

Dell™ PowerEdge™ R310

Delivers **10.0%** greater price-performance



versus
HP ProLiant DL120 G6



*And it offers more expansion room
for future growth!*

OUR FINDINGS

To minimize data center costs and provide capacity for future growth, companies need servers that deliver both strong price-performance and a variety of expansion options. In Principled Technologies' tests in our labs, the Dell PowerEdge R310 delivered 10.0% greater Web server performance per dollar, and handled 6.5% more requests per second, than the HP ProLiant DL120 G6 server—and it offered more hardware options for future growth. The Dell PowerEdge R310 lets a company spend less to achieve comparable performance today and secure greater options for tomorrow.

OUR PROCESS

To gauge how well each server handled Web server activity, we used WebBench, an industry-standard benchmark that measures how well servers handle Web-service functions. We configured both systems with Microsoft® Windows Server® 2008 R2 Enterprise Edition and ran Internet Information Services as our Web server.



PROJECT OVERVIEW

The goals of the project were to determine which of the following systems had better Web server price-performance and could deliver more requests per second, and to determine which server offered more advanced hardware options to allow for future growth:

- Dell PowerEdge R310
- HP ProLiant DL120 G6

Both servers ran Microsoft Windows Server 2008 R2 Enterprise Edition. We used 48 clients running Microsoft Windows XP Professional Service Pack 3 to induce a heavy Web server load on the server.

We also compared the upgrade capabilities of each server's online offerings to determine which system had superior hardware options.

WORKLOAD

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 the 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 performance of the server under test. The peak of that curve represents the peak throughput of the server. WebBench reports results in the total number of requests per second the server handled.

We ran WebBench's e-commerce CGI test suite, which generates a mixture of secure and non-secure, dynamic and static 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 number of clients increase, the clients increasingly saturate the Web server's resources until a component, in this case the network cards, reaches maximum utilization. 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. Once the increasing number of clients no longer demonstrated proportional growth in requests per second for three consecutive mixes, we took the highest measurement of requests per second from those mixes.

SYSTEM COMPARISON

Figure 1 highlights some similarities and differences between the two servers. Appendix A presents detailed system information.

Hardware specifications	Dell PowerEdge R310	HP ProLiant DL120 G6
CPU	Intel® Xeon® X3450	Intel Xeon X3450
CPU speed (GHz)	2.66	2.66
Number of processor packages	1	1
Number of cores per processor package	4	4
Number of hardware threads per core	2	2
Memory type	PC3-8500R	PC3-8500R
Total memory (GB)	8	8
Maximum supported memory (GB)	32	24
Redundant power supply	Available	Not available

Figure 1: System configuration information for the test servers.

As Figure 1 shows, the servers are very similar. The primary differences lie in the Dell PowerEdge R310's greater potential for future expansion in the following two areas:

- **Redundant power supply.** The Dell PowerEdge R310 is available with a redundant power supply option, while the HP ProLiant DL120 G6 only offers non-redundant configurations. Redundant power supplies prevent server downtime in the event of a power supply failure.
- **Maximum memory.** The Dell PowerEdge R310 offers expansive memory configuration options supporting up to 32GB RAM, while the HP ProLiant DL120 G6 supports only 16GB RAM.

Note: We configured our test systems with 8 GB of total RAM using two 4GB PC3-8500R, 1,066MHz, quad-ranked memory modules. You can alternatively configure the Dell PowerEdge R310 for faster memory performance – also at 8GB total RAM – using four 2GB PC3-10600R, 1,333MHz, dual-ranked memory modules.

WHAT WE FOUND

As Figure 2 shows, the Dell PowerEdge R310 achieved a WebBench price-performance score of 4.97 requests per second/dollar, a 10.0 percent greater price-performance score than the HP ProLiant DL120 G6, which achieved a price-performance score of 4.52 requests per second/dollar. To calculate the price-performance, we divided requests per second by price.



Figure 2: Normalized WebBench price-performance results for the two servers. Higher numbers are better.

Figure 3 shows the prices of the two servers on April 27, 2010. The Dell PowerEdge R310, at \$4,689, cost 3.2 percent less than the HP ProLiant DL120 G6 at \$4,844.



Figure 3: Price comparison for the two servers. Lower numbers are better.

As Figure 4 shows, the Dell PowerEdge R310 achieved a WebBench score of 23,308 requests per second, 6.5 percent greater than the HP ProLiant DL120 G6's score of 21,888 requests per second.

Figure 5 provides detailed test results for each WebBench mix, in requests per second, for the test servers.

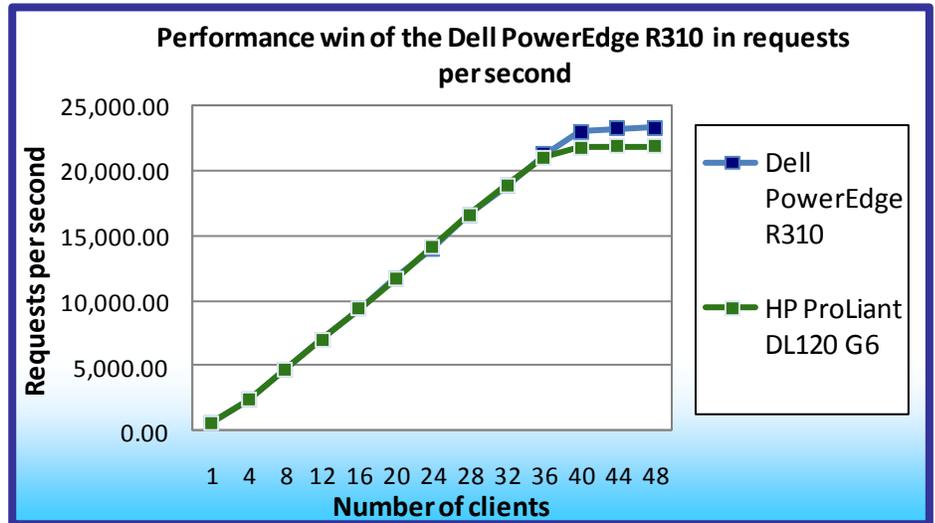


Figure 4: WebBench performance results, in requests per second, for the two servers. Higher numbers are better.

Server	Dell PowerEdge R310	HP ProLiant DL120 G6
Number of clients	Requests per second	Requests per second
1	574.279	580.088
4	2,340.512	2,337.488
8	4,681.692	4,711.704
12	7,022.587	7,026.521
16	9,382.458	9,365.325
20	11,698.133	11,661.446
24	14,035.303	14,130.662
28	16,632.879	16,581.821
32	18,853.863	18,866.693
36	21,248.233	21,024.729
40	23,041.900	21,812.949
44	23,275.841	21,860.871
48	23,308.699	21,888.088
Peak score	23,308.699	21,888.088

Figure 5: Detailed WebBench test results, in requests per second, for the test servers. Higher numbers are better.

HOW WE TESTED

Setting up the servers

For each server, we configured two internal SAS hard drives into a RAID 1 volume. We installed a fresh copy of Microsoft Windows Server 2008 R2 Enterprise Edition on both servers. Following the operating system installation, we installed all recommended Windows Updates through May 4th, 2010.

Installing Microsoft Windows Server 2008 R2 Enterprise Edition on the host 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 Enterprise (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 the network configuration on the server

1. Click Start→Network. Click Network and Sharing Center, and click Change Adapter Settings.
2. Double-click the appropriate Local Area Connection assigned to the first half of the clients.
3. Select Internet Protocol Version 4 (TCP/IPv4), and click Properties.
4. In the Internet Protocol Version 4 (TCP/IPv4) Properties screen, select the Use the following IP address radio button.
5. Enter a valid static IP address, subnet mask, and default gateway.
6. Click OK, and click Close to exit.
7. Repeat steps 2 through 6 for the second Local Area Connection assigned to the second half of the clients.

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.

Installing and configuring the Web server (WebBench)

Deploying WebBench data

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 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. The wwwroot directory is located at C:\inetpub\wwwroot).
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 simcgi.exe to the CGI-BIN folder.

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.

Installing certificate services

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

1. Go to Services and Applications→Internet Information Services (IIS) Manager→ServerName.
2. Double-click Server Certificates.
3. Click 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 the https entry, and click Edit.
8. Set the SSL Certificate to Performance, and click OK.
9. Click Add.
10. Set the type to http, and set the IP address to `192.168.1.1`
11. Set the Port to `81`, and click OK.
12. Click Add.
13. Set the type to https, and set the IP address to `192.168.1.1`
14. Select an appropriate SSL Certificate.
15. Set the Port to `444`, and click OK.
16. If a warning pops up, click Yes.
17. Click Close.
18. Double-click SSL settings.
19. Uncheck the Require SSL check box.
20. Click Apply.

Creating SSL Communication

We enabled SSL communication as follows:

1. Go to Services and Applications→Internet Information Services (IIS) Manager→ServerName.
2. Expand the Default Web site.
3. Expand wbtrees.
4. Click Wbssl.
5. Double-click SSL Settings.
6. Check Require SSL.
7. 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

Testing Procedure

To facilitate rebooting the clients, we stored a batch file in the Web Controller to reboot them remotely.

1. Restart the clients.
2. Restart the server.
3. Restart the Web Controller.
4. On the desktop, double-click the Web Controller shortcut.
5. Go to the top bar, and click Clients→Start Log In...
6. Restart all of the Web Clients.
7. Wait for all of the Web Clients to appear on the left side of the WebBench Controller Program.
8. Click OK.
9. When the application prompts you to add a test suite, click Yes.
10. Select the appropriate e-commerce CGI test suite file.
11. Give the run an appropriate name (e.g., ServerXYZ_TestRun1).
12. Click OK.
13. When the Would you like to start executing the test suites? Screen appears, do not click Yes or No. Instead, leave the screen.
14. Wait 5 minutes for the server to complete startup tasks, and then click Yes.

APPENDIX A – SERVER CONFIGURATION INFORMATION

Figure 6 provides detailed configuration information about the test servers.

Servers	Dell PowerEdge R310	HP ProLiant DL120 G6
General processor setup		
Number of processor packages	1	1
Number of cores per processor package	4	4
Number of hardware threads per core	2	2
CPU		
Vendor	Intel	Intel
Name	Xeon X3450	Xeon X3450
Stepping	B1	B1
Socket type	LGA1156	LGA1156
Core frequency (GHz)	2.66	2.66
Bus frequency	2.5 GT/s	2.5 GT/s
L1 cache	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)
L2 cache	256 KB (per core)	256 KB (per core)
L3 cache (MB)	8	8
Thermal design power (TDP, in watts)	95	95
Platform		
Vendor and model number	Dell PowerEdge R310	HP ProLiant DL120 G6
Motherboard chipset	Intel 3420	Intel 3420
BIOS name and version	Dell 1.0.0 (04/13/2010)	HP 0260126 (01/26/2010)
BIOS settings	Default	Default
Memory modules		
Vendor and model number	Hynix HMT151R7BFR8C-G7	Micron MT36JSZF51272PDZ-1G1F1AB
Type	PC3-8500R DDR3	PC3-8500R DDR3
Speed (MHz)	1,066	1,066
Speed in the system currently running @ (MHz)	1,066	1,066
Timing/Latency (tCL-tRCD-iRP-tRASmin)	7-7-7-20	6-6-6-16
Size (GB)	8	8
Number of RAM modules	2 x 4 GB	2 x 4 GB
Chip organization	Double-sided	Double-sided

Servers	Dell PowerEdge R310	HP ProLiant DL120 G6
Hard disk		
Vendor and model number	Dell ST3300657SS	HP EF0300FARMU
Number of disks in system	2	2
Size (GB)	300	300
Buffer size (MB)	16	16
RPM	15,000	15,000
Type	SAS 6Gb/s	SAS 6Gb/s
Controller	Dell PowerEdge RAID Controller (PERC) H700	HP Smart Array P212 Controller
Operating system		
Name	Windows Server 2008 R2 Enterprise	Windows Server 2008 R2 Enterprise
Build number	7600	7600
File system	NTFS	NTFS
Language	English	English
Network card/subsystem		
Vendor and model number	Broadcom BCM5716C NetXtreme II Gigabit Ethernet	Broadcom BCM5723 NetXtreme Gigabit Ethernet
Type	Integrated	Integrated
Number of ports	2	2
USB ports		
Number	4	6
Type	USB 2.0	USB 2.0

Figure 6: Detailed configuration information for the test servers.

ABOUT PRINCIPLED TECHNOLOGIES



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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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