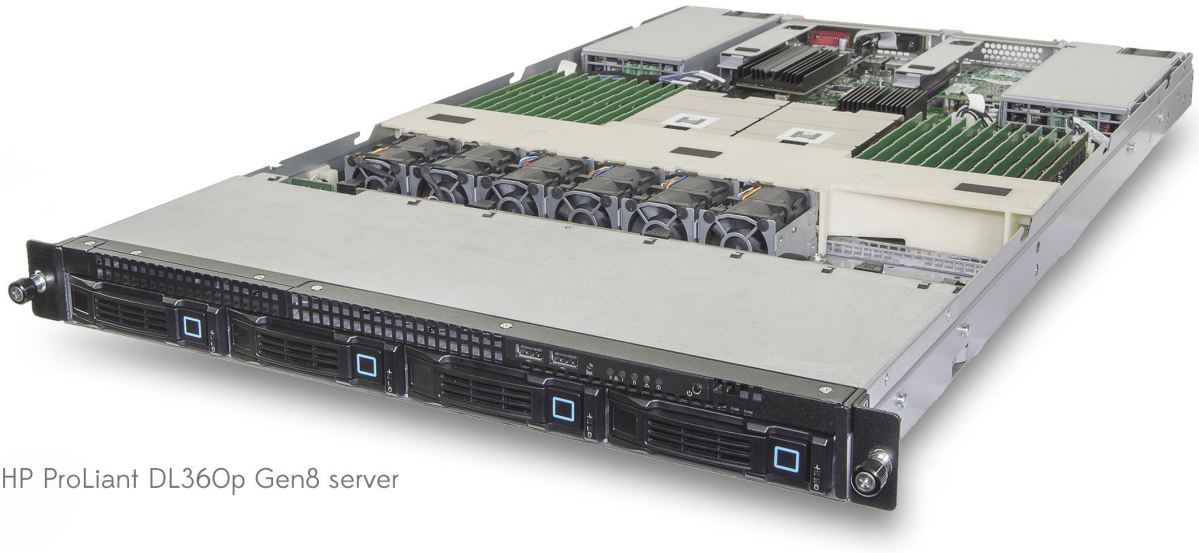
VDI PERFORMANCE AND PRICE COMPARISON: AMD-BASED OPEN COMPUTE 3.0 SERVER VS. HP PROLIANT DL360P GEN8

AMD-BASED OPEN COMPUTE 3.0 SERVER

COMPARABLE VDI PERFORMANCE.
57% LESS COST.



compared to the HP ProLiant DL360p Gen8 server

The new AMD-based Open Compute 3.0 server can deliver virtual desktop infrastructure (VDI) performance comparable to that of premium servers at a fraction of the price. We tested two servers, the AMD Opteron™ 6378-based Open Compute 3.0 server and the Intel® Xeon® processor E5-2640-based HP ProLiant DL360p Gen8, to see how many virtual desktops they could support.

The HP ProLiant DL360p Gen8, which costs $10,669, supported 117 desktops.[1] The AMD-based Open Compute 3.0 server, which costs only $4,589, supported 120 desktops.[2] That means an organization could enjoy comparable performance while spending 57 percent less.

Another way to look at the findings is by calculating the cost per desktop with each server. Each desktop hosted on the AMD-based server costs $38.24, whereas each desktop hosted on the HP server costs $91.19. This differential makes the AMD-based Open Compute 3.0 server an excellent, cost-effective choice for any organization using a virtual desktop infrastructure.

[1] Pricing is courtesy of the official HP Small and Medium Business Store, April 3 2013 http://h71016.www7.hp.com/dstore/home.asp?.
[2] Pricing is courtesy of Appro, April 3 2013.

APRIL 2013
A PRINCIPLED TECHNOLOGIES TEST REPORT
Commissioned by AMD

COMPARABLE VDI PERFORMANCE AT A LOWER PRICE POINT

To measure the VDI performance of the two servers, we used a tool (Login VSI 3.7) to create workloads that mimic the activity of typical office users completing moderate workloads, and then determined how many virtual sessions, reported as the VSImax, that the solution could handle simultaneously while still offering a satisfactory user experience.

We used the Login VSI Medium workload 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.

We configured Login VSI to run the Medium workload against a pool of virtual desktops and set up the test to incrementally log users into virtual desktop sessions every 30 seconds. Login VSI measures the total response time of all the applications from each session and calculates the VSI Index by taking the average response times and dropping the highest and lowest 2 percent.

For information about the servers we tested, see Appendix A. For complete details on how we tested, see Appendix B. For CPU utilization throughout our testing, see Appendix C.

WHAT WE FOUND

As Figure 1 shows, the AMD-based Open Compute 3.0 server was able to support 120 VMware® Horizon View® 5.2 virtual desktop users before reaching VSImax. VSImax represents the maximum user capacity at which performance did not degrade; therefore, not reaching VSImax is a positive indicator that response time remained satisfactory.

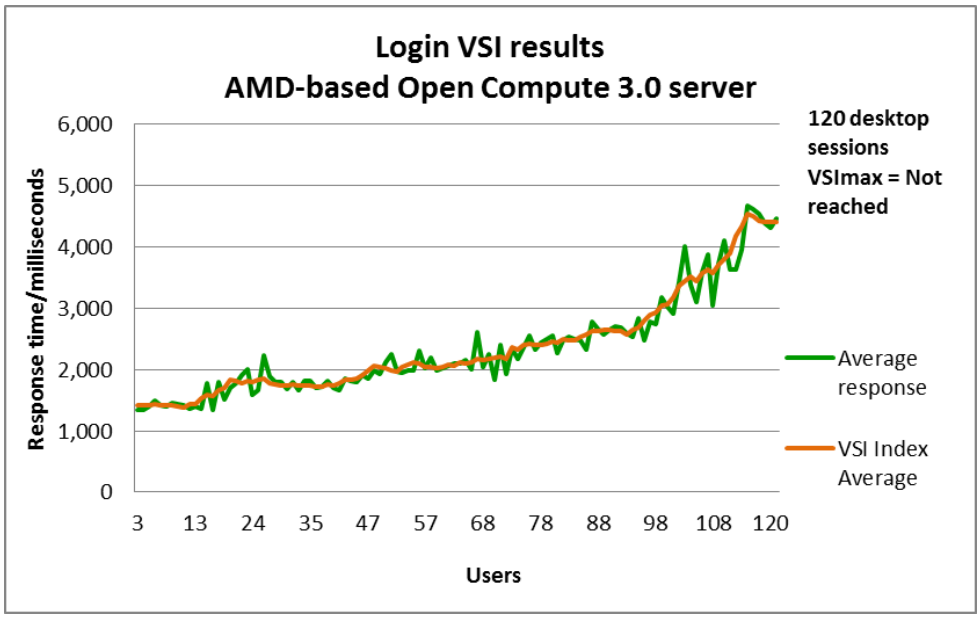


Figure 1: The AMD-based Open Compute 3.0 server supported 120 VMware Horizon View 5.2 virtual desktops.

As Figure 2 shows, the HP ProLiant DL360p Gen8 was able to support 117 VMware Horizon View 5.2 virtual desktop users without reaching VSImax, 2.6 percent fewer than the AMD-based Open Compute 3.0 server.

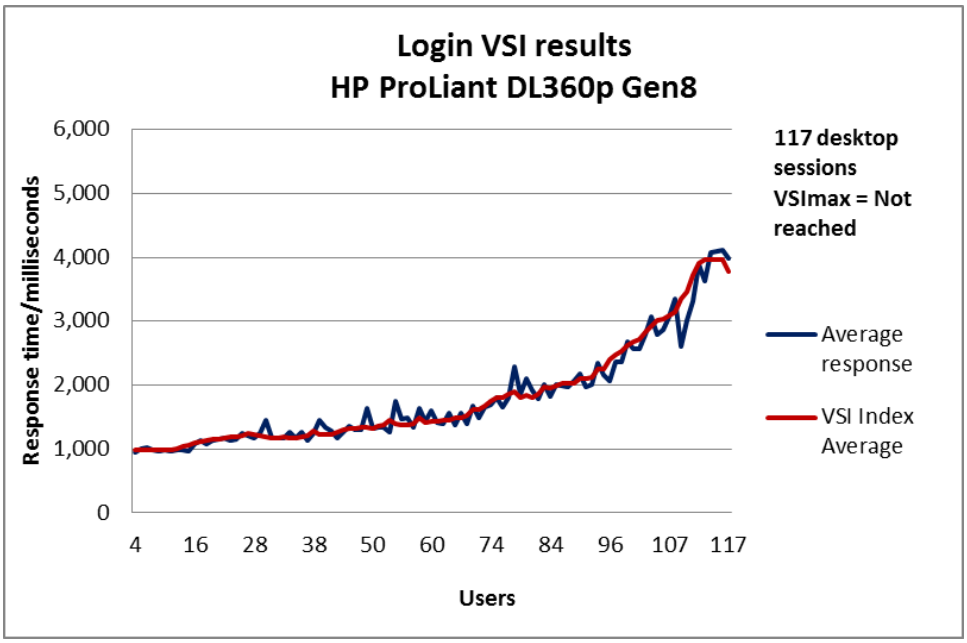


Figure 2: The HP ProLiant DL360p Gen8 supported 117 VMware Horizon View 5.2 virtual desktops.

WHAT WE TESTED

About AMD-based Open Compute 3.0 server

According to the mission statement of the Open Compute Project Foundation, this group is a "rapidly growing community of engineers around the world whose mission is to design and enable the delivery of the most efficient server, storage, and data center hardware designs for scalable computing. We believe that openly sharing ideas, specifications, and other intellectual property is the key to maximizing innovation and reducing operational complexity in the scalable computing space. "

AMD recently unveiled a new server platform, AMD Open 3.0, as part of its work with the Open Compute Project Foundation and its ongoing commitment to open industry standards. According to AMD, "Open 3.0 is a feature correct platform that enables low-cost, low power and flexible configurations, and offers the following advantages over off-the-shelf OEM platforms:

- A targeted feature-set that eliminates unnecessary components and optimizes the most important ones
- Low acquisition cost and low power, enabling lower total cost of ownership (TCO)
- A common platform for the financial services segment to help drive down server cost

Learn more about AMD-based Open Compute 3.0 at amd.com/opencompute.

About VMware Horizon View 5.2

Horizon View 5.2 is the latest desktop virtualization software from VMware. VMware designed its Horizon View 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 control settings such as policy enforcement, performance monitoring, connection brokering, and provisioning, to name a few. The result includes improved security, more cost-effective management, and faster provisioning and maintenance of desktop images and applications. The end-user can then enjoy easy access to his or her Horizon View desktop from a variety of locations, experience minimal downtime, customize the desktop, and utilize robust multimedia capabilities.

VMware Horizon View 5 introduces View Persona Management™, a technology they designed to preserve and dynamically synchronize user desktops. According to VMware, Persona Management simplifies how administrators handle user profiles by allowing them to manage user profiles completely from within View, and by minimizing the time to log in and out of desktops. Furthermore, VMware Horizon View allows you to maintain persistent desktops, where user documents are on a separate disk so users feel like they are logging onto the same PC each day, or non-persistent desktops, where user changes do not stick, or a mix of the two to address the needs of users in your organization.

To learn more about VMware View 5.2, visit www.vmware.com/products/view/overview.html.

About Login VSI 3.7

Login Virtual Session Indexer (Login VSI) 3.7 is a tool that assesses the virtual desktop performance, capacity, and scalability of a server. Login VSI incrementally logs users into virtual desktop sessions and measures the total response times of seven typical office operations from each session to calculate the VSI Index Average.

As more sessions begin to consume system resources, response times degrade and the VSI Index Average increases until it is above the Dynamic VSImax. When this condition is met, the benchmark records a Login VSImax, which is the maximum number of sessions that the platform can support. The average response time of the first 15 session determines a baseline; the VSImax is baseline x 125% +3000ms. Not reaching VSImax is an indication of satisfactory end user response time.

The newest version of Login VSI, Login VSI 3.7, includes client side performance testing that test character response, large text response, mouse-click feedback, and image quality and loading times on clients to ensure good end-user performance.

For more information about Login VSI 3.7, see www.loginvsi.com/product-overview.

CONCLUSION

Any organization using virtual desktop infrastructure can benefit by investing in servers that deliver high performance at a reasonable price. In our test, the AMD-based Open Compute 3.0 server hosted a few more virtual desktop sessions that the HP ProLiant DL360p Gen8 server did, while costing less than half as much.

APPENDIX A – SYSTEM CONFIGURATION INFORMATION

Figure 3 provides configuration information about the server we used in our tests.

System	AMD-based Open Compute 3.0 server	HP ProLiant DL360p Gen8
General		
Number of processor packages	2	2
Number of cores per processor	16	6
Number of threads per processor	**16**	**12**
CPU		
Vendor	AMD	Intel
Name	Opteron™	Xeon
Model number	6378	E5-2640
Socket type	G34	LGA2011
Core frequency (GHz)	2.4	2.5
Bus frequency	6.4 GT/s	7.2 GT/s
L1 cache	64 KB (per core)	32 KB + 32 KB (per core)
L2 cache	1,000 KB (per core)	256 KB (per core)
L3 cache	16 MB (shared)	15 MB (shared)
Platform		
Vendor	Quanta™	HP
Motherboard model number	S215-X1M2ZS	2M412456CN
BIOS name and version	American Megatrends 2.15.1236	HP P71
BIOS Settings (in addition to defaults)	C6 State disabled	Power setting set to performance
Memory module(s)		
Total RAM in system (GB)	192	192
Vendor and model number	Samsung® M393B1G73BH0-YH9	Hynix HMT31GR7BFR4A-H9
Type	PC3-10600	PC3L-10600R
Speed (MHz)	1,333	1,333
Speed running in the system (MHz)	1,333	1,333
Timing/Latency (tCL-tRCD-tRP-tRASmin)	9-9-9-36	9-9-9-36
Size (GB)	8	8
Number of RAM module(s)	24	24
Chip organization	Double-sided	Double-sided
Rank	Dual	Dual
OS/hypervisor		
Name	VMware ESXi 5.0	VMware ESXi 5.0
Build number	1022429	1022429
File system	VMFS	VMFS
Kernel	ACPI x64-based PC	ACPI x64-based PC
Language	English	English

System	AMD-based Open Compute 3.0 server	HP ProLiant DL360p Gen8
RAID controller		
Vendor and model number	AMD SB700 SATA	HP Smart Array P420i
Firmware version	N/A	3.22
Cache size (MB)	N/A	0
Hard drives		
Vendor and model number	Western Digital® WD800AAJS	HP 652605-B21
Number of drives	2	2
Size (GB)	80	146
Type	7.2K SATA	15K SAS
Ethernet adapter		
Vendor and model number	Mellanox® Technologies ConnectX-3 MT27500	QLogic® Corp NC523SFP
Number of ports	1	2
Type	10Gb adapter	10Gb adapter
USB ports		
Number	4	6
Type	2.0	2.0

Figure 3: System configuration information for our test servers.

APPENDIX B – HOW WE TESTED

Figure 4 presents the settings we used to configure the VMware Horizon View environment.

VM name	Hosted OS	Role (s)	Server	Memory	# of vCPUs
AD01	Win 2008 R2 x64 Enterprise	AD Domain controller VSI Share, DHCP, DNS, NTP	Infrastructure	4 GB	2
View Connection	Win 2008 R2 x64 Enterprise	VMware Horizon View Connection server	Infrastructure	4 GB	4
vCenter	Win 2008 R2 x64 Enterprise	VMware Virtual Center, Composer, SQL server	Infrastructure	4 GB	4
Launcher	Windows 7 x 64 Enterprise	Login VSI master launcher	Infrastructure	6 GB	2
Golden Desktop	Windows 7 x 86 Enterprise	Horizon View master images	Server under test	1 GB	1

Figure 4: Settings for the VMware Horizon View environment we tested.

To host all of our infrastructures and View desktop pools, we configured a high performance storage array to present NFS datastores to all ESXi servers.

Installing VMware ESXi 5.0 on AMD-based Open Compute 3.0 server and HP ProLiant DL360p Gen8 (servers under test)

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.

Configuring datastores

1. Connect to the `servers under test` via the VMware vSphere client.
2. Select Configuration→Storage→Add Storage…
3. Under Storage Type, select Network File System, and click Next.
4. Enter NFS information, datastore name, and click Next.
5. Click Finish.

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

1. Connect to the `infrastructure` sever 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 http://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.com` 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 `server 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.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=`172.0.0.20`
   - 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 saying that DHCP server install succeeded.
16. Click Close.

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. 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.com→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.com, 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.com→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 http://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 `servers under test` to the datacenter.

Setting up a database and ODBC DSN for Composer

1. Open a virtual machine console on `vCenter`.
2. From the server desktop, open Start→All Programs→Microsoft SQL Server 2008 R2→Configuration Tools→SQL Server Management Studio
3. Click Connect.
4. Select the Databases folder, right-click, and select New Database
5. Provide the name `composer` for the new database.
6. Click Options and change the recovery model from full to simple and click OK.
7. From the desktop of the vCenter server, select Start→Run→`odbcad32.exe`
8. Click the system DSN tab.
9. Click Add.
10. Click SQL Server Native Client 10.0, and click Finish.
11. In the Create a New Data Source to SQL Server text box, enter the connection name: `composer`
12. For Server, select SQL, and click Next.
13. 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.
14. Select the Change the default database to: checkbox, choose `composer` from the pull-down menu, and click Next.
15. Click Finish.
16. Click Test Data Source… to confirm correct configuration.
17. Click OK to create the Composer ODBC connection.

Setting up VMware Horizon View Composer 5.2

1. Open the View5 media folder, and run the file named VMware-viewcomposer-5.2.0
2. At the Welcome screen and the Patents screen, click Next.
3. Accept the VMware end user license agreement, and click Next.
4. Leave the Destination folder as default, and click Next.
5. In the Database information box, type `composer` as the source name and `sa` as the user name. Enter the password, and click Next.
6. Leave the default SOAP port, and click Next.
7. Click Install, and click Finish.
8. Restart the server.

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 4 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 http://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 Horizon View Connection Server

1. Open a Web browser to `<view connection server FQDN>/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.

Setting up a Windows 7 Enterprise x86 base images

Using the vSphere client, we created two Windows Enterprise X86 VMs base images, one on the AMD-based Open Compute 3.0 server, the other one on the HP ProLiant DL360p G8 server. We later used those images to create desktop pools for testing.

On both images, we installed Microsoft Office 2010, installed the Login VSI target software, added them to the vdi domain, added them to the Login VSI OU, and installed the respective VMware Horizon View 5.2 agents.

Installing the Windows 7 Enterprise (x86) base image VMs

1. In the vSphere client, connect to the vCenter Server, and browse to the `<server under test>` 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 `view_gold` and click Next.
6. Select the `<server under test>` 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 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. Click Finish.
18. Click Finish, and click OK.
19. Right-click the win7-temp VM, and click Edit settings.
20. Click the Resources tab, click Memory, and check the Reserve all guest memory checkbox.
21. Click the Hardware tab, CD/DVD Drive, and Connect the VM virtual CD-ROM to the Microsoft Windows 7 x86 installation disk.

22. Click OK.

Installing the Windows 7 Enterprise (X86) on the base image VMs

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 http://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.

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 `2048` for both values, and select Set.

Enabling ClearType fonts

1. Click Start→Run, and type `cttune.exe`
2. Check the Turn on ClearType checkbox, and click Next.
3. Follow the wizard to enable ClearType fonts.

Preparing view_gold for deployment

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 `view_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 Horizon View 5 agent

1. Browse to the VMware Horizon View 5 media, and run the VMware-viewagent-x86_64-5.2.0 file.
2. Click Run.
3. At the Welcome screen, click Next.
4. Accept the VMware end user license agreement, and click Next.
5. Select defaults, and click Next.
6. Enter the server name of the View Connection Server, and click Next.
7. Click Install.

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

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

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 5 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 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 http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=340
15. Reboot.
16. Join the `vdi.com` domain, and reboot.

Disabling Windows Firewall

The domain GPO automatically disables the Windows Firewall.

Installing the Horizon View 5.2 client

1. Browse to the VMware Horizon View 5.2.1 media, and run the VMware-viewclient-x86_64-5.2.1.exe file.
2. Click Run.
3. At the Welcome screen, click Next.
4. At the Patents screen, click Next.
5. Accept the VMware end user license agreement, and click Next.
6. Select defaults, and click Next.
7. Click Install.

Installing Virtual Audio Cables

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

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

1. Open vCenter→Datacenter→`infrastructure`, and right-click the base image VMs, select Snapshot→Take Snapshot.
2. Name the snapshots `view_gold`
3. Open the View Administrator.
4. Log in as `administrator`
5. Click Pools, and in the right window, click Add…
6. Select Automatic Pool, and click Next.
7. Select Floating, and click Next.
8. Select View Composer linked clones, and click Next.
9. Type `pool` for the pool ID and display name, and click Next.
10. Leave the pool settings as defaults, and click Next.
11. Under Naming Pattern, enter an appropriate name pattern for the pool.
12. Under Pool Sizing, enter a number for Max number of desktops and number of spare (power on) desktops.
13. Select provision all desktops up-front, and click Next.
14. Select Redirect disposable files to a non-persistent disk, type `4096` MB for Disk Size, and click Next.
15. Under Storage Optimization, click Next.
16. Under vCenter Settings, use:
    - Parent VM: `/vdi/vm/<name of parent vm>`
    - VM folder: `/vdi/vm/Pool`
    - Host or cluster: `/vdi/host/server under test`
    - Resource pool: `/vdi/host/server under test/Resources`
    - Datastores= `vdi(linked clone, replica, VAAI, etc.) Overcommit: Moderate`
17. Under Advanced Storage Options select Use host caching, OS disk, 7 days, and click Next.
18. Under Guest customization, select the following:
    - Domain: `vdi.com`
    - AD container: `OU=Users,OU=Login_VSI`
    - Select Use Quick Prep, and click Next.
19. Click Finish.
20. Click Pool, and click Entitlements…
21. Click Add, type `Login_VSI_TS` and click OK.
22. Click Desktops, and wait for the virtual desktops to report as ready.

Configuring the Login VSI Management Console

For VMware Horizon View testing, we used the following settings:

- Connection Type: Custom Commandline with CSV
- Specify Custom Commandline:
  `c:\program files\VMware\VMware View\Client\bin\wswc.exe –serverURL http://viewconnection.vdi.com -username: %view_user% -password Password1 –domainname vdi –desktopname Pool –Standalone –LoginAsCurrentUser False –ConnnectUSBonStartup False`
- Specify CSV file:
  \\AD01\Share\csv\view_user.csv
- Connection Settings session:

- Connect: Specify User
- Formatting Length: Set to 1
- Server Name: Leave blank
- User Name: Leave blank
- Password: Leave blank
- Domain: Leave blank

APPENDIX C – CPU UTILIZATION DURING TESTING

Figure 5 shows the percentage core utilization of the AMD-based Open Compute 3.0 server over the course of the Login VSI test.

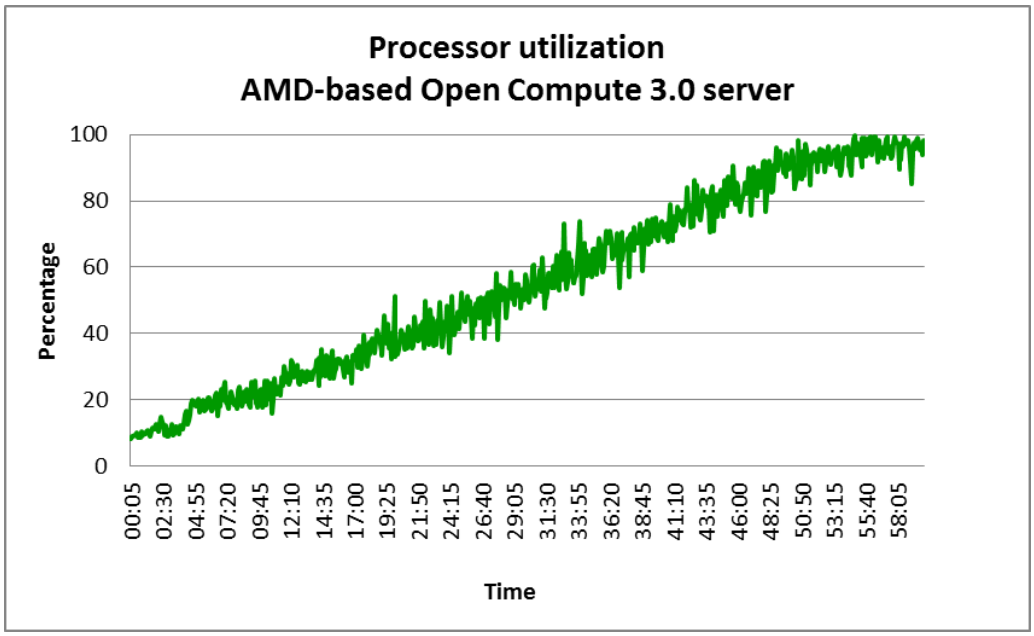


Figure 5: Percentage core utilization of the AMD-based Open Compute 3.0 server.

Figure 6 shows the percentage core utilization of the HP ProLiant DL360p Gen8 over the course of the Login VSI test.

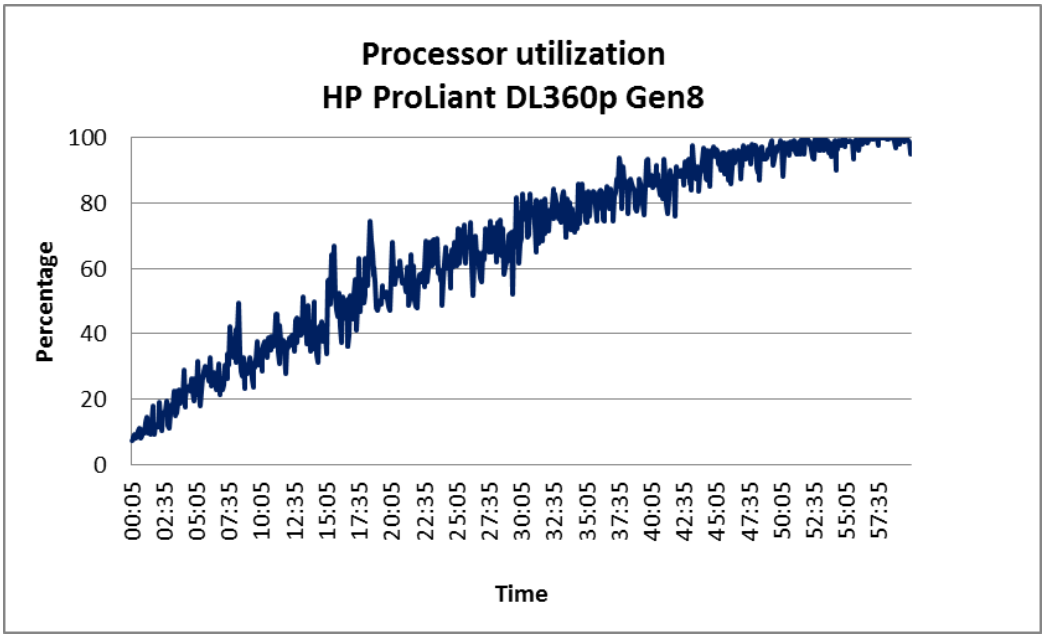


Figure 6: Percentage core utilization of the HP ProLiant DL360p Gen8.

ABOUT PRINCIPLED TECHNOLOGIES

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

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