Exchange performance comparison: Cisco UCS B200 M1 Blade Server vs. HP ProLiant BL465c G6 Server Blade

Executive summary

Cisco Systems®, Inc. (Cisco) commissioned Principled Technologies (PT) to compare the Microsoft® Exchange performance of the following two blade servers using VMware vSphere™ 4 (vSphere):

- Cisco UCS B200 M1 Blade Server with Intel® Xeon® Processor X5570
- HP ProLiant BL465c G6 Server Blade with AMD Opteron™ Processor 2435

The Cisco UCS B200 M1 Blade Server handled 3,000 users in each of eight virtual machines (VMs) and received a passing LoadGen 2007 latency, which we define as any latency less than 1,000ms. The HP ProLiant BL465c G6 Server Blade handled 3,000 Exchange 2007 users in each of seven VMs and received a passing LoadGen 2007 score.

As Figure 1 shows, the Cisco UCS B200 M1 Blade Server with vSphere handled one more virtual machine and provided 14.3 percent more total performance than did the HP ProLiant BL465c G6 Server Blade with vSphere.

We define the peak number of VMs per server as the maximum number of concurrent VMs under load where each VM has a less than 1,000ms response time with 3,000 users. We ensured the maximum number of concurrent VMs on each system by increasing VMs until at least one VM had a response time over 1,000ms. We then decreased the number of concurrent VMs by one to ensure that all VMs have an acceptable response time. We used a baseline server to gauge the number of users to run, which we explain in the Workload section below.

In our testing, the Cisco UCS B200 M1 Blade Server ran eight concurrent VMs with a response time less than 1,000ms, while the HP ProLiant BL465c G6 Server Blade could only run seven concurrent VMs with a response time faster than 1,000ms in each VM. In both cases, the server could run additional VMs, but at least one VM could not deliver a response time less than 1,000ms.

KEY FINDINGS

- The Cisco UCS B200 M1 Blade Server with VMware vSphere handled one more virtual machine running Exchange 2007 than did the HP ProLiant BL465c G6 Server Blade with VMware vSphere running Exchange 2007. (See Figure 1.)
- The Cisco UCS B200 M1 Blade Server delivered 14.3% more total performance than did the HP ProLiant BL465c G6 Server Blade. (See Figure 1.)
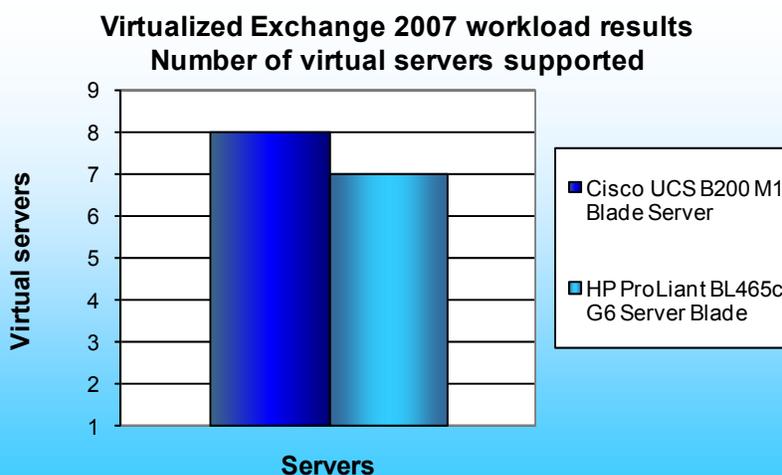

Figure 1: Virtualized Exchange 2007 workload performance results for the blade servers. Higher numbers are better.

Workload

To build the workload, we used Microsoft Exchange Load Generator 2007, an industry-standard tool for benchmarking an Exchange Mail Server. We based that workload on the settings from LoadGen's default 2007 Online Heavy workload. Our workload consisted of 3,000 users. We found the peak number of Exchange 2007 users on a typical 3- to 5-year-old, dual-socket server with two Intel Xeon 3.6GHz processors, 4 GB of RAM and two onboard NICs. We hooked the server up to one tray of the EMC® CLARiiON® CX4-240 storage, configured in a 15 disks RAID 0,

to hold the Exchange database. We chose 3,000 users with latency just under 500ms as it put a reasonable amount of stress on the legacy server. We then ran the same number of Exchange 2007 users inside a VM on the Cisco UCS B200 M1 Blade Server and HP ProLiant BL465c G6 Server Blade.

During the tests, LoadGen performs tasks to simulate a standard user generating mail activity. When the workload finishes, LoadGen reports the response time, which is the number of seconds necessary to complete the task. We used a weighted task system we based on the MMB3 workload, the forerunner to LoadGen. We modified the weight system to reflect the Online 2007 Heavy LoadGen profile. Appendix B shows the weight system we used for this test. We ran this workload on all virtual machines simultaneously for 30 minutes.

Both the Cisco UCS B200 M1 Blade Server and the HP ProLiant BL465c G6 Server Blade ran VMware vSphere 4.0, while running Microsoft Windows Server 2008 with Microsoft Exchange Server 2007 inside virtual machines.

System comparison

Figure 2 shows a side-by-side comparison of the key hardware differences between the Cisco UCS B200 M1 Blade Server and the HP ProLiant BL465c G6 Server Blade. We used the maximum supported memory for both systems in our testing.

Hardware specifications	Cisco UCS B200 M1 Blade Server	HP ProLiant BL465c Server Blade
CPU	Intel Xeon X5570	AMD Opteron 2435
CPU speed (GHz)	2.93	2.60
Number of processor packages	2	2
Number of cores per processor package	4	6
Number of hardware threads per core	2	1
Memory type	DDR3 PC3-10600R	DDR2 PC2-5300P
Total memory (GB)	96	64
Maximum supported memory (GB)	96	64

Figure 2: System configuration information for the Cisco UCS B200 M1 Blade Server and the HP ProLiant BL465c G6 Server Blade.

Figure 3 shows the settings we used on the Cisco UCS B200 M1 Blade Server and the HP ProLiant BL465c G6 Server Blade VMs for testing. Refer to the Test methodology section below for detailed steps of how we set up the VMs.

VM specifications	VM settings
vCPU	2
Memory (GB)	8
Virtual NIC type	VMXNET 3
Number of virtual disks	3 (OS, Exchange Database, Backup database)

Figure 3: VM configuration information we used for testing.

Test results

Figure 4 shows the latency, in milliseconds, from the median run for the Cisco UCS B200 M1 Blade Server and HP ProLiant BL465c G6 Server Blade. We ran the Cisco UCS B200 M1 Blade Server with eight virtual machines and the HP ProLiant BL465c G6 Server Blade with seven virtual machines, so we record the response time for each virtual machine.

To determine the maximum number of simultaneous virtual machines each server could handle, we added virtual machines until one or more had latency greater than 1 second (1000 milliseconds). We then subtracted one VM

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to identify the total number of VMs the server could handle. We performed three runs at the total number to verify the response time met these standards.

We used a 30-minute runtime for testing rather than a longer duration. We have found this shorter runtime produces valid and reproducible results. The results below are the medians of three runs.

VM (3,000 Exchange users)	Cisco UCS B200 M1 Blade Server	HP ProLiant BL465c G6 Server Blade
Virtual machine 1	743.6	757.73
Virtual machine 2	678.1	632.08
Virtual machine 3	701.7	713.98
Virtual machine 4	686.5	565.83
Virtual machine 5	640.3	639.85
Virtual machine 6	727.0	576.48
Virtual machine 7	717.6	714.75
Virtual machine 8	772.9	

Figure 4: Latency, in milliseconds, from the median run for each virtual machine for the blade servers. Lower numbers are better.

Figure 5 shows the read, write, and total input/output operations per second (IOPS) for the median run of the two servers. Higher numbers are better, as they show that the system is handling more requests.

IOPS	Cisco UCS B200 M1 Blade Server	HP ProLiant BL465c Server Blade
Read	4,123.4	3,534.4
Write	3,684.4	3,183.6
Total	7,808.1	6,718.3

Figure 5: IOPS from the median run of the two servers. Higher numbers are better.

Test methodology

Setting up and configuring the EMC storage

We used an EMC CLARiiON CX4-240 Fibre Channel connected SAN for this testing. By design, the CX4-240 has two Storage Processors, SP-A and SP-B. We used the integrated dual port host bus adapter (HBA) in the Cisco UCS B200 M1 Blade Server and HP ProLiant 465c G6 Server Blade. We cabled one HBA port to each SP (A and B) on the SAN to balance the load between SPs. We used five enclosures of disks on the SAN; with one exception, each enclosure had 15 disks. We designated RAID 0 for all RAID group configurations.

We created one RAID group on the enclosure that had only five disks. We then created one logical unit number (LUN) on this RAID group for the virtual hard drives (VHDs) that would hold the operating systems for the virtual machines.

We created seven RAID groups for Exchange data. Each of these seven RAID groups was composed of 10 disks. We then created 8 150GB LUNs per RAID group, for a total of 56 LUNs dedicated to virtual machines to hold Exchange data. We used the EMC MetaLUN feature and assigned seven LUNs to MetaLUN-A and seven LUNS to MetaLUN-B. We performed this step four more times so we had a total of eight MetaLUNs. To balance processing load and disk transfers, we assigned half of the MetaLUNs to SP-A and half to SP-B.

Figure 6 shows the configuration that we used to connect the EMC CLARiiON CX4-240 to the Cisco B200 M1 Blade Server for testing. We used a similar configuration for the HP BL465c blade server, but substituted a Brocade 200E in place of the Cisco UCS and fabric.
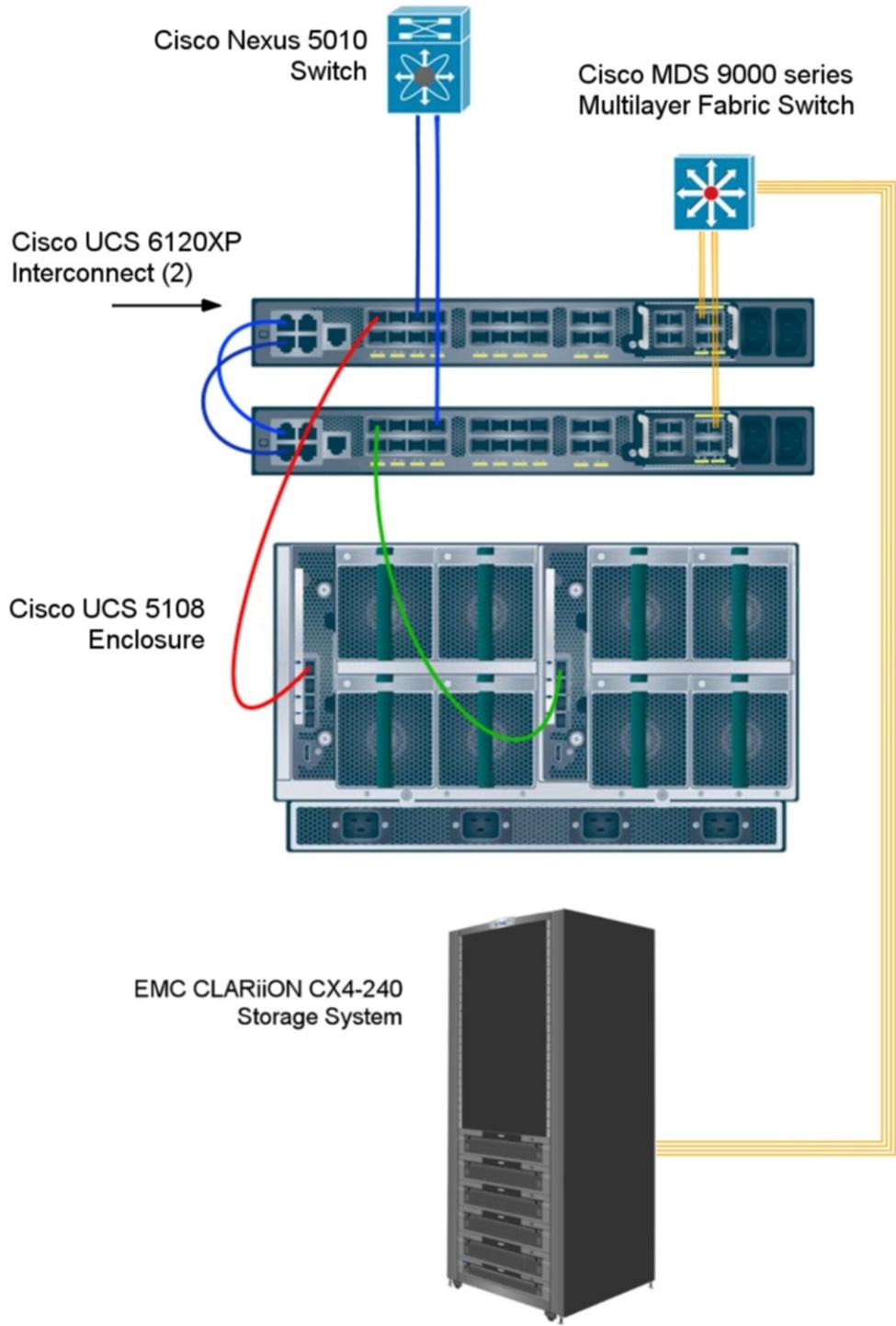
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Figure 6: Our test bed configuration for the Cisco Blade Server.

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Setting up the blade servers

We installed a fresh copy of VMware vSphere 4 on the Cisco UCS B200 M1 Blade Server and HP ProLiant 465c G6 Server Blade.

Installing VMware vSphere 4 on the host

1. Insert the ESX DVD, and restart the computer.
2. To start ESX in graphical mode, press Enter.
3. On the Welcome screen, click Next.
4. Click the checkbox to accept the terms of the license agreement, and click Next.
5. Accept the default keyboard layout, and click Next.
6. On the Custom Drivers screen, choose No to install custom drivers, and click Next.
7. You will receive a warning if you chose No. Click Yes to proceed. Drivers will load at this point.
8. Click Next.
9. Enter your serial number now, or choose to enter one later. Click Next.
10. On the Network Configuration screen, choose the NIC that you will use for system tasks and for the client/server test traffic. Click Next.
11. On the next Network Configuration screen, set your IP addressing information, subnet mask, DNS, and hostname. Click Next.
12. On the Setup Type screen, choose standard setup.
13. Select the virtual disk you wish to install ESX on, and click Next.
14. On the Data Loss warning screen, click OK.
15. On the Time Zone Settings screen, choose your appropriate time zone, and click Next.
16. On the Date and Time screen, modify the date and time as you wish, and click Next.
17. Assign a root password for ESX. Optionally, add additional users if you wish, and click Next.
18. On the Summary screen, click Next to install.
19. When the installation is complete, click Next.
20. Click Finish to reboot the system.

Enabling secure shell (ssh) access for the root user

1. Log in as root to the ESX console.
2. Type the following command to change to the appropriate directory:
   `# cd /etc/ssh`
3. Edit the sshd_config file using vi. Use the following command:
   `# vi sshd_config`
4. Press the down arrow key to move the cursor to the PermitRootLogin line, and move the cursor to the word no. Press the i key to insert text.
5. Type the word `yes` and delete the word no.
6. Press the Escape key to return to command mode.
7. Type the following command to save and exit the file:
   `:wq`
8. Type the following command to restart the ssh service:
   `# service sshd restart`

Installing vSphere on a management workstation

1. Configure your management workstation to be on the same subnet as your ESX server. In Internet Explorer, navigate to the IP address of your ESX Server.
2. Accept certificate warnings, and continue.
3. Click vSphere to download the vSphere client.
4. Choose Run to install.
5. Choose your language, and click OK.
6. On the Welcome screen, click Next.
7. Accept the license terms, and click Next.
8. Enter user and organization details, and click Next.
9. Optionally, click the checkbox to install the update utility. Click Next.
10. On the Destination Folder screen, click Next.

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11. Click Install.
12. Click OK.

Adding the storage volumes to ESX storage
1. In vSphere, click the Configuration tab.
2. Click Storage in the Hardware pane.
3. Click Add Storage…
4. Choose Disk/LUN. Click Next.
5. Select the appropriate LUN. Click Next.
6. Click Next.
7. Enter a name for the datastore. Click Next.
8. Choose 8MB block size from the drop-down menu. Click Next.
9. Click Finish to complete the addition of the LUN.

Installing and configuring the mail server
To set up this server, you must install several software components. The following subsections detail the necessary installation processes.

Creating the virtual machine with vSphere
1. Click Start, All Programs, VMware, VMware vSphere client.
2. Enter the IP address or hostname, user name, and password. Click Login.
3. Click the Virtual Machines tab.
4. Right-click, and choose New Virtual Machine.
5. Choose Custom, and click Next.
6. Assign a name to the virtual machine. Click Next.
7. Select a datastore for the virtual machine files. We chose the OS Datastore. Click Next.
8. Choose Virtual Machine Version 7. Click Next.
9. Choose Microsoft Windows, then Microsoft Windows Server 2008 (64-bit). Click Next.
10. Choose two virtual processors. Click Next.
11. Choose 8192MB RAM. Click Next.
12. Click 1 for the number of NICs, and select vmxnet3. Click Next.
13. Leave the default virtual storage controller. Click Next.
14. Choose to create a new virtual disk. Click Next.
15. Make the OS virtual disk size 24 GB, specify the OS datastore on the external storage, and click Next.
16. Keep the default virtual device node, and click Next.
17. Click Finish.

Installing the guest operating system
1. Insert the installation DVD for Windows Server 2008 x64 into the DVD drive.
2. In vSphere, right-click the virtual machine, and choose CD/DVD drive.
3. Click the Host Device radio button, and choose the appropriate drive.
4. Click OK.
5. Right-click the machine, and choose Power, Power On.
6. Right-click the machine, and choose Open console.
7. Choose the language, time and currency, and keyboard input. Click Next.
8. Click Install Now.
9. Choose Windows Server Enterprise (Full Installation). Click Next.
10. Accept the license terms, and click Next.
11. Click Custom.
12. Click the Disk, and click Drive options (advanced).
13. Click New, Apply, Format, and click Next.
14. Let the installation process continue. The VM will reboot several times.
15. After the installation completes, click OK to set the Administrator password.
16. Enter the administrator password twice, and click OK.
17. When the operating systems finishes booting, choose VM, Guest, Install/Upgrade VMware Tools.

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18. On the Install VMware Tools screen, click OK.
19. On the AutoPlay menu, click Run setup.exe.
20. On the Welcome screen, click Next.
21. On the Setup Type screen, choose Typical, and click Next.
22. Click Install.
23. On the various Windows Security screens, click Install each time.
24. Click Finish to complete the installation.
25. Click Yes to reboot the VM.
26. Log into the VM after reboot.
27. Click Start, Control Panel, and double-click System.
28. Click Change Settings.
29. Click Change.
30. Enter the new computer name, and click OK.
31. Click OK to restart, click Close, and click Restart Now.
32. Right-click the desktop, and select Personalize.
33. Click the Screen Saver link.
34. Click the Screen saver drop-down menu, and select (None).
35. Click Apply.
36. Click Change power settings.
37. Click Change plan settings under Balanced.
38. Change the Turn off monitor drop-down menu to Never.
39. Click Save changes, and close the Power Options, Screen Saver Settings, and Personalization windows.
40. Open the Start menu, type `regedit` in the search field, and press Enter.
41. To allow the VM to automatically log into the OS after a system reboot, change the following Registry key to have the values shown here:

```
[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Winlogon]
DefaultPassword=Password1
AutoAdminLogon=1
DefaultUsername=administrator
```

42. Restart the VM.

Installing Windows updates
1. Power on the VM, and open the console.
2. Log into the VM.
3. Click Start, Windows Update.
4. Click View Advanced Options.
5. Click Never Check for Updates.
6. Click OK.
7. Click Check for Updates.
8. Click Install Now when the application prompts you to install an update for Windows Update.
9. Click View available updates to ensure you install the necessary updates.
10. Click Install.
11. Agree to the license terms, and click Finish.
12. Reboot the VM when the application requests you do so.
13. After reboot, check Windows Update again for further updates. Click Start, Windows Update.
14. Click Check for updates.
15. If Windows lists no important updates, close the updates window.

Installing the domain controller
1. Set a static IP address using the following steps:
    a. Right-click the network icon in the quick-launch bar, and choose Network and Sharing Center.
    b. Click Manage network connections.
    c. Right-click the local area connection, and choose Properties.

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d. Select Internet Protocol Version (TCP/IPv4), and click Properties.
e. Select the Use the following IP address radio button, and type `192.168.1.250` in the IP address field.
f. Press Tab to auto-fill 255.255.255.0 in the Subnet mask field.
g. In the Preferred DNS server field, type `127.0.0.1` and click OK to close the IPv4 properties window.
h. Click Close.
2. Give the computer a name using the following steps:
   a. Click Start, right-click Computer, and select Properties.
   b. Click Change Settings.
   c. Click Change.
   d. Type `mailserver1` in the Computer name field, and click OK.
   e. In the Computer Name/Domain Changes pop-up window, click OK.
   f. Click OK.
   g. In the Microsoft pop-up window, click Restart Now.
3. Promote the mailserver to domain controller by following these steps:
   a. Select Start→Command Prompt.
   b. Type `dcpromo`
   c. At the Welcome pop-up window, click Next.
   d. At the Operating System Compatibility screen, click Next.
   e. At the Domain Controller Type screen, choose Domain controller for a new domain, and click Next.
   f. At the Create New Domain screen, select the Domain in a new forest radio button, and click Next.
   g. At the New Domain Name screen, type a domain name (i.e., `mailserver.com`), and click Next.
   h. At the NetBIOS Domain Name screen, leave defaults, and click Next.
   i. At the Database and Log Folders screen, accept defaults, and click Next.
   j. At the Shared System Volume screen, keep defaults, and click Next.
   k. At the DNS Registration Diagnostics window (if diagnostic fails), choose Install and configure the DNS server on this computer, set this computer to use this DNS server as its preferred DNS server, and click Next.
   l. At the Permissions window, accept defaults, and click Next.
   m. At the Directory Services Restore Mode Administrator Password screen, enter a password, and click Next.
   n. At the Summary screen, review the selections, and click Next.
   o. When the installation software prompts you to do so, insert the OS CD, and click OK.
   p. At the Completing the Active Directory Installation Wizard screen, click Finish.
   q. When the system prompts you to reboot the server, click Restart Now.
   r. After the server reboots, log into the system.

Installing Internet Information Services 6.0
1. Select Start→Administrative Tools→Manage Your Server.
2. Click Add or remove a role.
3. At the Preliminary Steps screen, click Next.
4. At the Configure Your Server Wizard popup window, click Continue.
5. At the Server Role screen, click Application Server (IIS), and click Next.
6. At the Summary of Selection screen, review your selections, and click Next.
7. At the This Server is Now an Application server screen, click Finish.

Installing .NET™ 3.5 SP1 and Windows PowerShell™ 1.0
1. Download .NET 3.5 SP1 from Microsoft's Web site.
2. Double-click the dotnetfx35.exe file.
3. At the Welcome to Setup screen, accept the license agreement, and click Install.
4. When the install is finished, click Exit.
5. Click Start→Server Manager, and choose Add a Feature.
6. Choose Windows PowerShell1.0. Click Next to enable the feature.

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Installing Exchange Server 2007
1. Insert the Microsoft Exchange Server 2007 CD.
2. In the pop-up AutoPlay window, click Run Setup.EXE.
3. The installer should consider Steps 1, 2, and 3 complete, and gray them out.
4. Click the link to Step 4: Install Microsoft Exchange Server 2007 SP1.
5. Click Next to go past the introduction screen.
6. Accept the license agreement, and click Next.
7. Select No for error reporting, and click Next.
8. Select Typical Exchange Server Installation, and click Next.
9. Leave the organization name at default (First Organization), and click Next.
10. At the question about client computers running Outlook 2003 and earlier, select No, and click Next.
11. If an error about the Active Directory domain is in mixed mode appears, raise the domain function level using the following steps:
    a. Click Start→All Programs→Administrative Tools→Active Directory Domains and Trusts.
    b. Right-click mailserver.com, and choose Raise Domain Functional Level.
    c. Choose Windows 2000 native in the drop-down menu, and click Raise.
    d. Click OK on the warning popup window.
    e. When the application raises the level successfully, click OK.
    f. Close the Active Directory Domains and Trusts window.
    g. At the Exchange 2007 setup window, click Retry on the Readiness Checks screen.
12. If a warning about a lack of SMTP appears after the check finishes, ignore it.
13. Click Install to start the installation process.
14. Once installation is complete, click Finish.
15. Click OK when the application prompts you to reboot.
16. Reboot the server.

Adding an additional virtual drive to the VM via vSphere
1. Power off the VM, right-click and choose Edit Settings.
2. Click Add.
3. Choose Hard Disk, and click Next.
4. Choose Raw Device Mappings, and click Next.
5. Choose the LUN you would like to use, and click Next.
6. Choose Store with Virtual Machine, and click Next.
7. Under Compatibility, choose Physical, and click Next.
8. From Virtual Device Node drop down menu, choose SCSI (1:0), and click Next.
9. Select new SCSI controller, and click Change Type.
10. In the pop-up window, choose VMware Paravirtual, and click OK.
11. Click OK.

Configuring additional drives in Disk Management
1. Power on the VM, and open the console.
2. Click Start, Administrative Tools, Computer Management.
3. Click Disk Management.
4. Right-click the uninitialized disks (if any), and choose Initialize Disk.
5. Choose MBR.
6. Right-click the volume, and choose New Simple Volume. Click Next.
7. Accept the default volume size. Click Next.
8. Choose E: from the drop-down menu for the drive letter. Click Next.
9. Type Exchange for the volume name. Click Next.
10. Choose NTFS, default allocation unit size, and check the Perform a quick format checkbox. Click Next.
11. Click Finish.

Configuring Exchange Server 2007
1. Select Start→All Programs→Microsoft Exchange Server 2007→Exchange Management Console.
2. In the left pane, expand Organization Configuration, and select Hub Transport.

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3. In the action pane on the far right, select New Send Connector.
4. Name the send connector SMTP, select the intended use as Internet, and click Next.
5. In the Address space window, click Add.
6. In the SMTP Address Space window, type * as the address, ensure that the installer has checked Include all subdomains, and click OK.
7. Click Next.
8. Accept defaults for the next two pages by clicking Next.
9. At the New Connector page, click New to create the connector.
10. Click Finish to close the New SMTP Send Connector wizard.
11. In the left pane of the Exchange Management Console window, expand Server Configuration, and select Mailbox.
12. In the Database Management tab, right-click First Storage Group, and select New Public Folder Database.
13. Name the new public folder database `Public Folder Database` and click New.
14. In the Completion page, click Finish to close the New Public Folder Database window.
15. Select Start→All Programs→Administrative Tools→Active Directory Users and Computers.
16. In the Active Directory Users and Computers window, select mailserver.com in the left pane, and open Users in the right pane.
17. Right-click a blank area in the Users folder, and select New→User.
18. In the New Object - User window, complete the name fields as you wish (we used first name: test, last name: tester, logon name: tester), and select Next.
19. Enter a secure password (we used Password1), and check Password never expires.
20. In the pop-up information window, click Accept.
21. Select Finish to close the New Object – User window.
22. Double-click the new user to bring up the Properties window.
23. Under the Member Of tab, click Add.
24. In the Enter the object names to select dialog box, type `Domain Admins; Exchange Organization Administrators` select Check Names to verify, and click OK.
25. Click OK to close the User Properties window and close the Active Directory Users and Computers window.
26. Select Start→All Programs→Microsoft Exchange Server 2007→Exchange Management Console.
27. In the left pane of the Exchange Management Console window, select Recipient Configuration; in the right pane, select New Mailbox.
28. In the New Mailbox window, select User Mailbox, and click Next.
29. In the User Type page, select Existing users, and click Add.
30. Select the new account you created earlier, and click OK to add it to selection box.
31. Click Next.
32. In the Mailbox Settings page, leave the Alias textbox with default settings, and select Browse in the Mailbox database selection spot.
33. In the Select Mailbox database window, select Mailbox Database, and click OK.
34. Click through the next screens to create the new mailbox, and close when you have done so.
35. In the left windowpane, expand Server Configuration and Mailbox so the First Storage Group is visible.
36. Right-click First Storage Group, and select Properties.
37. Check the Enable circular logging box.
38. Click OK.
39. Right-click First Storage Group, and select Move Storage Group Path.
40. Click Browse, change the log files and system files path locations to E:\Logs and E:\Database respectively, and click Move.
41. When the pop-up message appears asking if you want to perform this task, click Yes.
42. Click Finish.
43. Right-click First Storage Group, and select New Mailbox Database.
44. Under Mailbox database name, type `Mailbox Database 2`
45. Click the Browse button, and select E:\Mailstore. If there is not a directory with the name of Mailstore, create it.
46. Click the New button to create the database.

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47. Click Finish.
48. Right-click Mailbox Database under First Storage Group, and select Properties.
49. Check the box beside This database can be overwritten by a restore.
50. Click Customize next to Maintenance interval.
51. Remove all blue from the boxes so the system will not perform maintenance, and click OK.
52. At the Mailbox Store Properties window, click Apply.
53. Click OK to close the Mailbox Store Properties window.
54. Right-click Mailbox Database under First Storage Group, and select Move Database Path.
55. Click Browse, move the database file path to E:\Mailstore, and click Move.
56. When a warning message appears, click Yes.
57. Click Finish.
58. Right-click Mailbox Database 2 under First Storage Group, and select Properties.
59. Check the box beside This database can be overwritten by a restore.
60. Click Customize next to Maintenance interval.
61. Remove all blue from the boxes so the system will not perform maintenance, and click OK.
62. At the Mailbox Database 2 Properties window, click Apply.
63. Click OK to close the Mailbox Database 2 Properties window.
64. Right-click Public Folder Database, and choose Move Database Path.
65. Click Browse, and move the database file path to E:\Mailstore. Click Move.
66. When a warning message appears, click Yes.
67. Click Finish.
68. Right-click Public Folder Database under First Storage Group, and select Properties.
69. Check the box beside This database can be overwritten by a restore.
70. Click Customize next to Maintenance interval.
71. Remove all blue from the boxes so the system will not perform maintenance, and click OK.
72. At the Public Folder Database Properties window, click Apply.
73. Click OK to close the Public Folder Database Properties window.
74. Click Start→Administrative Tools→Services.
75. Find the Microsoft Exchange Search Indexer service, right-click the service, and choose Properties.
76. Click Stop, and choose Disabled in the Startup type drop-down menu.
77. Click OK.
78. Close the Services window.

Creating the additional VMs on the host blade

After installing and configuring the initial VM, we cloned that VM using a combination of the vmkfstools and vmware-cmd utilities on the VMware ESX Server platform. Below is a sample shell script to clone VMs containing three virtual disks, such as our configuration.

```
# cp –reply=yes /sourcepath/VM1.vmx /destpath/VM2.vmx
# sed –i "s/VM1/VM2/g" /destpath/VM2.vmx
# sed –i '/sched.swap.derivedName/d' /destpath/VM2.vmx
# sed –i '/checkpoint.vmState/d' /destpath/VM2.vmx
# vmkfstools –i /sourcepath/VM1.vmdk /destpath/VM2.vmdk
# vmware-cmd -s register /destpath/VM2.vmx
```

Configuring the additional VMs after cloning

1. Power on the VM, and open the console.
2. Click Start→Control Panel→Right-click Network Connections, and double-click the Local Area Connection.
3. Select Internet Protocol Version 4 (TCP/IPv4), and click Properties.
4. In the Internet Protocol Version 4 (TCP/IPv4) Properties screen, select the Use the following IP address radio button.
5. Enter a valid static IP address, subnet mask, and default gateway for this new VM.
6. Click OK, and click Close to exit.
7. Repeat steps 1 through 6 for each VM.

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Installing and configuring the mail clients

To create the mail client, you must install several software components. We followed this process for each installation:

1. Install Microsoft Windows Server 2003 R2 Enterprise x64 Edition Service Pack 2 on the client system.
2. Assign a computer name of `Clientx` for the mail client, where `x` is the client number.
3. For the licensing mode, use the default setting of five concurrent connections.
4. Enter a password for the administrator log on.
5. Select Eastern Time Zone.
6. Use typical settings for the Network installation.
7. Type `Testbed` for the workgroup.
8. Open the Start menu, and click Run.
9. Type `regedit` in the search field, and press Enter.
10. To allow the VM to automatically log into the OS after a system reboot, change the following Registry key to have the values shown here:

```
[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Winlogon]
DefaultPassword=Password1
AutoAdminLogon=1
DefaultUsername=tester
DefaultDomain=mailserver.com
```

To set up this system, we had to install several additional software components. The following subsections detail the necessary installation processes. Before following these instructions, make sure to assign a static IP address for the client, and to then plug that port into the system under test. This allows the client to join the Active Directory domain.

Joining the domain

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

Installing Internet Information Services 7.0

1. Select Start→Control Panel→Add or Remove Programs.
2. Click Add/Remove Windows Components.
3. Select Application Servers, and click Details.
4. Make sure a check appears in the Internet Information Services (IIS), Application Server Console, and Enable network COM+ access check boxes.
5. Click OK to close the Application Server window.
6. At the Windows Components Wizard, click Next to begin the installation.
7. When the system prompts you to do so, insert the OS CD, and click OK.

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8. At the Completing the Windows Components Wizard window, click Finish.
9. Close the Add or Remove Programs window.

Installing .NET™ 3.5 SP1 and Windows PowerShell™ 1.0
1. Download .NET 3.5 SP1 from Microsoft's Web site.
2. Double-click the dotnetfx35.exe file.
3. At the Welcome to Setup screen, accept the license agreement, and click Install.
4. When the install is finished, click Exit.
5. Download Windows PowerShell 1.0 from Microsoft's Web site.
6. Double-click the .EXE file.
7. At the Welcome window, click Next.
8. Accept the license agreement, and click Next.
9. When the install is complete, click Finish.

Installing Exchange Server 2007 and Load Generator
1. Insert the Microsoft Exchange Server 2007 CD.
2. In the pop-up AutoPlay window, click Run Setup.EXE.
3. The installer should consider Steps 1, 2, and 3 complete, and gray them out.
4. Click the link to Step 4: Install Microsoft Exchange Server 2007 SP1.
5. Click Next to go past the introduction screen.
6. Accept the license agreement, and click Next.
7. Select No for error reporting, and click Next.
8. Select Custom Exchange Server Installation, and click Next.
9. Select Custom Exchange Server Installation, and click Next.
10. Check Management Tools, and click Next.
11. If an error about the Active Directory domain is in mixed mode appears, raise the domain function level using the following steps:
    a. Click Start→All Programs→Administrative Tools→Active Directory Domains and Trusts.
    b. Right-click mailserver.com, and choose Raise Domain Functional Level.
    c. Choose Windows 2000 native in the drop-down menu, and click Raise.
    d. Click OK on the warning popup window.
    e. When the application successfully raises the level, click OK.
    f. Close the Active Directory Domains and Trusts window.
    g. At the Exchange 2007 setup window, click Retry on the Readiness Checks screen.
12. If a warning about a lack of SMTP appears after the check finishes, ignore it.
13. Click Install to start the installation process.
14. Once installation is complete, click Finish.
15. Click OK when the application prompts you to reboot.
16. Reboot the server.
17. Download and install Load Generator with all defaults.

Preparing Load Generator
1. Log into the MailClient using the tester account.
2. Select Start→All Programs→Microsoft Exchange→Exchange Load Generator.
3. When the Load Generator window appears, select Start a new test.
4. Select Create a new test configuration, and click Continue.
5. Type `tester` as the account name.
6. In the Specify test settings window, type `Password1` as the Directory Access Password and Mailbox Account Master Password, and click Continue with recipient management.
7. Type `3000` into the Number of users box, and click the Spread evenly across databases link. Click Continue.
8. To accept defaults for Advanced recipient settings, click Continue.
9. In the Specify test user groups window, select the plus sign to add a user group.
10. Change the Client Type to Outlook 2007 Online and the Action Profile to Heavy.
11. Leave defaults in Remote configurations, and click Continue.

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12. Click Save the configuration file as, and name it `Loadgencfg`
13. Click Start the initialization phase (recommended before running the test) to start initialization. The initialization process might take a few hours.

Testing procedure

To perform the test, we used a series of batch files. First, we powered on all virtual machines. We started the scripts, which copied the LoadGen parameter files to the clients. Then, we started our monitoring programs. To start the test, we executed the start batch file on our controller, which copied a file to all clients to start LoadGen. After LoadGen finished, we used another batch file to copy the results from all clients. The batch files simply used the copy command and referred to all clients by their IP addresses. Once a run finished, we used a restore batch file, which restored the MailStore to the original state. This allowed us to start from the same point in testing.

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Appendix A – Blade server configuration information

Figure 7 provides detailed configuration information about the blade servers.

Servers	Cisco UCS B200 M1 Blade Server	HP ProLiant BL465c G6 Server Blade
Enclosure		
Blade enclosure	Cisco UCS 5108	HP C7000
Power supplies		
Total number	4	6
Wattage of each (W)	2,500	2,450
Cooling fans		
Total number	8	10
Dimensions (h x w) of each	3 5/8" x 5 1/2"	3 1/2" x 7 1/2"
General processor setup		
Number of processor packages	2	2
Number of cores per processor package	4	6
Number of hardware threads per core	2	1
CPU		
Vendor	Intel	HP
Name	Xeon X5570	Opteron 2435
Stepping	5	0
Socket type	LGA 1366	Socket F (1207)
Core frequency (GHz)	2.93	2.60
Bus frequency	6.4 GT/s (QPI)	2,000 MHz HyperTransport
L1 cache	128 KB	6 x 64 KB
L2 cache	4 x 256 KB	6 x 64 KB
L3 cache (MB)	8	6
Thermal design power (TDP, in watts)	95	75
Platform		
Vendor and model number	Cisco B200 M1 Blade Server	HP ProLiant BL465c G6
Motherboard model number	QCI1327030G	1395T2206101
Motherboard chipset	Intel 5500	SMSC SCH5017
BIOS name and version	Intel S5500.86B.01.00.0036-191	A13 (05/07/2009)
BIOS settings	Default	Default
Memory modules		
Total RAM in system (GB)	96	64
Number of types of memory modules	1	1
Speed in the system currently running @ (MHz)	1,333	667
Timing/Latency (tCL-tRCD-iRP-tRASmin)	9-9-9-27	5-5-5-15
Vendor and model number	Samsung M393B1K70BH1	Samsung M393T1K66AZA-CE6Q0
Type	DDR3 PC3-10600R	DDR2 PC2-5300P

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Servers	Cisco UCS B200 M1 Blade Server	HP ProLiant BL465c G6 Server Blade
Speed (MHz)	1,333	667
Size (GB)	8	8
Number of RAM modules	12	8
Chip organization	Double-sided	Double-sided
Hard disk		
Vendor and model number	Seagate ST9146802SS	HP DG072BAAJA
Number of disks in system	2	1
Size (GB)	146	72
Buffer size (MB)	16	3
RPM	10,000	10,000
Type	SAS	SAS
Controller	LSI Logic SAS1064E	Smart Array E200i
Operating system		
Name	vSphere 4.0	vSphere 4.0
Build number	171294	171294
File system	VMFS	VMFS
Kernel	2.6.18-128.ESX	2.6.18-128.ESX
Language	English	English
Network card/subsystem		
Vendor and model number	Intel 82958BE 10 Gigabit AF Dual Port	NC370i Multifunction Gigabit Ethernet Server Adapter
Type	Integrated	Integrated
Fibre adapter		
Vendor and Model number	QLogic QLA2432	QLogic QMH2462
Type	PCI-Express	4Gb FC HBA Adapter
USB ports		
Number	0	2
Type	N/A	2.0

Figure 7: Detailed configuration information for the blade server systems.

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Appendix B – LoadGen latency result weights

Figure 8 lists the weight values that we added to the relative tasks used in the Outlook 2007 Heavy profile in LoadGen.

Latency95	Weight
BrowseCalendar	1
Logon	0
Logoff	0
SendMail	2
ReadAndProcessMessages	50
MoveMail	0
DeleteMail	0
ExportMail	0
CreateFolder	0
PublicFolderPost	0
BrowsePublicFolder	0
PostFreeBusy	2
RequestMeeting	1
MakeAppointment	1
BrowseContacts	2
CreateContact	1
BrowseTasks	0
CreateTask	0
EditRules	0
DownloadOab	0
EditSmartFolders	0
SynchronizeFolders	0
Search	0
InitializeMailbox	0
UserInit	0
UserTerm	0
ModuleInit	0
ModuleTerm	0
Total	60

Figure 8: The weights we used to generate our latency response time.

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About Principled Technologies

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

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

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

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

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