Principled Technologies®

TEST REPORT
OCTOBER 2009

SMB Workload performance testing: PowerEdge T110 vs. an older small business desktop running typical small business server and client applications

Executive summary

Dell, Inc. (Dell) commissioned Principled Technologies (PT) to compare the performance of the following Dell PowerEdge T110 server to that of a three-year-old desktop system acting as a small-business server:

- Dell™ PowerEdge™ T110 with an Intel® Xeon® Processor X3440 (2.53 GHz) running Microsoft® Windows Server® 2008 R2 Foundation Edition (Dell server solution)
- HP Compaq dc5700 Microtower PC system with an Intel® Core™ 2 Duo processor E6300 (1.86 GHz) running Microsoft® Windows® XP Service Pack 3 (HP desktop solution)

The goal was to help gauge the performance effects of switching from a desktop system acting as a server--a system with a desktop processor and a desktop operating system--to a Dell PowerEdge T110, a true entry-level server with a server processor, the Intel Xeon Processor X3440, and a server operating system, Microsoft Windows Server 2008 R2 Foundation Edition.

KEY FINDINGS

- The Dell PowerEdge T110 server with an Intel Xeon Processor X3440 running Microsoft Windows Server 2008 R2 Foundation Edition (Dell server solution) was 16.9 percent faster opening QuickBooks than the HP Compaq dc5700 Microtower PC system with an Intel Core 2 Duo processor E6300 running Microsoft Windows XP Service Pack 3 (HP desktop solution). (See Figure 1.)
- While also providing Web and intranet service, the Dell server solution was 12.8 percent faster opening QuickBooks than the HP desktop solution--which was not facing the additional work of running WebBench. (See Figure 2.)
- With both solutions running WebBench, the Dell server solution was 14.6 percent faster at Excel recalculation, 34.4 percent faster at virus scanning, and provided 200.9 percent more WebBench performance than did the HP desktop solution. (See Figure 3.)

We measured the performance of these two small-business server alternatives on workloads that a typical small business server may have to handle, including both server tasks (Web service) and client tasks (Intuit® QuickBooks® Pro® 2009 (QuickBooks), Microsoft® Excel® 2007 (Excel), and virus scanning). We used WebBench to simulate intranet and Web traffic. We measured the time each system took to open Intuit QuickBooks, perform an Excel recalculation, and complete a virus scan. See the Workload section for more information on the tests.

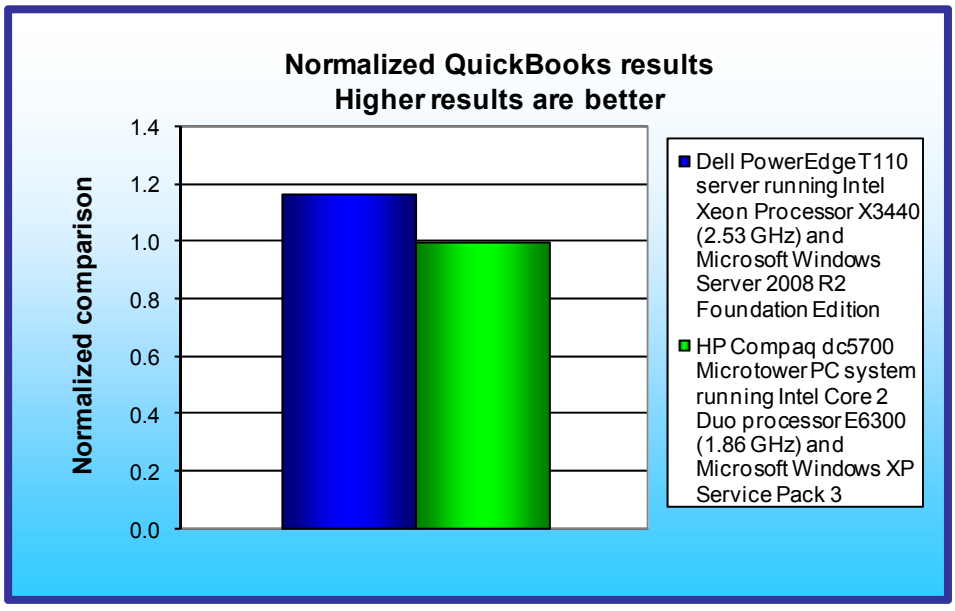

Figure 1: Normalized time to open QuickBooks for each solution. Higher numbers are better.

These results illustrate the types of performance gains that small business users would enjoy by switching to the Dell PowerEdge T110 with an Intel Xeon Processor X3440 and Microsoft Windows Server 2008 R2 Foundation Edition from the older HP desktop solution.

For each of the following figures, we normalize each result to that of the HP desktop solution, thus

showing the percentage increase of the Dell server solution over that of the HP desktop solution.

Figure 1 presents the QuickBooks launch results for the Dell server solution and the HP desktop solution. The Dell server solution was 16.9 percent faster opening QuickBooks than the HP desktop solution.

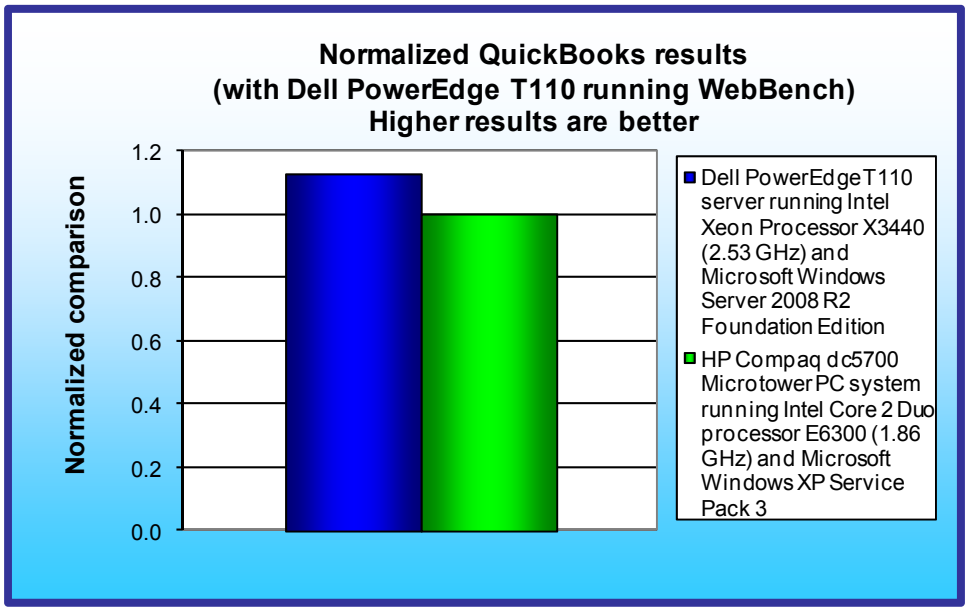

Figure 2: Normalized time to open QuickBooks for each solution, with the Dell server solution running WebBench. Higher numbers are better.

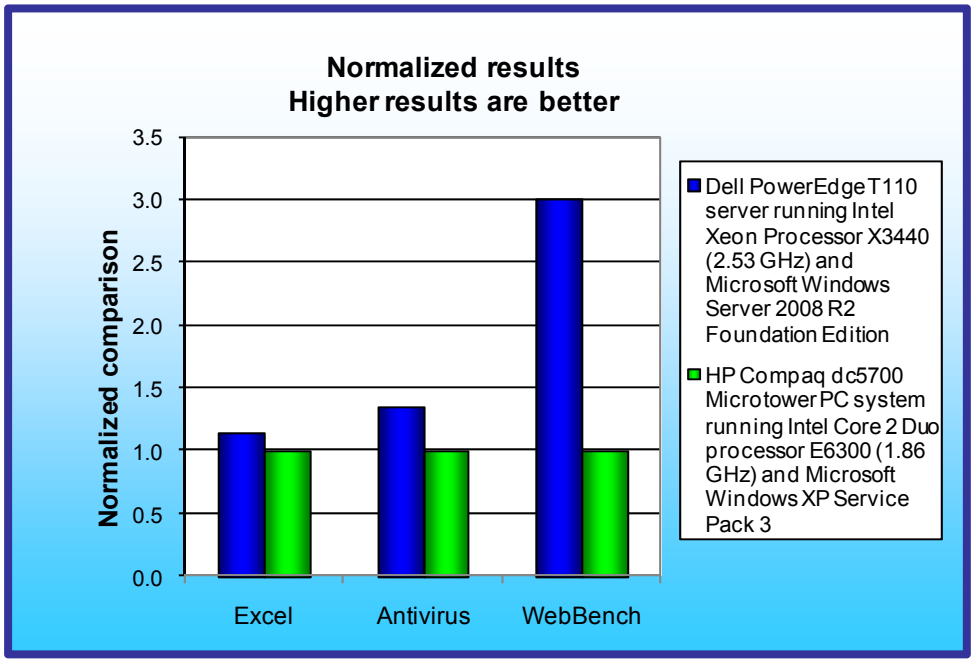

Figure 3: Normalized time to open combined workload for each solution, with both solutions running WebBench. Higher numbers are better.

Web service and common client functions.

Figure 2 presents QuickBooks launch results for the Dell server solution, which was also running WebBench, and the HP desktop solution, which did not face the additional load of WebBench. Even with this additional load, the Dell server solution was 12.8 percent faster opening QuickBooks than the HP desktop solution.

Figure 3 presents results of tests in which both solutions were running WebBench while also performing client functions. The Dell server solution was 14.6 percent faster than the HP desktop solution at Excel recalculation, 34.4 percent faster than the HP desktop solution at virus scanning, and provided 200 percent more WebBench performance than the HP desktop solution.

Workload

Small business servers often have to provide two very different types of functions. The first is to act as a real server, running workloads such as Web service. The second is to act as a user's desktop computer, running functions such as QuickBooks and Excel. Virus scanning is common regardless of what the server is doing. We crafted our test workloads to reflect these different functions and to test the performance of the servers while providing both

QuickBooks test

To gauge QuickBooks performance, we tested how long it took each solution to perform one of the most common operations: opening QuickBooks. On the Dell server solution, we also measured the time to perform this function while also providing Web service. We did not run WebBench on the HP desktop solution during this test. This test thus showed how the Dell server solution compared to the HP desktop solution while running QuickBooks alone and then while both running QuickBooks and performing a common server function.

Excel test

To gauge performance with multiple applications running at once, we performed an Excel recalculation while running a virus scan and with WebBench running in the background. For the virus scan, we copied the .cab files from the Windows XP Professional installation CD, which Windows places in the i386 directory, to both solutions three times. We set up the files in three different folders. We made a custom scan with Symantec Endpoint Protection Small Business Edition (for more information, visit: http://www.symantec.com/business/protection-suite-small-business-edition) to scan these three folders as a manual scan. We recorded how long it took to scan all three folders.

We used WebBench to simulate Web activity on each system under test. This activity simulates the Web traffic a server would face with Internet and/or Intranet activity.

In all our tests, the Dell PowerEdge T110 server ran Microsoft Server 2008 R2 Foundation Server, which is a server operating system. The HP Compaq dc5700 Microtower PC ran Microsoft Windows XP Service Pack 3, which is generally a desktop operating system. For the WebBench tests, we ran a Web server on Windows XP, just as a small business would have to do to provide Web service on such a system.

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 WebBench's default dynamic API test suite, which generates non-secure dynamic HTTP 1.0 GET requests. 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 dynamic API 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 30 clients, with 10 engines per client for the entire test. This allowed us to keep a constant Web load on the server. We modified the test suite to run three clients for two mixes. We allowed the system to ram up for one mix and then performed our hand-timing test during the second mix. Each mix lasted five minutes.

Test results

The following subsections summarize our results for each of these tests.

QuickBooks results

To gauge the performance of the two solutions running Microsoft QuickBooks Pro 2009, we opened the program with a 30MB database. Figure 4 shows the times, in seconds, that each solution took to open QuickBooks. The results are median times of three runs. Lower times are better.

	Dell PowerEdge T110	HP Compaq dc5700 Microtower PC
Opening QuickBooks	19.8	23.2
Normalized times (relative to HP desktop solution)	1.17	1.00

Figure 4: Median times, in seconds, it took the solutions to open QuickBooks. Lower numbers are better.

Additionally, we performed the same task of opening QuickBooks Pro 2009 on each solution, but had a WebBench 5.0 client running against the Dell PowerEdge T110. We did not have any additional activities running against the HP Compaq dc5700 Microtower PC during this test.

Figure 5 shows that, while handling Web traffic, the Dell PowerEdge T110 opened QuickBooks faster than the HP Compaq dc5700 Microtower PC, which was not performing any additional tasks.

	Dell PowerEdge T110	HP Compaq dc5700 Microtower PC
Opening QuickBooks	20.4	23.2
Normalized times (relative to HP desktop solution)	1.13	1.00

Figure 5: Median times, in seconds, it took the solutions to open QuickBooks Pro 2009. Lower numbers are better.

Excel results

Figure 6 shows the times, in seconds, and WebBench results that each solution took during a combined workload. The results are median times of three runs. Excel and virus scan results are in minutes:seconds. Lower is better. WebBench results are in request per second, with larger numbers being better.

	Dell PowerEdge T110	HP Compaq dc5700 Microtower PC
Recalculating business revenue using Microsoft Excel 2007	0:42.5	0:50.1
Normalized times (relative to the HP desktop solution)	1.15	1.00
Performing a virus scan	2:30.0	3:49.4
Normalized times (relative to the HP desktop solution)	1.34	1.00
WebBench	615.5	204.6
Normalized performance (relative to the HP desktop solution)	3.00	1.00

Figure 6: Median times it took the solutions to open Excel and perform a virus scan, and WebBench performance results for each solution.

Test methodology

For testing, Dell provided and configured the Dell PowerEdge T110 server. PT purchased the HP Compaq dc5700 PC, but Dell approved the configuration. Appendix A provides detailed configuration information.

Configuration of Dell PowerEdge T110

Installing and configuring the OS

We began our testing by installing a fresh copy of Microsoft Windows Server 2008 R2 Foundation Edition on the Dell PowerEdge T110 system. We followed this process for the installation:

1. Boot system from install disc.
2. When the application prompts you to choose an operating system to start, select Windows Setup [EMS Enabled], and press Enter.
3. At the Language/Time and Currency/Keyboard input method selection screen, click Next.
4. Click Install now.
5. At Please read the license terms, click I accept the license terms, and click Next.
6. At Which type of installation do you want? click Custom (Advanced).
7. Select the correct disk partition, and click Next.
8. If installing over previous versions of Windows, click OK when the warning pop up appears. The installer will write files and restart.
9. If the application prompts you to change the user's password, click OK.
10. For New password, use Password1. Confirm the password, and click the blue arrow button.
11. When the screen shows Your password has been changed, click OK.
12. When the Initial Configuration Tasks pane appears, check Do not show this window at logon, and click Close.

Installing system updates

We checked for available system updates using Microsoft Windows update feature, but none were available for Microsoft Windows Server 2008 R2 Foundation Edition at the time of testing.

Assigning static IPs to the NICs

1. Click Start→Control Panel.
2. Click Switch to Classic View.
3. Double-click Network Connections.
4. Right-click Local Area Connection.
5. Click Properties.
6. Click Internet Protocol Version 4 (TCP/IPv4), and click Properties.
7. Select Use the following IP Address, and input the following numbers:
   IP Address: `192.168.2.210`
   Subnet mask: `255.255.255.0`

Setting up the Application Server

1. Click Start→Administrative Tools→Server Manager.
2. Click Roles on the left side.
3. Click Add Roles.
4. Click the Application Server check box.
5. When the Add features required for Application Server? screen appears, click Add Required Features.
6. Click Next.
7. Click Next
8. At the Select Role Services page for Application Server, click the Web Server (IIS) Support check box.
9. When the Add features required for Web Server (IIS) Support? screen appears, click Add Required Features.
10. Click Next.
11. Click Next.
12. At the Select Role Services page for Web Server (IIS), click IIS 6 Management Compatibility, ASP, and CGI check boxes. Click Next.
13. Click Install.
14. Click Close.

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 Applications→Internet Information Services (IIS) Manager→ServerName.
3. Double-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. Double-click the server name on the left side of the window.
8. Double-click ISAPI and CGI Restrictions.
9. Click Edit Feature Settings.
10. Click the check boxes beside Allow unspecified CGI module and Allow unspecified ISAPI modules.
11. Click OK.
12. Go to Services and Applications→Internet Information Services (IIS) Manager→ServerName.
13. Double-click Logging.
14. Click Disable.

Configuration of HP Compaq dc5700 PC

Installing and configuring the OS

We began our testing by installing a fresh copy of Microsoft Windows XP Professional with Service Pack 3 on the HP Compaq dc5700 Microtower system. We followed this process for the installation:

1. Boot the system from the install disc.
2. At Windows XP Professional Setup screen, press Enter to set up Windows XP.
3. At Windows XP Licensing Agreement screen, press F8 to agree to terms.
4. Select the correct partition, and press Enter to continue.
5. Select Format the partition using the NTFS file system (Quick), and press Enter.
6. Press F to format the drive.
7. Installer will copy files and reboot system.
8. At the Regional and Language Options screen, click Next.
9. At the Personalize Your Software screen, enter name and organization. Click Next.
10. At the Your Product Key screen, enter the product key, and click Next.
11. At Computer Name and Administrative Password screen, type computer name `Client-3yr` and password `Password1`
12. At the Date and Time Setting screen, choose (GMT-5:00) Eastern Time (US & Canada), and click Next.
13. Installer will load files and reboot the system.
14. At Display Settings pop-up window, click OK.
15. At Monitor Settings pop-up window, click OK.
16. At Welcome to Microsoft Windows screen, click Next.
17. At Help protect your PC screen, select Not right now, and click Next.
18. At Who will use this computer? screen, type `Tester` in Your name field and click Next.
19. At the Thank You screen, click Finish.

Installing system updates

On the HP Compact dc5700 Microtower, we installed the following updates using Microsoft Windows update feature:

- Security Update for Jscript 5.8 for Windows XP (KB971961)
- Security Update for Windows Media Format Runtime 9, 9.5 & 11 for Windows XP SP 3 (KB968816)
- Security Update for Jscript 5.7 for Windows XP (KB971961)
- Windows Malicious Software Removal Tool - September 2009 (KB890830)
- Security Update for Windows XP (KB956844)
- Internet Explorer 8 for Windows XP
- Security Update for Windows XP (KB961371)
- Update for Windows XP (KB970653)
- Security Update for Windows XP (KB971657)
- Security Update for Windows XP (KB973815)
- Security Update for Windows XP (KB960859)
- Security Update for Windows XP (KB973507)
- Security Update for Windows XP (KB973354)

- Security Update for Windows XP (KB956744)
- Security Update for Windows XP (KB973869)
- Security Update for Windows XP Service Pack 3 (KB973540)
- Security Update for Windows XP (KB971557)
- Update for Windows XP (KB968389)
- Cumulative Security Update for Internet Explorer 6 for Windows XP (KB972260)
- Cumulative Security Update for ActiveX Killbits for Windows XP (KB973346)
- Security Update for Windows XP (KB971633)
- Security Update for Windows XP (KB970238)
- Security Update for Windows XP (KB968537)
- Security Update for Windows XP (KB961501)
- Security Update for Windows XP (KB959426)
- Security Update for Windows XP (KB960803)
- Security Update for Windows XP (KB952004)
- Security Update for Windows XP (KB956572)
- Security Update for Windows XP (KB923561)
- Windows Genuine Advantage Notification (KB905474)
- Update for Windows XP (KB967715)
- Security Update for Windows XP (KB938464)
- Security Update for Windows XP (KB960225)
- Security Update for Windows XP (KB958687)
- Security Update for Windows XP (KB956803)
- Security Update for Windows XP Service Pack 3 (KB952069)
- Security Update for Windows XP (KB956802)
- Security Update for Windows XP (KB954600)
- Security Update for Windows XP (KB957097)
- Security Update for Windows XP (KB954459)
- Security Update for Windows XP (KB955069)
- Security Update for Windows XP (KB958644)
- Update for Windows XP (KB952287)
- Security Update for Windows XP (KB950974)
- Security Update for Windows XP (KB952954)
- Security Update for Windows XP (KB946648)
- Security Update for Outlook Express for Windows XP (KB951066)
- Security Update for Windows XP (KB951748)
- Update for Windows XP (KB951978)
- Security Update for Windows XP (KB951376)
- Security Update for Windows XP (KB950762)
- Security Update for Flash Player (KB923789)
- Update for Windows XP (KB898461)
- Windows Genuine Advantage Validation Tool (KB892130)

Assigning static IPs to the NICs

8. Click Start→Control Panel.
9. Click Switch to Classic View.
10. Double-click Network Connections.
11. Right-click Local Area Connection.
12. Click Properties.
13. Click Internet Protocol Version 4 (TCP/IPv4), and click Properties.
14. Select Use the following IP Address, and input the following numbers:
    IP Address: `192.168.2.230`
    Subnet mask: `255.255.255.0`

Setting up the Internet Information Server

1. Click Start→Control Panel→Add/Remove Programs
2. Select Add/Remove Windows components.
3. Check the box next to Internet Information Services (IIS) in Windows Components Wizard screen.
4. Click Next.
5. Insert Windows XP CD when the application prompts you to do so.
6. Click Finish.

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 Applications→Internet Information Services (IIS) Manager→Web Sites.
3. Right-click Web Sites and select properties from the drop-down menu.
4. Select the HTTP Headers Tab.
5. Click the File Types… button in the MIME Map section.
6. In the File Types window, click New Type.
7. In the Associated extension field, type *****
8. In the Content type (MIME) field, type `application/octet-stream` and click OK.
9. Click OK to close the File Types window.
10. Click OK to close the Web Sites properties window.
11. Go to Services and Applications→Internet Information Services (IIS) Manager→Web Sites→Default Web Site.
12. Right-click Default Web Site, and select Properties from the drop-down menu.
13. On the Web Site tab, uncheck Enable Logging.
14. Click OK to close Default Web Site Properties window.

Configurations performed on both systems

Installing Microsoft Office Professional 2007

1. With Windows XP running, insert the Microsoft Office Professional 2007 install disc.
2. At the Enter your Product Key pop up, enter your product key, and click Continue.
3. In the Read the Microsoft Software License Terms window, check I accept the terms of this agreement, and click Continue.
4. Click Install Now
5. When the files load, click Close.

Installing QuickBooks

We installed Intuit QuickBooks Pro 2009 as follows:

1. Insert Intuit QuickBooks Accounting Pro 2009 install disc.
2. At the QuickBooks Installation window, click Next.
3. At the Welcome to QuickBooks Installation Wizard window click Next.
4. At the License Agreement, click I accept the terms in the license agreement, and click Next.
5. At Number of Users window, click One user, and click Next.
6. Enter License Number and Product Number, and click Next.
7. At Select Installation Folder window, click Next.
8. For Optional QuickBooks Search Feature with Google Desktop, select No, and click Next.
9. At Ready to install QuickBooks, click Install.
10. At QuickBooks Installation Complete, click Finish.

Installing Symantec Anti-Virus Software

We installed Symantec Endpoint Protection Small Business Edition as follows:

1. Launch Symantec Endpoint Protection Small Business Edition setup application.
2. When the Installation Program window appears, click Install an unmanaged client.
3. When asked Are you sure you want to continue?, click Yes

4. At Welcome to the InstallShield Wizard, click Next.
5. At the License Agreement, click I accept the terms in the license agreement, and click Next.
6. At Client Type window, select Unmanaged client, and click Next.
7. At the Setup Type window, select Typical, and click Next.
8. At the Ready to Install the Program, click Install.
9. At the InstallShield Wizard Complete, click Finish.
10. At Restart Notification, click Restart Now.

Installing and configuring WebBench

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

1. Copy the file wbtree.exe from the WebBench CD to the wwwroot directory on the server under test. (The wbtree.exe file is on the WebBench CD at \wb50\workload. The wwwroot directory is located at C:\inetpub\wwwroot.)
2. On the server, execute the wbtree.exe file. This program copies the WebBench workload to the server.
3. In the wwwroot folder on the server, create a new folder and name it `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. Double-click ISAPI and CGI Restrictions.
8. Click Add.
9. Enter the path for the simisapi.dll, and click the check box saying Allow extension path to execute.
10. Click OK.

Running the test

Opening QuickBooks Pro 2009

We have a 30MB QuickBooks database that we use for this test. Prior to the test, make sure that the last QuickBooks sample company that you opened was the test file so that it is the default choice the next time you open QuickBooks. This test requires a hand timer.

1. Boot the system to desktop.
2. Wait for 10 minutes so the system is idle.
3. Click one time on the QuickBooks Pro 2009 desktop icon to highlight it.
4. Simultaneously start timer and press Enter.
5. When the QuickBooks window opens to No Company Open, immediately press Enter.
6. When the QuickBooks Information pop up appears, immediately press Enter.
7. When the Register QuickBooks Pro 2009 window pops up, immediately hit the right arrow key to highlight the Remind Me Later button, and press Enter.
8. Stop the timer when the company Home window displays.

For the QuickBooks Pro 2009 test using WebBench we performed the same procedure as above, but started WebBench as we show below.

Running WebBench

1. Restart the Web Controller.
2. On the desktop, double-click the Web Controller shortcut.
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 appear on the left side of the WebBench Controller Program.
6. Click OK.
7. When the application prompts you to add a test suite, click Yes.
8. Select dynamic_api_template.tst.
9. Give the run an appropriate name (e.g., Dell PowerEdge T110_WB_Run1).
10. Click OK.
11. When the Would you like to start executing the test suites? Screen appears, click Yes to begin the test.

12. Start the Opening QuickBooks Pro 2009 test when Mix 2 begins to Execute.

Recalculating Excel

This test requires two hand timers.

1. Boot the system to desktop.
2. Wait 10 minutes so the system is idle.
3. Start WebBench as we describe above.
4. While the first WebBench mix is executing, set up the test:
    a. Open the Excel test file by double clicking the Excel icon we name `Excel2minA` on the desktop.
    b. When the file opens, click the Outputs tab at the bottom of the spreadsheet.
    c. In the Outputs spreadsheet, click cell A2 so that Excel calculates the right information.
    d. Open Symantec Endpoint Protection Small Business Edition by clicking the Symantec icon on the Windows toolbar.
    e. When the Symantec window opens, click Scan for threats.
    f. Right-click New scan 1 and place the curser over Scan Now but do not click it.
    g. Wait for the first WebBench mix to finish.
5. When WebBench begins to Execute Mix 2, simultaneously start the first timer, and click Scan Now.
6. Wait 10 seconds.
    a. While waiting, click the Excel window and make sure to highlight cell A2.
7. Simultaneously start the second timer and press F9 to begin the Excel calculation.
8. Stop the second timer when the Calculating status at the bottom of the Excel window disappears.
9. Click the New Scan 1 tab on the Windows toolbar to bring the virus scan to the front.
10. Stop the first timer when the status window says Complete.
11. Record the times.
12. When the second WebBench Mix is complete, close all applications. Do not save the changes to the Excel worksheet.

Configuring the network test bed

To generate the WebBench workload, we used four Dell laptops: three acting as client systems, and one acting as the WebBench controller. The WebBench client systems all contained Intel Core 2 Duo processors, with at least 1 GB of system memory and an 80GB hard drive running Microsoft Windows Vista. For the WebBench controller, we used a Dell Inspiron 9100 with an Intel Pentium 4 processor, 2 GB of memory, and a 60GB hard drive running Microsoft Windows Server 2003 Server Pack 2. We connected all systems to the integrated network adapter on the server under test via one NETGEAR GS724T Gigabit Smart Switch.

Appendix A – Test system configuration information

Figure 7 provides detailed configuration information about each of the two test systems.

Servers	Dell PowerEdge T110	HP Compaq dc5700 Microtower PC
General processor setup		
Number of processor packages	1	1
Number of cores per processor package	4	2
Number of hardware threads per core	2	1
System power management policy	Balanced	Home/Office Desk
CPU		
Vendor	Intel	Intel
Name	Intel Xeon X3440	Intel Core 2 Duo E6300
Stepping	B1	B2
Socket type	LGA1156	LGA775
Core frequency (GHz)	2.53	1.86
L1 cache	4 x 32 KB	2 x 32 KB
L2 cache	4 x 256 KB	2 MB
L3 cache (MB)	8	N/A
Platform		
Vendor and model number	Dell PowerEdge T110	HP Compaq dc5700 Microtower PC
Motherboard Revision Number	11	C1
Motherboard chipset	Intel 3420	Intel Q965
BIOS name and version	Dell 1.0.4	HP 786E v02.07
BIOS settings	Default	Default
Memory module(s)		
Total RAM in system (GB)	4	1
Number of types of memory modules	Samsung, M391B5673DZ1-CH9	Samsung M378T6553CZ3-CE6
Vendor and model number	PC3-10600E	PC2-5300
Type (MHz)	1,333	667
Speed (MHz)	1,333	667
Speed in the system currently running @ (MHz)	9-9-9-24	5-5-5-13
Timing/latency (tCL-tRCD-iRP-tRASmin)	2 GB	512 MB
Size (MB)	2	2
Number of RAM modules	Double-sided	Single-sided
Chip organization	Dual	Dual
Channel (GB)	4	1
Hard disk		
Vendor and model number	2 x Seagate ST314635655 2 x Fujitsu MBA3147RC	Western Digital WDC WD1600YD-01NVB1
Number of disks in system	4	1
Size (GB)	146	160
Buffer size (MB)	16	16
RPM	15,000	7,200
Type	SAS	SATA

Servers	Dell PowerEdge T110	HP Compaq dc5700 Microtower PC
Controller	Intel 3420	Intel 82801 HB/HR (ICH8/R)
Controller driver	Intel 7.0.0.1013 (6/4/2009)	Intel 8.2.0.1011 (11/15/2006)
Operating system		
Name	Windows Server 2008 R2 Foundation Edition	Windows XP Professional
Build number	7600	2600
Service Pack	N/A	Service Pack 3
File system	NTFS	NTFS
Kernel	ACPI x64-based PC	ACPI Multiprocessor PC
Language	English	English
Microsoft DirectX version	DirectX 11	DirectX 9.0c
Graphics		
Vendor and model number	Standard VGA Graphics Adapter	Intel® Q965/Q963 Express Chipset Family
Type	Integrated	Integrated
Memory size (MB)	8	256
Resolution	1,280 x 1,024	1,280 x 1,024
Driver	Microsoft 6.1.7600.16385 (6/21/2006)	Intel 6.14.10.5016 (12/12/2008)
Network card/subsystem		
Vendor and model number	Broadcom NetXtreme	Broadcom NetXtreme
Type	Gigabit Ethernet	Gigabit Ethernet
Driver	Broadcom 12.2.2.1 (8/6/2009)	Broadcom 10.86.0.0 (7/30/2008)
USB ports		
Number of ports	6	8
Type of ports (USB 1.1, USB 2.0)	2.0	2.0

Figure 7: Detailed system configuration information for the two test systems.

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.

Principled Technologies, Inc.
1007 Slater Road, Suite 250
Durham, NC 27703
www.principledtechnologies.com
info@principledtechnologies.com