Principled Technologies®

TEST REPORT
SEPTEMBER 2008

SPECjbb2005 performance on Red Hat Enterprise Linux 5.2 Intel-based servers

Executive summary

Red Hat®, Inc. (Red Hat) commissioned Principled Technologies (PT) to measure the SPECjbb®2005 performance of multi-processor servers using the following two processors:

- Red Hat Enterprise Linux 5.2 running native on an Intel Xeon® X7460-based (2.66 GHz) server
- Red Hat Enterprise Linux 5.2 running as guest on Red Hat Enterprise Linux 5.2 server on an Intel Xeon X7460-based (2.66 GHz) server

KEY FINDING

- Red Hat Enterprise Linux 5.2 guest on an Intel Xeon X7460-based server achieved 93.7 percent of the performance of running native on Red Hat Enterprise Linux 5.2 (see Figure 1).

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 shows the SPECjbb2005 results, in bops (business operations per second), of the test servers. Each result is the median peak 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. We configured the benchmark to utilize all of the cores of the Intel Xeon 7460 processor running both native and as a guest on Red Hat Enterprise Linux 5.2.

The Red Hat Enterprise Linux 5.2 guest on Red Hat Enterprise Linux 5.2 configuration achieved a score of 443,088 bops, which is 93.7 percent of the performance of running native on Red Hat Enterprise Linux 5.2. That configuration achieved a score of 472,625 bops.

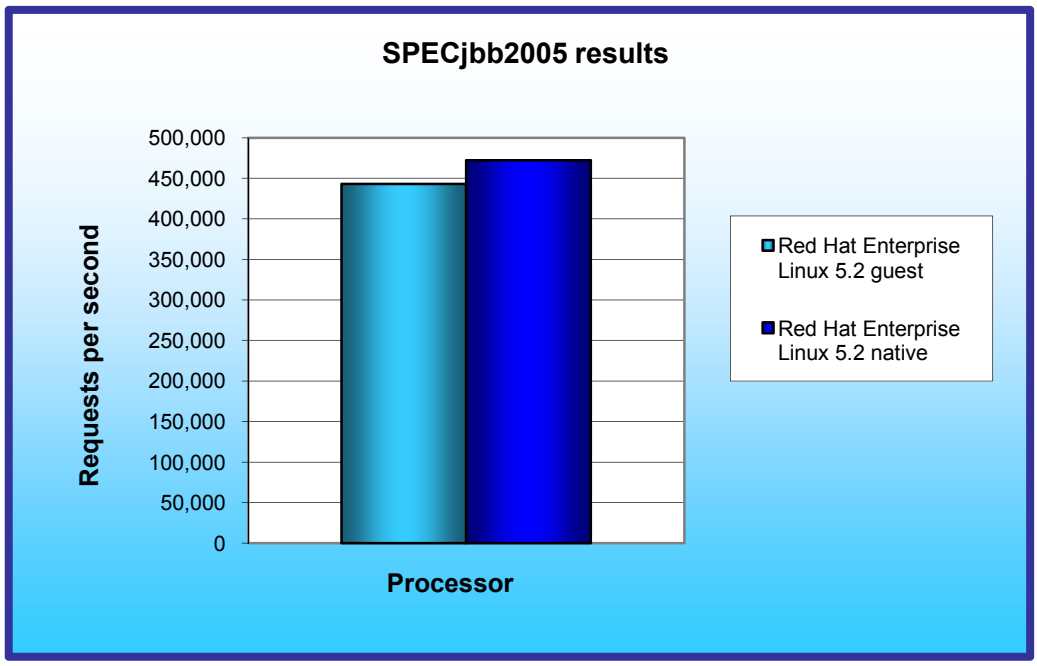


Figure 1: Peak performance of the servers with the SPECjbb2005 workload. Higher numbers are better.

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 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 and gives a final score along with the average bops/JVM. 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.)

	Red Hat Enterprise Linux 5.2 server: Intel Xeon X7460-based server	Red Hat Enterprise Linux 5.2 guest on Red Hat Enterprise Linux 5.2 server: Intel Xeon X7460-based server
JVM 1	117,669	111,693
JVM 2	118,106	112,223
JVM 3	118,300	109,577
JVM 4	118,550	109,595
SPECjbb2005 bops/JVM	**118,156**	**110,772**
Total score	**472,625**	**443,088**

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

Figure 3 shows the results by warehouse for the Red Hat Enterprise Linux 5.2 server: Intel Xeon X7460-based server for all three runs. Run 1 produced the median results.

Red Hat Enterprise Linux 5.2 server: Intel Xeon X7460-based server			
	Run 1	Run 2	Run 3
Warehouse	JVM 1		
1	31,426	31,111	31,603
2	65,035	65,160	65,340
3	87,184	89,217	88,898
4	105,233	107,095	108,370
5	118,360	118,315	119,412
6	122,317	122,442	123,530
7	120,787	121,938	122,057
8	119,040	119,828	119,849
9	117,495	118,505	118,730
10	115,396	116,015	116,745
11	115,171	115,783	115,078
12	113,475	112,593	113,648
Score	**117,669**	**118,158**	**118,520**

Warehouse	JVM 2		
1	31,939	31,427	31,230
2	66,023	64,609	64,790
3	89,360	88,800	88,238
4	106,871	105,465	107,792
5	119,449	118,001	118,596
6	122,286	122,278	123,136
7	122,148	121,638	120,201
8	118,980	120,886	120,156
9	117,530	117,418	116,672
10	116,496	116,482	115,441
11	115,750	115,233	114,880
12	113,549	112,806	113,057
Score	**118,106**	**118,106**	**117,649**
Warehouse	**JVM 3**		
1	32,233	31,381	31,593
2	65,577	64,827	64,346
3	88,516	88,637	88,119
4	107,466	105,363	105,072
5	118,513	118,553	118,605
6	121,869	122,178	122,177
7	122,095	121,240	121,104
8	120,624	120,693	120,768
9	118,303	117,923	118,433
10	116,687	116,326	117,117
11	115,363	115,353	115,251
12	113,162	113,668	113,655
Score	**118,300**	**118,197**	**118,358**
Warehouse	**JVM 4**		
1	32,585	31,578	30,782
2	65,356	64,275	64,589
3	88,799	87,732	86,507
4	105,335	104,815	106,071
5	118,543	118,722	118,822
6	123,095	122,298	122,504
7	122,011	122,613	120,542
8	119,323	119,341	118,172
9	118,639	118,418	117,507
10	116,911	116,092	116,265
11	115,680	115,531	114,674
12	114,195	114,003	113,505
Score	**118,550**	**118,328**	**117,596**
SPECjbb2005 bops/JVM	**118,156**	**118,197**	**118,031**
Total score	**472,625**	**472,789**	**472,123**

Figure 3: SPECjbb2005 results for the Red Hat Enterprise Linux 5.2 server: Intel Xeon X7460-based server. Higher numbers are better.

Figure 4 shows the results by warehouse for the Red Hat Enterprise Linux 5.2 guest on Red Hat Enterprise Linux 5.2 server: Intel Xeon X7460-based server for all three runs. Run 1 produced the median results.

Red Hat Enterprise Linux 5.2 guest on Red Hat Enterprise Linux 5.2 server: Intel Xeon X7460-based server			
	Run 1	**Run 2**	**Run 3**
Warehouse		**JVM 1**	
1	23,699	23,502	20,001
2	60,388	60,520	57,478
3	82,354	82,221	81,339
4	99,197	99,428	99,325
5	110,702	111,002	110,965
6	116,651	116,540	114,304
7	115,213	114,075	112,521
8	113,122	112,786	110,563
9	111,760	112,241	108,353
10	109,205	104,887	104,509
11	107,921	103,786	103,979
12	107,975	103,425	104,341
Score	**111,693**	**109,677**	**108,367**
Warehouse		**JVM 2**	
1	23,649	23,342	18,823
2	59,618	60,179	57,303
3	82,557	81,828	81,455
4	95,788	100,507	98,638
5	106,438	110,526	106,712
6	116,373	116,471	116,325
7	114,238	115,802	114,291
8	113,631	111,723	112,631
9	110,927	111,343	112,441
10	111,605	109,085	107,635
11	109,158	107,545	106,868
12	109,631	106,947	108,311
Score	**112,223**	**111,274**	**111,215**
Warehouse		**JVM 3**	
1	22,995	24,012	18,919
2	57,330	59,966	57,535
3	82,545	82,855	80,772
4	100,879	99,080	101,375
5	111,361	111,553	111,675
6	116,467	116,277	117,201
7	113,441	114,098	114,030
8	113,858	112,363	111,517
9	111,261	109,973	111,155
10	104,604	109,716	109,267
11	104,319	109,672	108,634
12	103,088	108,629	108,679
Score	**109,577**	**111,533**	**111,498**

Warehouse	JVM 4		
1	23,206	22,234	19,760
2	57,760	58,819	59,101
3	82,224	81,169	83,276
4	99,934	98,885	98,406
5	110,431	110,608	110,891
6	117,141	115,693	116,025
7	114,189	114,352	112,113
8	113,540	111,123	112,212
9	110,674	109,934	111,136
10	104,236	109,217	109,389
11	103,455	109,168	108,839
12	103,932	109,766	107,322
Score	**109,595**	**111,322**	**111,005**
SPECjbb2005 bops/JVM	**110,772**	**110,952**	**110,521**
Total score	**443,088**	**443,806**	**442,085**

Figure 4: SPECjbb2005 results for the Red Hat Enterprise Linux 5.2 guest on Red Hat Enterprise Linux 5.2 server: Intel Xeon X7460-based server. Higher numbers are better.

Test methodology

Red Hat configured and provided the test system.

We began by installing a fresh copy of Red Hat Enterprise Linux on the test system. For the Red Hat Enterprise Linux 5.2 native installation, we installed only the Software Development package, and disabled the firewall and SELinux. We used the same installation method for the Red Hat Enterprise Linux 5.2 guest installation, but installed Virtualization on the native installation for this configuration. We made no additional changes to the default installation options.

With the following exceptions, we used the default BIOS settings on each server: enabled AHCI, Intel Virtualization Technology, and High Bandwidth. In addition, we disabled both HW prefetcher and Adjacent Cache prefetcher.

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 BEA JRockit SE Runtime Environment 1.6.0_03 (build P27.5.0-5_o_CR371811_CR374296-100684-1.6.0_03-20080702-1650-linux-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 4. This change allows a server to run 4 JVM instances during testing.

We created a shell script, 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 to run this batch file. Figure 5 shows the contents of the shell script we used on the Red Hat Enterprise Linux 5.2 native configuration.

In the shell script we set the Java options that control the performance of the JVM.

- *-Xms3500m* 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 3500MB.
- *-Xns2500m* sets the JVM nursery size.
- *-Xmx3500m* sets the maximum heap size.
- *-XXaggressive* basically tells the JVM to perform at maximum speed.
- *-XXlargepages* tells the JVM to use large pages.
- *-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.
- *-XXcallprofiling* allows the use of call profiling for code optimizations.

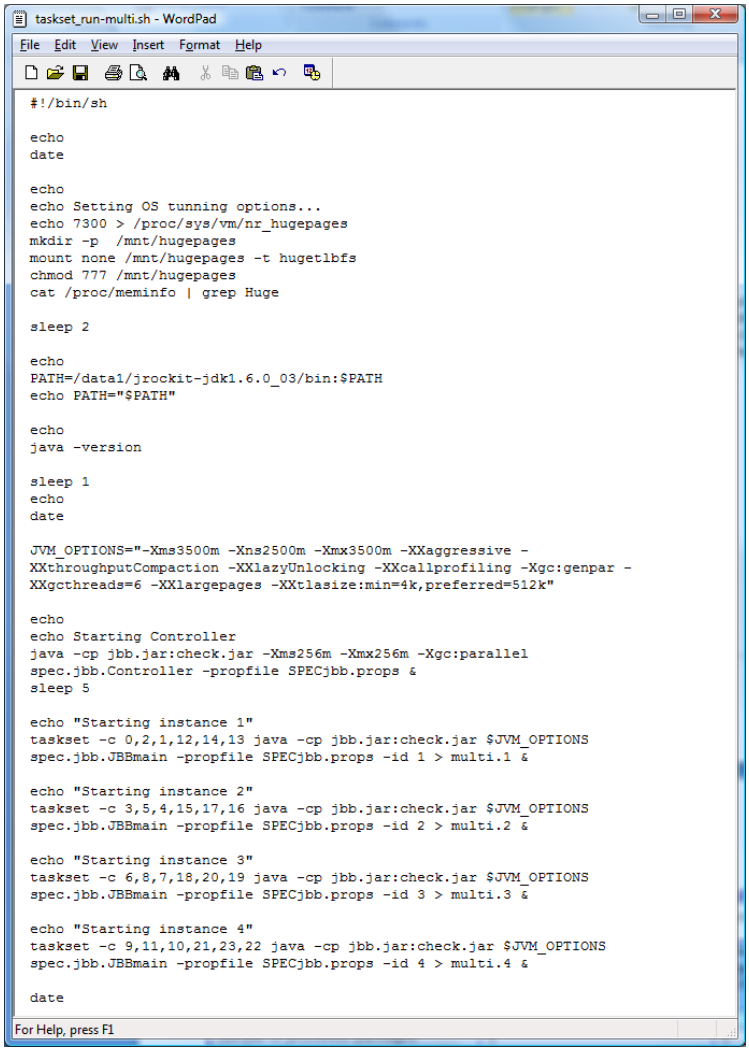


Figure 5: The text of the shell script we used to execute the SPECjbb2005 benchmark on Red Hat Enterprise Linux 5.2 native configuration.

We used the same shell script on the Red Hat Enterprise Linux 5.2 guest running on Red Hat Enterprise Linux 5.2 server, but modified a few of the options. We made the following changes: 3400 instead of 3500 for the –Xms and –Xmx option. The reason for these changes is the size of available memory differs between the two configurations because the guest OS is virtualized and has a higher memory overhead.

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.

Server	Red Hat Enterprise Linux 5.2 server: Intel Xeon X7460-based server	Red Hat Enterprise Linux 5.2 guest on Red Hat Enterprise Linux 5.2 server: Intel Xeon X7460-based server
General processor setup		
Number of processor packages	4	4
Number of cores per processor package	6	6
Number of hardware threads per core	1	1
CPU		
Vendor	Intel	Intel
Name	Intel Xeon X7460	Intel Xeon X7460
Stepping	1	1
Socket type	Socket P (478)	Socket P (478)
Core frequency (GHz)	2.66	2.66
Front-side bus frequency (MHz)	1,066	1,066
L1 cache	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)
L2 cache	3 x 3 MB (each 3 MB shared by 2 cores)	3 x 3 MB (each 3 MB shared by 2 cores)
L3 cache	16 MB	16 MB
Platform		
Vendor and model number	Intel Fox Cove	Intel Fox Cove
Motherboard model number	S7000FC4UR	S7000FC4UR
Motherboard chipset	Intel ID3600	Intel ID3600
Motherboard revision number	01	01
BIOS name and version	Intel SFC4UR.86B.01.00.S005 06/05/2008	Intel SFC4UR.86B.01.00.S005 06/05/2008
BIOS settings	- Enabled AHCI - Enabled Intel® Virtualization Technology -Disabled HW and Adjacent Cache perfetcher -Enabled High Bandwidth	- Enabled AHCI - Enabled Intel® Virtualization Technology -Disabled HW and Adjacent Cache perfetcher -Enabled High Bandwidth
Memory module(s)		
Vendor and model number	Kingston KVR667D2D8F5/1G	Kingston KVR667D2D8F5/1G
Type	PC2-5300 FB-DDR2	PC2-5300 FB-DDR2
Speed (MHz)	667	667
Speed in the system currently running @ (MHz)	667	667
Timing/Latency (tCL-tRCD-iRP-tRASmin)	5-5-5-11	5-5-5-11
Size	16,384 MB*	15,360 MB*
Number of RAM modules	16	16
Chip organization	Double-sided	Double-sided
Hard disk		
Vendor and model number	Seagate ST973401SS	Seagate ST973401SS
Number of disks in system	1	1
Size	73.4 GB	73.4 GB
Buffer size	8 MB	8 MB
RPM	10,000	10,000

Server	Red Hat Enterprise Linux 5.2 server: Intel Xeon X7460-based server	Red Hat Enterprise Linux 5.2 guest on Red Hat Enterprise Linux 5.2 server: Intel Xeon X7460-based server
Type	SAS	SAS
Hard disk (additional)		
Vendor and model number	Seagate ST973401SS	Seagate ST973401SS
Number of disks in system	1	1
Size	73.4 GB	73.4 GB
Buffer size	8 MB	8 MB
RPM	10,000	10,000
Type	SAS	SAS
Controller	Integrated Intel RAID Controller SROMBSASFC	Integrated Intel RAID Controller SROMBSASFC
Driver	00.00.03.15-RH1	00.00.03.15-RH1
Operating system		
Name	Red Hat Enterprise Linux 5.2	Red Hat Enterprise Linux 5.2
Kernel release	2.6.18-92.el5 x86_64	2.6.18-92.el5xen x86_64
Kernel version	#1 SMP Tue Apr 29 13:16:15 EDT 2008	#1 SMP Tue Apr 29 13:31:30 EDT 2008
File system	ext3	ext3
Language	English	English
Graphics		
Vendor and model number	ATI ES1000	Xen Virtual Framebuffer
Chipset	ES1000	ES1000
BIOS version	BK-ATI VER008.005.031.000	BK-ATI VER008.005.031.000
Type	Integrated	Virtual
Memory size	32 MB	32 MB
Resolution	1,024 x 768	1,024 x 768
Network card/subsystem		
Vendor and model number	Intel PRO/1000 EB	Xen Virtual Ethernet
Type	Integrated	Virtual
Driver	e1000 - 7.3.20-k2-NAPI	e1000 - 7.3.20-k2-NAPI
Optical drive		
Vendor and model number	Optiarc DVD-ROM DDU810A	Optiarc DVD-ROM DDU810A
USB ports		
Number	5	5
Type	USB 2.0	USB 2.0
Power Supplies		
Total number	2	2
Wattage of each	1,570W	1,570W
Cooling Fans		
Total Number	8	8
Dimensions	4 x 80 mm + 4 x 120 mm	4 x 80 mm + 4 x 120 mm
Voltage	12V	12V
Amps	4 x 1.76 A + 4 x 3.3 A	4 x 1.76 A + 4 x 3.3 A

Figure 6: Detailed system configuration information for the two test servers.

* The size of the memory modules differs between the two configurations because a guest OS is virtualized. This means that the native OS is running at the same time as the guest OS. The native OS needs available memory, thus reducing the amount available for the guest OS.

Appendix B – SPECjbb2005 output

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

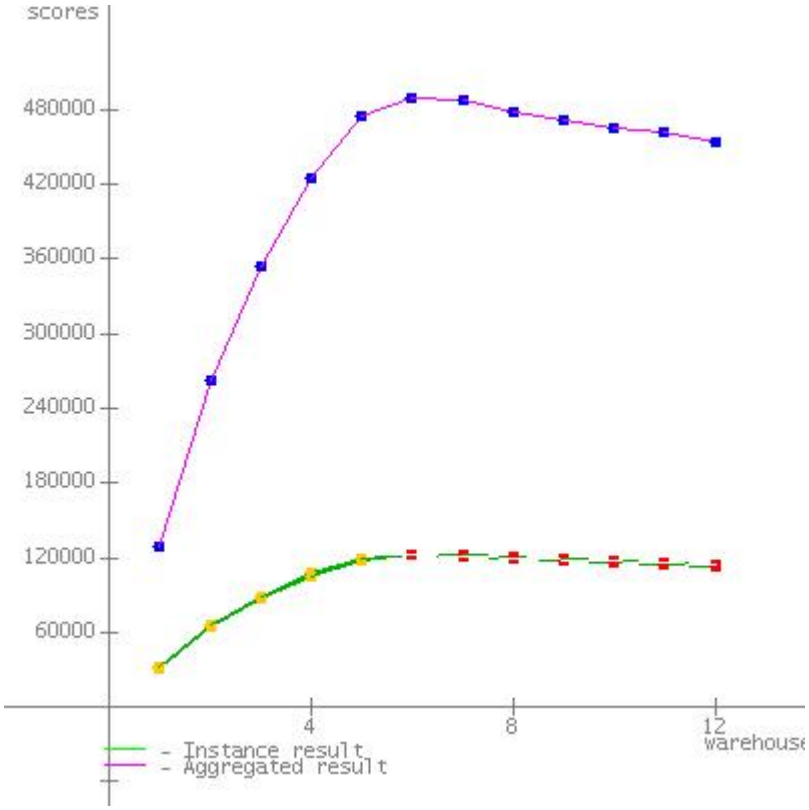
Red Hat Enterprise Linux 5.2 server: Intel Xeon X7460-based server

SPECjbb2005 **SPECjbb2005 bops = 472625, SPECjbb2005 bops/JVM = 118156**

Intel Fox Cove S7000FC4UR

BEA JRockit 1.6.0

JVM run	JVM Scores
1	117669
2	118106
3	118300
4	118550
SPECjbb2005 bops = 472625, SPECjbb2005 bops/JVM = 118156	



Hardware	
Hardware Vendor	Intel
Vendor URL	http://www.intel.com
Model	Fox Cove S7000FC4UR
Processor	Intel Xeon X7460
MHz	2666
# of Chips	4
# of Cores	24
# of Cores/Chip	6
HW Threading	No

Software	
Software Vendor	BEA
Vendor URL	http://www.bea.com
JVM Version	JRockit 1.6.0
JVM Command Line	java - `-Xms3500m -Xns2500m -Xmx3500m -XXaggressive -XXthroughputCompaction -XXlazyUnlocking -XXcallprofiling -Xgc:genpar -XXgcthreads=6 -XXlargepages -XXtlasize:min=4k,preferred=512k`
JVM Initial Heap	3500

Enabled?	
Procs Avail to Java	24
Memory (MB)	16384
Memory Details	Kingston KVR667D2D8F5/1G
Primary cache	32 KB + 32 KB (per core)
Secondary cache	3 x 3 MB (each 3 MB shared by 2 cores)
Other cache	16 MB L3
Filesystem	ext3
Disks	2 x 73 GB
Other hardware	

Memory (MB)	
JVM Maximum Heap Memory (MB)	3500
JVM Address bits	64
JVM CLASSPATH	jbb.jar: check.jar
JVM BOOTCLASSPATH	/data1/jrockit-jdk1.6.0_03/jre/lib/amd64/jrockit/jrockit1.6.0.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/amd64/jrockit/jmapi.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/amd64/jrockit/jmxmapi.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/amd64/jrockit/rmp.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/amd64/jrockit/latency.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/resources.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/rt.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/sunrsasign.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/jsse.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/jce.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/charsets.jar: /data1/jrockit-jdk1.6.0_03/jre/classes
OS Version	Red Hat Enterprise Linux 5.2
Other software	

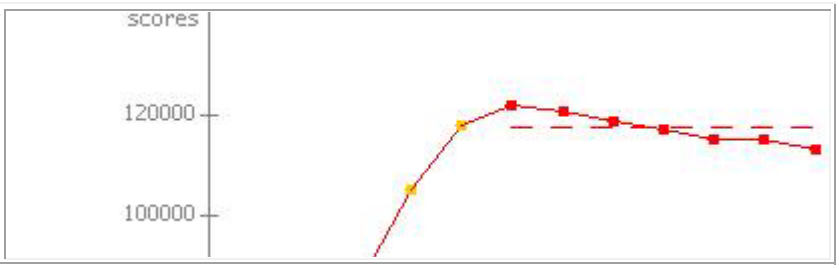
Test Information	
Tested by	Principled Technologies
SPEC license #	3184
Test location	Durham, NC
Test date	Sep 10, 2008
H/w available	
JVM available	
OS available	
Other s/w available	

AOT Compilation
Tuning
Notes

JVM 1 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	31426	
2	65035	
3	87184	
4	105233	



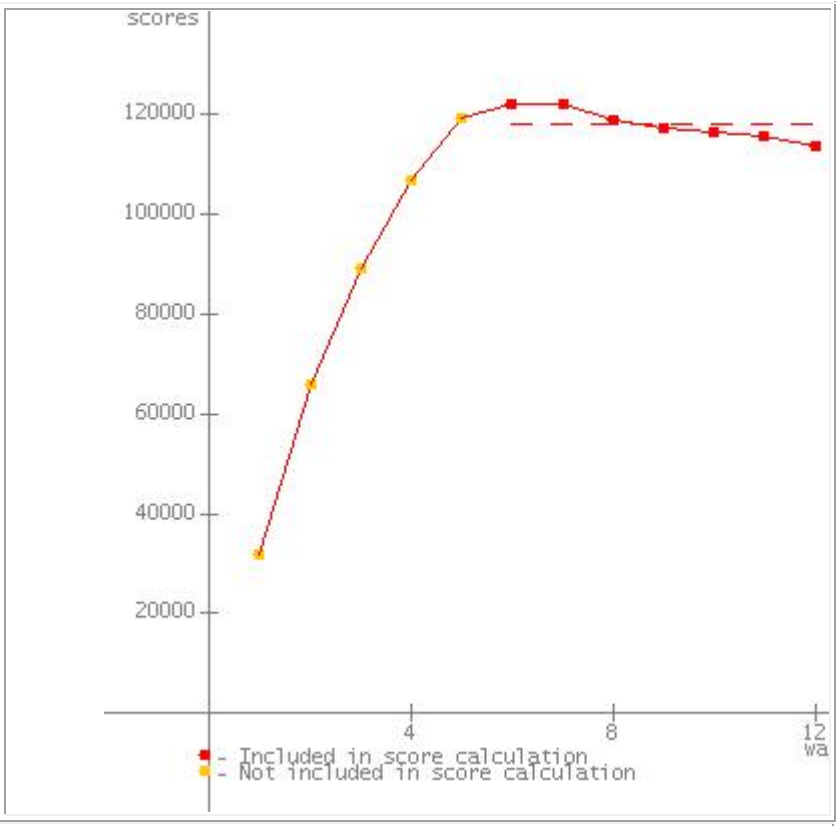
5	118360	
6	122317	*
7	120787	*
8	119040	*
9	117495	*
10	115396	*
11	115171	*
12	113475	*
SPECjbb2005	**(from 6 to 12)**	**117669 SPECjbb2005 bops**

SPEC license # 3184 **Tested by:** Principled Technologies **Test date:** Sep 10, 2008

JVM 2 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	31939	
2	66023	
3	89360	
4	106871	
5	119449	
6	122286	*
7	122148	*
8	118980	*
9	117530	*
10	116496	*
11	115750	*
12	113549	*
SPECjbb2005	**(from 6 to 12)**	**118106 SPECjbb2005 bops**



SPEC license # 3184 **Tested by:** Principled Technologies **Test date:** Sep 10, 2008

JVM 3 Scores:

No errors. Valid run.

Warehouse	SPECjbb200	Incl. in

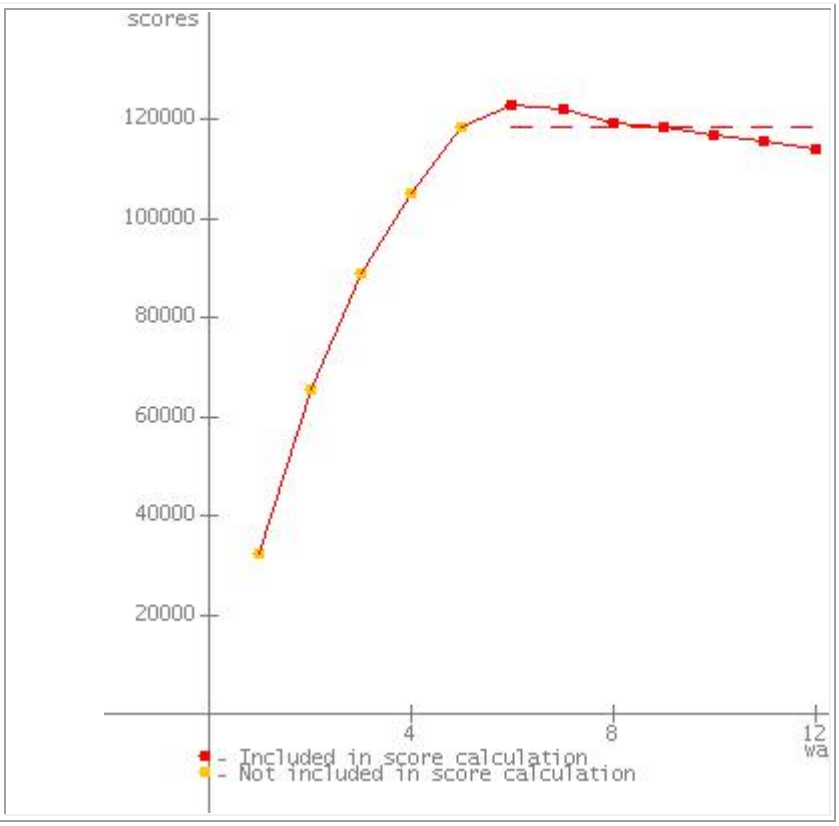
s	5 bops	metric
1	32233	
2	65577	
3	88516	
4	107466	
5	118513	
6	121869	*
7	122095	*
8	120624	*
9	118303	*
10	116687	*
11	115363	*
12	113162	*
SPECjbb2005	**(from 6 to 12)**	**118300 SPECjbb2005 bops**

SPEC license # 3184 **Tested by:** Principled Technologies **Test date:** Sep 10, 2008

JVM 4 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	32585	
2	65356	
3	88799	
4	105335	
5	118543	
6	123095	*
7	122011	*
8	119323	*
9	118639	*
10	116911	*
11	115680	*
12	114195	*
SPECjbb2005	**(from 6 to 12)**	**118550 SPECjbb2005 bops**



SPEC license # 3184	Tested by: Principled Technologies	Test date: Sep 10, 2008

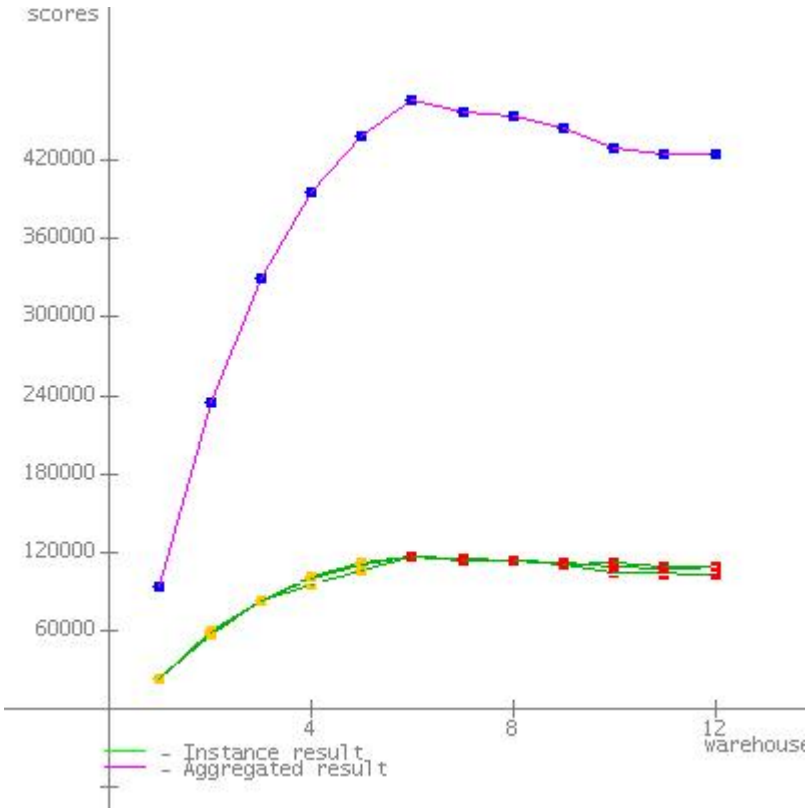
SPECjbb2005 Version: [SPECjbb2005 1.07, March 15, 2006]
Reporting page, Copyright © 2005 SPEC. All rights reserved

Red Hat Enterprise Linux 5.2 guest on Red Hat Enterprise Linux 5.2 server: Intel Xeon X7460-based server

SPECjbb2005 SPECjbb2005 bops = 443088, SPECjbb2005 bops/JVM = 110772

Intel Fox Cove S7000FC4UR
BEA JRockit 1.6.0

JVM run	JVM Scores
1	111693
2	112223
3	109577
4	109595
SPECjbb2005 bops = 443088, SPECjbb2005 bops/JVM = 110772	



Hardware	
Hardware Vendor	Intel
Vendor URL	http://www.intel.com
Model	Fox Cove S7000FC4UR
Processor	Intel Xeon X7460
MHz	2666
# of Chips	4
# of Cores	24
# of	6

Software	
Software Vendor	BEA
Vendor URL	http://www.bea.com
JVM Version	JRockit 1.6.0
JVM Command Line	java - `-Xms3400m -Xns2500m -Xmx3400m -XXaggressive -XXthroughputCompaction -XXlazyUnlocking -XXcallprofiling -Xgc:genpar -XXgcthreads=6 -XXlargepages -XXtlasize:min=4k,preferred=512k`

Cores/Chip	
HW Threading Enabled?	No
Procs Avail to Java	24
Memory (MB)	16384
Memory Details	Kingston KVR667D2D8F5/1G
Primary cache	32 KB + 32 KB (per core)
Secondary cache	3 x 3 MB (each 3 MB shared by 2 cores)
Other cache	16 MB L3
Filesystem	ext3
Disks	2 x 73 GB
Other hardware	

JVM Initial Heap Memory (MB)	3400
JVM Maximum Heap Memory (MB)	3400
JVM Address bits	64
JVM CLASSPATH	jbb.jar: check.jar
JVM BOOTCLASSPATH	/data1/jrockit-jdk1.6.0_03/jre/lib/amd64/jrockit/jrockit1.6.0.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/amd64/jrockit/jmapi.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/amd64/jrockit/jmxmapi.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/amd64/jrockit/rmp.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/amd64/jrockit/latency.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/resources.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/rt.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/sunrsasign.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/jsse.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/jce.jar: /data1/jrockit-jdk1.6.0_03/jre/lib/charsets.jar: /data1/jrockit-jdk1.6.0_03/jre/classes
OS Version	Red Hat Enterprise Linux 5.2
Other software	

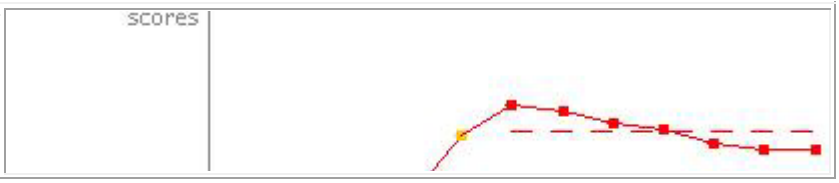
Test Information	
Tested by	Principled Technologies
SPEC license #	3184
Test location	Durham, NC
Test date	Sep 10, 2008
H/w available	
JVM available	
OS available	
Other s/w available	

AOT Compilation
Tuning
Notes

JVM 1 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	23699	
2	60388	



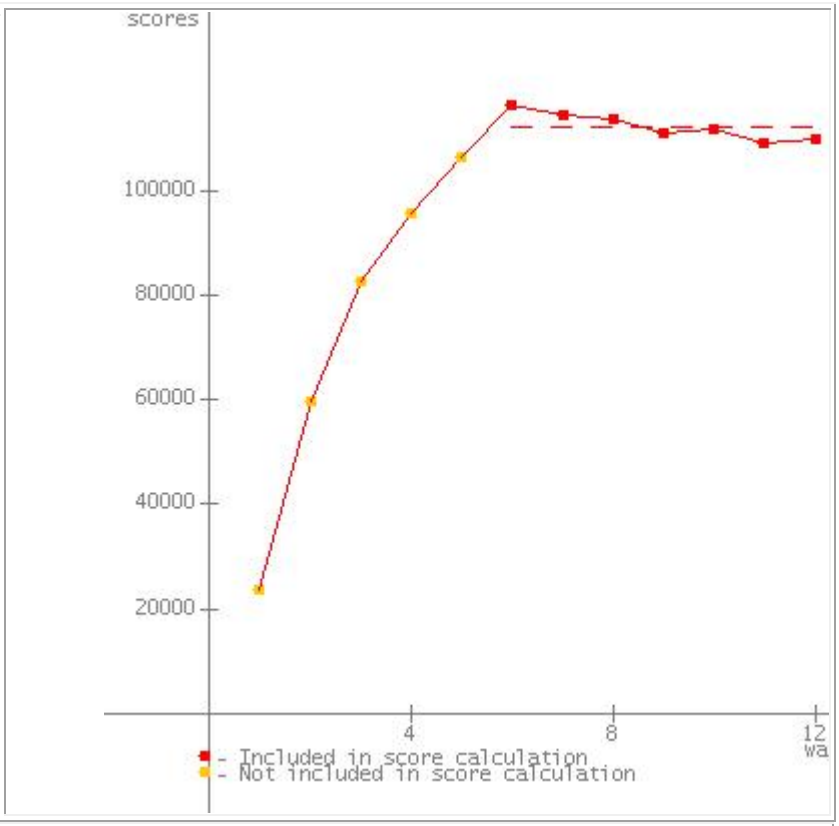
3	82354	
4	99197	
5	110702	
6	116651	*
7	115213	*
8	113122	*
9	111760	*
10	109205	*
11	107921	*
12	107975	*
SPECjbb2005	**(from 6 to 12)**	**111693 SPECjbb2005 bops**

SPEC license # 3184	**Tested by:** Principled Technologies	**Test date:** Sep 10, 2008

JVM 2 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	23649	
2	59618	
3	82557	
4	95788	
5	106438	
6	116373	*
7	114238	*
8	113631	*
9	110927	*
10	111605	*
11	109158	*
12	109631	*
SPECjbb2005	**(from 6 to 12)**	**112223 SPECjbb2005 bops**

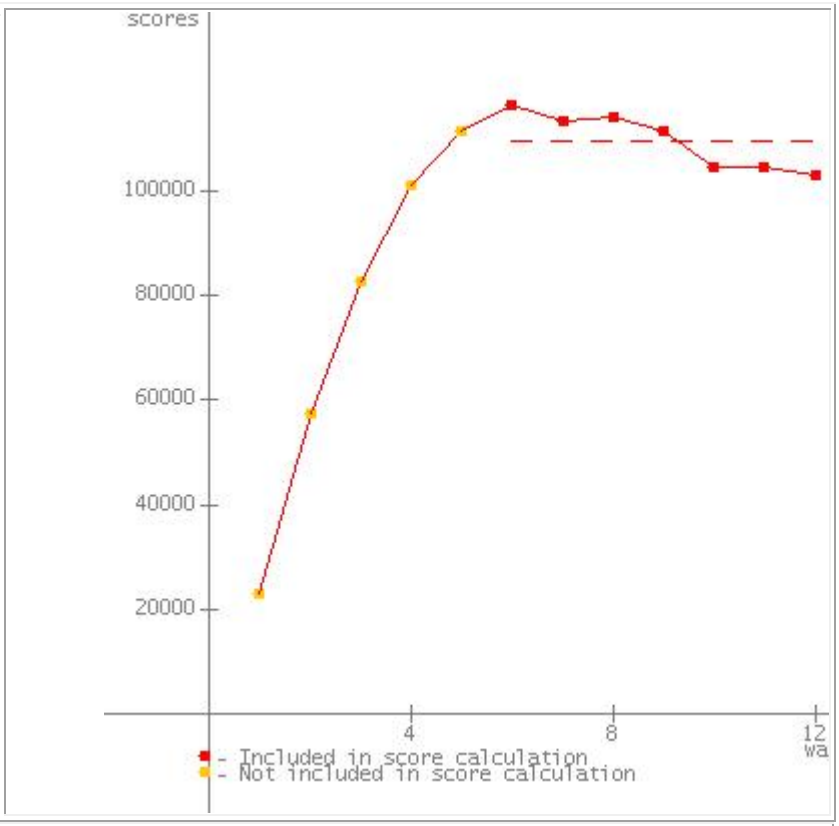


SPEC license # 3184	**Tested by:** Principled Technologies	**Test date:** Sep 10, 2008

JVM 3 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	22995	
2	57330	
3	82545	
4	100879	
5	111361	
6	116467	*
7	113441	*
8	113858	*
9	111261	*
10	104604	*
11	104319	*
12	103088	*
SPECjbb2005	**(from 6 to 12)**	**109577 SPECjbb2005 bops**

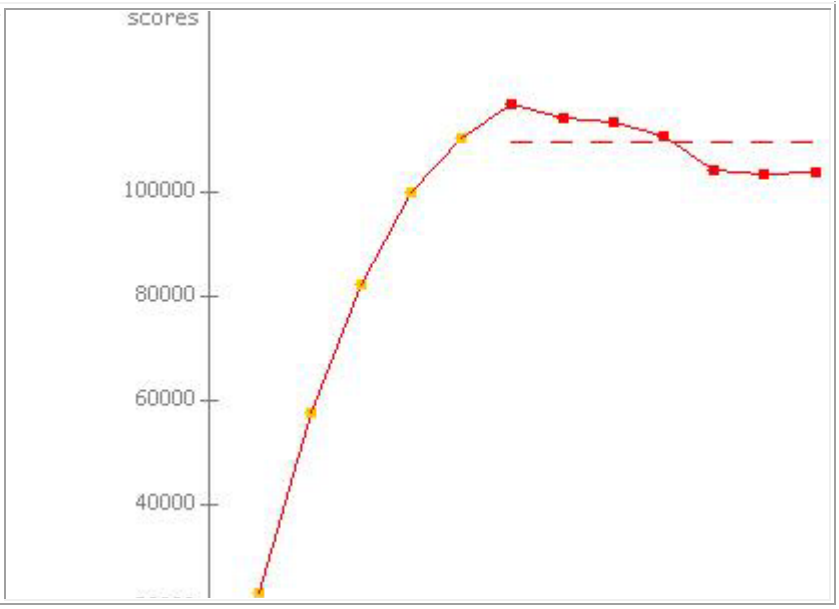


SPEC license # 3184 | **Tested by:** Principled Technologies | **Test date:** Sep 10, 2008

JVM 4 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	23206	
2	57760	
3	82224	
4	99934	
5	110431	
6	117141	*
7	114189	*
8	113540	*
9	110674	*
10	104236	*
11	103455	*
12	103932	*



SPECjbb2005	**(from 6 to 12)**	**109595 SPECjbb2005 bops**	

SPEC license # 3184	**Tested by:** Principled Technologies	**Test date:** Sep 10, 2008

SPECjbb2005 Version: [SPECjbb2005 1.07, March 15, 2006]
Reporting page, Copyright © 2005 SPEC. All rights reserved

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

Principled Technologies is a registered trademark of Principled Technologies, Inc.
Intel and Xeon are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries. All other product names are the trademarks of their respective owners.

Disclaimer of Warranties; Limitation of Liability:
PRINCIPLED TECHNOLOGIES, INC. HAS MADE REASONABLE EFFORTS TO ENSURE THE ACCURACY AND VALIDITY OF ITS TESTING, HOWEVER, PRINCIPLED TECHNOLOGIES, INC. SPECIFICALLY DISCLAIMS ANY WARRANTY, EXPRESSED OR IMPLIED, RELATING TO THE TEST RESULTS AND ANALYSIS, THEIR ACCURACY, COMPLETENESS OR QUALITY, INCLUDING ANY IMPLIED WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE. ALL PERSONS OR ENTITIES RELYING ON THE RESULTS OF ANY TESTING DO SO AT THEIR OWN RISK, AND AGREE THAT PRINCIPLED TECHNOLOGIES, INC., ITS EMPLOYEES AND ITS SUBCONTRACTORS SHALL HAVE NO LIABILITY WHATSOEVER FROM ANY CLAIM OF LOSS OR DAMAGE ON ACCOUNT OF ANY ALLEGED ERROR OR DEFECT IN ANY TESTING PROCEDURE OR RESULT.

IN NO EVENT SHALL PRINCIPLED TECHNOLOGIES, INC. BE LIABLE FOR INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH ITS TESTING, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT SHALL PRINCIPLED TECHNOLOGIES, INC.'S LIABILITY, INCLUDING FOR DIRECT DAMAGES, EXCEED THE AMOUNTS PAID IN CONNECTION WITH PRINCIPLED TECHNOLOGIES, INC.'S TESTING. CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES ARE AS SET FORTH HEREIN.