

SPECjbb performance and power consumption on multi-processor Intel- and AMD-based blade servers

Executive summary

Dell Inc. (Dell) commissioned Principled Technologies® (PT) to measure the SPECjbb®2005 performance of quad-socket blade servers for the purpose of demonstrating real-world performance and power differences using basic memory configurations. We tested the following single blades in their respective enclosures:

- Dell PowerEdge™ M905 (Quad-Core AMD* Opteron* processor 8354 [2.20 GHz, 75W])
- HP* ProLiant* BL680c G5 (Quad-Core Intel* Xeon* processor E7310 [1.60 GHz, 80W])
- HP ProLiant BL685c G5 (Quad-Core AMD Opteron processor 8354 [2.20 GHz, 75W])
- IBM* BladeCenter* LS42 (Quad-Core AMD Opteron processor 8356 [2.30 GHz, 75W])

Dell provided the Dell PowerEdge M905 and its enclosure. PT received the remainder of the equipment directly from third-party hardware resellers.

The IBM LS42 contained an AMD Opteron 8356 (2.30GHz) processor, while the Dell PowerEdge M905 and the HP ProLiant BL685c G5 contained AMD Opteron 8354

KEY FINDINGS

- The Dell PowerEdge M905 blade server delivered 58.1 percent more performance/watt than the HP ProLiant BL680c G5, 17.2 percent more performance/watt than the HP ProLiant BL685c G5, and 24.4 percent more performance/watt than the IBM BladeCenter LS42. (See Figure 1.)
- The Dell PowerEdge M905 blade server used on average 8.5 percent less power than the HP ProLiant BL680c G5, 11.5 percent less power than the HP ProLiant BL685c G5, and 18.4 percent less power than the IBM Blade Center LS42. (See Figure 2.)
- The Dell PowerEdge M905 blade server delivered 18.8 percent better price-performance than the HP ProLiant BL680c G5, 6.1 percent better price-performance than the HP ProLiant BL685c G5, and 59.8 percent better price-performance than the IBM BladeCenter LS42. (See Figure 3).
- The Dell PowerEdge M905 blade server delivered a 44.6 percent performance increase over the HP ProLiant BL680c G5 and a 3.7 percent performance increase over the HP ProLiant BL685c G5. Also, despite the IBM LS42's use of a processor with a slightly higher GHz rating, the Dell PowerEdge M905 blade server delivered a 1.4 percent performance increase over the IBM BladeCenter LS42. (See Figure 4.)

SPECjbb2005 relative performance/watt results

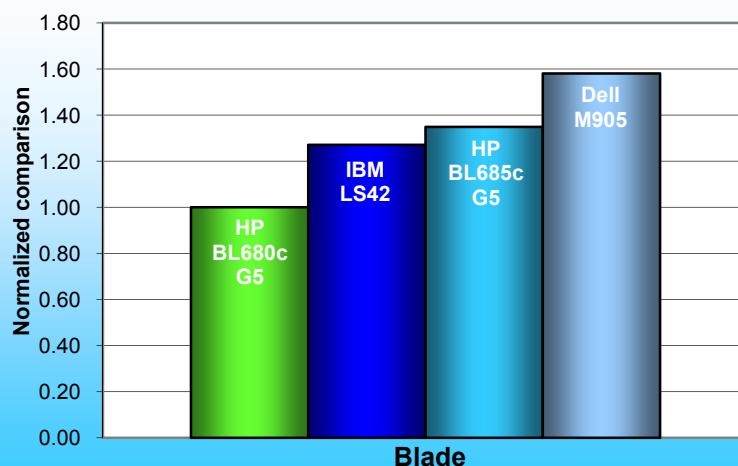


Figure 1: Performance/watt results for the test blade servers normalized to that of the HP BL680c G5. Higher numbers are better.

(2.20GHz) processors. IBM did not offer the BladeCenter LS42 with the AMD Opteron 8354 (2.20GHz) processor. As we discuss below, despite the IBM LS42's use of a processor with a slightly higher GHz rating, the Dell M905 delivered the highest SPECjbb2005 results of the four blade servers.

In this section, we present the best results for each server. For complete details of the performance of each Java Virtual Machine (JVM) by warehouse for each server, see the Test results section.

Figure 1 illustrates the performance/watt for each of the four blade servers. In this chart, we have normalized the results for each workload to those of the blade server with lowest

performance/watt.

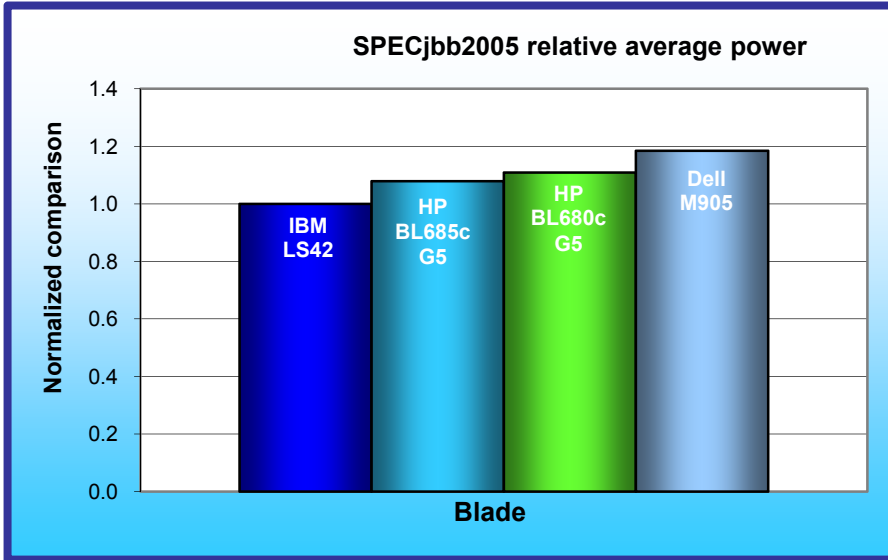


Figure 2: Average power results for the test blade servers normalized to that of the IBM LS42. Higher numbers are better.

have normalized the results for each workload to the lowest average power. Note: The power measurements we used in this calculation are for the blade enclosure and one blade. A full blade enclosure would have much higher wattage.

The Dell PowerEdge M905 blade server used on average 8.5 percent less power than the HP ProLiant BL680c G5, 11.5 percent less power than the HP ProLiant BL685c G5, and 18.4 percent less power than the IBM Blade Center LS42.

Performance/watt equals the benchmark's score divided by the average power consumption in watts during the period the benchmark was delivering peak performance.

As Figure 1 illustrates, the Dell PowerEdge M905 blade server delivered 58.1 percent more performance/watt than the HP ProLiant BL680c G5, 17.2 percent more performance/watt than the HP ProLiant BL685c G5, and 24.4 percent more performance/watt than the IBM BladeCenter LS42.

Figure 2 illustrates the relative average power consumption in watts for each of the four blade servers during the period of peak performance. In this chart, we

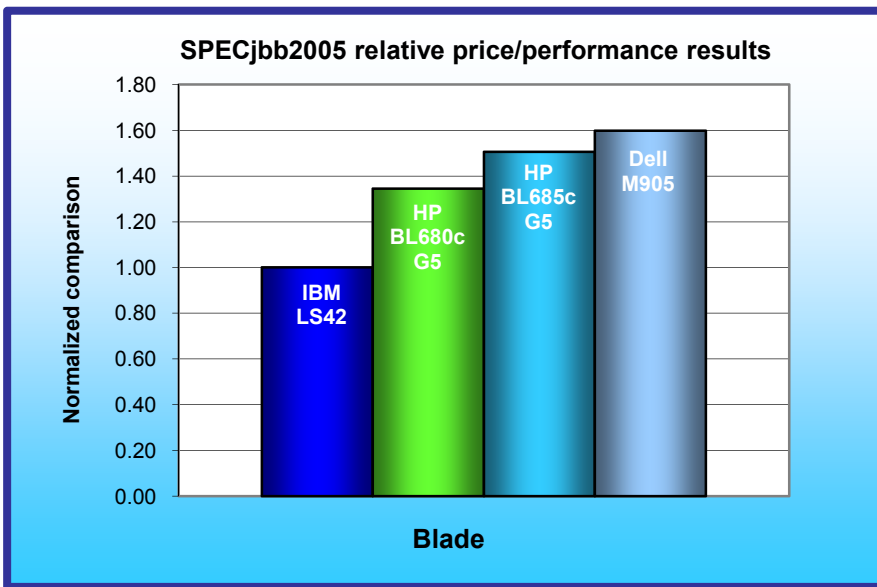


Figure 3: Price-performance of the blade servers with the SPECjbb2005 workload normalized to that of the IBM LS42. Higher numbers are better. For pricing information see Appendix C.

Figure 3 shows the price-performance of each system. The price-performance metric takes the SPECjbb2005 result in bops and divides that number by the per-blade cost of the blade and enclosure. We calculated the "per blade cost" by taking the actual blade cost and then adding the cost of the enclosure divided by the total capacity. For the Dell and HP enclosures, we divided the enclosure cost by 8, for the IBM enclosure we divided the cost by 7. Higher price-performance scores, indicating more cost-effective servers, are better.

The Dell PowerEdge M905 had a per-blade cost of \$14,286.75 and the highest price-performance. The Dell PowerEdge M905 delivered 18.8 percent higher

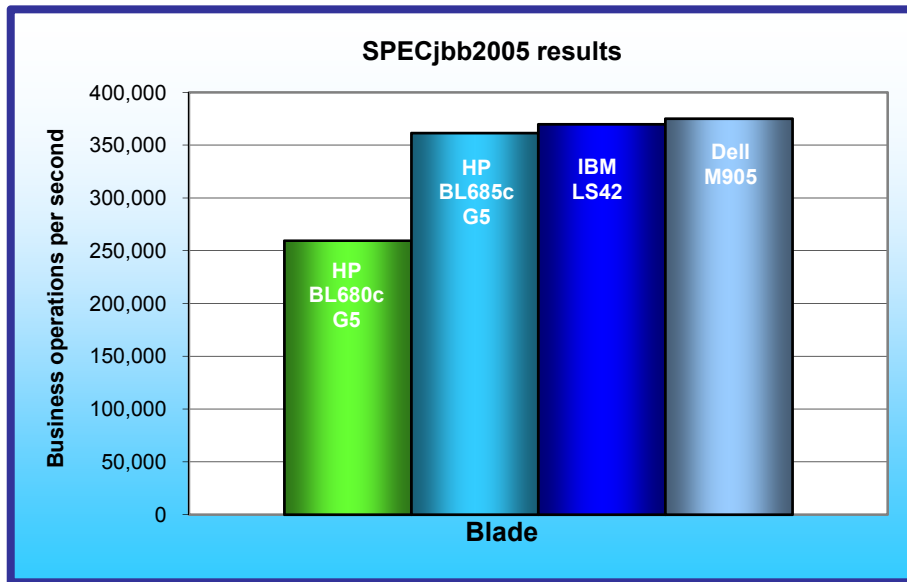


Figure 4: SPECjbb2005 results of the blade servers in business operations per second. Higher numbers are better.

price-performance than the HP ProLiant BL680c G5, which had a per-blade price of \$16,105.63. The Dell PowerEdge M905 also delivered 6.1 percent higher price-performance than the HP ProLiant BL685c G5, which had a per-blade price of \$16,903.63.

The Dell PowerEdge M905 delivered 59.8 percent higher price-performance than the IBM BladeCenter LS42, which had a per-blade price of \$20,892.29.

Figure 4 shows the peak performance of each blade server plus its enclosure. Each result is the median score of three runs of the benchmark. (See the Test results section for the scores from all three runs.) A higher SPECjbb2005 score indicates the server is able to

handle more Java requests and thus deliver greater throughput.

The Dell PowerEdge M905 blade server produced the highest results, 375,195 bops (business operations per second), while the HP ProLiant BL680c G5 achieved 259,489 bops. The Dell PowerEdge M905 thus delivered a 44.6 percent performance increase over the HP ProLiant BL680c G5.

The Dell PowerEdge M905 delivered 3.7 percent increase over the HP ProLiant BL685c G5 server, which achieved 361,646 bops, and a 1.4 percent increase over the IBM BladeCenter LS42, which achieved 369,860 bops.

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

Before we started the SPECjbb2005 benchmark, we logged into the system and allowed the servers to sit idle for 8 minutes. We then started recording power for 2 minutes. This process meant that all systems were idle for 10 minutes before we began the benchmark.

Figure 5 shows the median SPECjbb2005 results for all four blade servers. In each test, we ran four 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 of all the 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 M905	HP ProLiant BL680c G5	HP ProLiant BL685c G5	IBM BladeCenter LS42
JVM 1	87,662	65,282	89,762	94,218
JVM 2	99,885	64,590	90,937	90,746
JVM 3	99,103	64,848	90,164	93,023
JVM 4	88,545	64,769	90,783	91,873
Total score	375,195	259,489	361,646	369,860

Figure 5: SPECjbb2005 results for each blade server by JVM. Higher numbers are better.

Figure 6 shows the results by warehouse for the Dell PowerEdge M905 blade server for all three runs. Run 2 produced the median results.

Dell PowerEdge M905			
	Run 1	Run 2	Run 3
Warehouse	JVM 1		
1	24,664	24,510	24,700
2	57,410	57,093	57,277
3	75,854	75,487	74,765
4	89,232	88,470	88,162
5	89,312	88,164	87,618
6	89,182	87,864	87,429
7	88,331	87,181	86,699
8	87,683	86,629	86,340
Score	88,748	87,662	87,250
Warehouse	JVM 2		
1	26,705	26,314	36,331
2	61,907	61,683	62,018
3	84,097	84,629	84,086
4	100,656	100,549	99,632
5	100,430	100,600	99,719
6	99,993	100,215	99,157
7	99,055	99,534	98,219
8	98,549	98,526	97,932
Score	99,737	99,885	98,932
Warehouse	JVM 3		
1	26,711	26,634	26,524
2	62,056	61,234	61,852
3	83,885	83,875	85,196
4	100,179	99,499	100,219

5	100,412	99,699	100,331
6	100,133	99,375	99,959
7	99,810	98,957	98,840
8	98,738	97,985	99,083
Score	99,854	99,103	99,686

Warehouse	JVM 4		
1	24,380	24,790	24,242
2	56,527	56,957	56,856
3	76,636	76,451	76,475
4	88,680	89,704	88,774
5	88,580	89,216	88,355
6	88,490	88,479	87,740
7	87,624	87,959	87,208
8	86,832	87,368	86,952
Score	88,041	88,545	87,806
Total score	376,380	375,195	373,674

Figure 6: SPECjbb2005 results for the Dell PowerEdge M905 blade server. Higher numbers are better.

Figure 7 shows the results by warehouse for the HP ProLiant BL680c G5 blade server for all three runs. Run 1 produced the median results.

HP ProLiant BL680c G5			
Warehouse	Run 1	Run 2	Run 3
JVM 1			
1	18,756	19,221	18,958
2	38,371	38,345	38,712
3	57,169	58,321	56,524
4	65,846	66,421	64,952
5	65,855	66,320	65,578
6	65,528	65,336	64,686
7	64,917	64,747	64,045
8	64,264	64,578	63,524
Score	65,282	65,480	64,557
JVM 2			
1	19,563	19,316	19,248
2	39,406	38,144	40,275
3	57,402	57,080	56,723
4	65,205	65,474	65,908
5	65,379	65,139	65,592
6	64,808	64,539	64,783
7	64,224	63,950	64,307
8	63,331	63,719	63,893
Score	64,590	64,564	64,897
JVM 3			
1	19,312	19,274	19,591
2	38,860	38,097	40,585
3	57,655	56,997	58,171
4	65,757	65,339	66,548
5	65,618	65,098	66,192
6	64,933	64,988	65,821
7	64,328	64,087	65,050
8	63,607	63,689	64,576
Score	64,848	64,640	65,637

Warehouse	JVM 4		
1	19,201	19,189	19,467
2	38,021	38,813	39,028
3	56,951	56,917	57,416
4	65,542	65,285	65,378
5	65,555	65,305	65,393
6	64,803	64,677	64,808
7	64,156	63,724	64,089
8	63,787	62,879	63,716
Score	64,769	64,374	64,677
Total score	259,489	259,058	259,768

Figure 7: SPECjbb2005 results for the HP ProLiant BL680c G5 blade server. Higher numbers are better.

Figure 8 shows the results by warehouse for the HP ProLiant BL685c G5 blade server for all three runs. Run 3 produced the median results.

HP ProLiant BL685c G5			
	Run 1	Run 2	Run 3
Warehouse	JVM 1		
1	22,927	22,313	21,895
2	55,375	55,102	54,544
3	70,457	71,932	69,305
4	91,194	91,980	90,738
5	90,843	91,213	90,846
6	90,332	91,013	89,880
7	89,706	90,231	88,834
8	89,028	89,487	88,510
Score	90,221	90,785	89,762
Warehouse	JVM 2		
1	24,427	23,043	23,543
2	54,874	54,573	55,832
3	73,418	73,037	74,265
4	90,846	90,257	91,368
5	90,672	89,835	91,755
6	90,167	89,419	91,348
7	89,427	88,475	90,279
8	88,847	88,275	89,935
Score	89,992	89,252	90,937
Warehouse	JVM 3		
1	23,499	21,932	22,907
2	55,526	54,803	55,465
3	74,680	73,788	72,881
4	92,152	90,652	91,010
5	92,132	90,405	90,657
6	91,365	89,655	90,277
7	90,360	89,124	89,531
8	90,178	88,625	89,346
Score	91,237	89,692	90,164

Warehouse	JVM 4		
1	22,295	22,758	23,883
2	56,324	55,783	54,077
3	72,391	73,711	72,942
4	91,818	9,193	91,550
5	91,463	91,458	91,294
6	90,655	90,728	90,923
7	90,148	89,966	90,207
8	89,774	89,591	89,941
Score	90,772	90,731	90,783
Total score	362,222	360,460	361,646

Figure 8: SPECjbb2005 results for the HP ProLiant BL685c G5blade server. Higher numbers are better.

Figure 9 shows the results by warehouse for the IBM BladeCenter LS42 blade server for all three runs. Run 2 produced the median results.

IBM BladeCenter LS42			
	Run 1	Run 2	Run 3
Warehouse	JVM 1		
1	26,391	26,382	26,594
2	60,550	60,273	59,912
3	81,389	81,347	79,773
4	95,400	95,030	92,696
5	94,723	94,930	92,642
6	94,587	94,670	92,032
7	93,807	93,567	91,459
8	93,234	92,895	91,197
Score	94,350	94,218	92,005
Warehouse	JVM 2		
1	26,546	25,807	26,222
2	60,751	59,413	60,879
3	80,361	78,822	80,802
4	93,178	91,609	92,843
5	92,868	91,160	92,540
6	93,421	91,048	92,315
7	92,318	90,055	91,719
8	91,617	89,859	91,202
Score	92,680	90,746	92,124
Warehouse	JVM 3		
1	26,662	26,728	26,098
2	61,202	60,716	60,579
3	81,103	81,030	80,674
4	93,397	93,928	93,455
5	93,187	93,636	93,142
6	92,797	93,149	92,982
7	92,129	92,576	92,533
8	91,753	91,827	91,687
Score	92,653	93,023	92,760

Warehouse	JVM 4		
1	26,303	25,937	26,123
2	60,904	59,714	60,716
3	80,975	79,430	80,711
4	93,649	92,265	93,135
5	93,198	92,442	92,901
6	92,775	92,152	92,532
7	92,146	91,523	91,560
8	91,422	90,982	90,783
Score	92,638	91,873	92,182
Total score	372,321	369,860	369,071

Figure 9: SPECjbb2005 results for the IBM BladeCenter LS42 blade server. Higher numbers are better.

Figure 10 details the power consumption, in watts, of the test servers while idle and during the median run of the SPECjbb2005 benchmark.

Server	Idle power (watts)	Average power (watts)
Dell PowerEdge M905	535.4	823.4
HP ProLiant BL680c G5	751.9	900.0
HP ProLiant BL685c G5	672.8	930.1
IBM BladeCenter LS42	844.4	1,009.4

Figure 10: Average power usage (in watts) of the test servers while idle and during the median run of SPECjbb2005. Lower numbers are better.

Test methodology

Figure 11 summarizes some key aspects of the configurations of the four server systems; Appendix A provides detailed configuration information.

Server	Dell PowerEdge M905	HP ProLiant BL680c G5	HP ProLiant BL685c G5	IBM BladeCenter LS42
Enclosure	Dell PowerEdge M1000e	HP BladeSystem c-Class	HP BladeSystem c-Class	IBM BladeCenter H Type 8852
Processor frequency	2.2 GHz	1.6 GHz	2.2 GHz	2.3 GHz
Front-side bus frequency	2,000 MHz HyperTransport	1,066 MHz	2,000 MHz HyperTransport	2,000 MHz HyperTransport
Number of processor packages	4	4	4	4
Number of cores per processor package	4	4	4	4
Number of hardware threads per core	1	1	1	1
Motherboard	Dell 0D413F	HP ProLiant BL680c	HP ProLiant BL685c	IBM BladeCenter LS42 7902EDU
Chipset	NVIDIA nForce Pro 3600	Intel 7300	NVIDIA* nForce Pro 2050	ServerWorks HT2000
RAM (48 GB in each)	48 GB (24 x 2 GB) PC2-5300	48 GB (8 x 2 GB, 8 x 4 GB) PC2-5300 FB-DDR2	48 GB (8 x 2 GB, 8 x 4 GB) PC2-5300	48 GB (8 x 2 GB, 8 x 4 GB) PC2-5300
Hard drive	Seagate* ST973451SS	HP DH072BB978	HP DH072BB978	Seagate ST973451SS

Figure 11: Summary of some key aspects of the server configurations.

We began our testing by installing a fresh copy of Microsoft* Windows 2003 Server* x64 Enterprise Edition 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.

With the exception of disabling HW Prefetcher and Adjacent Cache Line Prefetcher on the HP ProLiant BL680c G5, we used the default BIOS settings on all servers.

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

Power measurement procedure

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 2 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 1-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 10 (idle and average peak power) for the results of these measurements.

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 on the system under test. We used the JRockit 1.6.0_03 (build P27.5.0-5-_o_CR371811_CR374296-100684-1.6.0_03-20080702-1651-windows-x86_64, compiled 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 four. This change allows a server to run four 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 2003 x64 Edition to run this batch file. Figure 12 shows the contents of the file used on all servers.

```

runit-affinity.bat - Notepad
File Edit Format View Help
@echo off

set JVM=4

:: Set JAVA_HOME to Java.exe path.
set JAVA_HOME="C:\jrockit-jdk1.6.0_03\bin"

set path=%JAVA_HOME%;%path%

:stage1
set PROFFILE=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

echo Using CLASSPATH entries:
for %c in ( %CLASSPATH% ) do echo %c
@echo on
start /b java %JAVAOPTIONS% spec.jbb.Controller -propfile %PROFFILE%
@echo off
set I=0
set J=F
:LOOP
set /a I=%I + 1
echo.
echo Starting JVM Number %I% with Affinity to CPU %J%
echo.

@echo on
start /AFFINITY %J% /B java -Xms3700m -Xns3200m -Xmx3700m -XXaggressive -XXlargepages -
XXcallprofiling -Xgc:genpar -XXthroughputCompaction -XXlazyunlocking -XXtlasize:min=4k,preferred=128k
spec.jbb.JBBmain -propfile %PROFFILE% -id %I% > multi.%I%
@echo off
set J=%J%0
IF %I% == %JVM% GOTO END
GOTO LOOP
:END

:egress

```

Figure 12: The text of the batch file we used to execute the SPECjbb2005 benchmark on all blade servers with 16 cores.

In the batch file we set the Java options that control the performance of the JVM:

- *-Xms3700m* sets the minimum heap size. We set the minimum and maximum heap sizes to be the same, so the heap size would stay a constant 3,700 MB.
- *-Xns3200m* sets the JVM nursery size.
- *-Xmx3700m* sets the maximum heap size.
- *-XXaggressive* basically tells the JVM to perform at maximum speed.
- *-XXlargepages* tells the JVM to use large pages.
- *-XXcallprofiling* uses call profiling for code optimization.
- *-Xgc:genpar* sets generational parallel garbage collection.
- *-XXthroughputCompaction* adjusts the compaction ratio dynamically based on live data in the heap.
- *-XXlazyUnlocking* affects when the JVM releases locks.
- *-XXtlasize* sets the thread-local area size the JVM uses.

Appendix A – Enclosure configuration information

This appendix provides detailed configuration information about the enclosures, which we present in alphabetical order.

Enclosure	Dell PowerEdge M1000e	IBM BladeCenter H Type 8852	HP BladeSystem c-Class
General dimension information			
Height (inches)	17.5	15.75	17.5
Width (inches)	19	19	19
Depth (inches)	30.5	28.0	31.0
U size in server rack	10	9	10
Number of blades	16	14	16
Power supplies			
Total number	6	4	6
Wattage of each	2,360	2,880	2,250
Cooling fans			
Total number	9	2 blowers	10
Dimensions (H x W) of each	3.5" x 3"	4.5" x 11.5"	3.5" x 3"
Voltage	12V	200–240V	12V
Amps	7A	5.5A	16.5A

Figure 13: Detailed configuration information about the enclosures.

Appendix B – Test system configuration information

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

Servers	Dell PowerEdge M905	HP ProLiant BL680c G5	HP ProLiant BL685c	IBM BladeCenter LS42
Enclosure				
Enclosure	Dell PowerEdge M1000e	HP BladeSystem c-Class	HP BladeSystem c-Class	IBM BladeCenter H Type 8852
General processor setup				
Number of processor packages	4	4	4	4
Number of cores per processor package	4	4	4	4
Number of hardware threads per core	1	1	1	1
System Power Management Policy	Always on	Always on	Always on	Always on
CPU				
Vendor	AMD	Intel	AMD	AMD
Name	Opteron 8354	Xeon E7310	Opteron 8354	Opteron 8356
Stepping	3	B	3	3
Socket type	Socket F (1207)	Socket 604 mPGA	Socket F (1207)	Socket F (1207)
Core frequency (GHz)	2.2	1.60	2.2	2.3
Front-side bus frequency	2,000 MHz HyperTransport Technology	1,066 MHz	2,000 MHz HyperTransport Technology	2,000 MHz HyperTransport Technology
L1 cache	64 KB + 64 KB (per core)	32 KB + 32 KB (per core)	64 KB + 64 KB (per core)	64 KB + 64 KB (per core)
L2 cache	2 MB (512 KB per core)	4 MB (2 x 2 MB)	2 MB (512 KB per core)	2 MB (512 KB per core)
Thermal design power (TDP, in watts)	75W	80W	75W	75W
Platform				
Vendor and model number	Dell 0D413F	HP ProLiant BL680c	HP ProLiant BL685c	IBM BladeCenter LS42 7902EDU
Motherboard model number	800VTG1	N382 MK0416	PU84MK0642	44X1607 LYR1
Motherboard chipset	NVIDIA nForce Pro 3600	Intel 7300	NVIDIA CK8-04,IO-04	ServerWorks HT2000
BIOS name and version	Dell 0.2.1 (6/20/2008)	HP I17 (2/13/2008)	HP A08 (5/29/2008)	IBM L8E123AUS-1.00 (8/15/2008)
BIOS settings	Default	Hardware Prefetcher Disabled Adjacent Cache Line Prefetcher Disabled	Default	Default
Chipset driver	Dell 1.3.2.0	HP 1.3.0.0	HP 1.3.0.0	Microsoft 5.2.3790.1830

Servers	Dell PowerEdge M905	HP ProLiant BL680c G5	HP ProLiant BL685c	IBM BladeCenter LS42
Memory modules				
Total RAM in system	48 GB	48 GB	48 GB	48 GB
Number of types of memory modules	1	2	2	2
First type of module in system				
Vendor and model number	Samsung* M393T5750EZA-CE6	Micron* MT36HTF51272FY-667E141D4	ELPIDA* EBE41AE4ACFA-6E-E	ELPIDA EBE41AF4A1QB-6E-E
Type	PC2-5300 DDR2	PC2-5300 FB-DDR2	PC2-5300 DDR2	PC2-5300 DDR2
Speed (MHz)	667	667	667	667
Speed in the system currently running @ (MHz)	667	667	667	667
Timing/Latency (tCL-tRCD-iRP-tRASmin)	5-5-5-15	5-5-5-15	5-5-5-15	5-5-5-15
Size	48 GB	32 GB	32 GB	32 GB
Number of RAM modules	24 x 2 GB	8 x 4 GB	8 x 4 GB	8 x 4 GB
Chip organization	Double-sided	Double-sided	Double-sided	Double-sided
Second type of module in system				
Vendor and model number	N/A	Hynix HYMP525F72CP4 N3-Y5	2 x Hynix HYMP525P72CP4-Y5 AB-A 2 x Hynix HYMP525P72CP4-Y5 AB-C 2 x Samsung M393T5750CZA-CE6Q0 2 x Nanya NT2GT72U4NA2B V-3C	Qimonda HYS72T256300EP-3S-C
Type	N/A	PC2-5300 FB-DDR2	PC2-5300	PC2-5300
Speed (MHz)	N/A	667	667	667
Speed in the system currently running @ (MHz)	N/A	667	667	667
Timing/Latency (tCL-tRCD-iRP-tRASmin)	N/A	5-5-5-15	5-5-5-15	5-5-5-15
Size	N/A	16 GB	16 GB	16 GB
Number of RAM modules	N/A	8 x 2 GB	8 x 2 GB	8 x 2 GB

Servers	Dell PowerEdge M905	HP ProLiant BL680c G5	HP ProLiant BL685c	IBM BladeCenter LS42
Chip organization	N/A	Double-sided	Double-sided	Double-sided
Hard disk				
Vendor and model number	Seagate ST973451SS	HP DH072BB978	HP DH072BB978	Seagate ST973451SS
Number of disks in system	2	2	2	2
Size	73 GB	72 GB	72 GB	73 GB
Buffer size	16 MB	16 MB	16 MB	16 MB
RPM	15,000	15,000	15,000	15,000
Type	SAS	SAS	SAS	SAS
Controller	Dell CERC 6/ Integrated RAID	HP Smart Array P400i	HP Smart Array E200i	LSI SAS 3000 Series
Driver version	Dell 2.14.0.64 (6/6/2007)	HP 6.12.4.64 (3/31/2008)	HP 6.8.0.64 (6/21/2007)	LSI 1.27.3.0 (4/8/2008)
Operating system				
Name	Windows Server 2003 Enterprise x64 Edition	Windows Server 2003 Enterprise x64 Edition	Windows Server 2003 Enterprise x64 Edition	Windows Server 2003 Enterprise x64 Edition
Build number	3790	3790	3790	3790
Service Pack	2	2	2	2
File system	NTFS	NTFS	NTFS	NTFS
Kernel	ACPI Multiprocessor x64-based PC	ACPI Multiprocessor x64-based PC	ACPI Multiprocessor x64-based PC	ACPI Multiprocessor x64-based PC
Language	English	English	English	English
Microsoft DirectX version	9.0c	9.0c	9.0c	9.0c
Graphics				
Vendor and model number	ATI ES1000	ATI ES1000	Standard VGA Graphics Adapter	Standard VGA Graphics Adapter
Chipset	ATI ES1000	ATI ES1000	ATI ES1000	ATI ES1000
BIOS version	BK-ATI VER008.005.031.0 00	BK-ATI VER008.005.028.0 01	01.00	01.00
Type	Integrated	Integrated	Integrated	Integrated
Memory size	32 MB	64 MB	32 MB	32 MB
Resolution	1,024 x 768 x 32-bit	1,024 x 768 x 32-bit	1,024 x 768 x 32-bit	1,024 x 768 x 32-bit
Driver version	ATI 8.240.50.2000 (10/25/2007)	ATI 8.240.50.2000 (10/25/2007)	Microsoft 5.2.3790.1830 (10/1/2002)	Microsoft 5.2.3790.1830 (10/1/2002)
Network card/ subsystem				
Vendor and model number	4 x Broadcom BCM57095 NetXtreme II GigE	2 x HP NC326i PCIe Dual Port Gigabit, 2 x HP NC373i Multifunction Gigabit	2 x HP NC326i PCIe Dual Port Gigabit, 2 x HP NC373i Multifunction Gigabit	4 x Broadcom BCM5709S NetXtreme II GigE
Type	Integrated	Integrated	Integrated	Integrated

Servers	Dell PowerEdge M905	HP ProLiant BL680c G5	HP ProLiant BL685c	IBM BladeCenter LS42
Driver version	Broadcom 4.4.15.0 (5/14/2008)	NC326i HP 10.85.0.0 (6/19/2008), NC373i HP 4.5.2.0 (7/18/2008)	NC326i HP 10.78.0.0 (3/19/2008), NC373i HP 4.4.15.0 (5/14/2008)	Broadcom 4.4.15.0 (5/14/2008)
Optical drive				
Vendor and model number	N/A	N/A	N/A	LG GSA-T20N
USB ports				
Number	3 on the blade, 2 on the chassis	2 with attachment	2 with attachment	2 on the chassis
Type	USB 2.0	USB 2.0	USB 2.0	USB 2.0

Figure 14: Detailed configuration information about the servers.

Appendix C – Pricing

Figure 15 provides the pricing breakdown for all four blade servers. Prices exclude tax and shipping. All pricing from online except the Dell M1000e enclosure for which Dell provided non-discounted pricing.

Server	Dell PowerEdge M905 (48 GB RAM)	HP ProLiant BL680c G5 (48 GB RAM)	HP ProLiant BL685c G5 (48 GB RAM)	IBM BladeCenter LS42 (48 GB RAM)
Enclosure	\$17,198.00	\$19,013.00	\$19,013.00	\$24,936.00
Blade server, processor, memory, and hard drives	\$12,137.00	\$13,729.00	\$14,527.00	\$17,330.00
Total	\$29,335.00	\$32,742.00	\$33,540.00	\$42,266.00
Date of price	November 6, 2008	November 6, 2008	November 6, 2008	November 6, 2008

Figure 15: Detailed pricing for the servers. Prices exclude tax and shipping.

Appendix D – SPECjbb2005 output

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

Dell PowerEdge M905 blade server

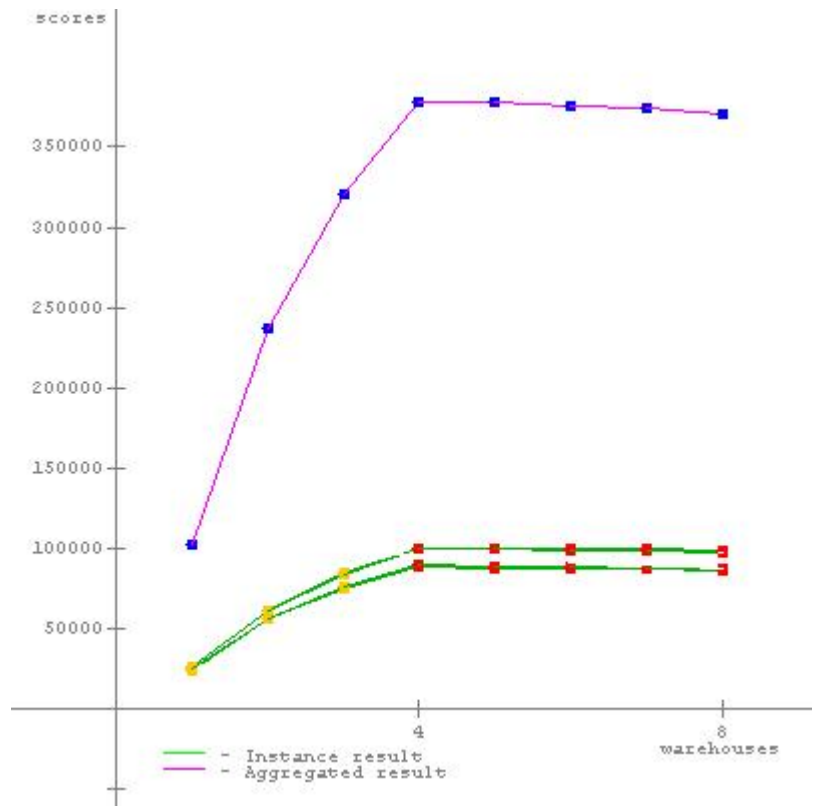
SPECjbb2005

**SPECjbb2005 bops = 375195,
SPECjbb2005 bops/JVM = 93799**

Dell PowerEdge M905

BEA JRockit 1.6.0_03 (build P27.5.0-5-
_o_CR371811_CR374296-100684-1.6.0_03-20080702-1651-
windows-x86_64, compiled mode)

JVM run	JVM Scores
1	87662
2	99885
3	99103
4	88545
SPECjbb2005 bops = 375195, SPECjbb2005 bops/JVM = 93799	



Hardware	
Hardware Vendor	Dell
Vendor URL	http://www.dell.com
Model	m905
Processor	Quad-core AMD Opteron processor 8354
MHz	2200
# of Chips	4
# of Cores	16
# of Cores/Chip	4

Software	
Software Vendor	BEA
Vendor URL	http://www.bea.com
JVM Version	JRockit 1.6.0_03 (build P27.5.0-5- _o_CR371811_CR374296-100684- 1.6.0_03-20080702-1651-windows- x86_64, compiled mode)
JVM Command Line	start /AFFINITY /B java -Xms3700m - Xns3200m -Xmx3700m -XXaggressive - XXlargepages -XXcallprofiling - Xgc:genpar -XXthroughputCompaction -

HW Threading Enabled?	No
Procs Avail to Java	16
Memory (MB)	49152
Memory Details	24 x 2GB DDR2-667 DIMM
Primary cache	64KBI+64KBD (per core)
Secondary cache	2MB (512 KB per core)
Other cache	
Filesystem	NTFS
Disks	2 x 73GB SAS
Other hardware	

	XXlazyUnlocking - XXtlasize:min=4k,preferred=128k spec.jbb.JBBmain
JVM Initial Heap Memory (MB)	3700
JVM Maximum Heap Memory (MB)	3700
JVM Address bits	64
JVM CLASSPATH	.\jbb.jar; .\jbb_no_precompile.jar; .\check.jar; .\reporter.jar;
JVM BOOTCLASSPATH	C:\jrocket-jdk1.6.0_03\jre\bin\jrocket\jrocket1.6.0.jar; C:\jrocket-jdk1.6.0_03\jre\bin\jrocket\jmap.jar; C:\jrocket-jdk1.6.0_03\jre\bin\jrocket\jmxmapi.jar; C:\jrocket-jdk1.6.0_03\jre\bin\jrocket\jrm.jar; C:\jrocket-jdk1.6.0_03\jre\bin\jrocket\latency.jar; C:\jrocket-jdk1.6.0_03\jre\lib\resources.jar; C:\jrocket-jdk1.6.0_03\jre\lib\rt.jar; C:\jrocket-jdk1.6.0_03\jre\lib\sunrsasign.jar; C:\jrocket-jdk1.6.0_03\jre\lib\sse.jar; C:\jrocket-jdk1.6.0_03\jre\lib\jce.jar; C:\jrocket-jdk1.6.0_03\jre\lib\charsets.jar; C:\jrocket-jdk1.6.0_03\jre\classes
OS Version	Microsoft Windows 2003 Server, x64 Enterprise Edition Service Pack 2
Other software	

Test Information	
Tested by	Principled Technologies
SPEC license #	3184
Test location	Durham, NC
Test date	August 19, 2008
H/w available	
JVM available	2008
OS available	2003
Other s/w available	

AOT Compilation	
Tuning	
In the local security settings, "Lock pages in memory" was enabled.	
Notes	

JVM 1 Scores:

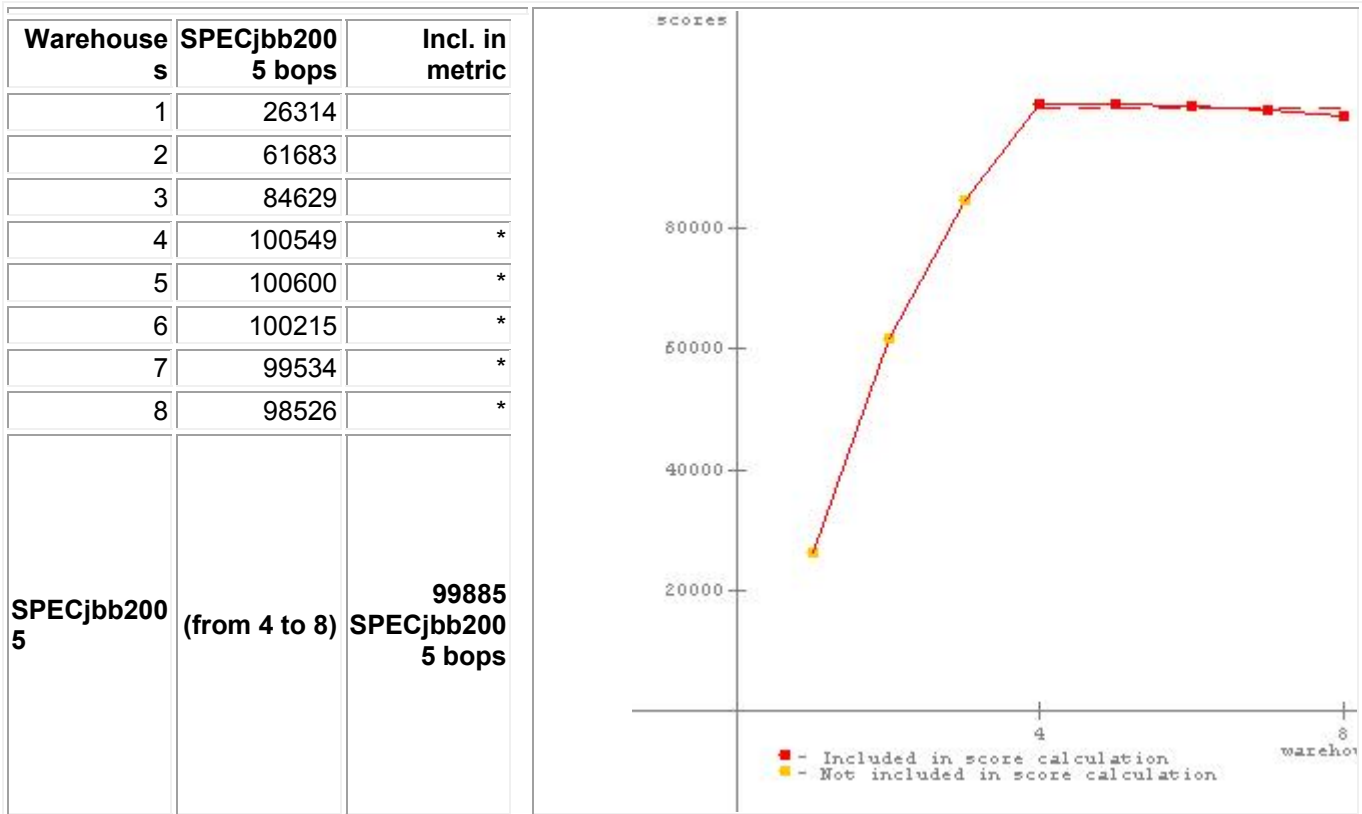
No errors. Valid run.

Warehouse	SPECjbb200 5 bops	Incl. in metric
1	24510	
2	57093	
3	75487	
4	88470	*
5	88164	*
6	87864	*
7	87181	*
8	86629	*
SPECjbb200 5	(from 4 to 8)	87662 SPECjbb200 5 bops

SPEC license # 3184 Tested by: Principled Technologies Test date: Aug 19, 2008

JVM 2 Scores:

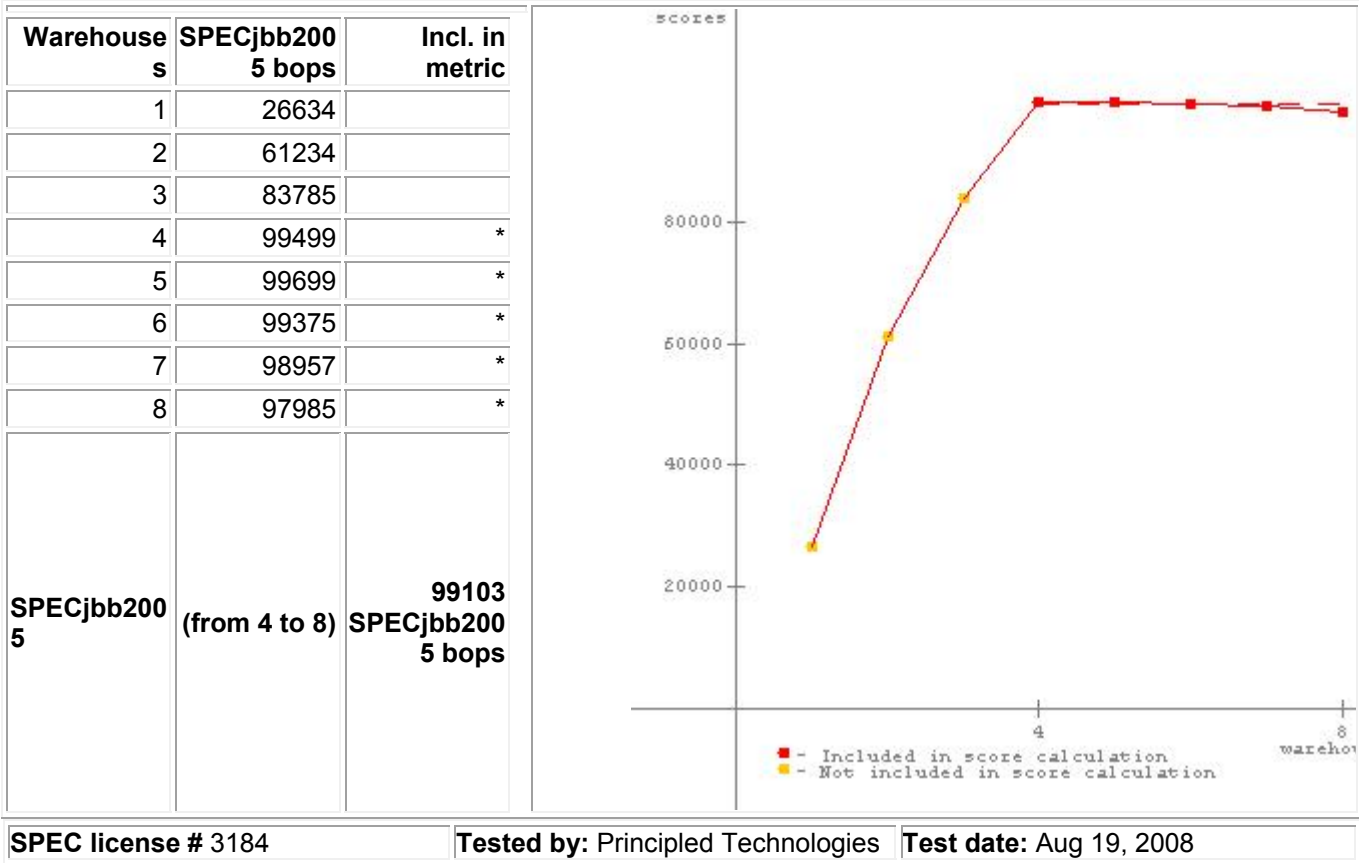
No errors. Valid run.



SPEC license # 3184 Tested by: Principled Technologies Test date: Aug 19, 2008

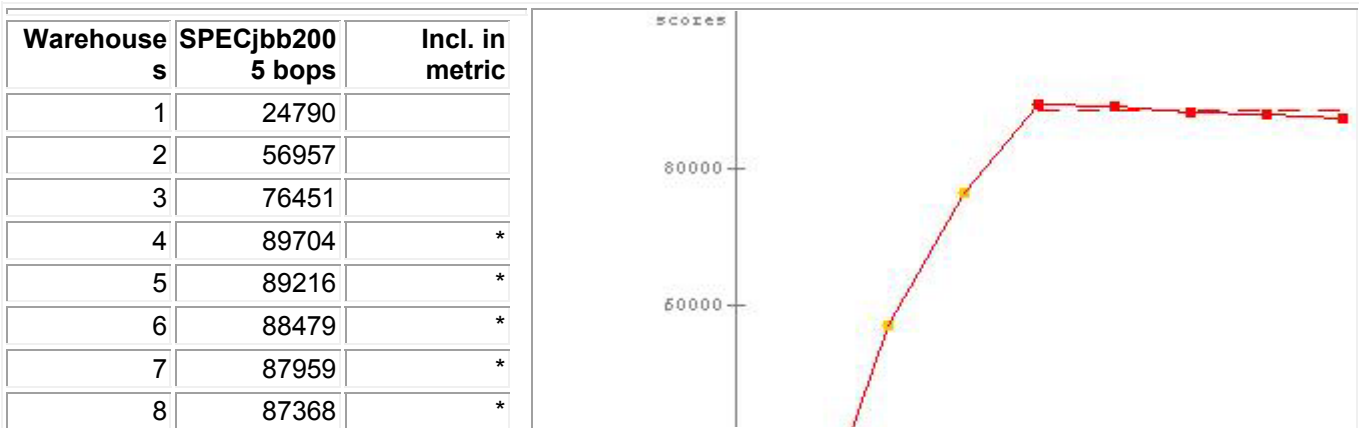
JVM 3 Scores:

No errors. Valid run.



JVM 4 Scores:

No errors. Valid run.



SPECjbb2005	(from 4 to 8)	88545 SPECjbb2005 5 bops	
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SPEC license # 3184	Tested by: Principled Technologies	Test date: Aug 19, 2008
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SPECjbb2005 Version: [SPECjbb2005 1.07, March 15, 2006]
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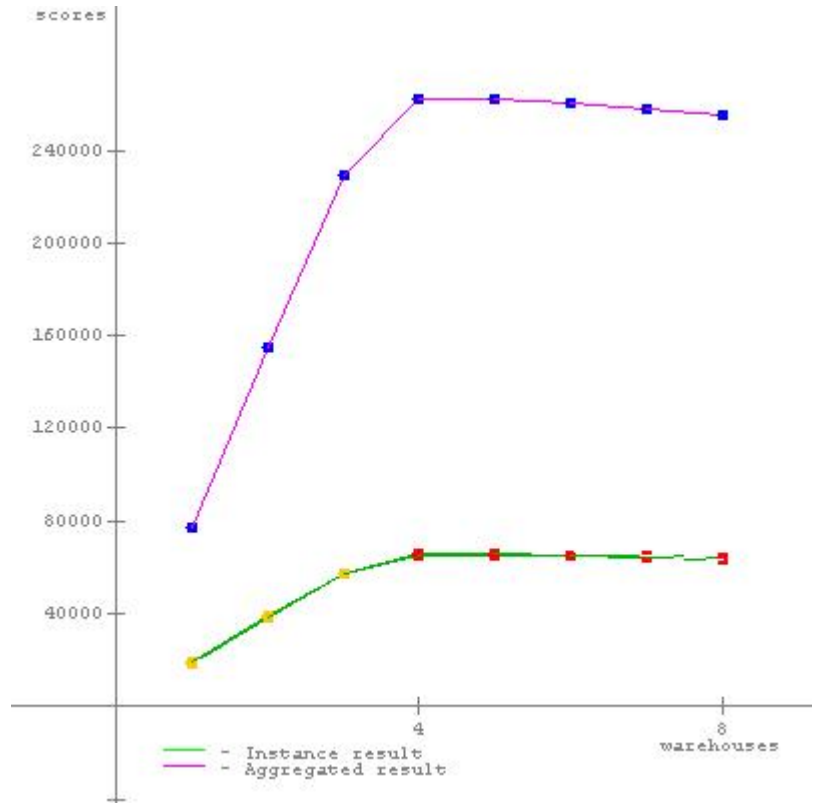
SPECjbb2005

**SPECjbb2005 bops = 259489,
SPECjbb2005 bops/JVM = 64872**

HP ProLiant BL680c

JRockit 1.6.0_03 (build P27.5.0-5-_o_CR371811_CR374296-100684-1.6.0_03-20080702-1651-windows-x86_64, compiled mode)

JVM run	JVM Scores
1	65282
2	64590
3	64848
4	64769
SPECjbb2005 bops = 259489, SPECjbb2005 bops/JVM = 64872	



Hardware	
Hardware Vendor	HP
Vendor URL	http://www.hp.com
Model	ProLiant BL680c
Processor	Quad-core Intel Xeon processor E7310
MHz	1600
# of Chips	4
# of Cores	16
# of Cores/Chip	4
HW Threading Enabled?	No

Software	
Software Vendor	BEA
Vendor URL	http://www.bea.com
JVM Version	JRockit 1.6.0_03 (build P27.5.0-5-_o_CR371811_CR374296-100684-1.6.0_03-20080702-1651-windows-x86_64, compiled mode)
JVM Command Line	start /AFFINITY /B java -Xms3700m -Xns3200m -Xmx3700m -XXaggressive -XXlargepages -XXcallprofiling -Xgc:genpar -XXthroughputCompaction -XXlazyUnlocking -XXtlasize:min=4k,preferred=128k spec.jbb.JBBmain
JVM Initial Heap	3700

Procs Avail to Java	16
Memory (MB)	49152
Memory Details	8 x 4GB DDR2-667 DIMM, 8 x 2GB DDR2-667 DIMM
Primary cache	32 KB + 32 KB (per core)
Secondary cache	4 MB (2 x 2 MB)
Other cache	
Filesystem	NTFS
Disks	2 x 72GB SAS
Other hardware	

Memory (MB)	
JVM Maximum Heap Memory (MB)	3700
JVM Address bits	64
JVM CLASSPATH	.\jbb.jar; .\jbb_no_precompile.jar; .\check.jar; .\reporter.jar;
JVM BOOTCLASSPATH	C:\jrockit-jdk1.6.0_03\jre\bin\jrockit\jrockit1.6.0.jar; C:\jrockit-jdk1.6.0_03\jre\bin\jrockit\jmap.jar; C:\jrockit-jdk1.6.0_03\jre\bin\jrockit\jmxmap.jar; C:\jrockit-jdk1.6.0_03\jre\bin\jrockit\rmp.jar; C:\jrockit-jdk1.6.0_03\jre\bin\jrockit\latency.jar; C:\jrockit-jdk1.6.0_03\jre\lib\resources.jar; C:\jrockit-jdk1.6.0_03\jre\lib\rt.jar; C:\jrockit-jdk1.6.0_03\jre\lib\sunrsasign.jar; C:\jrockit-jdk1.6.0_03\jre\lib\jsse.jar; C:\jrockit-jdk1.6.0_03\jre\lib\jce.jar; C:\jrockit-jdk1.6.0_03\jre\lib\charsets.jar; C:\jrockit-jdk1.6.0_03\jre\classes
OS Version	Microsoft Windows 2003 Server, x64 Enterprise Edition Service Pack 2
Other software	

Test Information	
Tested by	Principled Technologies
SPEC license #	3184
Test location	Durham, NC
Test date	August 19, 2008
H/w available	
JVM available	2008
OS available	2003
Other s/w available	

AOT Compilation
Tuning
In the local security settings, "Lock pages in memory" was enabled.
Notes

Disabled "Hardware Prefetching" and enabled "Adjacent Cache Line Prefetch" in the BIOS.

JVM 1 Scores:

No errors. Valid run.

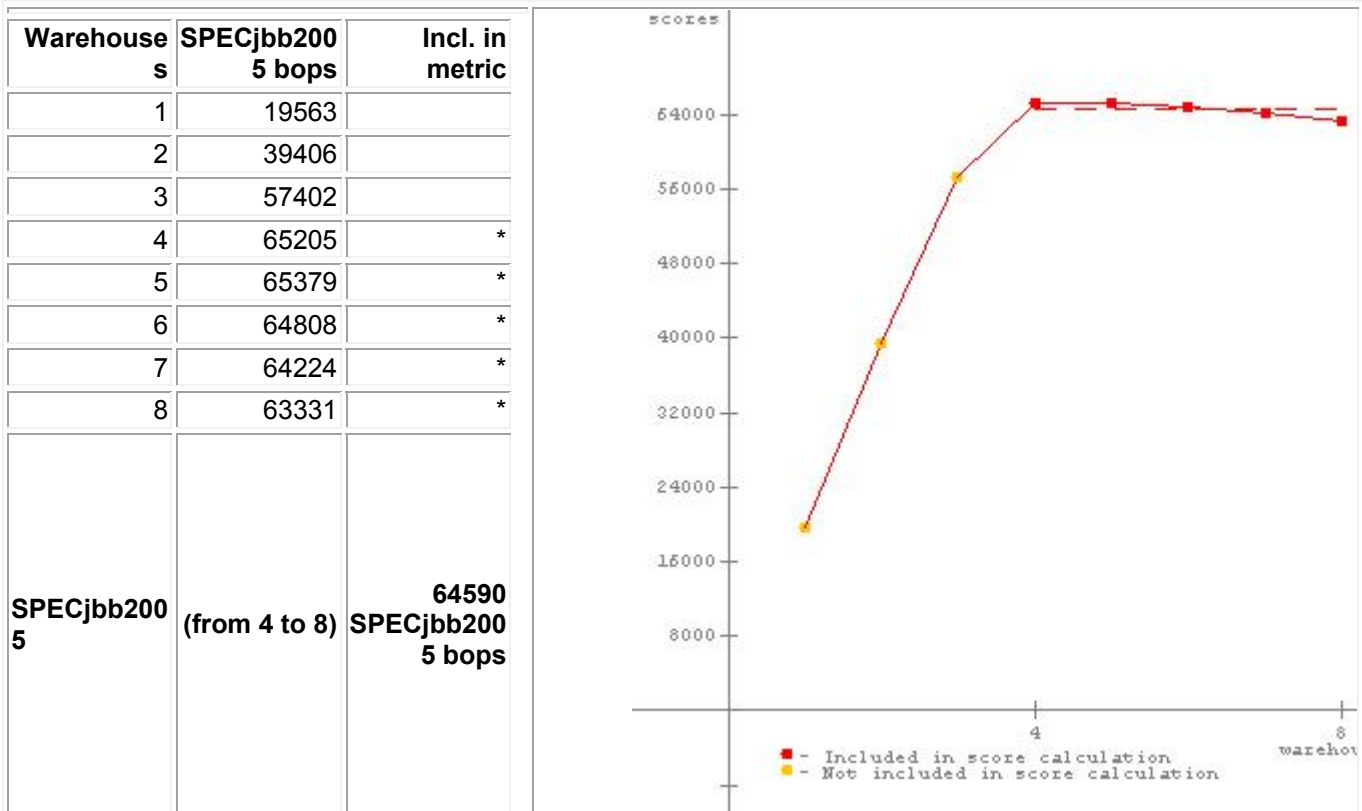
Warehouse	SPECjbb2005 bops	Incl. in metric
1	18756	
2	38371	

3	57169	
4	65846	*
5	65855	*
6	65528	*
7	64917	*
8	64264	*
SPECjbb2005	(from 4 to 8)	65282 SPECjbb2005 bops

SPEC license # 3184 Tested by: Principled Technologies Test date: Aug 19, 2008

JVM 2 Scores:

No errors. Valid run.



SPEC license # 3184 Tested by: Principled Technologies Test date: Aug 19, 2008

JVM 3 Scores:

No errors. Valid run.

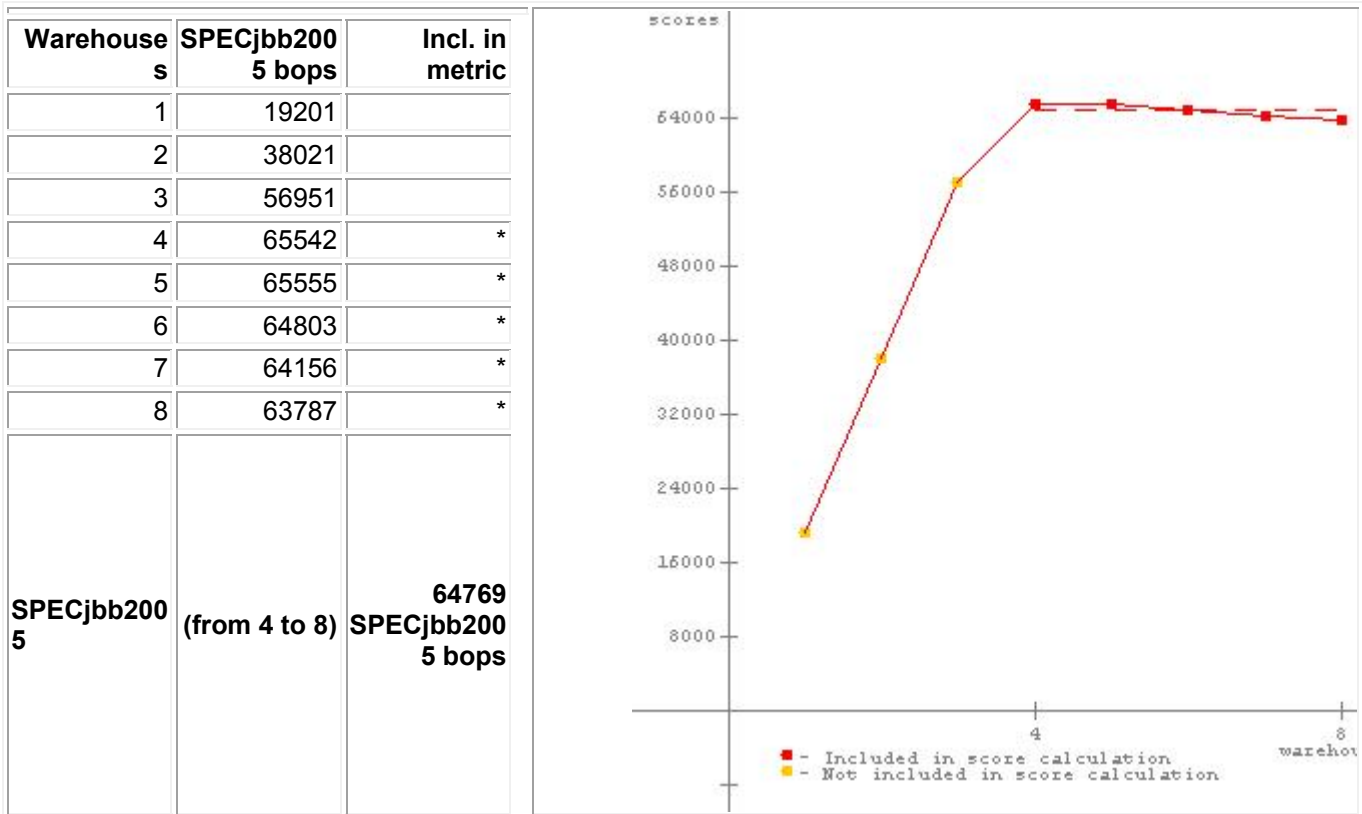


2	38860	
3	57655	
4	65757	*
5	65618	*
6	64933	*
7	64328	*
8	63607	*
SPECjbb2005	(from 4 to 8)	64848 SPECjbb2005 bops

SPEC license # 3184 **Tested by:** Principled Technologies **Test date:** Aug 19, 2008

JVM 4 Scores:

No errors. Valid run.



SPEC license # 3184 **Tested by:** Principled Technologies **Test date:** Aug 19, 2008

SPECjbb2005 Version: [SPECjbb2005 1.07, March 15, 2006]
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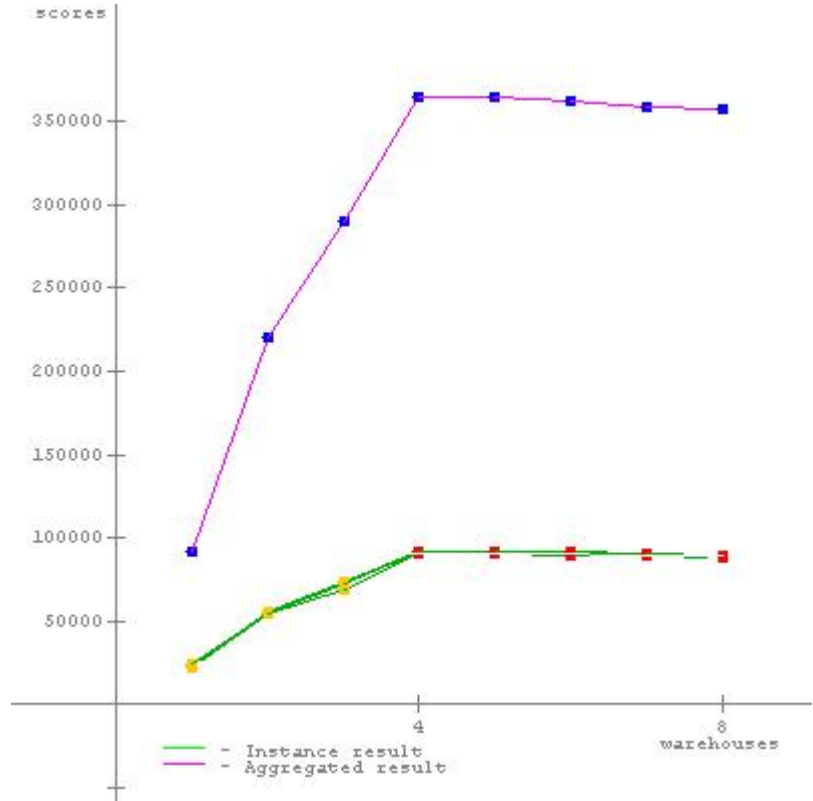
SPECjbb2005

SPECjbb2005 bops = 361646,
SPECjbb2005 bops/JVM = 90412

HP ProLiant BL685c

BEA JRockit 1.6.0_03 (build P27.5.0-5-
 _o_CR371811_CR374296-100684-1.6.0_03-20080702-1651-
 windows-x86_64, compiled mode)

JVM run	JVM Scores
1	89762
2	90937
3	90164
4	90783
SPECjbb2005 bops = 361646, SPECjbb2005 bops/JVM = 90412	



Hardware	
Hardware Vendor	HP
Vendor URL	http://www.hp.com
Model	ProLiant BL685c
Processor	Quad-core AMD Opteron processor 8354
MHz	2200
# of Chips	4
# of Cores	16
# of Cores/Chip	4
HW Threading Enabled?	No

Software	
Software Vendor	BEA
Vendor URL	http://www.bea.com
JVM Version	JRockit 1.6.0_03 (build P27.5.0-5- _o_CR371811_CR374296-100684- 1.6.0_03-20080702-1651-windows- x86_64, compiled mode)
JVM Command Line	start /AFFINITY /B java -Xms3700m - Xns3200m -Xmx3700m -XXaggressive - XXlargepages -XXcallprofiling - Xgc:genpar -XXthroughputCompaction - XXlazyUnlocking - XXtlasize:min=4k,preferred=128k spec.jbb.JBBmain
JVM Initial Heap	3700

Procs Avail to Java	16
Memory (MB)	49152
Memory Details	8 x 4GB DDR2-667 DIMM, 8 x 2GB DDR2-667 DIMM
Primary cache	64KBI+64KBD (per core)
Secondary cache	2MB (512 KB per core)
Other cache	
Filesystem	NTFS
Disks	2 x 72GB SAS
Other hardware	

Memory (MB)	
JVM Maximum Heap Memory (MB)	3700
JVM Address bits	64
JVM CLASSPATH	.\jbb.jar; .\jbb_no_precompile.jar; .\check.jar; .\reporter.jar;
JVM BOOTCLASSPATH	C:\jrockit-jdk1.6.0_03\jre\bin\jrockit\jrockit1.6.0.jar; C:\jrockit-jdk1.6.0_03\jre\bin\jrockit\jmap.jar; C:\jrockit-jdk1.6.0_03\jre\bin\jrockit\jmxmap.jar; C:\jrockit-jdk1.6.0_03\jre\bin\jrockit\rmp.jar; C:\jrockit-jdk1.6.0_03\jre\bin\jrockit\latency.jar; C:\jrockit-jdk1.6.0_03\jre\lib\resources.jar; C:\jrockit-jdk1.6.0_03\jre\lib\rt.jar; C:\jrockit-jdk1.6.0_03\jre\lib\sunrsasign.jar; C:\jrockit-jdk1.6.0_03\jre\lib\jsse.jar; C:\jrockit-jdk1.6.0_03\jre\lib\jce.jar; C:\jrockit-jdk1.6.0_03\jre\lib\charsets.jar; C:\jrockit-jdk1.6.0_03\jre\classes
OS Version	Microsoft Windows 2003 Server, x64 Enterprise Edition Service Pack 2
Other software	

Test Information	
Tested by	Principled Technologies
SPEC license #	3184
Test location	Durham, NC
Test date	August 20, 2008
H/w available	
JVM available	2008
OS available	2003
Other s/w available	

AOT Compilation
Tuning
In the local security settings, "Lock pages in memory" was enabled.
Notes

JVM 1 Scores:

No errors. Valid run.

Warehouse	SPECjbb2005 bops	Incl. in metric
1	21895	
2	54544	

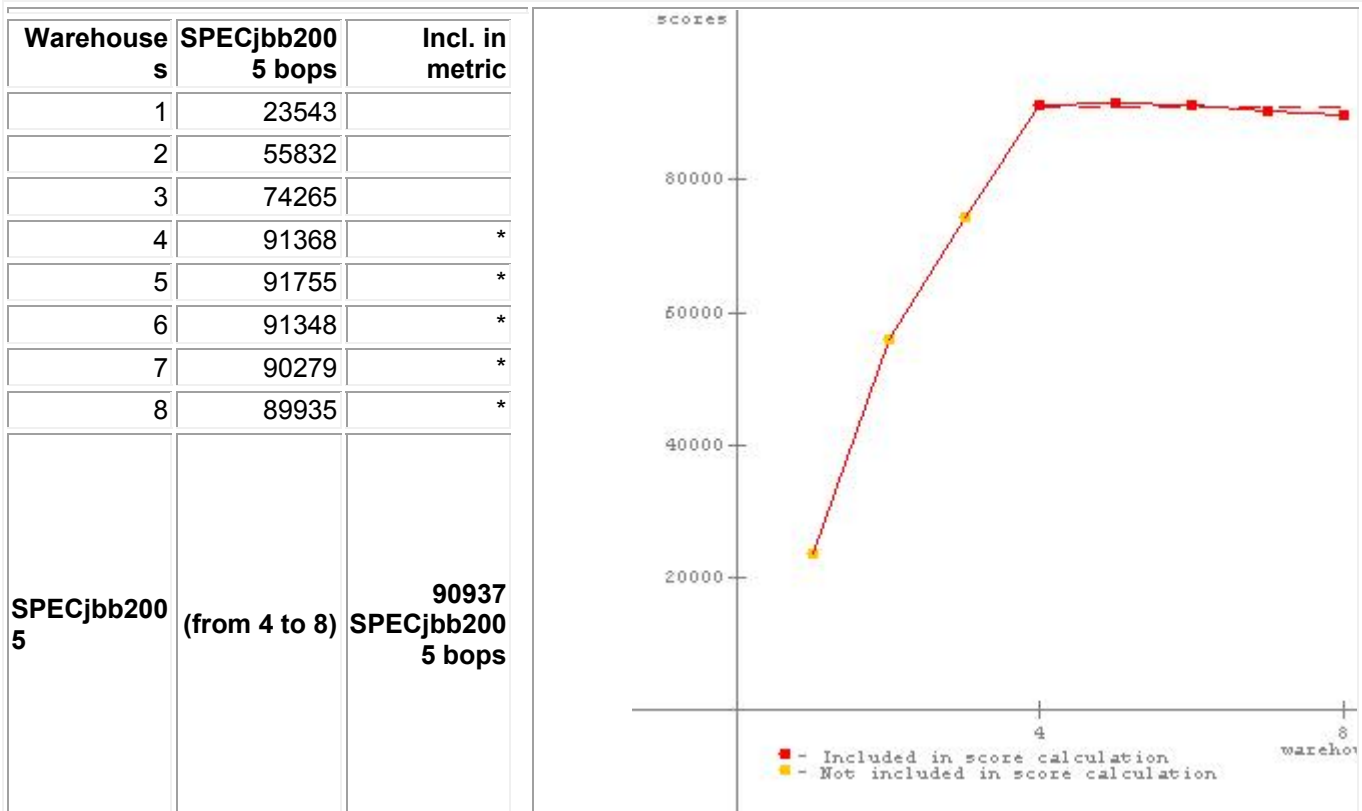
SCORES

3	69305	
4	90738	*
5	90846	*
6	89880	*
7	88834	*
8	88510	*
SPECjbb2005	(from 4 to 8)	89762 SPECjbb2005 bops

SPEC license # 3184 Tested by: Principled Technologies Test date: Aug 20, 2008

JVM 2 Scores:

No errors. Valid run.



SPEC license # 3184 Tested by: Principled Technologies Test date: Aug 20, 2008

JVM 3 Scores:

No errors. Valid run.

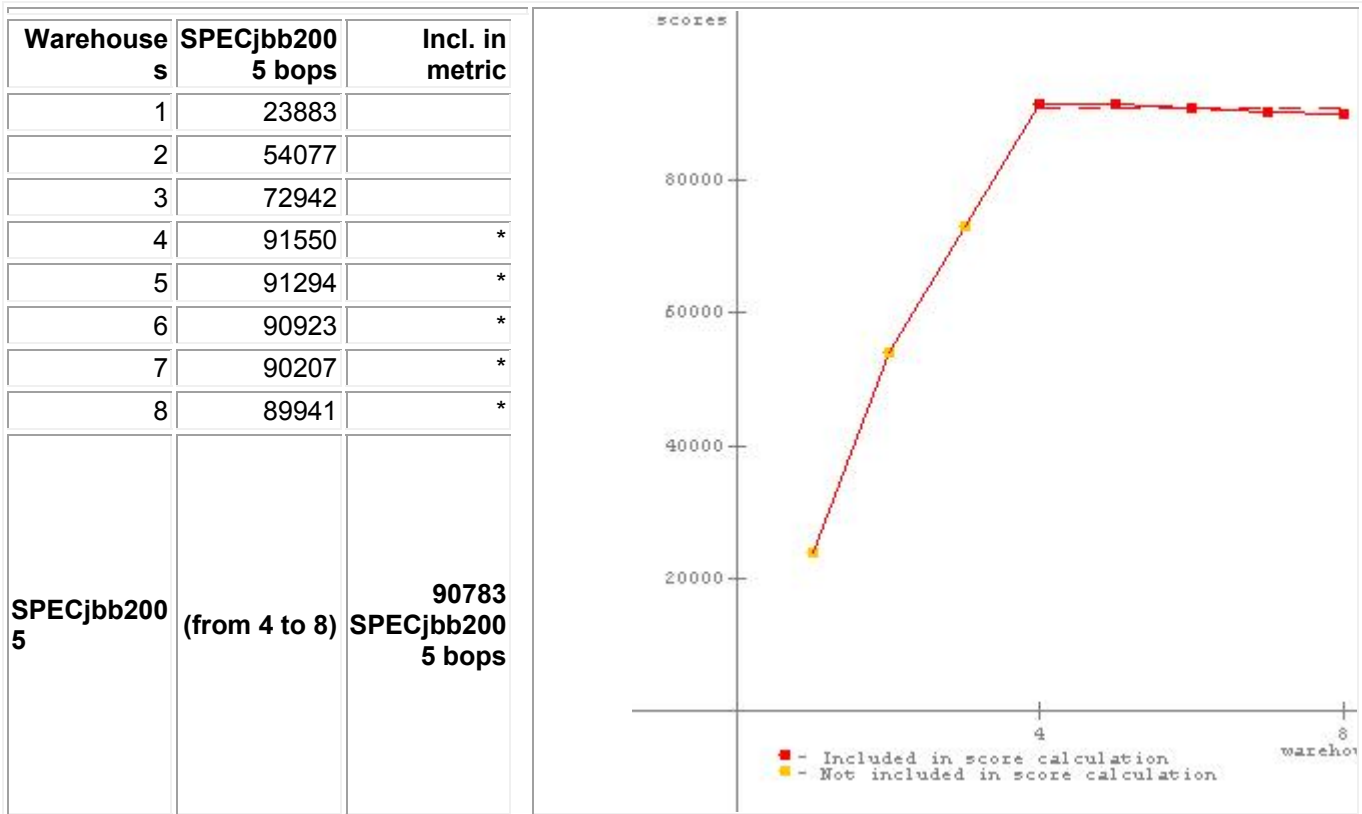


2	55465	
3	73881	
4	91010	*
5	90657	*
6	90277	*
7	89531	*
8	89346	*
SPECjbb2005	(from 4 to 8)	90164 SPECjbb2005 bops

SPEC license # 3184 **Tested by:** Principled Technologies **Test date:** Aug 20, 2008

JVM 4 Scores:

No errors. Valid run.



SPEC license # 3184 **Tested by:** Principled Technologies **Test date:** Aug 20, 2008

SPECjbb2005 Version: [SPECjbb2005 1.07, March 15, 2006]
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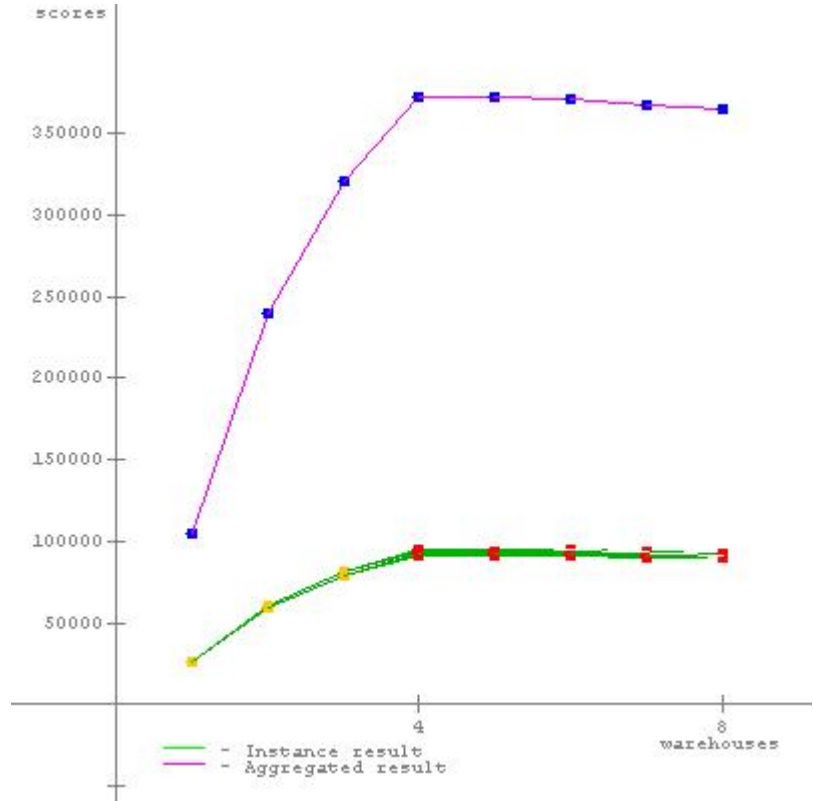
SPECjbb2005

**SPECjbb2005 bops = 369860,
SPECjbb2005 bops/JVM = 92465**

IBM LS42

JRokit 1.6.0_03 (build P27.5.0-5-_o_CR371811_CR374296-100684-1.6.0_03-20080702-1651-windows-x86_64, compiled mode)

JVM run	JVM Scores
1	94218
2	90746
3	93023
4	91873
SPECjbb2005 bops = 369860, SPECjbb2005 bops/JVM = 92465	



Hardware	
Hardware Vendor	IBM
Vendor URL	http://www.ibm.com
Model	LS42
Processor	Quad-core AMD Opteron processor 8356
MHz	2300
# of Chips	4
# of Cores	16
# of Cores/Chip	4
HW Threading Enabled?	No

Software	
Software Vendor	BEA
Vendor URL	http://www.bea.com
JVM Version	JRokit 1.6.0_03 (build P27.5.0-5-_o_CR371811_CR374296-100684-1.6.0_03-20080702-1651-windows-x86_64, compiled mode)
JVM Command Line	start /AFFINITY /B java -Xms3700m -Xns3200m -Xmx3700m -XXaggressive -XXlargepages -XXcallprofiling -Xgc:genpar -XXthroughputCompaction -XXlazyUnlocking -XXtlasize:min=4k,preferred=128k spec.jbb.JBBmain
JVM Initial Heap	3700

Procs Avail to Java	16
Memory (MB)	49152
Memory Details	8 x 4GB DDR2-667 DIMM, 8 x 2GB DDR2-667 DIMM
Primary cache	64KBI+64KBD (per core)
Secondary cache	2MB (512 KB per core)
Other cache	
Filesystem	NTFS
Disks	2 x 73GB SAS
Other hardware	

Memory (MB)	
JVM Maximum Heap Memory (MB)	3700
JVM Address bits	64
JVM CLASSPATH	.\jbb.jar; .\jbb_no_precompile.jar; .\check.jar; .\reporter.jar;
JVM BOOTCLASSPATH	C:\jrockit-jdk1.6.0_03\jre\bin\jrockit\jrockit1.6.0.jar; C:\jrockit-jdk1.6.0_03\jre\bin\jrockit\jmap.jar; C:\jrockit-jdk1.6.0_03\jre\bin\jrockit\jmxmap.jar; C:\jrockit-jdk1.6.0_03\jre\bin\jrockit\rmp.jar; C:\jrockit-jdk1.6.0_03\jre\bin\jrockit\latency.jar; C:\jrockit-jdk1.6.0_03\jre\lib\resources.jar; C:\jrockit-jdk1.6.0_03\jre\lib\rt.jar; C:\jrockit-jdk1.6.0_03\jre\lib\sunrsasign.jar; C:\jrockit-jdk1.6.0_03\jre\lib\jsse.jar; C:\jrockit-jdk1.6.0_03\jre\lib\jce.jar; C:\jrockit-jdk1.6.0_03\jre\lib\charsets.jar; C:\jrockit-jdk1.6.0_03\jre\classes
OS Version	Microsoft Windows 2003 Server, x64 Enterprise Edition Service Pack 2
Other software	

Test Information	
Tested by	Principled Technologies
SPEC license #	3184
Test location	Durham, NC
Test date	Oct 30, 2008
H/w available	
JVM available	2008
OS available	2003
Other s/w available	

AOT Compilation
Tuning
In the local security settings, "Lock pages in memory" was enabled.
Notes

JVM 1 Scores:

No errors. Valid run.

Warehouse	SPECjbb2005 bops	Incl. in metric
1	26382	
2	60273	

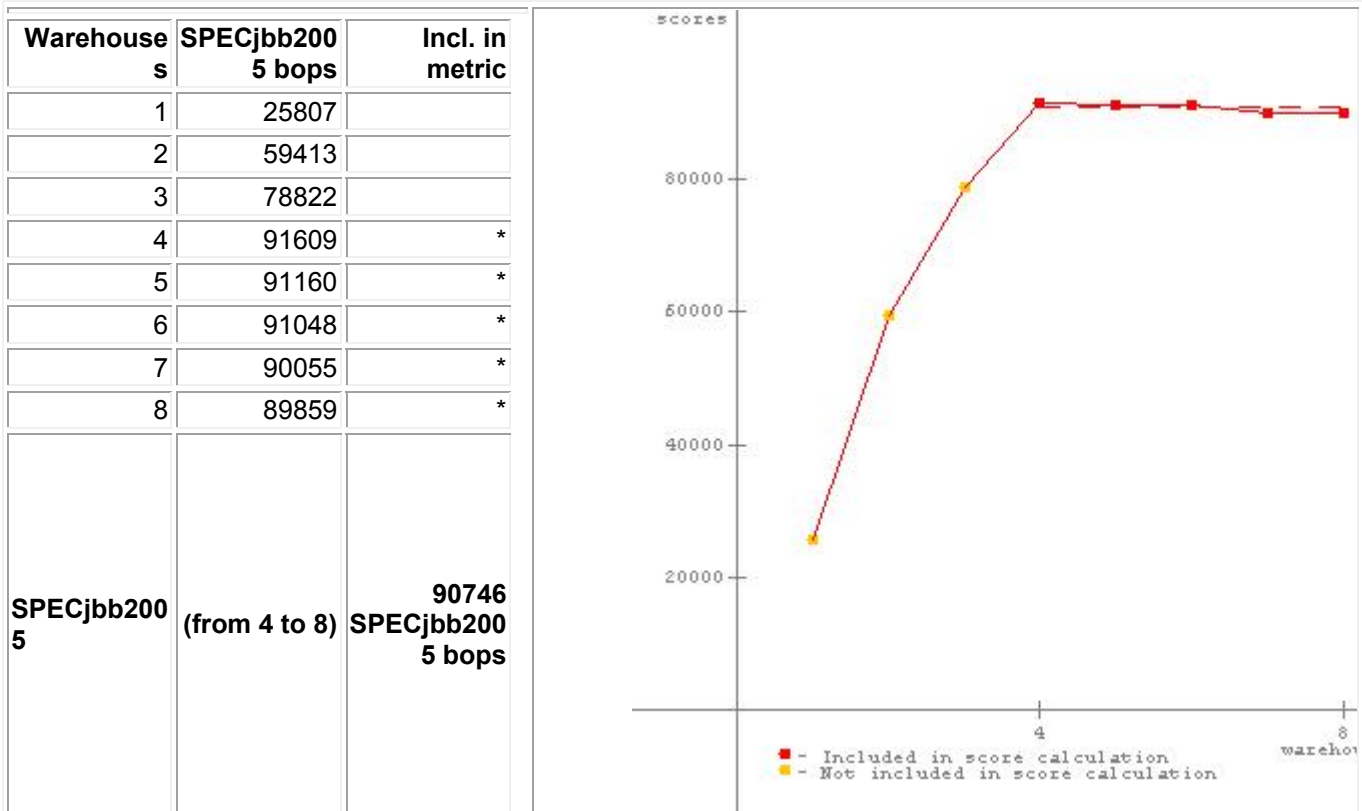
The graph displays two data points: Warehouse 1 with a score of 26382 and Warehouse 2 with a score of 60273. A red line connects the two points, showing a significant upward trend from Warehouse 1 to Warehouse 2.

3	81347	
4	95030	*
5	94930	*
6	94670	*
7	93567	*
8	92895	*
SPECjbb2005	(from 4 to 8)	94218 SPECjbb2005 bops

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JVM 2 Scores:

No errors. Valid run.



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JVM 3 Scores:

No errors. Valid run.

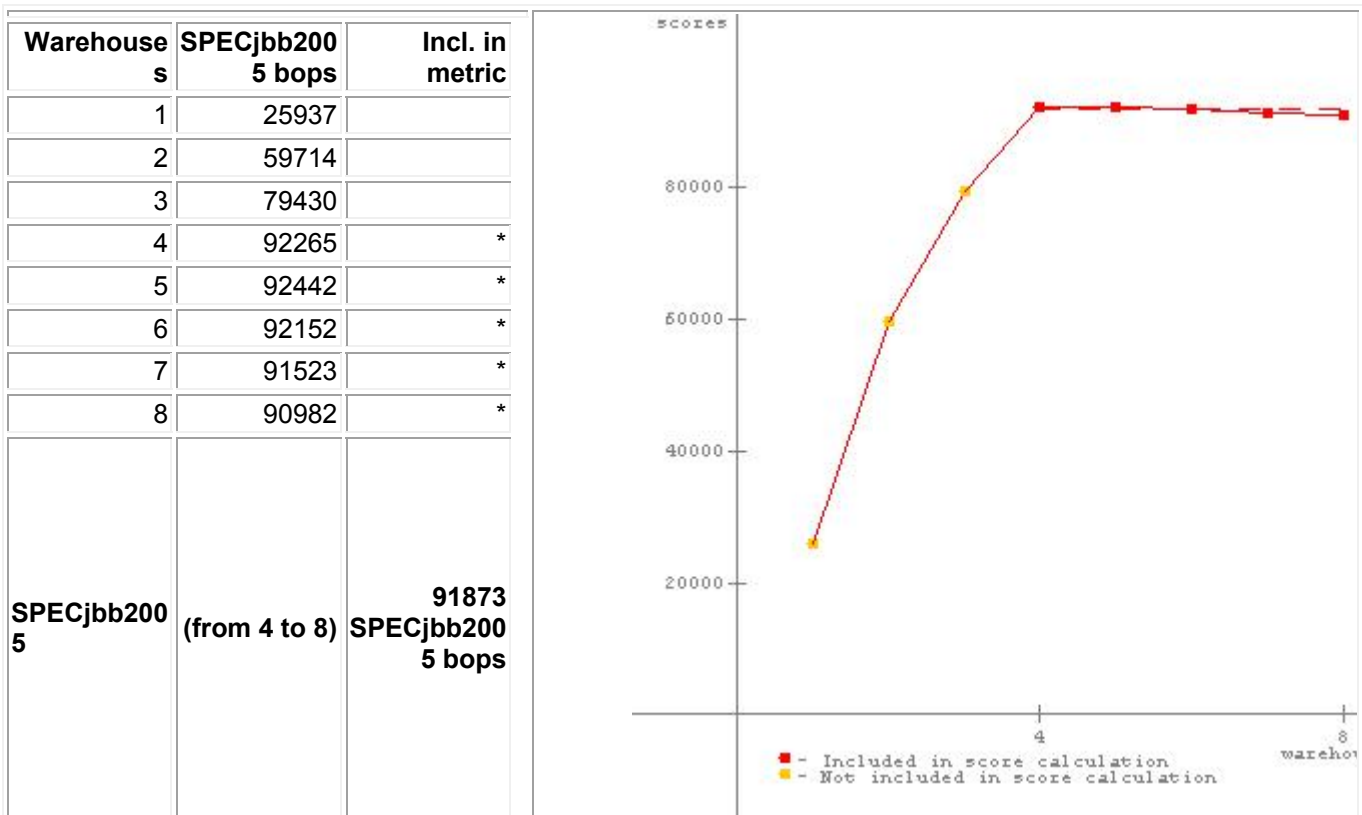


2	60716	
3	81030	
4	93928	*
5	93636	*
6	93149	*
7	92576	*
8	91827	*
SPECjbb2005	(from 4 to 8)	93023 SPECjbb2005 bops

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JVM 4 Scores:

No errors. Valid run.



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*SPECjbb2005 Version: [SPECjbb2005 1.07, March 15, 2006]
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