WEB SERVER PERFORMANCE: DELL SERVERS

Dell™ PowerEdge™ Web-server solutions handled growing business needs

WEB REQUESTS/SECOND

8,274 (1.0x)
Dell PowerEdge T110

13,154 (1.6x)
Dell PowerEdge T310

21,190 (2.3x)
Dell PowerEdge R310
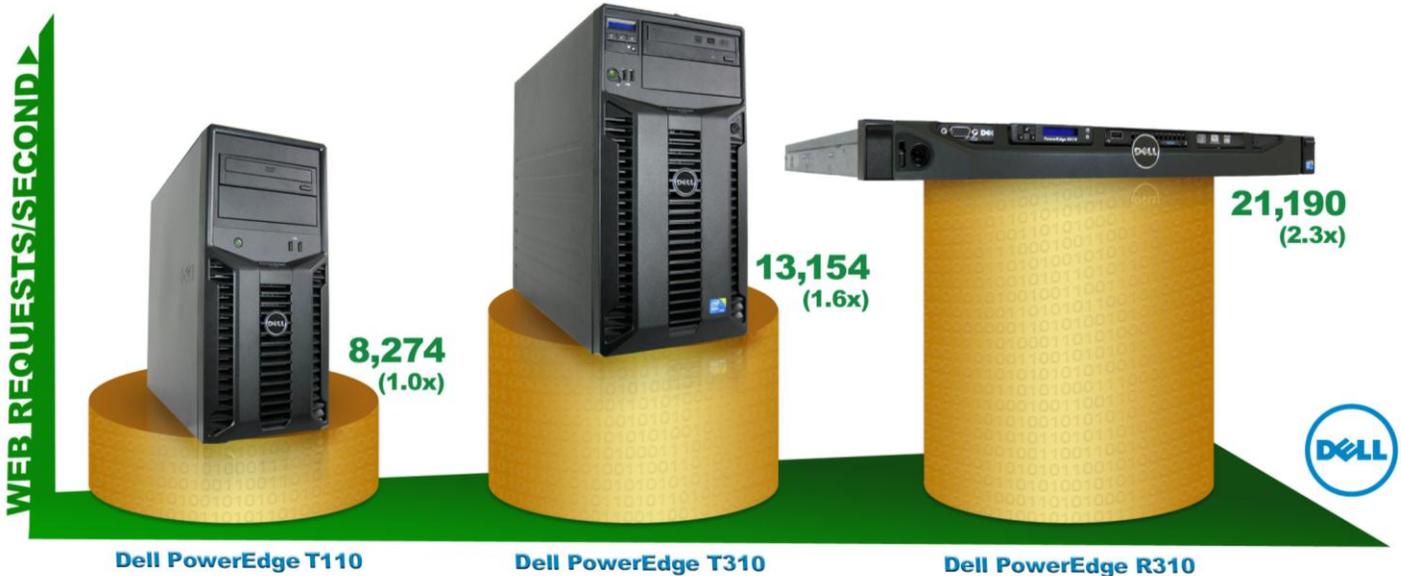
OUR FINDINGS

As companies' sizes and functions vary, so do their Web server needs. One means of evaluating a Web server is recording the number of requests per second it can handle. In Principled Technologies' tests in our labs, the Dell PowerEdge T110 supported 8,274 requests per second, an amount comparable to an entry-level Web server for a typical small business. The Dell PowerEdgeT310 supported 13,154 requests per second, or 1.6 times the performance of the Dell PowerEdge T110, and would support a more demanding small-to-medium business workload. The Dell PowerEdge R310 supported 21,190 requests per second, or 2.3 times the performance of the Dell PowerEdge T110, which would support a complex small-to-medium business Web server workload.

OUR PROCESS

We used the WSTest 1.5 Web Services benchmark, which is part of Microsoft® .NET StockTrader Portfolio version 2.04, to provide a workload representative of many real-world Web server applications. With it, we measured the Web server performance of Dell PowerEdge T110, which ran Microsoft Windows Server® 2008 R2 Foundation Edition, and the Dell PowerEdge T310 and Dell PowerEdge R310 servers, each of which ran Microsoft Windows Server 2008 R2 Standard Edition. Each server ran Microsoft SQL Server® 2008 R2 Standard Edition.

PROJECT OVERVIEW

The purpose of this report is to demonstrate how Dell servers can meet the needs of businesses' Web servers no matter the size or demand. Selecting a server that can handle the number of requests you incur is crucial, as a Microsoft Bing™ study found that a 2-second slowdown in answering requests is equivalent to up to a 4.3 percent reduction in revenue per user.[1] We tested the following servers to gauge how many Web server requests each server could handle:

- Dell PowerEdge T110
- Dell PowerEdge T310
- Dell PowerEdge R310

Note that the actual number of requests or transactions servers can handle in a particular company's environment is highly dependent on both the hardware and the complexity of the specific Web application. Our analysis can, however, give end-users a relative indication of how much load each server can bear.
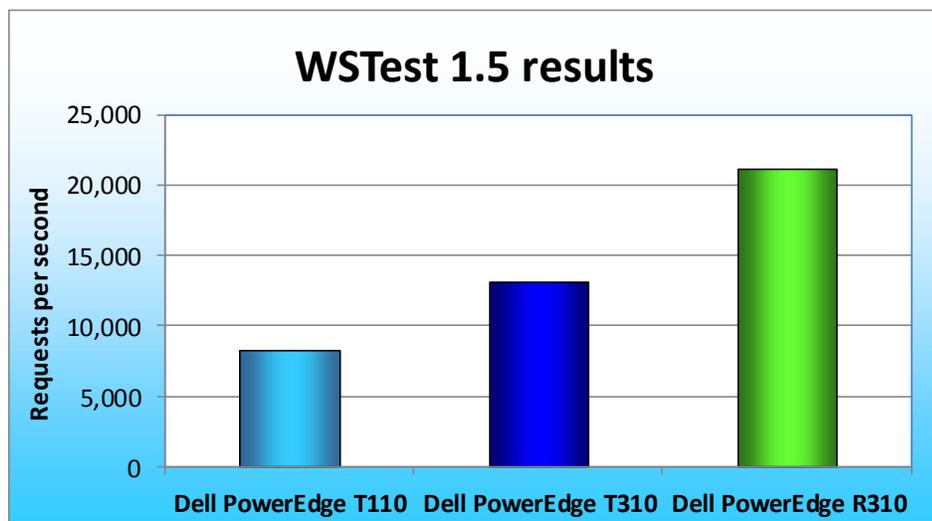

Figure 1: WSTest 1.5 results, in requests per second, for the test servers.

Figure 1 shows the WSTest 1.5 results, in requests per second, for the three Dell servers. The Dell PowerEdge T110 server supported 8,274 requests per second, the Dell PowerEdge T310 server supported 13,154 requests per second, and the Dell PowerEdge R310 server supported 21,190 requests per second.

WHAT WE TESTED

For our workload, we used the WSTest 1.5 Web services benchmark (WSTest), which is part of Microsoft .NET StockTrader Portfolio version 2.04 (.NET StockTrader), a benchmark application that simulates an online stock-trading scenario, demonstrating how Windows Communication Foundation (WCF)

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[1] Source: Schurman, E. (Microsoft) and Brutlag, J.(Google). 2009, "Performance Related Changes and their User Impact," *O'Reilly Velocity 2009*, San Jose, CA.

technologies work in end-to-end service-oriented, n-tier architecture. WSTest 1.5 is Microsoft's modified version of the original WSTest 1.0, which Sun Microsystems created. The WSTest 1.5 benchmark tests how well an application server performs as a Web service host across varying Simple Object Access Protocol (SOAP) object sizes. To this end, WSTest 1.5 measures the server's ability to process HTTP/SOAP requests, integrate Web servers, isolate the networking stack, and serialize XML engines. WSTest 1.5 consists of the five tests (which WSTest 1.5 refers to as "web service methods"), which test the SOAP network stack/serialization performance of the web server. Of the five, we are only using the GetOrder test, which simulates a complete purchase order request.

The WSTest 1.5 metric shows the peak throughput, or number of web service requests per second a server can handle.

SYSTEM COMPARISON

Figure 2 shows a side-by-side comparison of the key hardware differences between the servers. Appendix A presents detailed system information.

Hardware specifications	Dell PowerEdge T110	Dell PowerEdge T310	Dell PowerEdge R310
CPU	Intel Xeon X3430	Intel Xeon X3440	Intel Xeon X3470
CPU speed (GHz)	2.40	2.53	2.93
Number of processor packages	1	1	1
Number of cores per processor package	4	4	4
Number of hardware threads per core	1	2	2
Total memory (GB)	8 (2 x 4GB) PC3-10600E	8 (4 x 2GB) PC3-10600E	8 (4 x 2GB) PC3-10600E
Hard drives	2 x 160GB SATA	2 x 146GB SAS	2 x 146GB SAS
Total gigabit Ethernet ports	1	2	4

Figure 2: Key system configuration information for the three test servers.

WHAT WE FOUND

Figure 3 shows the WSTest 1.5 results, in requests per second, for the three Dell servers. We ran WSTest 1.5 three times for each server, and report the results of the median run.

	Dell PowerEdge T110	Dell PowerEdge T310	Dell PowerEdge R310
Requests per second	8,274	13,154	21,190

Figure 3: Median WSTest 1.5 results, in requests per second, for the test servers.

HOW WE TESTED

Setting up the servers

We installed a fresh copy of Windows Server 2008 R2 Foundation Edition on the Dell PowerEdge T110,

and installed a fresh copy of Windows Server 2008 R2 Standard Edition on both the Dell PowerEdge T310 and

Dell PowerEdge R310.

Installing Windows Server 2008 R2 Foundation Edition on the Dell PowerEdge T110 server

1. Boot the server, and insert the Windows Server 2008 R2 installation DVD in the DVD-ROM drive.
2. At the Language Selection Screen, click Next.
3. Click Install Now.
4. Select Windows Server 2008 R2 Foundation (Full Installation), and click Next. The installation requires no further user input.

Installing Windows Server 2008 R2 Standard Edition on the Dell PowerEdge T310 and R310 servers

1. Boot the server, and insert the Windows Server 2008 R2 installation DVD in the DVD-ROM drive.
2. At the Language Selection Screen, click Next.
3. Click Install Now.
4. Select Windows Server 2008 R2 Standard (Full Installation), and click Next.
5. Click the I accept the license terms check box, and click Next.
6. Click Custom.
7. Click Drive options (advanced).
8. Ensure you select the proper drive, and click New.
9. Click Apply.
10. Click Next.
11. At the User's password must be changed before logging on warning screen, click OK.
12. Type `Password1` as the new password in both fields, and click the arrow to continue.
13. At the Your password has been changed screen, click OK.

Setting up network configuration on the server

1. Click Start→Control Panel→Network and Internet→Network Connections, and double-click the Local Area Connection assigned to client/server network traffic.
2. Select Internet Protocol Version 4 (TCP/IPv4), and click Properties.
3. In the Internet Protocol Version 4 (TCP/IPv4) Properties screen, select the Use the following IP address radio button.
4. Enter a valid static IP address, subnet mask, and default gateway.
5. Click OK, and click Close to exit.

Installing system updates in Windows Server 2008 R2

The updates between systems differed slightly, because the Dell PowerEdge T110 used Windows

Server 2008 R2 Foundation Edition, and the Dell PowerEdge T310 and R310 ran Windows Server 2008 R2

Standard Edition. We applied all critical Windows updates available for each server as of September 28, 2010.

Installing Microsoft .NET Framework 4.0 runtime

1. Download dotNet40_Full_setup.exe
2. Double-click the file.
3. Click I have read and accept the license terms, and click Install.
4. When the install completes, click Finish.

Installing IIS 7.5 using the Server Manager Interface

1. At the Windows Server screen, click the Server Manager icon in the bottom right corner. In Server Manager, select Features. Click Add Features.
2. At the Select Features screen of the Add Features Wizard, do the following:
   a. Check Background Intelligent Transfer Services (BITS) for Windows Server 2008 R2.
   b. The application prompts you to add dependent components, which includes the Web Server IIS role. Click Add Required Role Services. Check Remote Differential Compression, and click Next.
3. At the Web Server (IIS) screen, click Next.
4. At the Select Role Services screen, select WebDAV Publishing. When the application prompts you to do so, select ASP .NET.
5. At the Confirmation screen, click Install, and complete the rest of the Add Features Wizard.
6. To exit the Add Features Wizard, click Close.

Adding Application Server Role

1. At the Windows Server screen, go to Start→All Programs→Administrative Tools→Server Manager. In Server Manager, select Roles. Click Add Roles.
2. Select Application Server, and click Next twice in a row.
3. At the NET 3.5.1 and TCP Port Sharing underneath the Application Server screen, click Install.
4. When the program completes installation, click Close.

Installing Message Queuing on Windows Server 2008 R2

1. In the bottom right of the screen, click the Server Manager.
2. Click Features.
3. To start the Add Features Wizard, click Add Features.
4. Expand Message Queuing, and expand Message Queuing Services. Select the Message Queuing Services.
5. Click Next, and click Install.
6. If the application prompts you to restart the computer, click OK to complete the installation. Otherwise, click close.

Enabling network DTC access

1. Click Server Manger in the bottom right corner. Click Roles, and Add Roles. (Select the Turn Windows features on or off link.)
2. On the Select Server Roles screen, click Application Server.
3. On the Add Roles Wizard screen, click Add Required Role Services.
4. On the Introduction to Application Server Screen, click Next.
5. On the Select Role Services screen, click Next.
6. On the Confirm Installation Selection screen, click Install.
7. On the Installation Results screen, click Close.

Turning-off Windows Firewall

1. Click Start→All Programs Administrative Tools→Windows Firewall and Advanced Security.
2. Select Windows Firewall Properties.
3. Go to Domain→Private and Public Firewall tabs. Change the setting for each tab to Off, click OK, and exit the Windows Firewall and Advanced Security screen.

Installing SQL Server 2008 R2 Standard Edition on the server

1. Insert the SQL Server 2008 R2 installation DVD into the DVD drive.
2. If AutoPlay does not begin the installation, navigate to the SQL Server 2008 R2 DVD, and double-click.
3. If the application prompts you with a .NET installation prompt, click Yes to enable the .NET Framework Core role.
4. At the SQL Server Installation Center screen, click Installation.
5. Click New installation or add features to an existing installation.
6. At the Setup Support Rules screen, click OK.
7. At the Product Key screen, specify the free Enterprise edition evaluation, and click Next.
8. At the License Terms screen, accept the license terms, and click Next.
9. At the Setup Support Files screen, click Install.
10. At the Setup Support Rules screen, click Next.
11. At the Setup Role screen, choose SQL Server Feature Installation, and click Next.
12. At the SQL Server 2008 R2 Feature Selection screen, select the following features: Database Engine Services, Full-Text Search, Client Tools Connectivity, Client Tools Backwards Compatibility, Management Tools – Basic, Management Tools – Complete, and click Next.
13. At the Installation Rules screen, click Next.
14. At the Instance Configuration screen, leave the defaults, and click Next.
15. At the Disk Space Requirements screen, click Next.
16. At the Server Configuration screen, choose the service account (we chose NT authority network service with no password), enter a password if necessary, and click Next.
17. At the Database Engine Configuration screen, select Mixed Mode, enter a password for the system administrator (sa) account, click Add Current User, and click Next.
18. At the Error Reporting screen, click Next.
19. At the Installation Configuration Rules screen, click Next.
20. At the Installation screen, click Install.
21. At the Complete screen, click Close.
22. Install SQL SP1 & SP2 2008 Standard.

Setting up .NET StockTrader 2.04/WSTest 1.5

1. Download StockTraderSetup.
2. Browse to the .msi file, and double click it to install.
3. At the Introduction screen, click Next.
4. At the License Agreement screen, click I Agree.
5. At Installation screen, review the information, and click Next.
6. At the Installation Type screen, click Full Install, and click Next.

7. Select the folder where you wish to install the program. We chose the default location, and selected the Everyone option.
8. At the screen that says the installation is ready to install, click Next to begin installation.
9. When the installation completes, click OK.

Configuring the Microsoft Distributed Transaction Coordinator

1. Run the following Start Menu command: comexp.msc Open Componet→Computers folder→My Computers→Distributed Transaction Coordinator folder→Local DTC.
2. Right-click Local DTC, and click Properties. Click the Security tab.
3. Select Network DTC Access, and click Allow Remote Clients.
4. For Transaction Manager Communication, select Allow Inbound and Allow Outbound.
5. Click Enable XA Transactions. Click Apply. If the service doesn't notify you that it has begun, complete Step 4.
6. At the Windows Start menu, run command services.msc. Locate the Distributed Transaction Coordinator service; right-click it, and choose Restart.

Allowing anonymous users to send order messages to MSMQ

The Order Processor Service uses tradeorders, which is an auto-created transaction queue.

Tradeorders uses a WCF binding with anonymous access from StockTrader Business Services. If you choose to, you can apply more restrictive security settings. We used the default WCF binding. To allow remote instances of the Business Services IIS Host to send orders to a system running the Order Processor Service, you must grant send permissions to this queue for the default Anonymous Logon account. You must also grant send permission to the Everyone group. Complete the following steps to apply these settings:

1. Click Start→Run, and type `Order Processor`.
2. Click .NET StockTrader Order Processor Service Self Host. If you have properly installed MSMQ as a Windows feature, it will create the MSMQ automatically when it runs. Note that when you install MSMQ as a Windows feature, install only the CORE. Do not choose Active Directory Integration.
3. When the Order Processor Service Console window notifies you that the tradeorders transacted message queue has been created, close the Order Processor Service Windows host program.
4. Click the Control Panel→Administrative Tools→Computer Management.
5. Click Services and Applications. Click Message Queuing→Private Queues.
6. Right-click the tradeorders queue. Choose Properties.
7. Click the Security tab, and click Add.
8. Click Locations, and select the topmost icon, which will be the local computer.
9. Type `anonymous logon` and click OK. The application should automatically grant send message permissions.

Installing the StockTrader client on the client workstations

1. Download a copy of .NET 3.5.1.
2. Install it on the client workstations, and reboot the workstation.
3. Navigate to the StockTrader folder located on the server.
4. Navigate to the Builds folder. Copy the CapacityPlannerAgent subfolder to a USB drive.

5. Copy the client onto the client workstations.

Setting up the Performance Counter
1. Click Start, and type `perfmon` to launch the performance monitor.
2. Under Data Collector Sets, click the plus to reveal User Defined. Right click User Defined, and select New→Data Collector Set.
3. On the Create New Data Collector Set screen, type in a name for the data collector, select Create Manually, and click Next.
4. On the Create new Data Collector Set screen, choose Performance Counter, and click Next.
5. On the next Create Data Collector Set screen, we added the following counters:
   - Under Network Interface, we added Bytes total/Sec and selected Each Individual Network Interface Card under instances of selected object.
   - Under Processor, we added % Processor Time and selected Total under instances of selected object.
   - Under Web Service, we added Total Method Requests/sec. and selected Total under instances of selected object.
6. Click OK to create the counter.

Running the test
1. Browse to C:\StockTrader\Builds\ and launch the SQL_Loader.
2. To create the initial database, change the username to 'sa' and enter the password. Under Specify Load, use the default options.
3. Click Create Initial StockTrader Database. At the prompt to ensure the information you entered is correct, click OK.
4. Leave the default name for the database. Change the location of the Data file and Log file to C:\StockTrader\ and click OK.
5. At the warning that this will drop any databases named StockTraderDB, click OK. At the warning that there will be a user created called trade, click Yes.
6. Click Load StockTrader Database. (Times vary.)
7. Click OK. (Note between each subsequent run, come back to this program and click Reset StockTrader to reset the database.)
8. Browse to C:\StockTrader\Builds\CapacityPlannerController, and click CapacityPlanner.CapacityPlannerHost.exe.
9. Click Setup Remote Agent, and click Add to add the individual client machines. Enter the Machine Name, the number `400` for the threads, and click OK. Do this for each of the clients.
10. Click Launch WSTest Benchmark. For the WSTest Operation, select getOrder, for message size use 10, and leave think time at 1 second. Click Check Connectivity to ensure that the program can connect to the SQL server.
11. Click Launch Test and start the Performance Counter.

In this report, we report the average requests per second for each system for the median of three runs. We calculated the average from the entire 45-minute run. WSTest shows the requests per second in real time on its GUI interface, but does not log the information to an output file. We used the \web

service(_Total)\Total Method Requests/sec counter from performance monitor to calculate the average. We did some experimental testing by recording the WSTest counters at certain times in the run and then verified the data from the Total Method Requests/sec counter gave the same data output.

APPENDIX A – SERVER CONFIGURATION INFORMATION

Figure 4 provides detailed configuration information about the test servers.

System	Dell PowerEdge T110	Dell PowerEdge T310	Dell PowerEdge R310
Power supplies			
Total number	1	2	2
Vendor and model number	Dell L305P-01	Dell D400EF-S0	Dell D400EF-S0
Wattage of each (W)	305	400	400
Cooling fans			
Total number	1	1	5
Vendor and model number	Delta Electronics EFC0912BF	Sunon PSD1212PMB1-A	San Ace 40 9CRD0412P5K06
Dimensions (h x w) of each	3 5/8" X 3 5/8"	5 1/4" x 5 1/4"	1 5/8" x 2 1/4"
Volts	12	12	12
Amps	0.6	2.0	1.2
General			
Number of processor packages	1	1	1
Number of cores per processor	4	4	4
Number of hardware threads per core	1	2	2
System power management policy	Balanced	Balanced	Balanced
CPU			
Vendor	Intel	Intel	Intel
Name	Xeon	Xeon	Xeon
Model number	X3430	X3440	X3470
Stepping	B1	B1	B1
Socket type	1156 LGA	1156 LGA	1156 LGA
Core frequency (GHz)	2.40	2.53	2.93
Bus frequency (GT/s)	2.5	2.5	2.5
L1 cache	4 X 32 KB	4 X 32 KB	4 X 32 KB
L2 cache	4 X 256 KB	4 x 256 KB	4 X 256 KB
L3 cache (MB)	8	8	8
Platform			
Vendor and model number	Dell PowerEdge T110	Dell PowerEdge T310	Dell PowerEdge R310

System	Dell PowerEdge T110	Dell PowerEdge T310	Dell PowerEdge R310
Motherboard model number	Dell Inc. 0X744K	Dell Inc. 0P673K	Dell Inc. 0P229K
Motherboard chipset	Intel 3420	Intel 3420	Intel 3420
BIOS name and version	Dell Inc. 1.3.4 (5/24/2010)	Dell Inc. 1.3.6 (05/24/2010)	Dell Inc. 1.1.5 (05/24/2010)
BIOS settings	Default	Default	Default
Memory module (s)			
Total RAM in system (GB)	8	8	8
Vendor and model number	Hynix HMT351U7BFR8C-H9	Hynix HMT125U7BFR8C-H9	Hynix HMT125U7BFR8C-H9
Type	PC3-10600E	PC3-10600E	PC3-10600E
Speed (MHz)	1,333	1,333	1,333
Speed running in the system (MHz)	1,333	1,333	1,333
Timing/Latency (tCL-tRCD-tRP-tRASmin)	9-9-9-24	9-9-9-24	9-9-9-24
Size (GB)	4	2	2
Number of RAM module(s)	2 X 4GB	4 X 2 GB	4 X 2 GB
Chip organization	Double-sided	Double-sided	Double-sided
Rank	Dual	Dual	Dual
Hard disk			
Vendor and model number	Dell WD1602ABKS	Dell MBA3147RC	Dell MBA3147RC
Number of disks in system	2	2	2
Size (GB)	160	146	146
Buffer size (MB)	8	16	16
RPM	7,200	15,000	15,000
Type	SATA	SAS 3 GB/s	SAS 3 GB/s
Disk controller			
Vendor and model	Dell PERC S100	Dell PERC 6/i	Dell PERC H200
Controller cache	N/A	256 MB	N/A
Controller driver	Microsoft 6.1.7600.16385 (6/21/2006)	LSI 4.5.0.64 (02/06/2009)	Del 2.0.12.20 (12/18/2009)
Controller firmware	1.01-0021	6.2.0-0013	2.15.63.00-IR
RAID configuration	RAID 1	RAID 1	RAID 1
Operating system			
Name	Windows Server 2008 R2, Foundation Edition	Windows Server 2008 R2, Standard Edition	Windows Server 2008 R2, Standard Edition

System	Dell PowerEdge T110	Dell PowerEdge T310	Dell PowerEdge R310
Build number	7600	7600	7600
File system	NTFS	NTFS	NTFS
Kernel	ACPI x64-based PC	ACPI x64-based PC	ACPI x64-based PC
Language	English	English	English
Graphics			
Vendor and model number	Matrox® G200eW	Matrox G200eW	Matrox G200eW
Graphics memory (MB)	8	8	8
Driver	Matrox Graphics Inc. 1.1.3.0 (07/27/2009)	Matrox Graphics Inc. 1.1.3.0 (07/27/2009)	Matrox Graphics Inc. 1.1.3.0 (07/27/2009)
Ethernet			
Vendor and model number	Broadcom® NetXtreme® Gigabit Ethernet	Broadcom BCM5716C NetXtreme II GigE	Broadcom BCM5716C NetXtreme II GigE
Type	Integrated	Integrated	Integrated
Driver	Microsoft 10.100.4.0 (4/26/2009)	Broadcom 5.2.14.0 (12/17/2009)	Broadcom 5.2.14.0 (12/17/2009)
Ethernet 2			
Vendor and model number	N/A	N/A	Broadcom BCM5709C NetXtreme GigE
Type	N/A	N/A	PCIe
Driver	N/A	N/A	Broadcom 5.2.14.0 (12/17/2009)
Optical drive(s)			
Vendor and model number	PLDS DVD-ROM DH-16D5S	HL-DT-ST DVD+RW GH50N ATA Device	TSSTCorp DVD + - RW TS-L633C ATA Device
Type	DVD-ROM	DVD+RW	DVD +/ - RW
USB ports			
Number	6	6	4
Type	2.0	2.0	2.0

Figure 4: Configuration information for the test servers.

ABOUT PRINCIPLED TECHNOLOGIES

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

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 our clients assess how it will fare against its competition, its performance, its market readiness, 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.