Principled Technologies®

SMB workload performance comparison: AMD Opteron™ 1389 processor-based Dell PowerEdge T105 vs. Intel processor-based Dell Vostro 220 Mini Tower

Executive summary

Dell Inc. (Dell) and Advanced Micro Devices, Inc. (AMD) commissioned Principled Technologies (PT) to measure the performance of the following two Dell systems running a representative small-business workload on Microsoft® Windows Small Business Server® 2008 Standard Edition:

- A typical small-business server: Dell™ PowerEdge™ T105 server using an AMD Opteron™ 1389 processor and 8GB RAM
- A typical small-business desktop: Dell™ Vostro™ 220 Mini Tower desktop system using an Intel® Core™ 2 Duo Processor E8600 and 4GB RAM

We base our testbed on a common small business scenario; one where the business is currently using an end user's desktop as their server. As the business size and workload increases over time, these desktop-class systems often cannot keep up with the demand from either the underlying server activities or from the productivity applications being run on the local console. This report shows the potential benefit and performance gain a business and end user would receive from upgrading to a server-class system like the Dell PowerEdge T105. Actual results will vary based on specific application- and server-side workloads. We should note that running Windows Small Business Server 2008 on a desktop-class machine is not a recommended configuration. We used Windows Small Business Server 2008 on both machines in order to provide a fair performance comparison between the two systems.

KEY FINDINGS

- The Dell PowerEdge T105 server delivered 90 percent more combined WebBench and LoadGen operations than the Dell Vostro 220 Mini Tower desktop system. (See Figure 1.)

- With the system under load, a user on the Dell PowerEdge T105 server was able to open various productivity applications in a total time of 58.5 seconds, for a time savings of 33.7 percent compared to that of the Dell Vostro 220 Mini Tower desktop system, which required a total time of 88.3 seconds to open these same applications. (See Figure 2.)

Averaged throughput results
Higher results are better

Legend:
- Dell Vostro 220 Mini Tower desktop system using an Intel Core 2 Duo Processor E8600
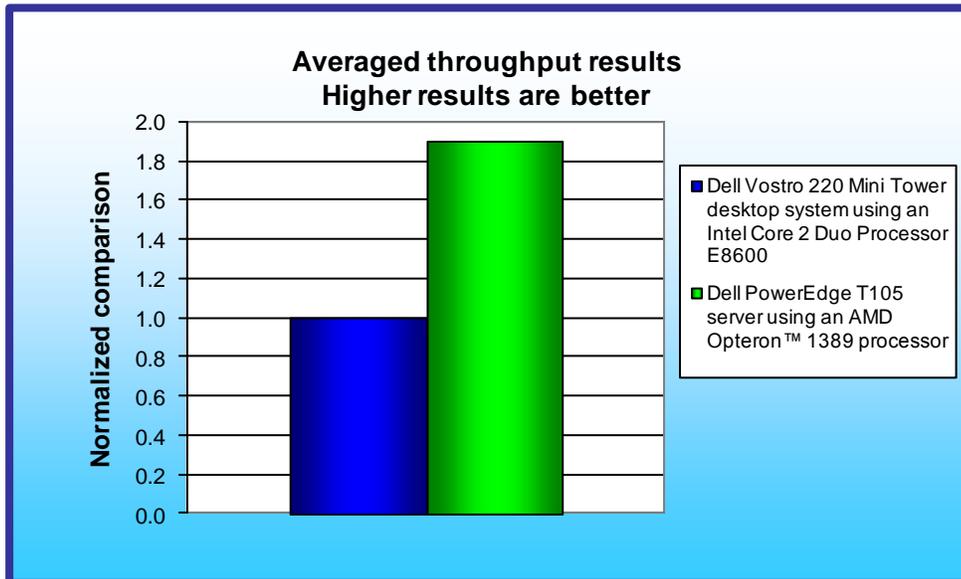- Dell PowerEdge T105 server using an AMD Opteron™ 1389 processor

Figure 1: Averaged throughput results of the test systems across the two benchmarks relative to the Dell Vostro 220 Mini Tower. Higher numbers are better.

To test performance, we simultaneously ran workloads that exercised two characteristic small business functions: Web traffic and email activity. We used WebBench to simulate Web traffic and Microsoft Exchange Load Generator (LoadGen) to simulate email activity. The Workload section provides more benchmark information. We define a small business workload as consisting of between 25 to 75 users, with 50 users as the average.

Additionally, we timed how long several productivity applications took to open on either system while under the same Web and email workload. For this test, we used Microsoft® Word, Microsoft® Excel®, and Adobe® Reader®. Our goal was to show the increase in performance an end user might experience if they were using the Dell PowerEdge T105 server instead of the Dell Vostro 220 Mini Tower desktop system to complete these tasks.

Figure 1 presents averaged throughput results for the Dell PowerEdge T105 server and the Dell Vostro 220 Mini Tower desktop system running the two workloads relative to the lower-performing system, the Dell Vostro 220 Mini Tower. For each workload, we assigned a value of 100 percent to that system's results and then calculated the percentage performance improvement of the Dell PowerEdge T105. This approach makes each data point a comparative number, with higher numbers indicating better performance. Finally, we took the percentage performance improvement over the Dell Vostro 220 Mini Tower for the two benchmarks and averaged them.

As Figure 1 illustrates, the Dell PowerEdge T105 server delivered an average of 90 percent greater performance across the two benchmarks than did the Dell Vostro 200 Mini Tower desktop system.
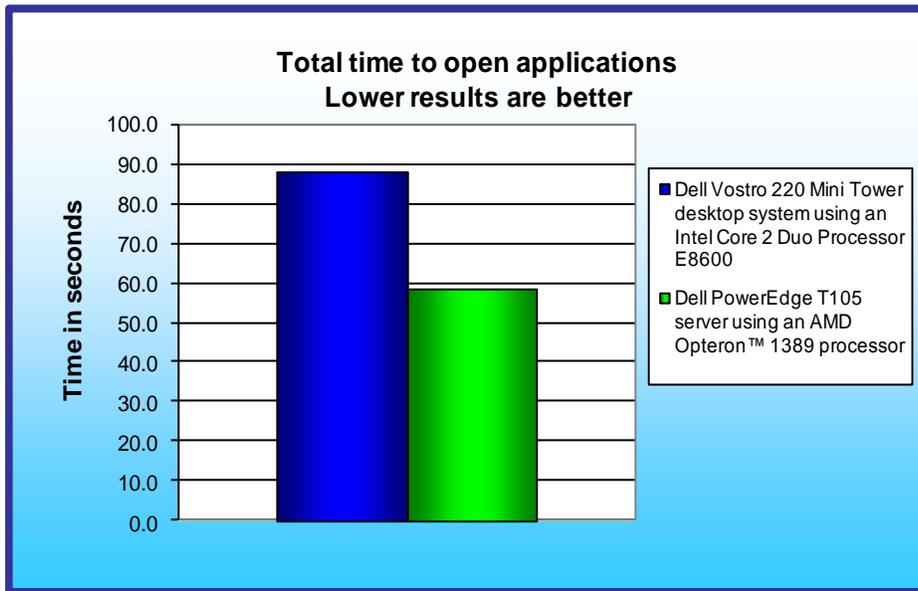

Figure 2: Total time for a user on the test systems to open productivity applications while each test system is under load. Lower numbers are better.

As Figure 2 illustrates, with the system under load, a user on the Dell PowerEdge T105 server took 58.5 seconds to open the productivity applications, for a time savings of 33.7 percent over that on the Dell Vostro 200 Mini Tower desktop system, which required 88.3 seconds to open the productivity applications while under load.

Workload

We ran the following two workloads simultaneously, as a typical small business server might.

WebBench

WebBench 5.0 (128-bit US version) is an industry-standard benchmark for Web server software and hardware. It uses PC clients to send Web requests to a server under test. It generates performance results by incrementally increasing the number of clients making HTTP 1.0 GET requests to the Web server; the result is a curve showing the server's performance under increasing load. The peak of that curve represents the peak throughput of the server. WebBench reports both the total number of requests per second the server handled and the server's total throughput in bytes per second.

We ran the WebBench e-commerce CGI test suite for 40 minutes on both the Dell PowerEdge T105 server and the Dell Vostro 220 Mini Tower desktop system. This suite generates both secure and non-secure static and dynamic requests. While running the e-commerce suite, the clients must negotiate to a secure Web server port using the Secure Socket Layer (SSL) protocol.

A default WebBench test suite incrementally increases the number of clients making the HTTP 1.0 GET requests to the Web server. As the workload increases the number of clients, the Web server's processor utilization also increases, until the clients saturate the processor in the Web server with work. Each workload point with a fixed number of clients is a WebBench "mix." The e-commerce CGI test suite begins with a mix that involves one client; the next mix involves four clients; and each subsequent mix increases the number of clients by four.

We modified the test suite so it would run 10 clients, with 10 engines per client for the entire test. This allowed us to keep a constant Web load on the system. To limit the amount of time WebBench ran, we performed only four mixes for testing. The first two mixes ran for 5 minutes each, while the last two ran for 15 minutes each.

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LoadGen

LoadGen is an industry-standard tool for benchmarking an Exchange 2007 Mail Server. 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.

Our goal was to compare the Microsoft Exchange Server 2007 performance of the Dell PowerEdge T105 server to that of the Dell Vostro 220 Mini Tower desktop system.

Microsoft Exchange Load Generator is a simulation tool that measures the impact that various clients (MAPI, OWA, IMAP, POP, and SMTP) have on Exchange servers. This allows users to test how effectively a server running Exchange responds to e-mail loads. The simulator sends multiple message requests to the server running Exchange, resulting in a mail load.

We ran the Microsoft Exchange Load Generator benchmark in stress mode for 30 minutes on both the Dell PowerEdge T105 server and the Dell Vostro 220 Mini Tower desktop system.

For more details about LoadGen, see http://www.microsoft.com/downloads/details.aspx?FamilyId=DDEC1642-F6E3-4D66-A82F-8D3062C6FA98&displaylang=en.

Additionally, we chose three applications that a user working on a small business server would typically open: Microsoft Word 2007, Microsoft Excel® 2007, and Adobe® Reader®. We timed how long the Dell PowerEdge T105 server and the Dell Vostro 220 Mini Tower took to open a document with these applications while running the WebBench and LoadGen workload. We present our results in the Test results section.

Test results

We staggered the starting times of the benchmarks to allow each system to ramp up slowly. We began the benchmarks in the following order: WebBench and then LoadGen. Figure 3 shows a timeline for the benchmark runs. To obtain the final results, we removed the first parts of the WebBench run, and computed the results based on the 30 minutes of peak performance during the LoadGen run.

To make sure both systems achieved their optimum results, we allowed them to sit idle for 10 minutes before starting the workload.

Figure 3: The timeline we followed when starting the benchmarks for the multiple-benchmark runs on both systems. The shaded areas from 00:10 to 00:40 represent the period during which we measured performance.

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Figure 4 presents results for the systems on the two benchmarks relative to the lower-performing system, the Dell Vostro 220 Mini Tower. For each benchmark, we assigned a value of 100 percent to that system's results and then calculated the percentage performance improvement of the Dell PowerEdge T105. This approach makes each data point a comparative number, with higher numbers indicating better performance. Finally, we took the percentage performance improvement over the Dell Vostro 220 Mini Tower for the two benchmarks and averaged them.

As Figure 4 shows, the Dell PowerEdge T105 server achieved better performance on both benchmarks than did the Dell Vostro 220 Mini Tower desktop system. Each result is the median of three runs. With the exception of CPU utilization, all results are relative to the Dell Vostro 220 Mini Tower. We used LoadGen to determine the median for all runs.

System	Percentage CPU utilization	Normalized Web requests per second*	Normalized messages delivered per second*	Average of Web and email results*
Dell PowerEdge T105	85.9	2.3	1.4	1.9
Dell Vostro 220 Mini Tower	98.3	1.0	1.0	1.0

Figure 4: Performance for the system on the two benchmarks, relative to the Dell Vostro 220 Mini Tower. Higher numbers are better.
* Relative to Dell Vostro 220 Mini Tower

WebBench results

A WebBench run reports the total requests per second a server can perform and the total throughput, in bytes per second, that the server delivered. WebBench reports these results for each mix. To obtain the results we list in Figure 5, we averaged the requests per second and throughput from the mixes that ran during the peak performance of the benchmark run, as Figure 3 illustrates.

Figure 5 shows the WebBench peak results in requests per second and in throughput (bytes per second) for the test systems. Each result is the median of three runs.

Server	Throughput (bytes per second)	Requests per second (raw)	Normalized requests per second*
Dell PowerEdge T105	210,429,903.6	21,561.2	1.4
Dell Vostro 220 Mini Tower	147,128,779.1	15,072.4	1.0

Figure 5: Median WebBench results for the two systems. Higher numbers are better.
* Relative to Dell Vostro 220 Mini Tower

LoadGen results

Figure 6 shows the shows the number of Microsoft Exchange Load Generator messages per second each system delivered during the test. We gathered these results by using the MSExchangeIS Mailbox\Messages Delivered/sec counter in Windows Performance Monitor and averaging the results. Each result is the median of three runs.

Server	Messages delivered per second	Normalized messages delivered per second*
Dell PowerEdge T105	8.5	2.3
Dell Vostro 220 Mini Tower	3.7	1.0

Figure 6: Median LoadGen results for the two systems. Higher numbers are better.
* Relative to Dell Vostro 220 Mini Tower

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Figure 7 shows the time, in seconds, each system took to open the three productivity applications while each system is under load and in a stressed state. Lower numbers are better.

Application	Application open time on the Dell PowerEdge T105 (seconds)	Application open time on the Dell Vostro 220 Mini Tower (seconds)
Microsoft Word 2007	26.3	23.1
Microsoft Excel 2007	21.0	30.5
Adobe Reader	11.2	34.7
Total	58.5	88.3

Figure 7: Time, in seconds, for each system to open the three productivity applications. Lower numbers are better.

Test methodology

Figure 8 summarizes some key aspects of the configurations of the two systems; Appendix A provides detailed configuration information.

Server	Dell PowerEdge T105	Dell Vostro 220 Mini Tower
Processor	AMD Opteron™ 1389 processor	Intel Core 2 Duo Desktop Processor E8600
Processor frequency (GHz)	2.90	3.33
RAM	8 GB (4 x 2 GB) PC2-6400E	4 GB (2 x 2 GB) PC2-6400
Hard drive	2 x 300 GB, SAS	1 x 320 GB, SATA

Figure 8: Key aspects of the system configurations.

For testing, we configured the Dell PowerEdge T105 with redundancy by placing the two hard disks in a RAID 1. The Dell Vostro 220 Mini Tower only had one hard disk, so we could not configure this system with any hard drive redundancy. We used the default BIOS options on both systems for testing.

Test bed configuration

To generate the workload, we used 12 Dell™ PowerEdge™ M600 Blade Servers installed in a Dell™ PowerEdge™ M1000e Modular Blade Enclosure, with two Cisco® Catalyst® Blade Switch M 3130G installed in the back of the enclosure. We configured 10 of the PowerEdge M600 Blade Servers with Microsoft® Windows Server® 2003 R2, Enterprise Edition and WebBench 5.0 client. We used these 10 blades to drive the WebBench workload on both systems under test. On the remaining two Dell PowerEdge M600 Blade Servers, we installed Microsoft Windows Server 2003 R2, Enterprise x64 Edition and Microsoft LoadGen 64-bit. We used one of these two blades for each system under test.

We installed an Intel® PRO/1000 PT Dual Port adapter in the Dell PowerEdge T105 and Dell Vostro 220 Mini Tower for testing. We configured both ports of the adapter with static IP addresses and connected them to one of the Cisco Catalyst M 3130G switches, which we used for WebBench traffic. We connected the integrated network adapter on the Dell PowerEdge T105 and Dell Vostro 220 Mini Tower to the second Cisco Catalyst M 3130G for LoadGen traffic.

We began our testing by installing a fresh copy of Microsoft Windows Small Business Server 2008 on each system. We followed this process for each installation:

1. Accept the default language settings.
2. Click install now.
3. Enter the product key.
4. Click Next.
5. Select a Custom Install.
6. Accept the default settings.
7. Click Next at the Continue Installation screen.
8. Set the time/date to the correct time/date.
9. Fill Out the Company information screen.

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10. Assign the computer a name of `SERVER` and a domain name of `TEST`.
11. Fill out the Add a network administrator account screen with `FIRST` as the first name, `LAST` as the last name, `root` as the Administrator username, and `Password1` as the Administrator password.

OS configuration
1. Open the control panel.
2. Double-click User Accounts.
3. Click on Turn User Account Control on or off.
4. Uncheck the radio box saying, Use User Account Control (UAC) to help protect your computer.

Installing system updates
We installed the following updates using Microsoft Windows update feature:
- Windows Server 2008 Service Pack 2 for x64-based Systems (KB948465)
- Update for Windows Server 2008 x64 Edition (KB957200)
- Update for Windows Server 2008 x64 Edition (KB957321)
- Update for Windows Server 2008 x64 Edition (KB959130)
- Update for Windows Server 2008 x64 Edition (KB972036)
- Update for Windows Server 2008 x64 Edition (KB955430)
- Security Update for Microsoft .NET Framework 2.0 Service Pack 2 (KB972594)
- Update for Windows Server 2008 x64 Edition (KB968389)
- Security Update for Jscript 5.8 for Windows Server 2008 x64 Edition (KB971961)
- Update for Windows Server 2008 x64 Edition (KB952287)
- Security Update for Windows Server 2008 x64-based Systems (KB938464)
- Security Update for Windows Server 2008 x64 Edition (KB949014)
- Security Update for Windows Server 2008 x64 Edition (KB950974)
- Security Update for Windows Mail for Windows Server 2008 x64 Edition (KB951066)
- Security Update for Windows Server 2008 x64 Edition (KB952004)
- Security Update for Windows Server 2008 x64 Edition (KB953733)
- Security Update for Windows Server 2008 x64 Edition (KB954459)
- Security Update for Windows Server 2008 x64 Edition (KB955069)
- Security Update for Windows Server 2008 x64 Edition (KB956572)
- Security Update for Windows Server 2008 x64 Edition (KB956744)
- Security Update for Windows Server 2008 x64 Edition (KB956802)
- Security Update for Windows Server 2008 x64 Edition (KB957097)
- Security Update for Windows Server 2008 x64 Edition (KB958623)
- Security Update for Windows Server 2008 x64 Edition (KB958624)
- Security Update for Windows Server 2008 x64 Edition (KB958644)
- Security Update for Windows Server 2008 x64 Edition (KB958687)
- Security Update for Windows Server 2008 x64 Edition (KB959426)
- Security Update for Windows Server 2008 x64 Edition (KB960225)
- Security Update for Windows Server 2008 x64 Edition (KB960803)
- Security Update for Windows Server 2008 x64 Edition (KB960859)
- Security Update for Windows Server 2008 x64 Edition (KB961063)
- Security Update for Windows Server 2008 x64 Edition (KB961371)
- Security Update for Windows Server 2008 x64 Edition (KB961501)
- Security Update for Windows Server 2008 x64 Edition (KB967723)
- Security Update for Windows Server 2008 x64 Edition (KB968537)
- Security Update for Windows Server 2008 x64 Edition (KB970238)
- Security Update for Windows Server 2008 x64 Edition (KB971557)
- Security Update for Windows Server 2008 x64 Edition (KB971657)
- Security Update for Microsoft .NET Framework 2.0 Service Pack 1 (KB972593)
- Security Update for Windows Server 2008 x64 Edition (KB973507)

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- Update for Windows Server 2008 x64 Edition (KB951978)
- Update for Windows Server 2008 for x64-based Systems (KB955020)
- Update for Windows Server 2008 x64 Edition (KB955302)
- Update for Windows Server 2008 x64 Edition (KB970653)
- Internet Explorer 8 for Windows Server 2008 x64 Edition
- Cumulative Security Update for ActiveX Killbits for Windows Server 2008 x64 Edition (KB973346)
- Update to .NET Framework 3.5 Service Pack 1 for the .NET Framework Assistant 1.0 x64 (KB963707)
- Windows SharePoint Services 3.0 Service Pack 2 for x64 Edition (KB953338)
- Microsoft .NET Framework 3.5 Service Pack 1 and .NET Framework 3.5 Family Update (KB951847) x64
- Windows Update Agent 7.4.7600.226

Installing and configuring the mail server

Due to the nature of Microsoft Windows Small Business Server 2008, all components for the mail server are setup upon initial installation of the OS.

Installing and configuring the Web server

Deploying WebBench data

WebBench includes data that must reside on the server and that the Web server must use. We loaded that data and set the Web server to use it with the following procedure:

1. Copy the file wbtree.exe from the WebBench CD to the wwwroot directory on the system under test. (The wbtree.exe file is on the WebBench CD at \wb50\workload.)
2. On the system, execute the wbtree.exe file. This program copies the WebBench workload to the system.
3. In the wwwroot folder on the system, create a new folder with the name CGI-BIN.
4. Copy the file simcgi.exe to the CGI-BIN folder.
5. Click Start→Programs→Administrative Tools→Computer Management to open the management console.
6. Navigate to Services and Application→Internet Information Services (IIS) Manager→ServerName.
7. Click ISAPI and CGI Restrictions.
8. Click Add.
9. Enter the path for the simcgi.exe, and click the radio box saying allow extension path to execute.

Configuring Internet Information Services (IIS)

We configured the Windows Internet Information Services Web server as follows:

1. Open Computer Management.
2. Navigate to Services and Application→Internet Information Services (IIS) Manager→ServerName.
3. Click MIME Types.
4. In the MIME Types window, click Add.
5. In the File name extension field, type *.
6. In the MIME type field, type application/octet-stream, and click OK.
7. Click OK to exit the MIME Types window.
8. In the Computer Management window, select Services and Application→Internet Information Services (IIS) Manager→ServerName.
9. Click ISAPI and CGI Restrictions.
10. Click Edit Feature Settings.
11. Click the radio boxes Allow unspecified CGI module and Allow unspecified ISAPI modules.
12. Click OK.
13. Navigate to Services and Application→Internet Information Services (IIS) Manager→ServerName.
14. Double-click Logging.
15. Click Disable.

Installing certificate services

Because WebBench includes tests that involve security, we installed Windows Certificate Services as follows:

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1. Navigate to Services and Application→Internet Information Services (IIS) Manager→ServerName.
2. Click Server Certificates.
3. Click Create Self-Signed Certificate.
4. Name it `Performance`, and click OK.
5. Navigate to Services and Application→Internet Information Services (IIS) Manager→ServerName→Sites→Default Web Site.
6. Click Bindings....
7. Click Add.
8. Set the type to https, and set the SSL Certificate to Performance.
9. Click Yes when the warning pops up.
10. Click Close.

Creating SSL Communication
Finally, we had to enable SSL communication as follows:

1. Navigate to Services and Application→Internet Information Services (IIS) Manager→ServerName.
2. Expand the Default Web site.
3. Expand wbtree.
4. Click Wbssl.
5. Click SSL Settings.
6. Check Require secure channel (SSL).
7. Check Require 128-bit encryption.
8. Click Apply.

We then set the following operating system tuning parameters to reflect the WebBench recommendation in the Microsoft performance Tuning Guidelines for Windows Server document, which is available on Microsoft's Web site here: http://www.microsoft.com/whdc/system/sysperf/Perf_tun_srv.mspx. When creating the following parameters, ensure that they are DWORD files, with decimal coding (rather than hexadecimal):

- HKLM\System\CurrentControlSet\Services\Inetinfo\Parameters\MaxCachesFileSize to 1048576
- HKLM\System\CurrentControlSet\Services\HTTP\Parameters\UriMaxUriBytes to 1048576
- HKLM\System\CurrentControlSet\Control\FileSystem\NtfsDisableLastAccess to 1
- HKLM\System\CurrentControlSet\Services\Tcpip\Parameters\MaxHashTableSize to 65535

Installing the mail test client
We began our testing by installing a fresh copy of Microsoft® Windows Server® 2003 R2, Enterprise x64 Edition Service Pack 2 on the client. Before following these instructions, make sure to statically assign an IP address for the client, and then plug that port into the system under test. This allows the client to correctly join the domain. We followed this process for each installation:

1. Assign a computer name of `Clientx` for the mail client, where `x` is the client number.
2. For the licensing mode, use the default setting of five concurrent connections.
3. Enter a password for the administrator log on.
4. Select Eastern Time Zone.
5. Use typical settings for the Network installation.
6. Use Test for the workgroup.

To set up this server, we had to install several additional software components. The following subsections detail the necessary installation processes.

Joining the domain
1. Right-click My Computer, and select Properties.
2. Under the Computer Name tab, click Change.
3. In the Computer Name Changes window, under the Member of section, select the Domain radial box, and type `test`.

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4. Select OK to start joining the domain.
5. When the window appears asking for a person qualified on the domain, type `root` as the username and `Password1` as the password.
6. Click OK at the welcome pop-up window and the window warning that you must reset the computer for the changes to take effect.
7. Click OK in the System Properties window.
8. When a pop-up appears asking if you want to restart now, click Yes to restart your computer.

Installing Internet Information Services 6.0
1. Select Start→Control Panel→Add or Remove Programs.
2. Click Add/Remove Windows Components.
3. Click Active Directory Services, and make sure a check appears in the check box.
4. Select Application Servers, and click Details.
5. Select Internet Information Services (IIS), and click Details.
6. Click NNTP Services and SMTP Services, make sure a check appears in both check boxes, and click OK.
7. Click OK to close the Application Server window.
8. At the Windows Components Wizard, click Next to begin the installation.
9. When the system prompts you to do so, insert the OS CD, and click OK.
10. At the Completing the Windows Components Wizard window, click Finish.
11. Close the Add or Remove Programs window.

Installing Exchange Server 2007 and Load Generator
1. Insert the Microsoft Exchange Server 2007 CD. The CD should automatically launch the installation software.
2. Click the link to Step 1: Install .NET Framework 2.0.
3. When you arrive at the download link, download the x64 version of the .NET Framework, and install.
4. Click the link to Step 3: Install Microsoft Windows PowerShell to open the download link.
5. When you arrive at the download link, download Microsoft Windows PowerShell, and install with defaults.
6. Search for and download .NET 2.0 SP1 x64.
7. Install SP1 with all defaults.
8. Click the link to Step 4: Install Microsoft Exchange Server 2007 SP1.
9. Click Next to go past the introduction screen.
10. Accept the license agreement, and click Next.
11. Select No for error reporting, and click Next.
12. Select Custom Exchange Server Installation, and click Next.
13. Check Management Tools, and click Next.
14. After the check finishes, click Install to start the installation process.
15. Once installation is complete, click Finish.
16. Download and install Load Generator using all defaults.

Preparing Load Generator
1. Select Start→All Programs→Microsoft Exchange→Exchange Load Generator.
2. When the Load Generator window appears, select Start a new test.
3. Select Create a new test configuration, and click Continue.
4. In the Specify test settings window, type `Password1` as the Directory Access Password and the Mailbox Account Master Password, and click Continue with recipient management.
5. Make 50 users in the Mailbox Database, and click Continue.
6. To accept defaults for Advanced recipient settings, click Continue.
7. In the Specify test user groups window, select the plus sign to add a user group.
8. Change the Client Type to Outlook 2007 Online and the Action Profile to Average, and click Continue.
9. Leave defaults in Remote configurations, and click Continue.
10. Click Save the configuration file as, and name it `Loadgencfg`.
11. Click Start the initialization phase (recommended before running the test) to start initialization. The initialization process might take a few hours.

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Backing up the mail database

On the test server, once you have set up LoadGen and created its initial mail database, you need to back up that database so you can have clean copies for each test. Use this process to back up that database.

1. Select Start→All Programs→Microsoft Exchange Server 2007→Exchange Management Console in the mail server.
2. In the left pane, under Server Configuration, click Mailbox.
3. In the right pane, right-click Mailbox Database, and select Dismount Database from the menu.
4. Click Yes on the Do you want to continue? pop-up message.
5. Right-click Public Folder Database, and select Dismount Database from the menu.
6. Click Yes on the Do you want to continue? pop-up message. The red arrow appears when you've dismounted the Public Folder Store.
7. Using Windows Explorer, create two new folders C:\backup\mailstore and C:\backup\publicstore.
8. With Windows Explorer, copy all files from C:\Program Files\Microsoft\Exchange Server\Mailbox\First Storage Group to C:\backup\mailstore and all the files from C:\Program Files\Microsoft\Exchange Server\Mailbox\Second Storage Group to C:\backup\publicstore. This process may take several minutes.
9. Close Windows Explorer.
10. In Exchange Management Console, right-click Mailbox Database, and select Mount Database from the menu.
11. Right-click the Public Folder Database, and select Mount Database from the menu.
12. Close Exchange System Manager.

Setting up the run tests for additional applications

We used the following steps to perform each test.
1. Restart the Web Controller, Web clients, and Mail client.
2. Wait for everything to reboot.
3. Double-click the Web Controller shortcut on the desktop.
4. Navigate to the top bar and click Clients→Start Log In…
5. Restart all of the web clients.
6. Wait for all of the web clients to appear on the left side of the WebBench Controller Program.
7. Click OK.
8. Click Yes when the application prompts you if you would like to add a test suite.
9. Select ecommerce_cgi_template.tst
10. Give the run an appropriate name (e.g.: WB_Run1).
11. Click OK.
12. Open Exchange Load Generator on the Mail client.
13. Click Start a new test.
14. Select the radio button for Use the following saved configuration file.
15. Click Browse, and select the file 50users_average.xml.
16. Click OK, and click Continue.
17. In the Specify test settings screen, click Skip recipient management and continue with user group configuration
18. In the Specify test user groups screen, leave default options selected, and click Continue.
19. In the Remote configurations screen, click Continue.
20. Stop at the Configuration summary screen.
21. Wait 10 minutes to allow all processes to finish loading on the server.
22. Click Yes at the Would you like to start executing the test suites screen.
23. Let WebBench run for 10 minutes before starting LoadGen.
24. In the Configuration summary screen, click Skip the initialization phase and run the simulation immediately to begin LoadGen.

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Hand timing

Setting up the test workload
We used a specific test workload of three productivity applications a user would typically open on a small business server: Microsoft Word 2007, Microsoft Excel 2007, and Adobe Reader. We describe the initial setup of the test workload below.

For testing, we used the following files:
- Excel document: ftpbox.us.dell.com/slg/californ/dellware.xls
- Word document: www.dell.com/downloads/global/solutions/OMSA_Event_Management_System.doc
- PDF document: support.dell.com/support/edocs/systems/per710/multilang/GSG/DAO_BCC/YX389A01.zip

Setting up the test workload on the test system
1. Copy the Word file, the Excel file, and the PDF file onto the desktop of the system.

Opening a Microsoft Word file
This test requires a stopwatch. We used the OMSA_Event_Management_System_Mod.doc test document.

Setting up the test
1. Allow the system to idle for 5 minutes before starting the benchmarks.
2. Allow WebBench to run for 10 minutes, start LoadGen, and wait for 5 minutes before running the test.

Running the test
1. Right-click the OMSA_Event_Management_System_Mod.doc file, and place the cursor over Open.
2. Simultaneously click to open the test document and start the timer.
3. Stop the timer when the status bar displays the correct number of pages in the lower left corner of the window.
4. Close Microsoft Word 2007.

Opening a Microsoft Excel file
This test requires a stopwatch. We used the dellware_mod.xls test document.

Setting up the test
1. Allow the system to idle for 5 minutes before starting the benchmarks.
2. Allow WebBench to run for 10 minutes, start LoadGen, and wait for 5 minutes before running the test.

Running the test
1. Right-click the dellware_mod.xls file, and place the cursor over Open.
2. Simultaneously click to open the test document and start the timer.
3. Stop the timer when the spreadsheet finishes loading.
4. Close Microsoft Excel 2007.

Opening an Adobe Reader file
This test requires a stopwatch. We used the YX389A01.pdf test document.

Setting up the test
1. Open the YX389A01.pdf file, and maximize the window.
2. In the left hand pane, click the Pages icon so that the page previews are showing.
3. Expand the left hand preview pane until all of the pages in the document are visible.
4. Navigate to Edit, Preferences.
5. In the Preferences window, select Documents under Categories, and click to check the Restore last view settings when reopening documents box.
6. Close Adobe Reader, and restart the system.
7. Allow the system to idle for 5 minutes before starting the benchmarks.
8. Allow WebBench to run for 10 minutes, start LoadGen, and wait for 5 minutes before running the test.

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Running the test

1. Right-click the YX389A01.pdf file, and place the cursor over Open.
2. Simultaneously click to open the test document and start the timer.
3. Stop the timer when all of the pages have loaded in the preview pane.
4. Close Adobe Reader.

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Appendix A – Test system configuration information

Figure 9 provides detailed configuration information about each of the test server systems, which we list in alphabetical order.

Servers	Dell PowerEdge T105	Dell Vostro 220 Mini Tower
General		
Number of processor packages	1	1
Number of cores per processor package	4	2
Number of hardware threads per core	1	1
System power management policy	Balanced	Balanced
Power Supplies		
Total number	1	1
Wattage of each (W)	305	300
CPU		
Vendor	AMD	Intel
Name	AMD Opteron™ 1389 processor	Core 2 Duo Desktop Processor E8600
Stepping	C2	E0
Socket type	AM3	LGA775
Core frequency (GHz)	2.90	3.33
Front-side bus frequency (MHz)	2,200	1,333
L1 cache (KB)	512	128
L2 cache (MB)	2	6
L3 cache (MB)	6	N/A
Platform		
Vendor and model number	Dell PowerEdge T105	Dell Vostro 220 Mini Tower
Motherboard model number	0P957K	G45M03
Motherboard revision number	A01	A00
BIOS name and version	Dell 1.4.4 (7/30/2009)	Dell 1.2.0 (6/26/2009)
BIOS settings	Default	Default
Memory module(s)		
Vendor and model number	Hynix HYMP125U72CP8-S6	Corsair CM2X22048-6400C5
Type	PC2-6400E	PC2-6400
Speed (MHz)	800	800
Speed in the system currently running @ (MHz)	800	800
Timing/latency (tCL-tRCD-iRP-tRASmin)	6-6-6-18	5-5-5-18
Size (GB)	2	2
Number of RAM modules	4	2
Chip organization	Dual-sided	Dual-sided
Hard disk		
Vendor and model number	Seagate ST3300656SS	Seagate ST3320418AS
Number of disks in system	2	1
Size (GB)	300	320
Buffer size (MB)	16	16

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Servers	Dell PowerEdge T105	Dell Vostro 220 Mini Tower
RPM	15,000	7,200
Type	SAS	SATA
Controller	Dell SAS 6/iR Adapter Controller	Intel ICH10 Family 6 Port SATA AHCI Controller
Controller driver	LSI Corp. 1.29.3.0 (10/14/2008)	Intel 7.0.0.1000 (2/25/2008)
Operating system		
Name	Windows Small Business Server 2008 Standard x64	Windows Small Business Server 2008 Standard x64
Build number	6002	6002
Service Pack	2	2
File system	NTFS	NTFS
Kernel	ACPI x64-based PC	ACPI x64-based PC
Language	English	English
Microsoft DirectX version	10	10
Graphics		
Vendor and model number	ATI ES 1000	Intel GMA X4500HD
Type	Integrated	Integrated
Resolution	1,280 x 1,024	1,280 x 1,024
Driver	Microsoft 6.0.6001.18000 (6/21/2006)	Microsoft 6.0.6001.18000 (6/21/2006)
Network card/subsystem		
Vendor and model number	Broadcom NetXtreme Gigabit Ethernet BCM 5722	Realtek Gigabit Ethernet RTL8168/8111
Type	Integrated	Integrated
Driver	Broadcom 12.2.2.1 (8/6/2009)	Realtek 6.226.729.2009 (7/29/2009)
Additional network adapter	Intel PRO/1000 PT Dual Port Adapter EXPI9402PT	Intel PRO/1000 PT Dual Port Adapter EXPI9402PT
Type	PCI-Express	PCI-Express
Driver	Intel 9.12.36.0 (7/8/2009)	Intel 9.12.36.0 (7/8/2009)
Optical drive		
Vendor and model number	Dell DH-16D5S	Dell DH20N
Type	DVD-ROM	DVD-ROM
USB ports		
Number of ports	Dell DH-16D5S	Dell DH20N
Type of ports (USB 1.1, USB 2.0)	DVD-ROM	DVD-ROM

Figure 9: Detailed system configuration information for the two systems.

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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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