Principled Technologies®

TEST REPORT
MARCH 2007

WebBench performance and power consumption on uniprocessor Intel- and AMD-processor-based servers

Executive summary

Intel Corporation (Intel) commissioned Principled Technologies (PT) to measure the WebBench performance on servers using the following five processors:

- AMD Opteron processor model 1214
- Intel Pentium D processor 840
- Intel Pentium D processor 950
- Intel Xeon processor 3070
- Quad-Core Intel Xeon processor X3220

For this report, we used the WebBench results from our June 2006 test report (http://www.principledtechnologies.com/clients/reports/Intel/UPWebBench0606.pdf) for the Intel Pentium D processor 840- , the Intel Pentium D processor 950- , and the Intel Xeon processor 3070-based servers. We ran WebBench on the AMD Opteron processor model 1214-based server and the Quad-Core Intel Xeon processor X3220-based server in March 2007 and include those results in addition to the previous scores in this report.

KEY FINDINGS

- The Quad-Core Intel Xeon processor X3220-based server delivered over 83 percent higher peak WebBench performance than the AMD Opteron processor model 1214-based server (see Figure 1).
- The Quad-Core Intel Xeon processor X3220-based server delivered almost 13 percent higher performance/watt than the AMD Opteron processor model 1214-based server (see Figure 2).
- The Quad-Core Intel Xeon processor X3220-based server delivered from 33 percent to over 147 percent higher peak WebBench performance than the previous generation Intel Xeon and Intel Pentium D processor-based servers.

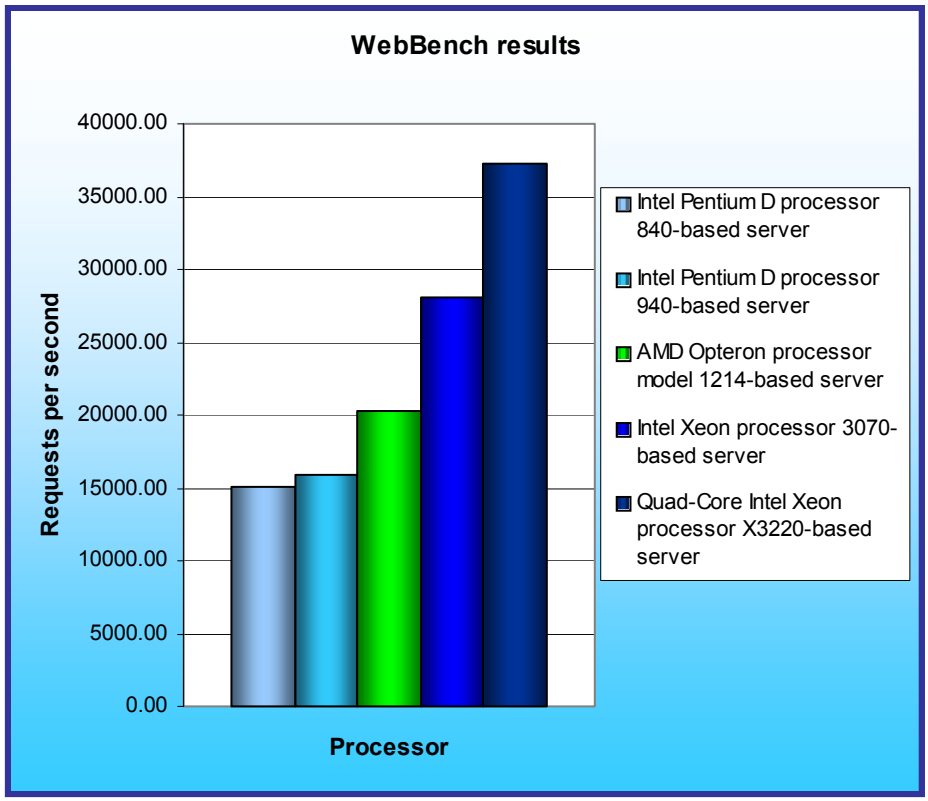

Figure 1: Peak performance of the test servers running WebBench 5.0. Higher numbers of requests per second are better.

Figure 1 shows the median WebBench peak results, in requests per second (rps), of the test servers. To obtain the median results, we performed three runs with each server and selected the middle peak result of each set of runs. A higher number of requests per second is better, because the more Web requests a server can handle, the better.

As Figure 1 illustrates, the Quad-Core Intel Xeon processor X3220-based server produced the highest result, 37,262.7 rps. This result is an 83.5 percent performance increase over the AMD Opteron processor model 1214-based server, which achieved 20,306.7 rps. The Intel Xeon processor 3070-based server outperformed the AMD Opteron processor model 1214-based server by 38 percent with a score of 28,023.5 rps.

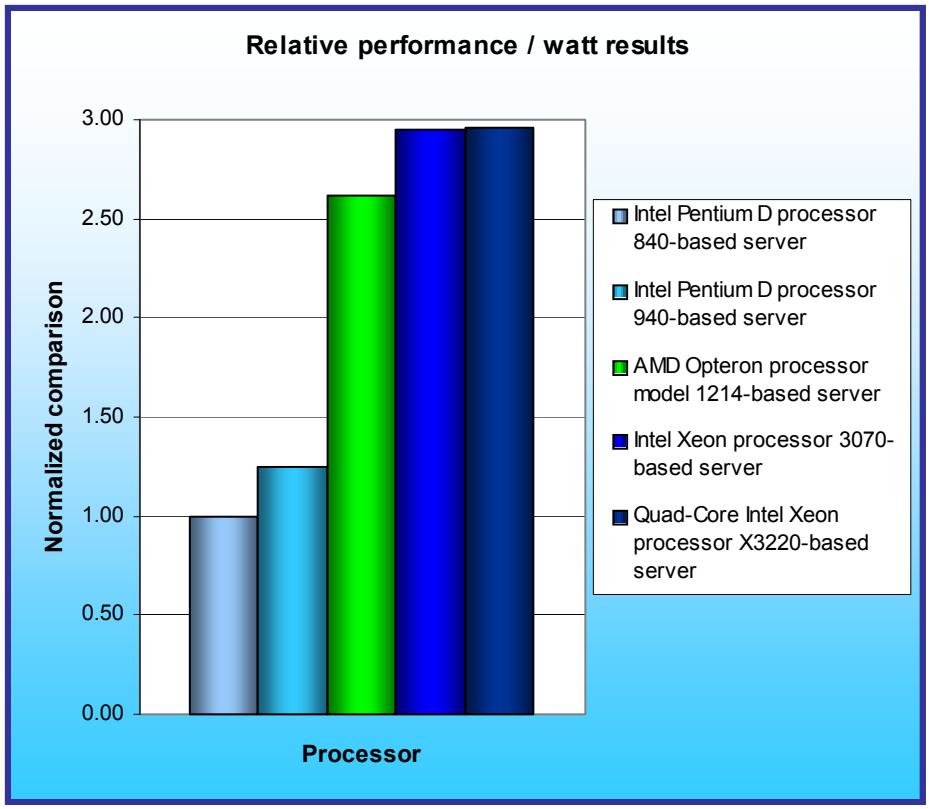

Figure 2: Performance/watt results of the test servers running WebBench 5.0. Higher numbers indicate better performance/watt.

Figure 2 illustrates the performance/watt for each of the servers. In this chart, we normalized the results for each system to the lowest performance/watt configuration. The lowest system's performance/watt result is thus always 1.00. By normalizing, we make each data point in these charts a comparative number, with higher results indicating better performance/watt. To calculate the performance/watt we used the following formula:

Performance/watt = the benchmark's peak score / average power consumption in watts during the time period in which the benchmark was delivering peak performance

As Figure 2 illustrates, at the times of peak performance in their WebBench runs, the Quad-Core Intel Xeon processor X3220-based server delivered almost 13 percent more performance/watt than the AMD Opteron processor model 1214-based server, and the Intel Xeon processor 3070-based server delivered 12.5 percent more performance/watt than the AMD Opteron processor-based server.

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 both the total number of requests per second the server handled and its total throughput in bytes per second. To be certain that we found the true peak performance in our testing, we measured the processor utilization on the server and made sure that it reached or was extremely close to 100 percent during the test.

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. WebBench 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, then a mix with four clients, and then increases the number of clients by four with each mix to a total of 60 clients. A standard WebBench run thus involves 16 mixes.

One option we did change in the default test suite is the number of engines per client. An engine runs on each client and produces the GET requests to the server. We increased the number of engines to 8, which caused each of the 60 clients to run 8 engines during 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. A graph of these results yields a performance curve with a peak at some number of clients.

Test results

Figure 3 shows the WebBench peak results in requests per second and in throughput (bytes per second) of the test servers. Each result is the median of three runs.

Server	Requests per second	Throughput (Bytes per second)
AMD Opteron processor model 1214-based server	20,306.7	82,290,313.9
Intel Pentium D processor 840-based server	15,059.1	60,723,288.9
Intel Pentium D processor 950-based server	15,861.8	64,260,912.1
Intel Xeon processor 3070-based server	28,023.5	113,465,301.7
Quad-Core Intel Xeon processor X3220-based server	37,262.7	151,327,236.3

Figure 4 details the power consumption, in watts, of the test servers while idle and during the median peak runs of the benchmark.

Server	Idle power (watts)	Average power (watts)
AMD Opteron processor model 1214-based server	98.2	125.3
Intel Pentium D processor 840-based server	139.0	243.3
Intel Pentium D processor 950-based server	134.0	204.9
Intel Xeon processor 3070-based server	137.0	153.7
Quad-Core Intel Xeon processor X3220-based server	178.7	203.6

Figure 4: Average power usage (in watts) of the test servers while idle and during the median peak runs of the WebBench workload. Lower numbers are better.

Figure 5 shows a graph of the WebBench requests per second results for all servers. This graph illustrates the server's performance under load for each of the 16 client mixes. As the number of clients increases, so does the load on the server and the number of requests per second the server must perform. During the first couple of mixes, the client count is low, so all of the servers can handle the load with capacity to spare. As the load increases, however, the server reaches its maximum capacity and the processor utilization becomes 100 percent (or very close to that). The curves peak and flatten at those points. A higher peak indicates better performance; therefore, the Quad-Core Intel Xeon processor X3220-based server yielded the best performance.

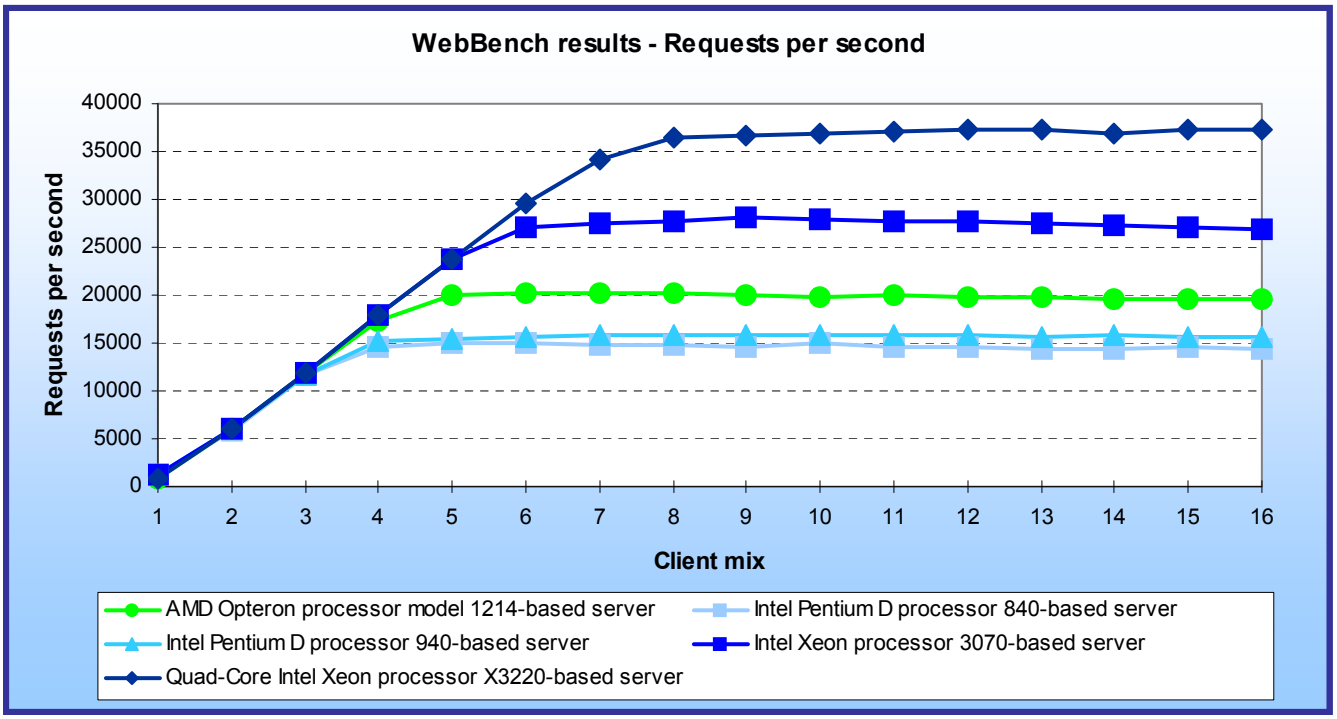

Figure 5: Line graph of the WebBench requests per second results for the test servers. A higher peak indicates better performance.

Figure 6 shows the WebBench throughput results, in bytes per second, for all servers. As with the previous graph, a higher peak is better. Again, the Quad-Core Intel Xeon processor X3220-based server yielded the best performance.

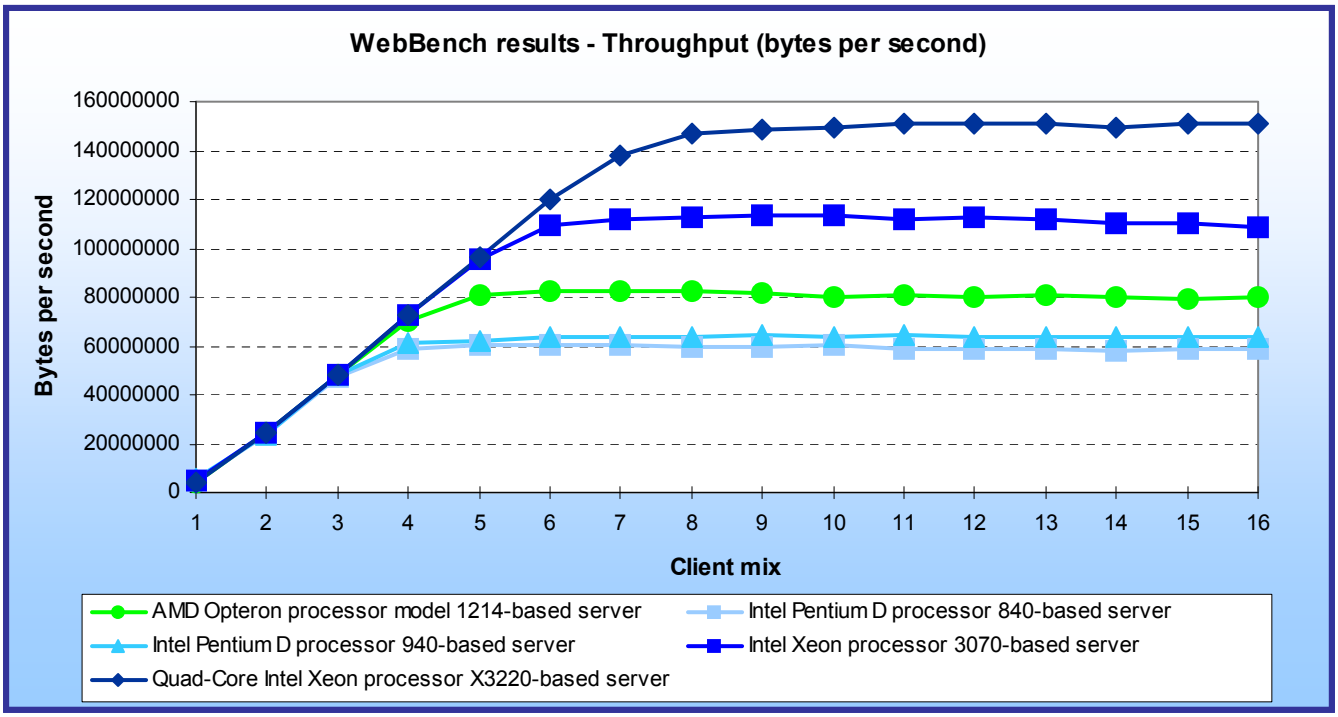

Figure 6: Line graph of the WebBench throughput results for the test servers. A higher peak indicates better performance.

Results of experimental testing

For the above testing, we installed two Intel PRO/1000 PT Dual Port Server Adapters in all servers. We did not, however, achieve 100 percent processor utilization on the Quad-Core Intel Xeon processor X3220-based server during our experimental testing due to all the I/O interrupts being handled by one processor. To resolve this issue, we installed a single Intel PRO/1000 MT Quad Port Server Adapter in the Quad-Core Intel Xeon processor X3220-based server and configured Microsoft's Interrupt-Affinity tool to distribute the interrupts across all logical processors. Adding the new server adapter allowed us to achieve 100 percent processor utilization. The other servers achieved 100 percent processor utilization with the two Intel PRO/1000 PT Dual Port Server Adapters installed.

We could not install the Intel PRO/1000 MT Quad Port Server Adapter, a PCI-X card on the AMD Opteron processor model 1214-based server, because that system did not have a PCI-X slot. To make sure the AMD Opteron processor model 1214-based server achieved the best results possible in both peak performance and energy consumption, we ran an experimental test with an Intel PRO/1000 PT Quad Port Server Adapter. This experiment produced lower WebBench peak results but used the same amount of energy as the tests with the two Intel PRO/1000 PT Dual Port Server Adapters. We also performed an experimental run on this server with Microsoft's Interrupt-Affinity, but we did not see a performance increase.

We ran no experimental testing on the Intel Pentium D processor 840-, Intel Pentium D processor 950-, or Intel Xeon processor 3070-based server because the results from these systems are, as we noted earlier, from an earlier test and the systems were not available to us during this test.

Test methodology

Figure 7 summarizes some key aspects of the configurations of the server systems; Appendix A provides detailed configuration information.

Server	AMD Opteron processor model 1214-based server	Intel Pentium D processor 840-based server	Intel Pentium D processor 950-based server	Intel Xeon processor 3070-based server	Quad-Core Intel Xeon processor X3220-based server
Processor frequency (GHz)	2.20 GHz	3.20 GHz	3.40 GHz	2.66 GHz	2.40 GHz
System bus	1000 MHz	800 MHz	800 MHz	1066 MHz	1066 MHz
Number of processor packages	1	1	1	1	1
Number of cores per processor package	2	2	2	2	4
Number of hardware threads per core	1	1	1	1	1
Motherboard	IBM eServer x3105 – (434764U)	Intel 3000 Chipset-based internal reference board	Intel 3000 Chipset-based internal reference board	Intel 3000 Chipset-based internal reference board	Intel Entry Server Board S3000AHLX (LX version)
Chipset	NVIDIA nForce4	Intel 3010 Chipset	Intel 3010 Chipset	Intel 3010 Chipset	Intel 3000 Chipset
RAM (4 x 2GB in each)	PC2-5300	PC2-4200	PC2-4200	PC2-4200	PC2-4200
Hard drive	Western Digital WD1600YD	Western Digital WD1600YD	Western Digital WD1600YD	Western Digital WD1600YD	Western Digital WD1600YD

Figure 7: Summary of some key aspects of the server configurations.

Intel configured and provided all five servers. We received the AMD Opteron processor model 1214-based server system unopened from the vendor. That server used the highest frequency AMD Opteron processor available from the vendor at the time we began testing.

With the following exception, we used the default BIOS settings on each server: we disabled the HW Prefetcher on the Intel Pentium D processor 840, Intel Pentium D processor 950, and Intel Xeon processor 3070 based servers.

We began our testing by installing a fresh copy of Microsoft Windows 2003 Server, Enterprise Edition Service Pack 1 on each server. We followed this process for each installation:

1. Assign a computer name of “Server”.
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.

We applied the following updates from the Microsoft Windows Update site:

- Security Update for Windows Server 2003 (KB908531)
- Windows Malicious Software Removal Tool – April 2006 (KB890830)
- Cumulative Security Update for Internet Explorer for Windows Server 2003 (KB912812)
- Security Update for Windows Server 2003 (KB911562)

- Cumulative Security Update for Outlook Express for Windows Server 2003 (KB911567)
- Security Update for Windows Server 2003 (KB913446)
- Security Update for Windows Media Player Plug-in (KB911564)
- Security Update for Windows Server 2003 (KB911927)
- Security Update for Windows Server 2003 (KB908519)
- Security Update for Windows Server 2003 (KB912919)
- Security Update for Windows Server 2003 (KB904706)
- Update for Windows Server 2003 (KB910437)
- Security Update for Windows Server 2003 (KB896424)
- Security Update for Windows Server 2003 (KB900725)
- Security Update for Windows Server 2003 (KB901017)
- Security Update for Windows Server 2003 (KB899589)
- Security Update for Windows Server 2003 (KB902400)
- Security Update for Windows Server 2003 (KB905414)
- Security Update for Windows Server 2003 (KB899591)
- Security Update for Windows Server 2003 (KB890046)
- Security Update for Windows Server 2003 (KB899587)
- Security Update for Windows Server 2003 (KB896358)
- Security Update for Windows Server 2003 (KB896422)
- Security Update for Windows Server 2003 (KB896428)
- Security Update for Windows Server 2003 (KB893756)
- Security Update for Windows Server 2003 (KB899588)
- Security Update for Windows Server 2003 (KB901214)
- Update for Windows Server 2003 (KB898715)

Power measurement configuration

To record each server's power consumption during each test, we used an Extech Instruments (www.extech.com) 380803 Power Analyzer / Datalogger. We connected the power cord from the server under test to the Power Analyzer's output load power outlet. We then plugged the power cord from the Power Analyzer's input voltage connection into a power outlet.

We used the Power Analyzer's Data Acquisition Software (version 2.11) to capture all recordings. We installed the software on a separate Intel–processor-based PC, which we connected to the Power Analyzer via an RS-232 cable. We captured power consumption at one-second intervals.

To gauge the idle power usage, we recorded the power usage for two minutes while each server was running the operating system but otherwise idle.

We then recorded the power usage (in watts) for each server during the testing at one-second intervals. To compute the average power usage, we averaged the power usage during the time the server was producing its peak performance results. We call this time the power measurement interval. See Figure 4 (idle and average peak power) for the results of these measurements.

Installing Internet Information Services

WebBench requires a Web server, so we installed the Windows Internet Information Services with the following procedure:

1. Click Start→Control Panel→Add/Remove Programs.
2. Select Add/Remove Windows Components.
3. Highlight Application Server and click the Details button.
4. Check the Internet Information Services (IIS) item, and Click OK.
5. Make sure you select enable ASP during the IIS installation.
6. Click the Next button.
7. Click Finish when the installation completes.
8. Close the Add or Remove Programs window.

Deploy WebBench data

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

1. Copy the file wbtree.exe from the WebBench CD to the wwwroot directory on the server under test. (The wbtree.exe file is on the WebBench CD at \wb50\workload).
2. On the server, execute the wbtree.exe file. This program will copy 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 from the wwwroot folder to the CGI-BIN folder.
5. Click Start button→Programs→Administrative Tools→Computer Management to open the management console.
6. Go to Services and Application→Internet Information Services→Default Web Site→CGI-BIN, and right click to bring up a menu. Select Properties.
7. Go to the Directory Tab, and Set Execute Permissions to Scripts and Executables.
8. When the IIS WWW Configuration popup window displays, click Yes.
9. Close the Computer Management window.

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.
3. Right click to bring up a menu. Select Properties.
4. Click the MIME Types button.
5. In the MIME Types window, click the New button.
6. In the Extension field, type "*".
7. In the MIME type field, type "application/octet-stream". Click the OK button.
8. Click the OK button to exit the MIME Types window.
9. Click the OK button to exit the Internet Information Services (IIS) Manager Properties window.
10. In the Computer Management window, go to Web Sites→Default Web Site under Internet Information Services. Right click it to bring up a menu. Select Properties.
11. Select the Home Directory tab.
12. Check the following boxes: Script source access, Read, Write, and Directory browsing.
13. Uncheck the following boxes: Log visits and Index this resource.
14. In the Execute permissions field, select Scripts and Executables.
15. Click the Apply button.
16. Select the Web Site tab.
17. Uncheck Enable Logging.
18. Click the OK button to close the Default Web Site Properties window.
19. In the Computer Management window, go to the Web Service Extensions item under Internet Information Services.
20. In the right panel, highlight All Unknown ISAPI Extensions and click the Allow button. Acknowledge the IIS Manager warning that appears by clicking the Yes button.
21. In the right panel, highlight All Unknown CGI Extensions and click the Allow button. Acknowledge the IIS Manager warning that appears by clicking the Yes button.
22. Close the Computer Management window.

Installing certificate services

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

1. Click Start→Control Panel→Add/Remove Programs.
2. Select Add/Remove Windows Components.
3. Put a check mark by Certificate Services.

4. Accept the notice that the server's name cannot be changed after you install this service.
5. Press Next.
6. Select Stand Alone Root CA, and click Next.
7. On the CA Identifying Information window, enter the server name in the Common name for this CA field, and click Next.
8. Leave the default Certificate Database Settings as they are, and click Next.
9. Click Yes at the prompt asking if you want to enable Active Server Pages (ASP) in IIS.
10. Click yes at the prompt that explains that Internet information Services will be temporarily stopped.
11. Click Next.
12. Click Finish.
13. Click Close.

Set up Internet Explorer

We had to set up Internet Explorer on the server as follows to be able to get the necessary certificates:

1. Double click the Internet Explorer icon on the desktop.
2. Select the Tools→Internet Options menu item.
3. On the Connections tab, click the LAN Settings button.
4. Check Automatically detect settings, and click OK.
5. Click OK to exit the Internet Options window.

Requesting the server certificate

We had to set up Internet Explorer on the server as follows to be able to get the necessary certificates:

1. Open Internet Explorer and enter the following website, http://server/certsrv. This should bring up a page entitled "Microsoft Certificate Services – server".
2. Select Request a Certificate link.
3. Select Advanced Certificate Request link.
4. Select "Create and submit a certificate request to this CA" link.
5. Fill out the appropriate Identifying Information details on the Advanced Certificate Request.
   - Name: Performance
   - Company: PT
   - Type of certificate needed: Server Authentication Certificate
   - Key Options:
     - CSP: Microsoft Base Cryptographic Provider v1.0
     - Usage: Exchange and Signature – select both
     - Key size: 512
     - Check "Automatic key container name"
     - Check "Store certificate in the local computer certificate store"
   - Additional Options:
     - Hash Algorithm: SHA-1
   - Otherwise use default
6. Click [Submit]. Acknowledge the "Potential Scripting Violation" by clicking the [Yes] button.
7. There should now be a page informing that there is a Certificate Pending.

Issuing the server certificate

Next we had to issue a server certificate as follows:

1. Select Start→Programs→Administrative Tools→Certification Authority.
2. Click the server's name.
3. Select Pending Requests.
4. Right click Pending Requests, select All Tasks, and choose Issue.
5. Close Certification Authority.

Installing the server certificate

We then installed the server certificate as follows:

1. Open Internet Explorer.
2. Go to the page http://server/certsrv again.
3. Click the View the status of a pending certificate link.
4. Click the Server Authentication Certificate link.
5. Click the Install this Certificate link.
6. Acknowledge the Potential Scripting Violation warning by clicking the OK button.
7. A message will note that a certificate has been successfully installed.
8. Close Internet Explorer.

Set IIS to use the server certificate

We then set IIS to use the server certificate as follows:

1. Click Start→Programs→Administrative Tools→Computer Management to open the management console.
2. Select Services and Applications→Internet Information Services→Web Sites.
3. Right click the Default Web site, and select Properties.
4. Select the Directory Security tab, and Click the Server Certificate button.
5. The Welcome to the Web Server Certificate Wizard window appears. Click Next.
6. Select Assign an Existing Certificate, and click Next.
7. Select your server certificate (Intended Purpose: Server Authentication). Click Next.
8. Accept the default SSL port (443) in the next window that appears, and click Next.
9. On the Certificate Summary screen click Next.
10. Click Finish.

Create SSL Communication

Finally, we had to enable SSL communication as follows:

1. Go to Computer management→Services and Application→Internet Information Services.
2. Expand the Default Web site.
3. Expand wbtree.
4. Right click Wbssl, and select properties.
5. Select the Directory Security tab.
6. Click the Edit button under Secure communications.
7. Check Require secure channel (SSL).
8. Check Require 128-bit encryption.
9. Click OK.
10. Click OK.

We then set the following operating system tuning parameters to reflect the WebBench recommendations in the Microsoft Performance Tuning Guidelines for Windows Server 2003 document, which is available on Microsoft's Web site.

- HKLM\System\CurrentControlSet\Services\Inetinfo\Parameters\MaxCachedFileSize 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

Network test bed configuration

To generate the WebBench workload, we used a network with 60 client PCs. Each PC contained an Intel Pentium 4 3.0 GHz with HT Technology (or faster) processor, 512 MB of system memory, a 40 GB hard drive, and a

Gigabit Ethernet network adapter. We configured each client with Windows XP Professional with Service Pack 2 and all critical updates available as of January 3, 2006.

We split the 60 clients into four segments, or subnets, of 15 clients each. 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 port of the server's network adapters. Figure 8 illustrates the test bed configuration.

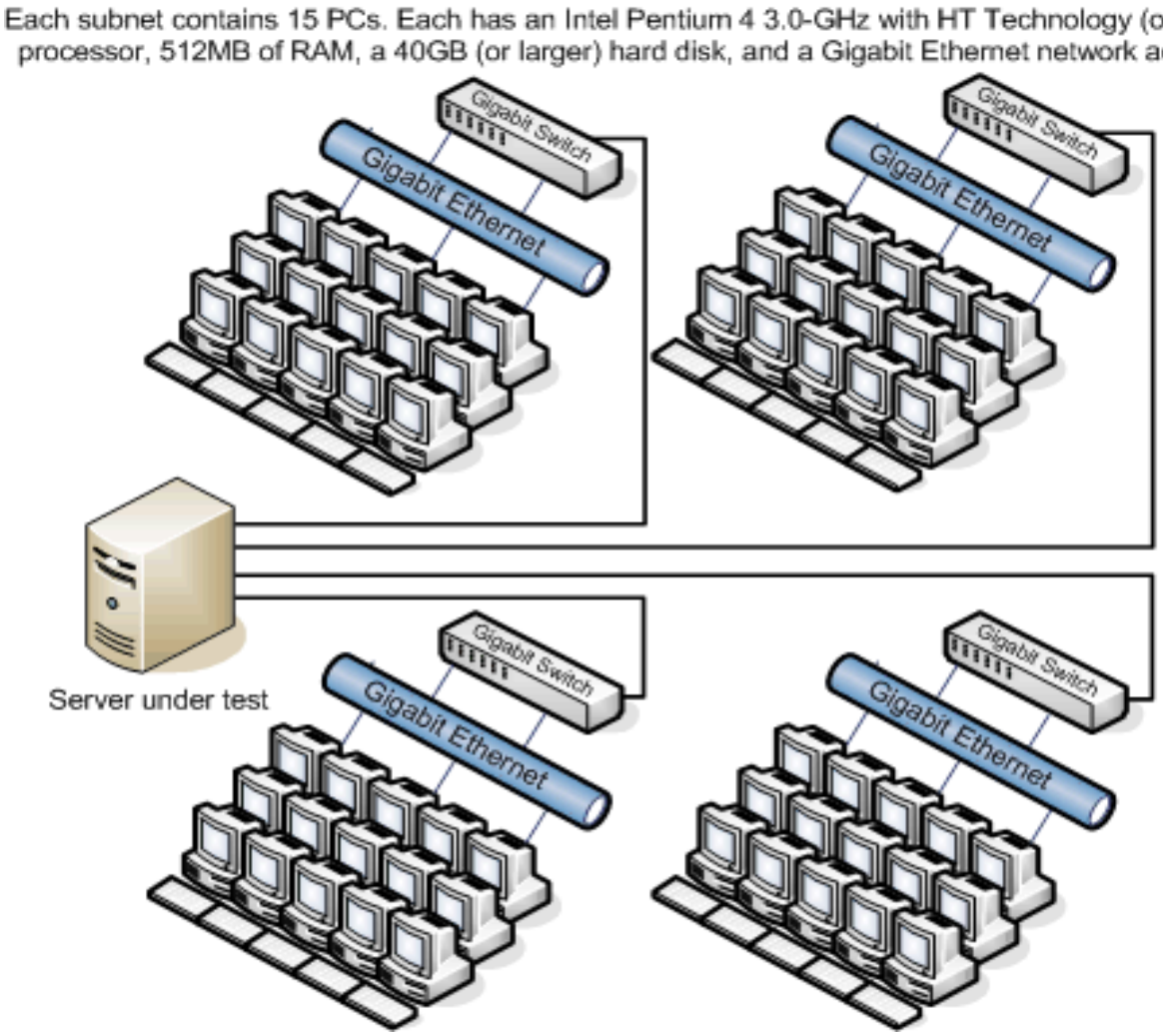

Figure 8: Illustration of the test network we used to generate the WebBench workload.

Appendix A – Test server configuration information

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

Processors	AMD Opteron processor model 1214	Intel Pentium D processor 840	Intel Pentium D processor 950	Intel Xeon processor 3070	Quad-Core Intel Xeon processor X3220
System configuration information					
General processor setup					
Number of processor packages	1	1	1	1	1
Number of cores per processor package	2	2	2	2	4
Number of hardware threads per core	1	1	1	1	1
System Power Management Policy	Always On	Always On	Always On	Always On	Always On
CPU					
Vendor	AMD	Intel	Intel	Intel	Intel
Name	Next-Generation AMD Opteron 1214	Intel Pentium D processor 840	Intel Pentium D processor 950	Intel Xeon processor 3070	Quad-Core Intel Xeon processor X3220
Stepping	2	7	4	4	4
Socket type	AM2	LGA775	LGA775	LGA775	LGA775
Core frequency (GHz)	2.20 GHz	3.20 GHz	3.40 GHz	2.66 GHz	2.40 GHz
System bus	1000 MHz	800 MHz	800 MHz	1066 MHz	1066 MHz
L1 Cache	64 KB + 64 KB (per core)	16 KB + 12 KB	16 KB + 12 KB	32 KB + 32 KB	32 KB + 32 KB (per core)
L2 Cache	2 MB (1 MB per core)	2 MB (1 MB per core)	4 MB (2 MB per core)	4 MB (Shared)	2 x 4 MB (each 4 MB shared by 2 cores)
Platform					
Vendor and model number	IBM System x3105 server	Intel Pentium D processor 840 server	Intel Pentium D processor 950 server	Intel Xeon processor 3070 server	Quad-Core Intel Xeon processor X3220 server
Motherboard model number	IBM eServer x3105 – (434764U)	Intel 3000 Chipset-based internal reference board	Intel 3000 Chipset-based internal reference board	Intel 3000 Chipset-based internal reference board	Intel Entry Server Board S3000AHLX (LX version)
Motherboard chipset	NVIDIA nForce4	Intel 3010 Chipset	Intel 3010 Chipset	Intel 3010 Chipset	Intel 3000 Chipset
Motherboard revision number	A3	C0	C0	C0	00
Motherboard serial number	K109068S1H6	8MWH61400065	8MWH61400065	8MWH61400139	SMWH61400139

BIOS name and version	IBM 1.16-A2E116AUS-1.16, 09/07/06	American Megatrends Inc. EXTWM210.86P, 5/23/2006	American Megatrends Inc. EXTWM210.86P, 5/23/2006	American Megatrends Inc. EXTWM210.86P, 5/23/2006	Intel S3000.86B.02.00.0035.11102006 1326
BIOS settings	Default	Default	Default	Default	Default
Chipset INF driver	NA	8.1.1.1001	8.1.1.1001	8.1.1.1001	8.1.1.1010
Memory module(s)					
Vendor and model number	Micron 18HTF25672AY-667D1	Kingston KVR533D2E4/2G	Kingston KVR533D2E4/2G	Kingston KVR533D2E4/2G	Kingston KVR533D2E4/2G
Type	PC2-5300	PC2-4200	PC2-4200	PC2-4200	PC2-4200
Speed (MHz)	667 MHz	533 MHz	533 MHz	533 MHz	533 MHz
Speed in the system currently running @ (MHz)	333 MHz	400 MHz	400 MHz	533 MHz	533 MHz
Timing/Latency (tCL-tRCD-iRP-tRASmin)	5-5-5-15	3-3-3-9	3-3-3-9	4-4-4-12	4-4-4-12
Size	8192 MB	8192 MB	8192 MB	8192 MB	8192 MB
Number of RAM modules	4	4	4	4	4
Chip organization	Double-Sided	Double-sided	Double-sided	Double-sided	Double-sided
Hard disk					
Vendor and model number	Western Digital WD1600YD	Western Digital WD1600YD	Western Digital WD1600YD	Western Digital WD1600YD	Western Digital WD1600YD
Number of disks in system	1	1	1	1	1
Size	160 GB	160 GB	160 GB	160 GB	160 GB
Buffer Size	16 MB	16 MB	16 MB	16 MB	16 MB
RPM	7200	7200	7200	7200	7200
Type	SATA	SATA	SATA	SATA	SATA
Controller	NVIDIA nForce4 MCP	Intel 82801GB Serial ATA	Intel 82801GB Serial ATA	Intel 82801GB Serial ATA	Intel 82801GB Serial ATA
Controller driver	NVIDIA 5.10.2600.552	Intel 7.0.0.1020	Intel 7.0.0.1020	Intel 7.0.0.1020	Intel 8.2.0.1008
Operating system					
Name	Microsoft Windows 2003 Server, x32 Enterprise Edition	Microsoft Windows 2003 Server, x32 Enterprise Edition	Microsoft Windows 2003 Server, x32 Enterprise Edition	Microsoft Windows 2003 Server, x32 Enterprise Edition	Microsoft Windows 2003 Server, x32 Enterprise Edition
Build number	3790	3790	3790	3790	3790
Service Pack	SP1	SP1	SP1	SP1	SP1
Microsoft Windows update date	6/7/2006	6/7/2006	6/7/2006	6/7/2006	6/7/2006
File system	NTFS	NTFS	NTFS	NTFS	NTFS
Kernel	ACPI Multiprocessor x32-based PC	ACPI Multiprocessor x32-based PC	ACPI Multiprocessor x32-based PC	ACPI Multiprocessor x32-based PC	ACPI Multiprocessor x32-based PC
Language	English	English	English	English	English

Microsoft DirectX version	DirectX 9.0c	DirectX 9.0c	DirectX 9.0c	DirectX 9.0c	DirectX 9.0c
Graphics					
Vendor and model number	ATI ES1000	ATI ES1000	ATI ES1000	ATI ES1000	ATI ES1000
Chipset	ATI ES1000 PCI	ATI ES1000 PCI	ATI ES1000 PCI	ATI ES1000 PCI	ATI ES1000 PCI
BIOS version	1.00	01.00	01.00	01.00	BK-ATI ver008.005.023.000
Type	Integrated	Integrated	Integrated	Integrated	Integrated
Memory size	16 MB	32 MB	32 MB	32 MB	16 MB
Resolution	1024 x 768	1024 x 768	1024 x 768	1024 x 768	1024 x 768
Driver	Microsoft 5.2.3790.0	Microsoft 5.2.3790. 0	Microsoft 5.2.3790. 0	Microsoft 5.2.3790. 0	ATI 8.24.3.0
Network card/subsystem					
Vendor and model number	Broadcom NetXtreme Gigabit Ethernet	Intel PRO/1000 PM Dual Port Network adapter	Intel PRO/1000 PM Dual Port Network adapter	Intel PRO/1000 PM Dual Port Network adapter	Intel PRO/1000 PM Dual Port Network adapter
Type	Integrated	Integrated	Integrated	Integrated	Integrated
Driver	Broadcom 9.81.0.0	Intel 9.3.28.0	Intel 9.3.28.0	Intel 9.3.28.0	Intel 9.3.28.0
Additional card information	2 x Intel PRO/1000 PT Dual Port Server Adapter	2 x Intel PRO/1000 PT Dual Port Server Adapter	2 x Intel PRO/1000 PT Dual Port Server Adapter	2 x Intel PRO/1000 PT Dual Port Server Adapter	1 x Intel PRO/1000 MT Quad Port Server Adapter
Additional card type	PCI Express	PCI Express	PCI Express	PCI Express	PCI–X
Additional card driver	Intel 9.3.28.0	Intel 9.3.28.0	Intel 9.3.28.0	Intel 9.3.28.0	Intel 8.6.17.0
Optical drive					
Vendor and model number	TSSTcorp TS-H492C	Sony DDU1615	Sony DDU1615	Sony DDU1615	Sony DDU1615
Type	DVD-ROM/CD-RW	DVD-ROM	DVD-ROM	DVD-ROM	DVD-ROM
Interface	IDE	IDE	IDE	IDE	IDE
USB ports					
Number	6	4	4	4	4
Type	USB 2.0	USB 2.0	USB 2.0	USB 2.0	USB 2.0

Figure 9: Detailed configuration information for the test servers.

Appendix B – Test network configuration

This appendix provides configuration information about the test network we used to run WebBench 5.0 against the servers under test.

Client #	Make/Model	Processor Speed	Memory Size/Type
Segment/Subnet 1			
Client 1	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 2	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 3	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 4	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 5	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 6	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 7	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 8	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 9	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 10	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 11	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 12	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 13	Custom built	Intel Pentium 4 3.2GHz w/HT	512MB PC2-5300
Client 14	HP d4100y	Intel Pentium D 3.2GHz (DC)	1GB PC2-4300
Client 15	Dell Optiplex GX280	Intel Pentium 4 3.4GHz w/HT	512MB PC3200
Segment/Subnet 2			
Client 16	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 17	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 18	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 19	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 20	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 21	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 22	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 23	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 24	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 25	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 26	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 27	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 28	Custom built	Intel Pentium 4 3.2GHz w/HT	512MB PC3200
Client 29	HP a750y	Intel Pentium 4 3.2GHz w/HT	512MB DDR2-400
Client 30	Custom built	Intel Pentium 4 3.6GHz w/HT	512MB PC2-4300
Segment/Subnet 3			
Client 31	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 32	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 33	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 34	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 35	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 36	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 37	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 38	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 39	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 40	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 41	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 42	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200

Client 43	HP dc5100mt	Intel Pentium 4 3.2GHz w/HT	512MB PC4200
Client 44	HP m1050Y	Intel Pentium 4 3.2GHz w/HT	1GB PC3200
Client 45	HP Dc7100CMT	Intel Pentium 4 3.4GHz w/HT	512MB PC3200
Segment/Subnet 4			
Client 46	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 47	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 48	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 49	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 50	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 51	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 52	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 53	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 54	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 55	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 56	Intel Desktop Board D915GMH	Intel Pentium 4 3.0GHz w/HT	512MB PC3200
Client 57	Dell Optiplex GX270	Intel Pentium 4 3.2GHz w/HT	512MB PC2700
Client 58	Custom built	Intel Pentium 4 3.0GHz w/HT	1GB PC3200
Client 59	IBM ThinkCentre 842243U	Intel Pentium 4 3.4GHz w/HT	512MB PC3200
Client 60	Custom built	Intel Pentium 4 3.6GHz w/HT	512MB PC2-4300

Figure 10: Configuration information about the test network.

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