



## Performance of Dell and HP servers running Windows Small Business Server 2008

### Executive summary

Dell Inc. (Dell) commissioned Principled Technologies (PT) to measure the performance of a Dell and an HP server running Microsoft's Windows Small Business Server 2008 (SBS2008):

- Dell PowerEdge T300
- HP ProLiant ML310 G5

We simultaneously ran workloads that simulated three of the functions a typical small business server may have to handle: Web, email, and database service. We used WebBench to simulate Web traffic, Microsoft Exchange Load Generator (LoadGen) to simulate email activity, and SysBench to simulate the database activity. The Workload section provides more information on each of the benchmarks.

Figure 1 presents averaged results for the two servers running SBS2008 on the three workloads relative to the lower-performing server, the HP ProLiant ML310 G5. For each benchmark, we assigned a value of 100 percent to that server's results and then calculated the percentage performance improvement of the Dell PowerEdge T300. This approach makes each data point a comparative number, with higher numbers indicating better performance.

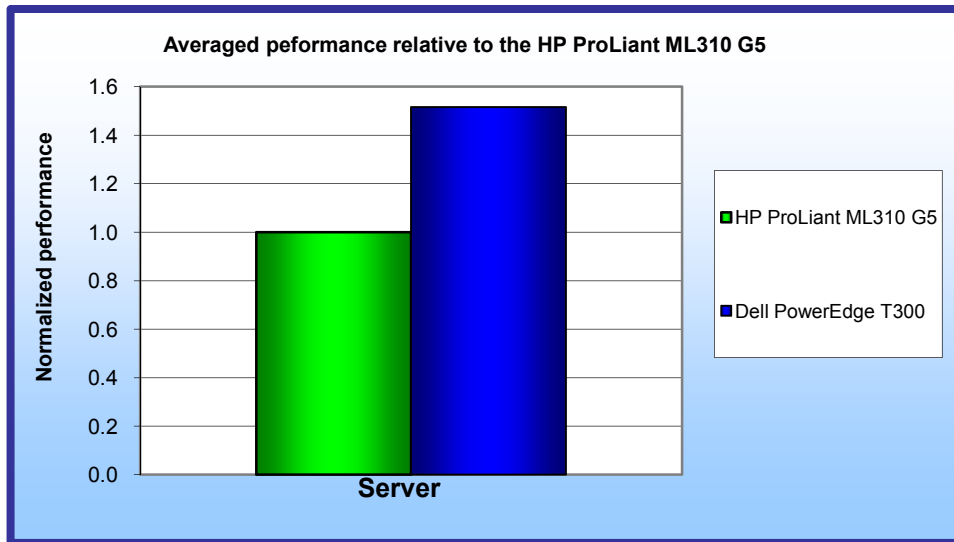


Figure 1: Averaged performance of the two test servers running SBS2008 across the three benchmarks relative to the HP ProLiant ML310 G5. Higher numbers are better.

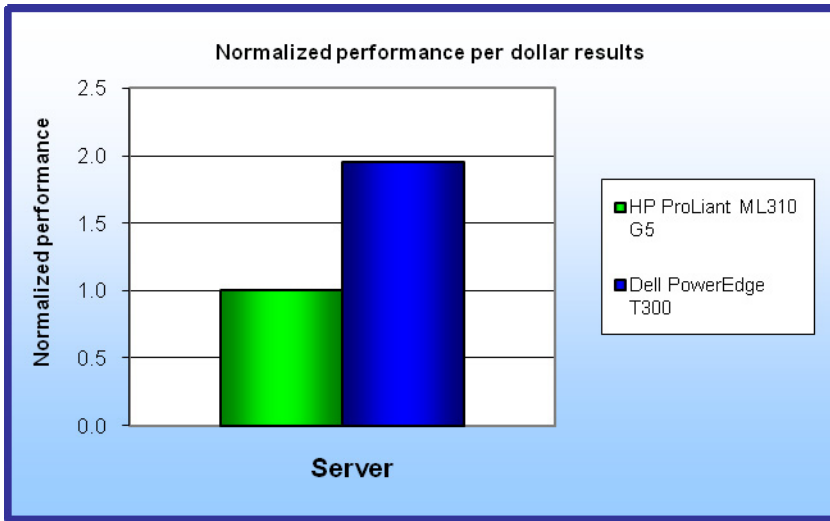
### KEY FINDINGS

- The Dell PowerEdge T300 delivered an average of 51.6 percent better performance across the three workloads on Windows Small Business Server 2008 than did the HP ProLiant ML310 G5 (see Figure 1).
- The Dell PowerEdge T300 produced a 95.1 percent higher performance-per-dollar result across the three workloads on Windows Small Business Server 2008 than the HP ProLiant ML310 G5 (see Figure 2).

Finally, we took the percentage performance improvement over the HP ProLiant ML310 G5 for the three benchmarks and averaged them.

As Figure 1 illustrates, while running SBS2008, the Dell PowerEdge T300 delivered an average of 51.6 percent better performance across the three benchmarks than did the HP ProLiant ML310 G5.

For each of the two servers, we took the averaged relative performance results in Figure 1 and divided them by the price (see Appendix B). For ease of comparison,



**Figure 2: Normalized performance-per-dollar result of the test servers running SBS2008 across the three benchmarks. Higher numbers are better.**

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. To be certain that we found the true peak performance in our testing, we verified that the server's processor utilization reached or was extremely close to 100 percent during the test.

### LoadGen

Microsoft Exchange LoadGen 2007 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.

### SysBench

The developers at SourceForge.net ([www.sourceforge.net](http://www.sourceforge.net)) created SysBench to test various aspects of the performance of servers running database systems. The benchmark's original target was the MySQL database system (see [www.mysql.com](http://www.mysql.com)). Intel created a version of SysBench 0.4.0 that would work with Microsoft SQL Server 2005 Enterprise Edition ([www.microsoft.com/sql/editions/enterprise/default.mspx](http://www.microsoft.com/sql/editions/enterprise/default.mspx)). We ran that version in our test. SysBench created a 100,000-row SQL database and executed a batch of online transaction processing (OLTP) transactions against that data.

## Test results

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

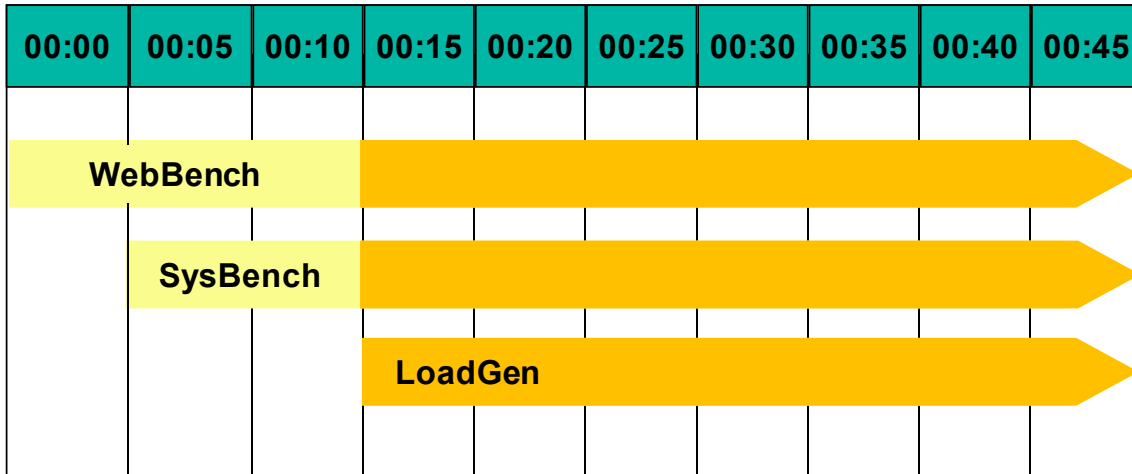
we then normalized those results to that of the HP ProLiant ML310 G5. As Figure 2 illustrates, the Dell PowerEdge T300 produced a 95.1 percent higher performance-per-dollar result running SBS2008 than the HP ProLiant ML310 G5.

## Workload

### 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

**Multiple benchmark timeline  
45 minutes total time**



**Figure 3: The timeline we followed when starting the benchmarks for the multiple-benchmark runs on all servers. The shaded areas from 00:15 to 00:45 represent the period that we measured performance.**

Figure 4 presents results for the two servers on the three benchmarks relative to the lower-performing server, the HP ProLiant ML310 G5. For each benchmark, we assigned a value of 100 percent to that server's results and then calculated the percentage performance improvement of the Dell PowerEdge T300. This approach makes each data point a comparative number, with higher numbers indicating better performance. Finally, we took the percentage performance improvement over the HP ProLiant ML310 G5 for the three benchmarks and averaged them.

As Figure 4 shows, the Dell PowerEdge T300 running SBS2008 achieved better performance on all benchmarks than the HP ProLiant ML310 G5. Each result below is the median of three runs. We used LoadGen to determine the median for all runs.

Server	Percentage CPU utilization	Web requests per second (relative to HP ProLiant ML310 G5)	Email response time (relative to HP ProLiant ML310 G5)	Database transactions per second (relative to HP ProLiant ML310 G5)	Average of Web, email, and database scores (relative to HP ProLiant ML310 G5)
Dell PowerEdge T300	98.0	107.4%	145.2%	202.2%	151.6%
HP ProLiant ML310 G5	99.0	100.0%	100.0%	100.0%	100.0%

**Figure 4: Performance relative to the HP ProLiant ML310 G5 for the two servers on the three benchmarks. Higher numbers are better.**

**WebBench results**

We ran WebBench's default ecommerce API test suite, which generates both secure and non-secure static and dynamic HTTP 1.0 GET requests. While running the ecommerce 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 processor in the Web server is saturated with work. Each workload point with a fixed number of clients is a WebBench "mix." The ecommerce API test suite begins with a mix that involves one client; the next mix has four clients, and each subsequent mix increases the number of clients by four to a total of 60 clients. We modified the test suite so it

would run eight clients with 10 engines per client for the entire test. This allowed us to keep a constant Web load on the server. We performed the standard 16 mixes for testing.

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 below, we averaged the requests per second and throughput from the mixes that ran during the peak performance of the benchmark run as illustrated in Figure 3.

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

Server	Throughput (bytes per second)	Requests per second (raw)	Requests per second (relative HP ProLiant ML310 G5)
Dell PowerEdge T300	145,744,417.8	9,355.6	107.4%
HP ProLiant ML310	138,050,593.2	8,714.8	100.0%

Figure 5: Median WebBench results for the two servers. Higher numbers are better.

### LoadGen results

LoadGen results show the response time each for each server, the time in milliseconds it took to complete a request. Because the object of the server is to handle as many requests as possible, lower scores, which show a server able to handle more requests in a given time, are better. Because the results are in response time for each tasks, we created a weighted average to calculate a final score. To create a weighted average, we used the same procedure used in Microsoft Exchange Server 2003 Load Simulator (LoadSim), another tool used to test Exchange Mail Servers that Microsoft has replaced with LoadGen. Figure 6 shows the weighted average we used for testing.

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

Figure 6: Weighted average for LoadGen tasks.

People usually run LoadGen tests on servers with large disk storage systems, i.e., a large number of total disk drives. Because our testing focused on small business servers, which do not typically have a large number of disks, the scaling between the servers was not as good as the other benchmarks. The systems were mostly bottlenecked waiting on the disk, prohibiting a large amount of scaling. This bottleneck created an inverse relationship between SysBench and LoadSim results: as SysBench scores increased, LoadSim scores dropped and vice versa.

For testing we used 75 Microsoft Exchange mailboxes; all of the servers could handle the load while performing other tasks. Figure 7 shows the average response time for both systems. Each result is the median of three runs.

Server	Average response time (in seconds)	Median 95th percentile (relative to HP ProLiant ML310 G5)
Dell PowerEdge T300	402.1	145.2%
HP ProLiant ML310 G5	733.6	100.0%

Figure 7: Median LoadGen results for the two servers. Lower response time is better.

### SysBench results

For testing, we created a script so each system would perform as many transactions as possible in a given time. The script processed 10,000 transactions as quickly as possible and then started over again. The output shows the completion time in seconds for each group of 10,000 transactions. We calculated the transactions per second by using the following formula:

$$\frac{\text{total transactions}}{\text{time in seconds}} = \text{transactions per second}$$

Figure 8 shows the median SysBench results and processor utilization for the two test servers. Each result below is the median of three runs.

Server	Completion time (seconds)	Transactions completed	Transactions per second	Transactions per second (relative to HP ProLiant ML310 G5)
Dell PowerEdge T300	30:00	1,544,577	858.1	202.2%
HP ProLiant ML310	30:00	763,768	424.3	100.0%

Figure 8: Median SysBench results for the two servers. Higher numbers are better.

### Test methodology

Figure 9 summarizes some key aspects of the configurations of the two server systems; Appendix A provides detailed configuration information.

Server	Dell PowerEdge T300	HP ProLiant ML310 G5
Processor frequency (GHz)	3.16	3.00
Front-side bus frequency (MHz)	1,333	1,333
Processors	Intel Xeon X5460	Intel Xeon X3370
Motherboard chipset	Intel 5100	Intel 3200
RAM (8 GB in each)	PC2-5300 FB-DIMM	PC2-6400
Hard drive	4 x 73GB SAS	4 x 73GB SAS
NICs	2 x Broadcom NetXtreme Gigabit Ethernet	HP NC326i PCIe Dual Port Gigabit Server Adapter

Figure 9: Key aspects of the server configurations.

Dell configured both servers, and PT purchased them.

We began our testing by installing a fresh copy of Windows Small Business Server 2008 on each server. 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. Click "Do not get the most recent installation updates."
10. Fill Out the "Company information" screen.
11. Assign the computer a name of ORANGESERVER and a domain name of ORANGE.
12. Fill out the "Add a network administrator account screen" with ro as the first name, ot as the last name, root as the Administrator use name and Passw0rd as the Administrator password.

### General OS Stuff

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

### Installing and configuring the mail server

Due to the nature of Windows SBS2008, 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 wbtrees.exe from the WebBench CD to the wwwroot directory on the server under test. (The wbtrees.exe file is on the WebBench CD at \wb50\workload).
2. On the server, execute the wbtrees.exe file. This program copies the WebBench workload to the server.
3. In the wwwroot folder on the server, create a new folder with the name CGI-BIN.
4. Copy the file simisapi.dll to the CGI-BIN folder.
5. Click Start→Programs→Administrative Tools→Computer Management to open the management console.
6. Go to Services and Application→Internet Information Services (IIS) Manager→ServerName.
7. Click ISAPI and CGI Restrictions.
8. Click Add.
9. Put in the path for the simisapi.dll 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. Go 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 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, go to Go to 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 beside Allow unspecified CGI module and Allow unspecified ISAPI modules.
12. Click OK.
13. Go 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:

1. Go to Services and Application→Internet Information Services (IIS) Manager→ServerName.
2. Click on Server Certificates.
3. Click on Create Self-Signed Certificate.
4. Name it Performance, and click OK.
5. Go 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 OK.

## Creating SSL Communication

Finally, we had to enable SSL communication as follows:

1. Go to Computer and Application→Internet Information Services (IIS) Manager→ServerName.
2. Expand the Default Web site.
3. Expand wbtrees.
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 for optimum WebBench performance. 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 and configuring the database server

### Creating the test database and generating data

1. Select Start→Microsoft SQL Server 2005→SQL Server Management Studio.
2. Click Connect to connect to the server.
3. Right-click the Database folder in the left window, and select New Database from the pop-up menu.
4. In the Database name field, type `sbtest`, and click OK.
5. Open a command prompt by selecting Start→Run, type `cmd`, and click OK.
6. In the command prompt, type `cd\` to change to C:\.
7. To prepare the database, type `sysbench.exe --test=oltp --sql-host=ORANGESERVER\SBSMONITORING --oltp-table-size=100000 prepare`, and press Enter.
8. When the command finishes, the C:\ prompt appears.
9. Type `exit`, and press Enter to close the command prompt.
10. In SQL Server 2005 Management Studio, stop the database service by right-clicking server in the left window pane, and then select Stop from the drop-down menu.
11. Using Windows Explorer, create the folder C:\sysbench\_backup.
12. With Windows Explorer, copy all sbtest files from C:\Program File (x86)\Microsoft SQL Server\MSSQL.1\MSSQL\Data\ to c:\sysbench\_backup. (You should see two files: sbtest.mdf and sbtest\_log.ldf.)
13. Close Windows Explorer once the copy completes.
14. Restart the database service using SQL Server 2005 Management Studio by right-clicking server and selecting Start.

### Installing the mail test client

We began our testing by installing a fresh copy of Microsoft Windows Server 2003 R2 x64, Enterprise Edition Service Pack 2 on the test 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 "Testbed" 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 orange.
4. Select OK to start joining the domain.
5. When the window appears asking for a person qualified on the domain, enter root as the username and Password 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. Select Application Servers, and click Details.
4. Click Active Directory Services, and make sure a check appears in the check box.
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 be sent to 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 `Passw0rd` as the Directory Access Password and Mailbox Account Master Password, and click Continue with recipient management.
5. Make 100 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 MMB4, 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.

### Back up the mail database

On the test server, once you've 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.

### Run Methodology

#### WebBench

1. Restart the Web Controller.
2. Double-Click the Web Controller shortcut on the desktop.
3. Go to the top bar and click Clients->Start Log In...
4. Restart all of the Web Clients.
5. Wait for all of the Web Clients to show up on the left side of the WebBench Controller Program.
6. Click OK.
7. Click Yes when prompted if you would like to add a test suite.
8. Select Bermuda 8 client `ecommerce_api_template.tst`
9. Give the run an appropriate name (IE: `Orange_WB_Run1`)
10. Click OK.
11. Leave the Screen sitting at "Would you like to start executing the test suites" screen.

#### LoadGen

1. Restart the Mail Client.

2. Leave the screen sitting when it boots up.

### **SysBench**

1. Restart the system under test.
2. Let the SUT idle for 10 minutes
3. Run `c:\sysbench_run1.cmd`
4. Start WebBench when the script tells you to.
5. LoadGen and SysBench will kick off automatically in the next 15/30 minutes respectively.
6. Run the `restore_all` script between each run.

### **Network test bed configuration**

To generate the workload, we used a network with 10 client PCs. Each PC contained an Intel Pentium 4 3.0GHz with HT Technology processor, 512MB of system memory, a 40GB hard drive, and a Gigabit Ethernet network adapter.

We split eight of the clients into two segments, or subnets, of four clients each. We configured these clients with Windows XP Professional with Service Pack 2 and all critical updates available as of June 7, 2007. We connected each segment to the server under test via one NETGEAR GS724T Gigabit Smart Switch. To balance the load on the server and to prevent a network throughput bottleneck, we connected each segment to a separate network port. We used the remaining two clients for the WebBench controller and LoadGen client.

## Appendix A – Test system configuration information

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

Servers	Dell PowerEdge T300	HP ProLiant ML310 G5
<b>General</b>		
Number of processor packages	1	1
Number of cores per processor package	4	4
Number of hardware threads per core	1	1
System power management policy	Always on	Always on
<b>CPU</b>		
Vendor	Intel	Intel
Name	Intel Xeon X5460	Intel Xeon X3370
Stepping	6	A
Socket type	Socket 771 LGA	Socket 775 LGA
Core frequency (GHz)	3.16	3.00
Front-side bus frequency (MHz)	1,333	1,333
L1 cache	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)
L2 cache	12 MB (2 x 6 MB)	12 MB (2 x 6 MB)
<b>Platform</b>		
Vendor and model number	Dell	HP
Motherboard chipset	Intel 5100	Intel 3200
BIOS name and version	Dell 1.2.0 (04/07/2008)	HP W05 (06/20/2008)
BIOS settings	Default	Default
Chipset INF driver	Intel 8.6.0.1007	NA
<b>Memory module(s)</b>		
Vendor and model number	Samsung M393T5160CZA-CE6	Micron Technology MT18HTF25672AY-800E1
Type	PC2-5300 FB-DIMM	PC2-6400
Speed (MHz)	667	800
Speed in the system currently running @ (MHz)	667	800
Timing/latency (tCL-tRCD-iRP-tRASmin)	5-5-5-12	5-6-6-18
Size	8,192 MB	8,192 MB
Number of RAM modules	2 x 4,096 MB	4 x 2,048 MB
Chip organization	Double-sided	Double-sided
Channel	Dual	Dual
<b>Hard disk</b>		
Vendor and model number	Seagate ST373455SS	Fujitsu MAX3073RC
Number of disks in system	4	4
Size	73 GB	73 GB
Buffer size	16 MB	16 MB
RPM	15,000	15,000
Type	SAS	SAS
Controller	Dell PERC 6/I Adapter RAID Controller	Smart Array E200 Controller

<b>Servers</b>	<b>Dell PowerEdge T300</b>	<b>HP ProLiant ML310 G5</b>
Controller driver	Dell 2.20.0.64 (02/14/2008)	HP 6.12.4.64 (03/31/2008)
<b>Operating system</b>		
Name	Windows Small Business Server 2008 x64	Windows Small Business Server 2008 x64
Build number	6001	6001
Service Pack	NA	NA
Microsoft Windows update date	NA	NA
File system	NTFS	NTFS
Kernel	ACPI x64-based PC	ACPI x64-based PC
Language	English	English
Microsoft DirectX version	10	10
<b>Graphics</b>		
Vendor and model number	ATI ES1000	ATI ES1000
Chipset	ATI ES1000	ATI ES1000
BIOS version	BK-ATI VER008.005.031.000	BK-ATI VER008.005.028.001
Type	Integrated	Integrated
Memory size	32 MB	32 MB
Resolution	1,280 x 1,024	1,280 x 1,024
Driver	ATI 8.240.50.3000 (01/21/2008)	ATI 8.240.50.3000 (01/21/2008)
<b>Network card/subsystem</b>		
Vendor and model number	2 x Broadcom NetXtreme Gigabit Ethernet	HP NC326i PCIe Dual Port Gigabit Server Adapter
Type	Integrated	Integrated
Driver	Microsoft 10.10.0.1 (08/01/2006)	HP 10.81.0.0 (03/20/2008)
Additional network adapter	Intel PRO/1000 PT Dual Port Server Adapter	Intel PRO/1000 PT Dual Port Server Adapter
Driver	Intel 9.12.17.0 (02/06/2008)	Intel 9.12.17.0 (02/06/2008)
<b>Optical drive</b>		
Vendor and model number	LG DH10N	LG GDRH20N
Type	DVD-ROM	DVD-ROM
Interface	IDE	IDE
Dual/single layer	Dual layer	Dual layer
<b>USB ports</b>		
Number of ports	6	4
Type of ports (USB 1.1, USB 2.0)	USB 2.0	USB 2.0

Figure 10: Detailed configuration information for the test systems.

## Appendix B – Price information

Figure 10 presents the price information for the test systems as of August 28, 2008. Prices exclude tax and shipping costs.

System	Dell PowerEdge T300	HP ProLiant ML310 G5
Price as of 8/28/08	\$2,884.00	\$3,711.00

Figure 11: Price information for the test systems. Prices exclude tax and shipping costs.



Principled Technologies, Inc.  
1007 Slater Road, Suite 250  
Durham, NC 27703  
[www.principledtechnologies.com](http://www.principledtechnologies.com)  
[info@principledtechnologies.com](mailto:info@principledtechnologies.com)

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

**Disclaimer of Warranties; Limitation of Liability:**

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

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