Principled Technologies®

TEST REPORT
SEPTEMBER 2009

SPECjbb2005 performance and price of the Dell PowerEdge R710 and HP ProLiant DL380 G6

Executive summary

Dell Inc. (Dell) commissioned Principled Technologies (PT) to measure the SPECjbb®2005 performance of similar Intel® Xeon® Processor 5500 series based dual-socket, quad-core servers for the purpose of demonstrating real-world performance and price differences.

We compared the following two servers:

- Dell™ PowerEdge™ R710
- HP ProLiant DL380 G6

KEY FINDING

The Dell PowerEdge R710 server delivered 15.7 percent higher performance/price—more BOPS per dollar—than did the HP ProLiant DL380 G6. (See Figure 1.)*

Dell provided the Dell PowerEdge R710. PT received the HP ProLiant DL380 G6 directly from third-party hardware resellers.

Figure 1 shows the performance/price of the Dell PowerEdge R710 and HP ProLiant DL380 G6. The performance/price metric takes the SPECjbb2005 result in business operations per second (BOPS) and divides that number by the cost of the server. Higher performance/price scores, indicating more cost-effective servers, are better.

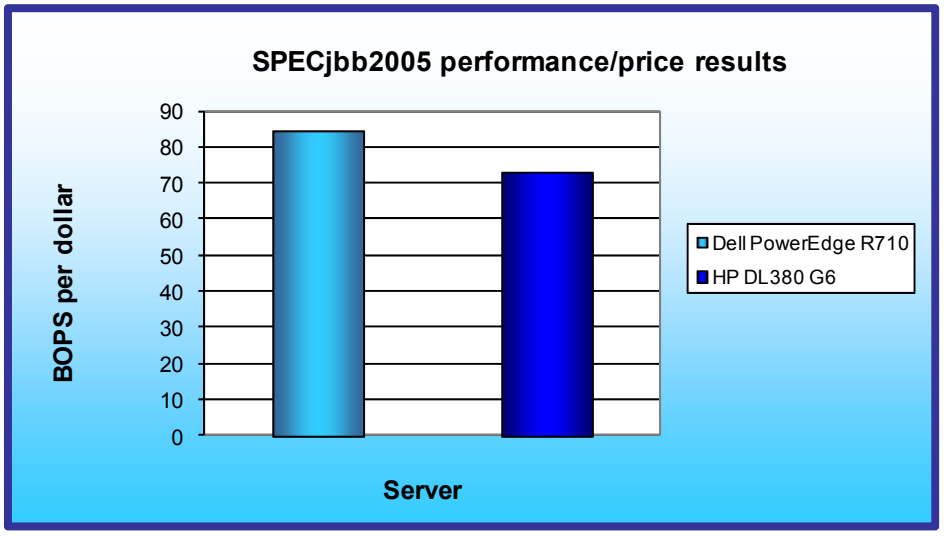


Figure 1: Performance/price of the servers with the SPECjbb2005 workload. Higher numbers are better. For pricing information, see Appendix B.

The Dell PowerEdge R710 had a cost of $5,474 and the higher performance/price, 84.4 BOPS per dollar. The Dell PowerEdge R710 delivered 15.7 percent higher performance/price than the HP ProLiant DL380 G6, which had a price of $6,300 and 72.9 BOPS per dollar.

The Dell PowerEdge R710 produced the higher results, 461,867 BOPS; the HP ProLiant DL380 G6 achieved 459,532 BOPS. A higher SPECjbb2005 score indicates the server is able to handle more Java requests and thus deliver greater throughput.

Each result in this section is the median score of three benchmark runs. For complete details of the performance of each Java Virtual Machine (JVM) by warehouse for each server, see the Test results section.

*Based on a report published by Principled Technologies, commissioned by Dell, "SPECjbb2005 performance and price of the Dell PowerEdge R710 and HP ProLiant DL380 G6" September 2009.

Workload

SPECjbb2005 is an industry-standard benchmark created by the Standard Performance Evaluation Corp. (SPEC) to measure a server's Java performance. (Note: SPEC and the SPECjbb2005 are trademarks of the Standard Performance Evaluation Corporation.) SPEC modeled SPECjbb2005 on the three-tier client/server architecture, with the middle layer as the primary focus. According to SPEC, "Random input selection represents the first (user) tier. SPECjbb2005 fully implements the middle tier business logic. The third tier is represented by tables of objects, implemented by Java Collections, rather than a separate database." (www.spec.org/jbb2005/docs/UserGuide.html).

SPECjbb2005 utilizes multiple special data groups and multiple threads as it runs. Each data unit is a "warehouse," a roughly 25MB collection of data objects. Each thread represents an active user posting transaction requests within a warehouse. The benchmark run begins with one warehouse and then increases the number of warehouses; its goal is to saturate the server's processor capacity. As the number of warehouses increases, so does the number of threads. The benchmark's results portray the server's throughput in business operations per second or SPECjbb2005 BOPS. A higher number of SPECjbb2005 BOPS is better. (For more information on SPECjbb2005, go to www.spec.org.)

Test results

Figure 2 shows the median SPECjbb2005 results for both servers. In each test, we ran two JVMs at the same time, a common practice on servers with many processors. To compute the overall score for the system, SPECjbb2005 sums the scores from both JVMs. SPECjbb2005 computes the score of each JVM by taking the average of the results during mixes when the server is running at peak performance. (In SPEC's terms, these results are from "compliant" runs, which means we can disclose them publicly though we are not posting them on the SPEC Web site with all the files SPEC requires. We do present here all the data necessary to reproduce these results.)

	Dell PowerEdge R710	HP ProLiant DL380 G6
JVM 1	230,015	227,676
JVM 2	231,852	231,856
Total score	461,867	459,532

Figure 2: SPECjbb2005 results for each server by JVM. Higher numbers are better.

Figure 3 shows the results by warehouse for the Dell PowerEdge R710 for all three runs. Run 3 produced the median results.

Dell PowerEdge R710			
	Run 1	Run 2	Run 3
Warehouse	**JVM 1**		
1	53,850	54,558	36,645
2	74,795	75,472	109,576
3	159,927	160,701	140,284
4	207,905	199,392	160,035
5	218,932	217,848	218,350
6	221,006	225,637	220,082
7	228,017	229,190	226,609
8	233,067	233,426	231,015
9	232,955	232,900	230,954
10	232,277	232,154	230,300
11	232,902	232,786	230,895
12	231,391	233,039	229,140
13	231,152	232,495	229,736
14	231,196	231,210	229,517
15	231,001	230,924	229,586
16	230,784	231,243	228,994
Score	231,858	232,242	230,015
Warehouse	**JVM 2**		
1	54,165	54,061	36,917
2	75,384	73,452	75,579
3	130,333	156,507	143,086
4	198,119	199,328	173,596
5	219,277	214,889	219,719
6	225,342	220,354	225,381
7	228,290	223,530	228,477
8	232,648	228,096	233,015
9	232,869	228,180	233,143
10	231,890	227,577	232,239
11	232,716	228,114	232,624
12	230,902	226,055	230,977
13	231,319	226,569	231,280
14	231,085	226,494	231,532
15	230,807	226,191	231,066
16	230,739	225,952	230,792
Score	231,664	227,025	231,852
Total score	463,522	459,267	461,867
Bops/JVM	231,761	229,634	230,934

Figure 3: SPECjbb2005 results for the Dell PowerEdge R710. Higher numbers are better.

Figure 4 shows the results by warehouse for the HP ProLiant DL380 G6 for all three runs. Run 3 produced the median results.

HP ProLiant DL380 G6			
	Run 1	Run 2	Run 3
Warehouse	**JVM 1**		
1	54,356	54,838	54,608
2	90,744	110,646	108,012
3	153,538	161,532	158,084
4	201,210	193,231	176,917
5	205,205	219,259	214,985
6	208,096	217,447	220,287
7	220,324	227,072	223,632
8	227,316	231,283	229,060
9	229,793	231,766	228,749
10	228,658	231,005	228,159
11	229,809	231,509	228,812
12	229,428	229,497	226,682
13	228,329	229,986	227,261
14	227,809	230,089	227,197
15	227,100	229,875	226,768
16	227,845	229,490	226,394
Score	228,454	230,500	227,676
Warehouse	**JVM 2**		
1	53,259	54,606	54,659
2	108,877	110,387	110,540
3	158,705	160,850	154,290
4	206,206	191,386	203,146
5	214,657	219,089	219,233
6	216,455	224,504	224,090
7	223,636	227,976	228,168
8	225,944	232,422	232,848
9	228,940	232,412	232,883
10	228,363	232,039	232,018
11	228,720	232,608	233,034
12	226,860	230,772	231,176
13	227,822	230,927	231,098
14	227,409	231,028	231,340
15	227,098	230,776	231,284
16	226,789	230,605	231,024
Score	227,549	231,510	231,856
Total score	456,003	462,010	459,532
Bops/JVM	228,002	231,005	229,766

Figure 4: SPECjbb2005 results for the HP ProLiant DL380 G6. Higher numbers are better.

Test methodology

We began our testing by installing a fresh copy of Microsoft Windows Server® 2008 Enterprise x64 Service Pack 2 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 logon.
4. Select Eastern Time Zone.
5. Use typical settings for the Network installation.
6. Use `Testbed` for the workgroup.

We used the default BIOS settings, with the exception of disabling HW Prefetcher, Adjacent Cache Line Prefetcher, and Turbo mode on both servers and setting Power Management to Active Power Controller Dell PowerEdge R710.

To improve Java performance, we enabled large pages in memory on all servers. To enable this service, the administrator must first assign additional privileges to the user who will be running the application. We assigned this privilege to only the administrator, because we used that account for our tests. To enable large pages, we selected the following:

- Control Panel→Administrative Tools→Local Security Policy
- Local Policies→User Rights Assignment
- Lock pages in memory, add users and/or groups

SPECjbb2005 configuration

We used SPECjbb2005 version 1.07, dated March 15, 2006. We followed SPEC's run rules. (For more information about SPECjbb2005 and its run rules, see www.spec.org/jbb2005/docs/RunRules.html.) We installed SPECjbb2005 by copying the contents of the SPECjbb2005 CD to the directory C:\SPECjbb2005v1.07 on the server's hard disk.

SPECjbb2005 requires a Java Virtual Machine (JVM) on the system under test. We used the Sun Microsystems Java HotSpot™ 64-bit Server VM (build 14.0-b15, mixed mode) JVM for this testing and left the default installation settings.

After installation, as per the run rules, we edited the SPECjbb_config.props file in the root SPECjbb2005 directory to include disclosure information about the server and our license information. SPECjbb2005 uses this file when generating the results output for each run. We also modified the SPECjbb.props file to change the number of JVM instances to two. This change allows a server to run two JVM instances during testing.

We created a batch file, which we placed in the root SPECjbb2005 directory, to issue the Java run command to launch the benchmark. During testing, we used the command prompt window within Microsoft Windows Server 2008 Enterprise x64 SP2 to run this batch file. The contents of the file we used on each server are as follows:

```
@echo off

set JVM=2

:: Set JAVA_HOME to Java.exe path.
set JAVA_HOME="C:\jdk-6u14-p-windows-x64\bin"

set path=%JAVA_HOME%;%path%

:stage1
set PROPFILE=SPECjbb.props
```

```
set JAVAOPTIONS= -Xms256m -Xmx256m
rem set JBBJARS=.\jbb.jar;.\check.jar
set JBBJARS=.\jbb.jar;.\jbb_no_precompile.jar;.\check.jar;.\reporter.jar

set CLASSPATH=%JBBJARS%;%CLASSPATH%

:stage2
java -version
echo Using CLASSPATH entries:
for %%c in ( %CLASSPATH% ) do echo %%c

@echo on
start /b java %JAVAOPTIONS% spec.jbb.Controller -propfile %PROPFILE%
@echo off

set I=0
:LOOP
set /a I=%I + 1

set J=00FF
IF %I% == 2 set J=FF00



ping localhost > nul
echo.
echo Starting JVM Number %I% with Affinity to CPU %J%
echo.

@echo on
start /HIGH /AFFINITY %J% /B java -server -XX:+UseStringCache -
XX:ParallelGCThreads=8 -XX:+UseCompressedOops -XX:+AggressiveOpts -
XX:+UseLargePages -XX:-UseAdaptiveSizePolicy -Xmx10g -Xms10g -Xmn8g -Xss256k -
XX:SurvivorRatio=24 spec.jbb.JBBmain -propfile %PROPFILE% -id %I% > multi.%I%
@echo off
IF %I% == %JVM% GOTO END
GOTO LOOP
:END

exit
:egress
```

Appendix A – Test system configuration information

This appendix provides detailed configuration information about each of the test server systems, which we list in alphabetical order in Figure 5.

Servers	Dell PowerEdge R710	HP ProLiant DL380 G6
General dimension information		
Height (inches)	3.50	3.39
Width (inches)	17.50	17.53
Depth (inches)	27.00	25.81
U size in server rack (U)	2	2
Power supplies		
Total number	2	2
Wattage of each (W)	570	460
Cooling fans		
Total number	5	6
Dimensions (h x w) of each	2 1/2” x 2 1/2”	2 3/8” x 2 1/2”
Voltage (V)	12	12
Amps (A)	1.60	2.45
General processor setup		
Number of processor packages	2	2
Number of cores per processor package	4	4
Number of hardware threads per core	2	2
System power management policy	Balanced	Balanced
CPU		
Vendor	Intel	Intel
Name	Xeon E5540	Xeon E5540
Stepping	D0	D0
Socket type	LGA1366	LGA1366
Core frequency (GHz)	2.53	2.53
L1 cache	4 x 32 KB + 32 KB	4 x 32 KB + 32 KB
L2 cache	4 x 256 KB	4 x 256 KB
L3 cache (MB)	8	8
Platform		
Vendor and model number	Dell PowerEdge R710	HP ProLiant DL380 G6
Motherboard model number	0M233H	PADAB0G9VXC1CQ
Motherboard revision number	13	0G
BIOS name and version	Dell 1.1.4 (05/08/2009)	HP BIOS P62 (06/01/2009)
BIOS settings	Adjacent Cache Line Prefetch disabled, Hardware Prefetcher disabled, Turbo mode disabled, Power Management set to Active Power Controller	Adjacent Cache Line Prefetch disabled, Hardware Prefetcher disabled, Turbo mode disabled

Servers	Dell PowerEdge R710	HP ProLiant DL380 G6
Memory modules		
Total RAM in system (GB)	24	24
Vendor and model number	Samsung M393B5170DZ1	Samsung M393B5170DZ1
Type	PC3-10600R DDR3	PC3-10600R DDR3
Speed (MHz)	1,333	1,333
Speed in the system currently running @ (MHz)	1,066	1,066
Timing/latency (tCL-tRCD-iRP-tRASmin)	7-7-7-19	7-7-7-20
Size (GB)	24	24
Number of RAM modules	6 x 4 GB	6 x 4 GB
Chip organization	Double-sided	Double-sided
Hard disk		
Vendor and model number	Seagate ST973451SS	HP DH072BAAKN
Number of disks in system	2	2
Size (GB)	73	72
Buffer size (MB)	16	16
RPM	15,000	15,000
Type	SAS	SAS
Controller	Dell PERC 6/i Integrated RAID Controller	HP 410i/256 Integrated Smart Array Controller
Operating system		
Name	Windows Server 2008 Enterprise x64	Windows Server 2008 Enterprise x64
Build number	6001	6001
File system	NTFS	NTFS
Language	English	English
Network card/subsystem		
Vendor and model number	Broadcom NetXtreme II 5709C Dual-Port Ethernet	Broadcom NetXtreme II 5709C Dual-Port Ethernet
Type	Integrated	Integrated
Optical drive		
Vendor and model number	TSSTcorp TS-L333A DVD-ROM	LG GDR-D20N DVD-ROM
USB ports		
Number	4	4
Type	2.0	2.0

Figure 5: Detailed system configuration information for the two test servers.

Appendix B – Pricing

Figure 6 provides the pricing breakdown for each server. Prices exclude tax and shipping.

Server	Dell PowerEdge R710 (24GB RAM)	HP ProLiant DL380 G6 (24GB RAM)
Server, processor, memory, and hard drives	$5,474.00	$6,300.00
Date of price	August 19, 2009	August 19, 2009

Figure 6: Detailed pricing for the servers. Prices exclude tax and shipping.

Appendix C – SPECjbb2005 output

This appendix provides the SPECjbb2005 output files from the median run for all test servers.

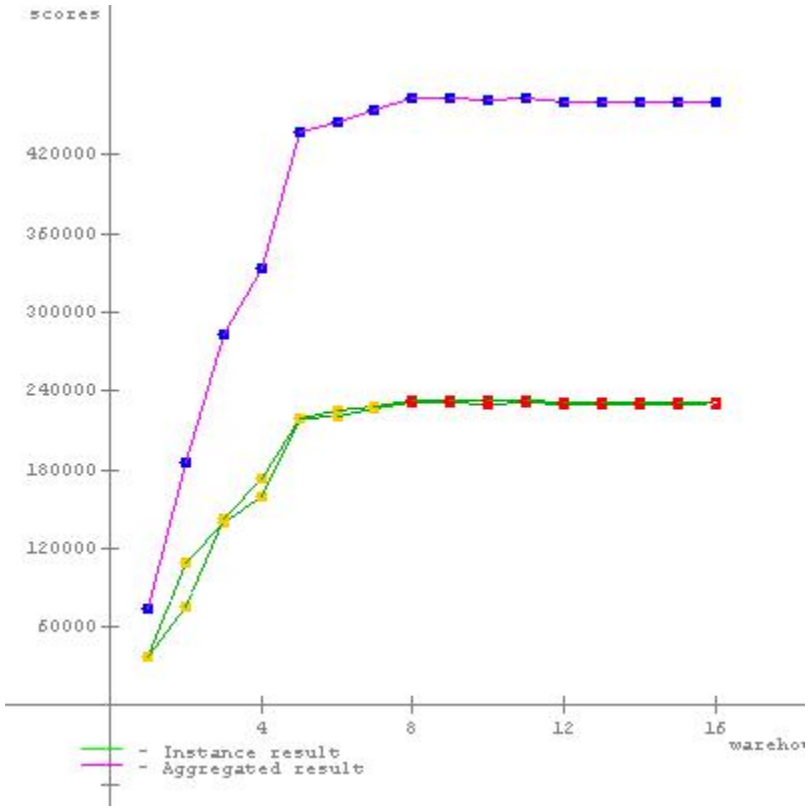
Dell PowerEdge R710 server

SPECjbb2005

SPECjbb2005 bops = 461867, SPECjbb2005 bops/JVM = 230934

Dell PowerEdge R710

Sun Microsystems Java HotSpot 64-bit Server VM (build 14.0-b15, mixed mode)



JVM run	JVM Scores
1	230015
2	231852
SPECjbb2005 bops = 461867, SPECjbb2005 bops/JVM = 230934	

Hardware	
Hardware Vendor	Dell
Vendor URL	http://www.dell.com
Model	PowerEdge R710
Processor	Intel Xeon E5540
MHz	2530
# of Chips	2
# of Cores	8
# of Cores/Chip	4

Software	
Software Vendor	Sun Microsystems
Vendor URL	http://www.sun.com
JVM Version	Java HotSpot 64-bit Server VM (build 14.0-b15, mixed mode)
JVM Command Line	start /HIGH /AFFINITY %J% /B java -server -XX:+UseStringCache -XX:ParallelGCThreads=8 -

HW Threading Enabled?	Yes
Procs Avail to Java	16
Memory (MB)	24576
Memory Details	PC3-10600R DDR3
Primary cache	4 x 32 KB + 32KB
Secondary cache	4 x 256 KB
Other cache	8 MB
Filesystem	NTFS
Disks	2 x 73 GB, 15,000 RPM, SAS
Other hardware	

	XX:+UseCompressedOops -XX:+AggressiveOpts -XX:+UseLargePages -XX:-UseAdaptiveSizePolicy -Xmx10g -Xms10g -Xmn8g -Xss256k -XX:SurvivorRatio=24
JVM Initial Heap Memory (MB)	10 GB
JVM Maximum Heap Memory (MB)	10 GB
JVM Address bits	64
JVM CLASSPATH	.\jbb.jar; .\check.jar;
JVM BOOTCLASSPATH	C:\jdk-6u14-p-windows-x64\jre\lib\alt-rt.jar; C:\jdk-6u14-p-windows-x64\jre\lib\resources.jar; C:\jdk-6u14-p-windows-x64\jre\lib\rt.jar; C:\jdk-6u14-p-windows-x64\jre\lib\sunrsasign.jar; C:\jdk-6u14-p-windows-x64\jre\lib\jsse.jar; C:\jdk-6u14-p-windows-x64\jre\lib\jce.jar; C:\jdk-6u14-p-windows-x64\jre\lib\charsets.jar; C:\jdk-6u14-p-windows-x64\jre\classes
OS Version	Windows Server 2008 Enterprise x64 Edition
Other software	

Test Information	
Tested by	Principled Technologies
SPEC license #	3184
Test location	Durham, NC
Test date	Aug 13, 2009
H/w available	
JVM available	
OS available	
Other s/w available	

AOT Compilation

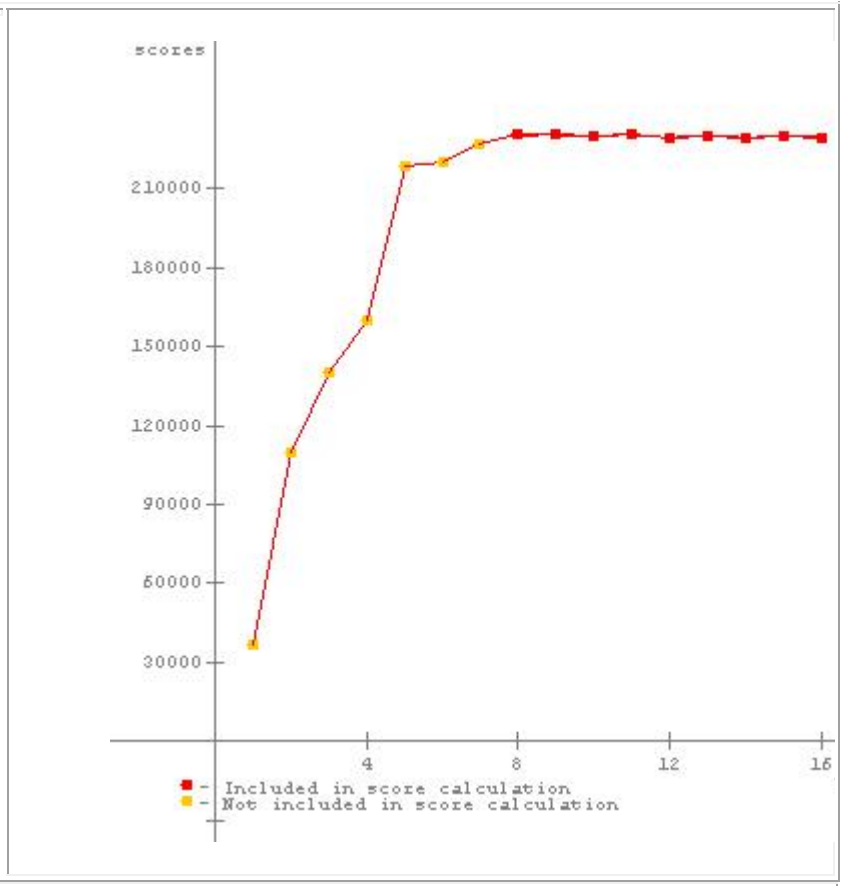
Tuning
• Lock pages in memory

Notes
Adjacent Cache Line Prefetch disabled, Hardware Prefetcher disabled, Turbo mode disabled

JVM 1 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	36645	
2	109576	
3	140284	
4	160035	
5	218350	
6	220082	
7	226609	
8	231015	*
9	230954	*
10	230300	*
11	230895	*
12	229140	*
13	229736	*
14	229517	*
15	229586	*
16	228994	*
SPECjbb2005	**(from 8 to 16)**	**230015 SPECjbb2005 bops**

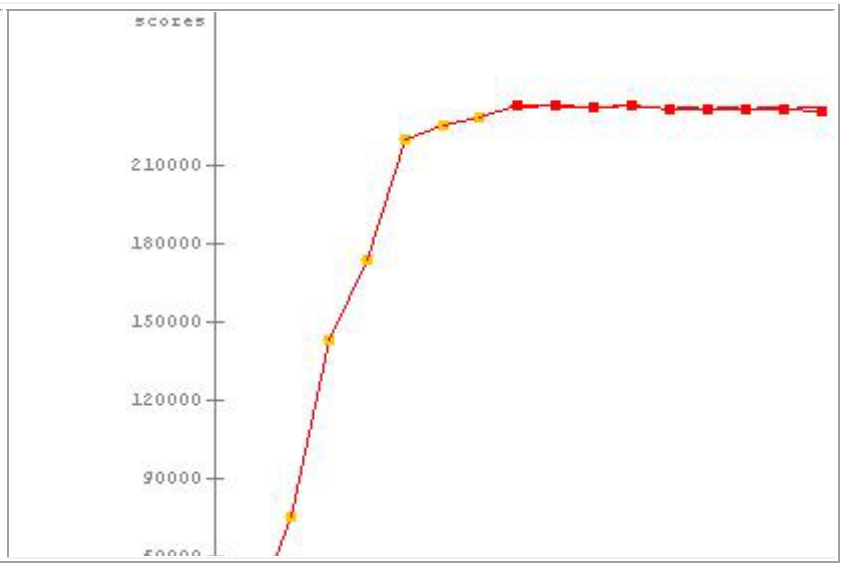


SPEC license # 3184 **Tested by:** Principled Technologies **Test date:** Aug 13, 2009

JVM 2 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	36917	
2	75579	
3	143086	
4	173596	
5	219719	
6	225381	
7	228477	
8	233015	*
9	233143	*
10	232239	*
11	232624	*



12	230977	*
13	231280	*
14	231532	*
15	231066	*
16	230792	*
SPECjbb2005	**(from 8 to 16)**	**231852 SPECjbb2005 bops**

SPEC license # 3184	**Tested by:** Principled Technologies	**Test date:** Aug 13, 2009

HP ProLiant DL380 G6 server

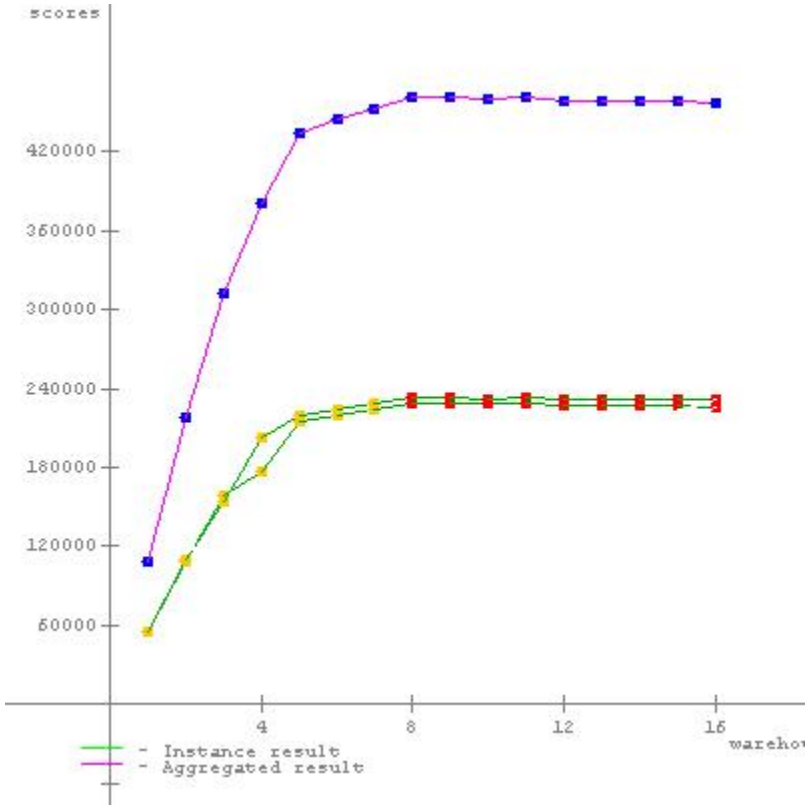
SPECjbb2005

SPECjbb2005 bops = 459532, SPECjbb2005 bops/JVM = 229766

HP ProLiant DL380 G6

Sun Microsystems Java HotSpot 64-bit Server VM (build 14.0-b15, mixed mode)

JVM run	JVM Scores
1	227676
2	231856
SPECjbb2005 bops = 459532, SPECjbb2005 bops/JVM = 229766	



Hardware	
Hardware Vendor	HP
Vendor URL	http://www.hp.com
Model	ProLiant DL380 G6
Processor	Intel Xeon E5540
MHz	2530
# of Chips	2
# of Cores	8
# of Cores/Chip	4
HW Threading Enabled?	Yes
Procs Avail to Java	16
Memory (MB)	24576
Memory Details	PC3-10600R DDR3
Primary cache	4 x 32 KB + 32KB
Secondary cache	4 x 256 KB
Other cache	8 MB
Filesystem	NTFS
Disks	2 x 73 GB, 15,000 RPM, SAS
Other hardware	

Software	
Software Vendor	Sun Microsystems
Vendor URL	http://www.sun.com
JVM Version	Java HotSpot 64-bit Server VM (build 14.0-b15, mixed mode)
JVM Command Line	start /HIGH /AFFINITY %J% /B java -server -XX:+UseStringCache -XX:ParallelGCThreads=8 -XX:+UseCompressedOops -XX:+AggressiveOpts -XX:+UseLargePages -XX:-UseAdaptiveSizePolicy -Xmx10g -Xms10g -Xmn8g -Xss256k -XX:SurvivorRatio=24
JVM Initial Heap Memory (MB)	10 GB
JVM Maximum Heap Memory (MB)	10 GB
JVM Address bits	64
JVM CLASSPATH	.\jbb.jar; .\check.jar;
JVM BOOTCLASSPATH	C:\jdk-6u14-p-windows-x64\jre\lib\alt-rt.jar;

	C:\jdk-6u14-p-windows-x64\jre\lib\resources.jar; C:\jdk-6u14-p-windows-x64\jre\lib\rt.jar; C:\jdk-6u14-p-windows-x64\jre\lib\sunrsasign.jar; C:\jdk-6u14-p-windows-x64\jre\lib\jsse.jar; C:\jdk-6u14-p-windows-x64\jre\lib\jce.jar; C:\jdk-6u14-p-windows-x64\jre\lib\charsets.jar; C:\jdk-6u14-p-windows-x64\jre\classes
OS Version	Windows Server 2008 Enterprise x64 Edition
Other software	

Test Information	
Tested by	Principled Technologies
SPEC license #	3184
Test location	Durham, NC
Test date	Aug 13, 2009
H/w available	
JVM available	
OS available	
Other s/w available	

AOT Compilation

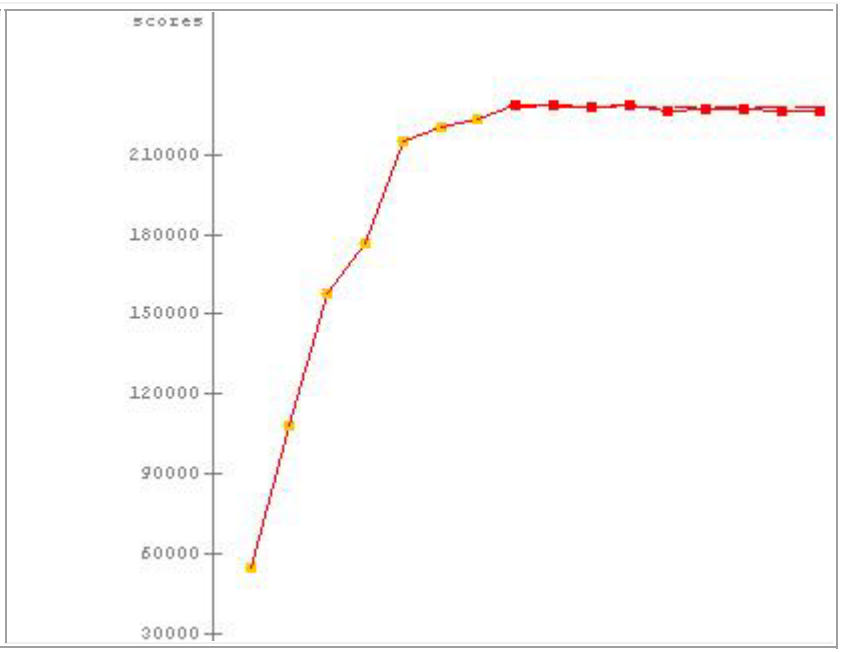
Tuning
• Lock pages in memory

Notes
Adjacent Cache Line Prefetch disabled, Hardware Prefetcher disabled, Turbo mode disabled

JVM 1 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	54608	
2	108012	
3	158084	
4	176917	
5	214985	
6	220287	
7	223632	
8	229060	*
9	228749	*
10	228159	*
11	228812	*
12	226682	*
13	227261	*



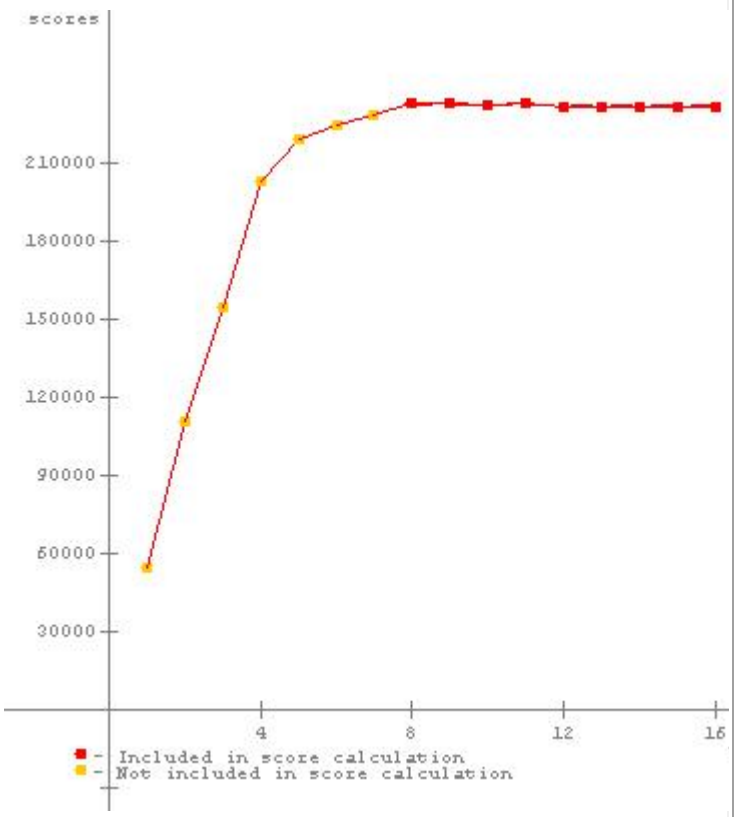
14	227197	*
15	226768	*
16	226394	*
SPECjbb2005	**(from 8 to 16)**	**227676 SPECjbb2005 bops**

SPEC license # 3184	**Tested by:** Principled Technologies	**Test date:** Aug 13, 2009

JVM 2 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	54659	
2	110540	
3	154290	
4	203146	
5	219233	
6	224090	
7	228168	
8	232848	*
9	232883	*
10	232018	*
11	233034	*
12	231176	*
13	231098	*
14	231340	*
15	231284	*
16	231024	*
SPECjbb2005	**(from 8 to 16)**	**231856 SPECjbb2005 bops**



SPEC license # 3184	**Tested by:** Principled Technologies	**Test date:** Aug 13, 2009

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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 Rd., Suite 250
Durham, NC 27703
www.principledtechnologies.com
info@principledtechnologies.com