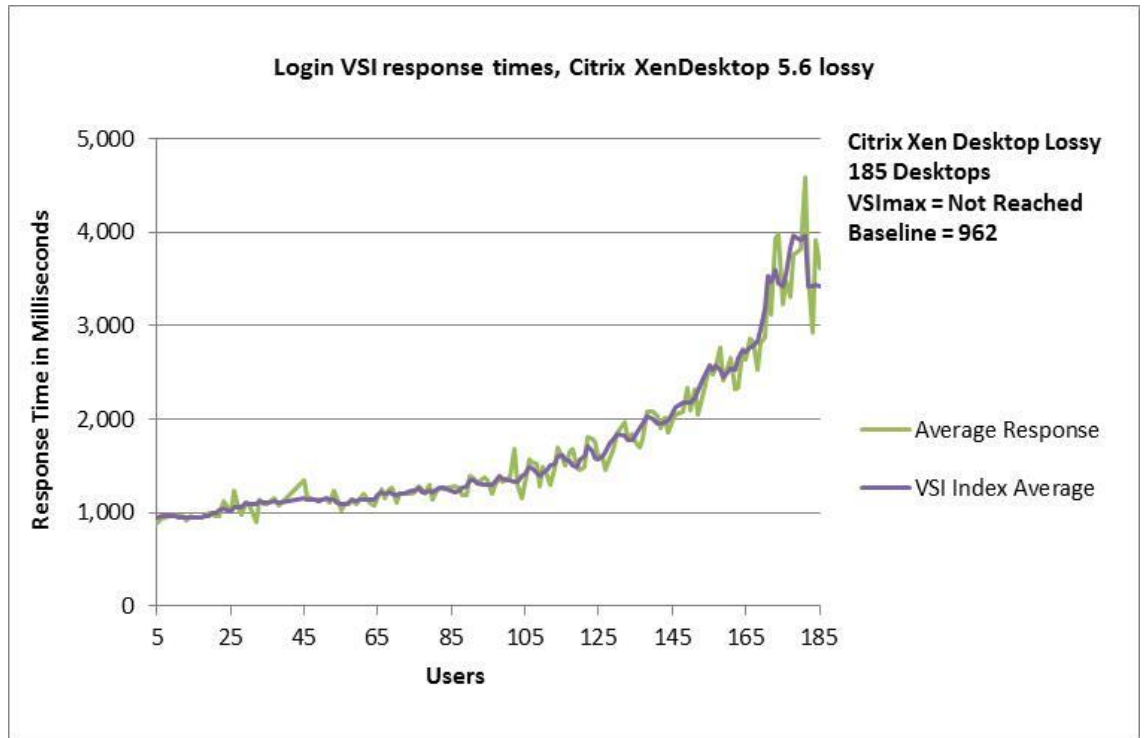
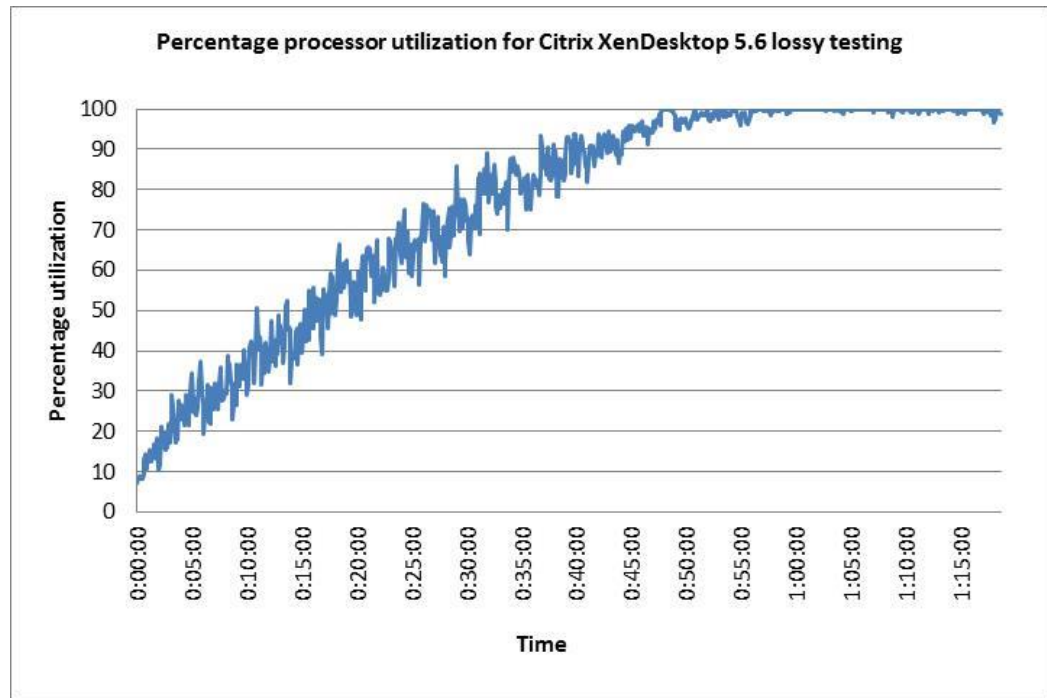


Figure 19 shows the percentage CPU utilization throughout our lossy Citrix XenDesktop 5.6 tests. Additional sessions exceed the VSImax for the server under test due to CPU utilization.

Figure 19: CPU utilization for our server under test throughout the lossy Citrix XenDesktop 5.6 test period.



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