Principled Technologies®

TEST REPORT
JANUARY 2007

Performance and power consumption of an Intel Itanium 2 processor-based server and an IBM POWER5+ processor-based server running three different SPEC workloads

Executive summary

Intel Corporation (Intel) commissioned Principled Technologies (PT) to measure performance and power consumption with three workloads, SPECjbb2005, SPEC CPU2000 SPECint_rate_base2000, and SPEC CPU2000 SPECfp_rate_base on the following two servers:

- IBM System p5 550Q POWER5+ processor-based server
- Intel Itanium 2 processor 9050-based server

Figure 1 illustrates the performance/watt for each of the test servers on all three benchmarks. In this chart, we normalized each pair of results to those of the lower performance/watt configuration. The lower system's performance/watt result is thus 1.00 for each benchmark. By normalizing, we make each data point in the chart a comparative number, with higher results indicating better performance/watt.

KEY FINDINGS

- The Intel Itanium 2 processor 9050-based server delivered 14 percent more performance/watt than the IBM System p5 POWER5+ processor-based server while running SPECjbb2005.
- The Intel Itanium 2 processor 9050-based server delivered 4.2 percent more peak performance/watt than the IBM System p5 POWER5+ processor-based server running the SPECint_rate_base2000 workload.
- The Intel Itanium 2 processor 9050-based server delivered 1.4 percent more peak performance/watt than the IBM System p5 POWER5+ processor-based server running the SPECfp_rate_base2000 workload.

To calculate the performance/watt we used the following formula:

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

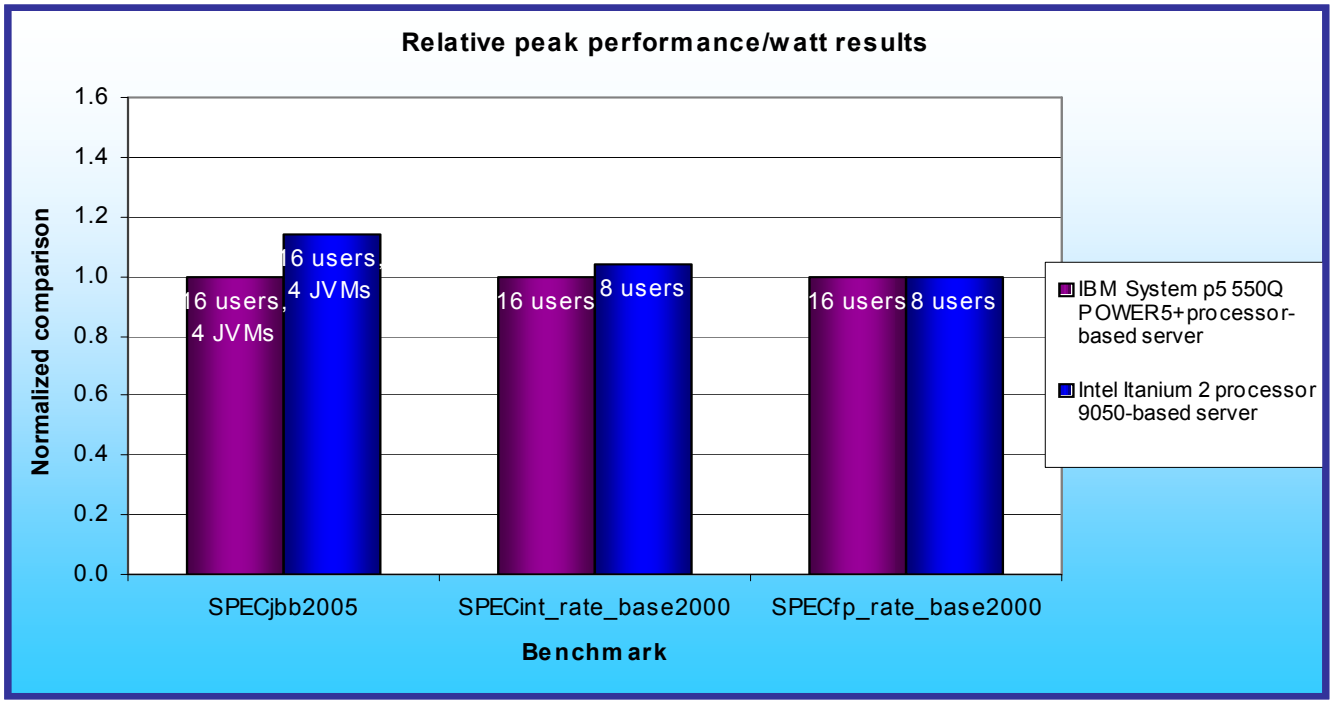


Figure 1: Normalized performance/watt results of the test servers running SPECjbb2005, SPECint_rate_base2000, and SPECfp_rate_base2000. Higher numbers indicate better performance/watt.

As Figure 1 illustrates, the Intel Itanium 2 processor 9050-based server delivered 14 percent more performance/watt than the IBM System p5 550Q POWER5+ processor-based server on SPECjbb2005. It also delivered more peak performance/watt on the other two benchmarks, edging the IBM System p5 Power5+ processor-based server's performance/watt by 4.2 percent on SPECint_rate_base2000 and by 1.4 percent on SPECfp_rate_base2000.

Workloads

SPECjbb2005

SPECjbb2005 is an industry-standard benchmark created by the Standard Performance Evaluation Corp. (SPEC) to measure a server's Java performance. (For more information on SPECjbb2005 and other SPEC benchmarks, see www.spec.org.) SPEC modeled SPECjbb2005 on the three-tier client/server architecture, with the middle layer as the primary focus. Per 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", which is 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 bops (business operations per second). Because bops is a rate, a higher number of bops is better.

SPECint_rate_base2000

SPEC CPU2000 is an industry-standard benchmark created by SPEC to measure a server's compute-intensive performance. The benchmark consequently stresses the CPU and memory subsystems of the system under test.

The SPEC CPU2000 benchmark consists of two benchmark suites, each of which focuses on a different aspect of compute-intensive performance. CINT2000 measures and compares compute-intensive integer performance, while CFP2000 measures and compares compute-intensive floating-point performance. A "rate" version of each, which runs multiple instances of the benchmark to assess server throughput, is also available.

We measured the performance of the two servers on its SPECint_rate_base2000 test with 4, 8, and 16 users. This workload produces results as the average of twelve normalized throughput ratios with conservative optimization for each benchmark. Figure 2 lists the 12 applications that compose the CINT2000 benchmark. Eleven of the applications were written in C; one (252.eon) was written in C++.

Name	Reference Time	Remarks
164.gzip	1400	Data compression utility
175.vpr	1400	FPGA circuit placement and routing
176.gcc	1100	C compiler
181.mcf	1800	Minimum cost network flow solver
186.crafty	1000	Chess program
197.parser	1800	Natural language processing
252.eon	1300	Ray tracing
253.perlbmk	1800	Perl
254.gap	1100	Computational group theory
255.vortex	1900	Object Oriented Database
256.bzip2	1500	Data compression utility
300.twolf	3000	Place and route simulator

Figure 2: The applications that make up the CINT2000 benchmark.

A CINT2000 run performs each of the 12 application (tasks) three times and reports the median for each. It also calculates the geometric mean of those 12 results to produce an overall score.

SPECfp_rate_base2000

The other suite that makes up the SPEC CPU2000workload is CFP2000, which focuses on measuring and comparing compute-intensive floating point performance. Like CINT2000, it includes multiple test options. We

measured the performance of the two servers on its SPECfp_rate_base2000 test with 4, 8, and 16 users. This workload produces results as the average of 14 normalized throughput ratios with conservative optimization for each benchmark. Figure 3 lists the 14 applications that compose the CFP2000 benchmark.

Name	Reference Time	Remarks
164.wupwise	1600	Quantum chromodynamics
171.swim	3100	Shallow water modeling
172.mgrid	1800	Multi-grid solver in 3D potential field
173.applu	2100	Parabolic/elliptic partial differential equations
177.mesa	1400	3D Graphics library
178.galgel	2900	Fluid dynamics: analysis of oscillatory instability
179.art	2600	Neural network simulation; adaptive resonance theory
183.equake	1300	Finite element simulation; earthquake modeling
187.facerec	1900	Computer vision: recognizes faces
188.ammp	2200	Computational chemistry
189.lucas	2000	Number theory: primality testing
191.fma3d	2100	Finite element crash simulation
200.sixtrack	1100	Particle accelerator model
301.apsi	2600	Solves problems regarding temperature, wind, velocity and distribution of pollutants

Figure 3: The applications that make up the CFP2000 benchmark.

A CFP2000 run performs each of the 14 application (tasks) three times and reports the median for each. It also calculates the geometric mean of those 14 results to produce an overall score.

Test results

In SPEC's terms, our results for all three benchmarks 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.

SPECjbb2005 results

Figure 4 shows the median SPECjbb2005 results, in bops, for both servers. During our tests, we ran four JVMs at the same time. Running multiple JVMs is a common practice on servers that can handle larger loads. To compute the total score, SPECjbb2005 adds the score from each JVM instance. For each JVM, SPECjbb2005 computes its score by taking the average of the results during mixes when the server is running at peak performance. In our testing, the servers achieved peak performance during mixes 4 through 8. Each result we show is the median peak score of three runs of the benchmark. We enabled the hardware multithreading support on both test servers, because that configuration yielded the best performance for each server.

A higher SPECjbb2005 score indicates the server is able to handle more Java requests and thus deliver greater throughput.

The Intel Itanium 2 processor 9050-based server produced the highest results, 119,969 bops, while the IBM System p5 550Q POWER5+ processor-based server achieved 113,145 bops. The Intel Itanium 2 processor 9050-based server thus delivered a 6 percent performance increase over the IBM System p5 550Q POWER5+ processor-based server.

Operations per second		
	IBM System p5 550Q POWER5+processor-based server	**Intel Itanium 2 processor 9050-based server**
JVM 1	27,046	30,089
JVM 2	28,853	29,660
JVM 3	29,320	30,244
JVM 4	27,926	29,976
Total Score	**113,145**	**119,969**

Figure 4: SPECjbb2005 results for each server by JVM. Higher numbers are better.

At the time we were preparing this report, SPEC's Web site contained a higher SPECjbb2005 result for a similar IBM server, but that server contained more RAM than our test system, and the result used a newer JVM than the one that was available at the time of our test.

Figure 5 shows the results by warehouse for the IBM System p5 550Q POWER5+ processor-based server for all three runs. Run 3 produced the median results.

IBM System p5 550Q POWER5+ processor-based server			
	Run 1	**Run 2**	**Run 3**
Warehouse		**JVM 1**	
1	9,858	9,746	9,235
2	18,157	20,206	19,612
3	25,108	24,785	24,299
4	29,516	29,241	28,192
5	29,067	28,314	27,678
6	28,511	27,729	27,161
7	27,956	26,987	26,483
8	27,266	26,214	25,717
Score	28,463	27,697	27,046
Warehouse		**JVM 2**	
1	9.920	9,803	9,763
2	20,952	19,605	20,688
3	24,813	25,734	25,395
4	29,474	30,080	29,894
5	29,064	29,453	29,464
6	28,564	28,752	28,940
7	27,923	28,090	28,230
8	27,330	27,150	27,737
Score	28,471	28,705	28,853
Warehouse		**JVM 3**	
1	9,799	10,043	10,219
2	19,216	20,928	21,422
3	25,179	25,364	25,836
4	29,195	29,699	30,502
5	28,642	28,670	29,842
6	28,040	28,143	29,400
7	27,263	27,693	28,777
8	26,320	26,977	28,080
Score	27,892	28,236	29,320
Warehouse		**JVM 4**	
1	9,862	10,135	9,740
2	20,354	21,582	17,071
3	24,969	26,201	24,650
4	29,405	30,693	29,117
5	28,679	30,201	28,673
6	28,136	29,673	28,045
7	27,335	28,974	27,303
8	26,571	28,252	26,490
Score	28,025	29,559	27,926
Total Score	**112,851**	**114,197**	**113,145**

Figure 5: SPECjbb2005 results for the IBM System p5 550Q POWER5+ processor-based server. Higher numbers are better.

Figure 6 shows the results by warehouse for the Intel Itanium 2 processor 9050-based server for all three runs. Run 3 produced the median results.

Intel Itanium 2 processor 9050-based server			
	Run 1	**Run 2**	**Run 3**
Warehouse		**JVM 1**	
1	10,288	10,327	10,563
2	26,872	26,671	27,191
3	27,407	28,604	30,882
4	30,007	29,847	30,048
5	30,542	31,008	30,229
6	30,646	29,258	30,621
7	30,149	29,756	29,956
8	29,978	29,131	29,592
Score	30,264	29,800	30,089
Warehouse		**JVM 2**	
1	10,713	10,733	10,722
2	25,863	26,054	25,809
3	26,146	28,318	29,085
4	30,848	30,085	30,583
5	29,633	30,009	29,117
6	30,117	29,757	29,209
7	29,712	29,968	30,359
8	29,860	29,553	29,033
Score	30,034	29,874	29,660
Warehouse		**JVM 3**	
1	10,484	10,188	10,404
2	27,178	26,082	26,764
3	32,265	28,499	27,968
4	29,995	30,564	29,940
5	30,831	30,324	31,209
6	29,723	30,357	30,406
7	30,307	29,838	29,573
8	29,528	29,837	30,091
Score	30,077	30,184	30,244
Warehouse		**JVM 4**	
1	10,689	10,863	10,594
2	26,274	26,713	26,891
3	31,359	29,186	26,865
4	30,436	30,442	30,744
5	29,902	29,301	30,240
6	29,344	30,000	29,032
7	29,835	30,135	29,910
8	29,477	29,938	29,955
Score	29,799	29,963	29,976
Total Score	**120,174**	**119,821**	**119,969**

Figure 6: SPECjbb2005 results for the Intel Itanium 2 processor 9050-based server. Higher numbers are better.

Figure 7 details the power consumption, in watts, of the test servers while idle and during the median peak runs of the benchmark. The Intel Itanium 2 processor 9050-based server had 8 percent lower average power usage during the workload than the IBM System p5 550Q POWER5+ processor-based server.

Server	Idle power (watts)	Average power (watts)
IBM System p5 550Q POWER5+ processor-based server	758.9	785.2
Intel Itanium 2 processor 9050-based server	666.2	728.8

Figure 7: Average power usage (in watts) of the test servers during the median peak runs of SPECjbb2005. Lower numbers are better.

SPECint_rate_base2000 results

Typically, a server produces the optimum SPECfp_rate_base2000 and SPECint_rate_base2000 results by using the same number of users as available execution units. The IBM System p5 550Q POWER5+ processor-based server has 2 processor sockets. Each contained a processor package that held four processor cores. Each of those cores supports multithreading technology. Consequently, it has 16 execution units (2 packages times 4 cores per package times 2 logical execution units per core) available, though these are logical execution units. Thus, we expected the optimum user count for this server would be 16, and in our testing that proved to be the case. The Intel Itanium 2 processor 9050-based server has 4 physical processors with 2 cores per processor, and each of those cores supports multithreading technology. We found, however, that the system achieved its optimum performance on both SPEC CPU2000 tests with the multithreading technology disabled, so we tested the server in that configuration. Thus, its optimum user count should have been 8, because it had 8 available execution units, and it was indeed 8 in our testing.

Figure 8 shows the SPECint_rate_base2000 results for both servers with 4, 8, and 16 users. Each result is the SPECint_rate_base2000 score in operations per second. By default, the benchmark performs three runs and uses the median result. A higher score is better.

Server / # of users	4	8	16
IBM System p5 550Q POWER5+ processor-based server	57.2	114	136
Intel Itanium 2 processor 9050-based server	67.2	132	128

Figure 8: SPECint_rate_base2000 results of the servers with 4, 8, and 16 users. Higher numbers are better.

Figure 9 details the average power consumption, in watts, of the test servers while idle and during the peak runs of the benchmark with each server's optimum number of users. The Intel Itanium 2 processor 9050-based server had 7 percent lower average power usage during its SPECint_rate_base2000 8-user test than the IBM System p5 550Q POWER5+ processor-based server during its SPECint_rate_base2000 16-user test.

Server / # of users	Idle power (watts)	Average power (watts)
IBM System p5 550Q POWER5+ processor-based server (16 users)	756.3	779.0
Intel Itanium 2 processor 9050-based server (8 users)	667.4	725.7

Figure 9: Average power usage (in watts) of the test servers while idle and during the runs of the SPECint_rate_base2000 test with the optimum user count for each server. Lower numbers are better.

SPECfp_rate_base2000 results

Figure 10 shows the SPECfp_rate_base2000 results of the test servers with 4, 8, and 16 users. Each result is the SPECfp_rate_base2000 score in operations per second. By default, the benchmark performs three runs and uses the median result. A higher score is better.

Server / # of users	4	8	16
IBM System p5 550Q POWER5+ processor-based server	90.5	180	194
Intel Itanium 2 processor 9050-based server	122	188	185

Figure 10: SPECfp_rate_base2000 results of the servers with 4, 8, and 16 users. Higher numbers are better.

Figure 11 details the average power consumption, in watts, of the test servers while idle and during the peak runs of the benchmark with each server's optimum number of users. The Intel Itanium 2 processor 9050-based server had 5 percent lower average power usage during its SPECfp_rate_base2000 8-user test than the IBM System p5 550Q POWER5+ processor-based server during its SPECint_rate_base2000 16-user test.

Server / # of users	Idle power (watts)	Average power (watts)
IBM System p5 550Q POWER5+ processor-based server / 16 users	755.5	840.3
Intel Itanium 2 processor 9050-based server / 8 users	665.7	803.3

Figure 11: Average power usage (in watts) of the test servers while idle and during the runs of the SPECfp_rate_base2000 test with optimum users. Lower numbers are better.

Test methodology

Figure 12 summarizes some of the key aspects of the configurations of the two server systems; Appendix A provides detailed configuration information.

Server	IBM System p5 550Q POWER5+ processor-based server	Intel Itanium 2 processor 9050-based server
Processor frequency (GHz)	1.65 GHz	1.60 GHz
Front-side bus frequency (MHz)	NA	533
Number of processor packages	4	2
Number of cores per processor package	2	4
Number of hardware threads per core	2	2
Motherboard	IBM System p5 550Q 683037	Hitachi Cold Fusion 3e 1HBW01201-B
RAM (32GB in each)	16 x 2GB DDR2-533	32 x 1GB DDR2-667
Hard Drive	1 x 73 GB 10,000 RPM SCSI	1 x 73.5 GB 15,000 RPM SAS

Figure 12: Summary of some key aspects of the server configurations.

Intel configured and provided both servers.

With the following exception, we used the default BIOS settings on each server: we disabled multithreading on the Intel Itanium 2 processor 9050-based server for SPEC CPU2000 testing.

For the Intel Itanium 2 processor 9050-based server, we began our testing by installing a fresh copy of Red Hat Enterprise Linux Advanced Server 4 Update 3 for Itanium-based servers and used the default kernel of 2.6.9-42.EL. The IBM System p5 550Q POWER5+ processor-based server arrived with IBM AIX 5L version 5.3.0.0 preinstalled. We followed this process for configuring each installation:

1. Assign a computer name of “Server”.
2. Enter a password for the root log on.
3. Select Eastern Time Zone.
4. Use typical settings for the Network installation.

For SPECjbb2005, we added an additional step to improve Java performance. We set huge pages to 400 by typing the following at the command prompt while logged in as root:

```
echo 400 /proc/sys/vm/nr_hugepages
```

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 two minutes while each server was running the operating system but otherwise idle.

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

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 root ("/") directory on each server's hard disk.

SPECjbb2005 requires a Java Virtual Machine (JVM) on the system under test. We used the BEA JRockit JDK 5.0 Update 6 (P26.4.1-12-67782-1.5.0_06-20061003-1620-linux-ia64) JVM for this test and left the default installation settings on the Intel Itanium 2 processor 9050-based server. For the IBM System p5 550Q POWER5+ processor-based server, we used the IBM version Java 2 Runtime Enviroment, Standard Edition (build 1.4.2) Classic JVM ((build 1.4.2, J2RE 1.4.2 IBM AIX build ca142-20060421 (SR5) (JIT enabled: jitc)). We chose this JVM because our research suggested it was better-suited to AIX and provided the best performance for this system.

After installation, as per the SPEC 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.

For each system, we created a script file, which we placed in the root SPECjbb2005 directory, to issue the Java run command to launch the benchmark. Figure 13 shows the contents of the script file we used on the IBM System p5 550Q POWER5+ processor-based server.

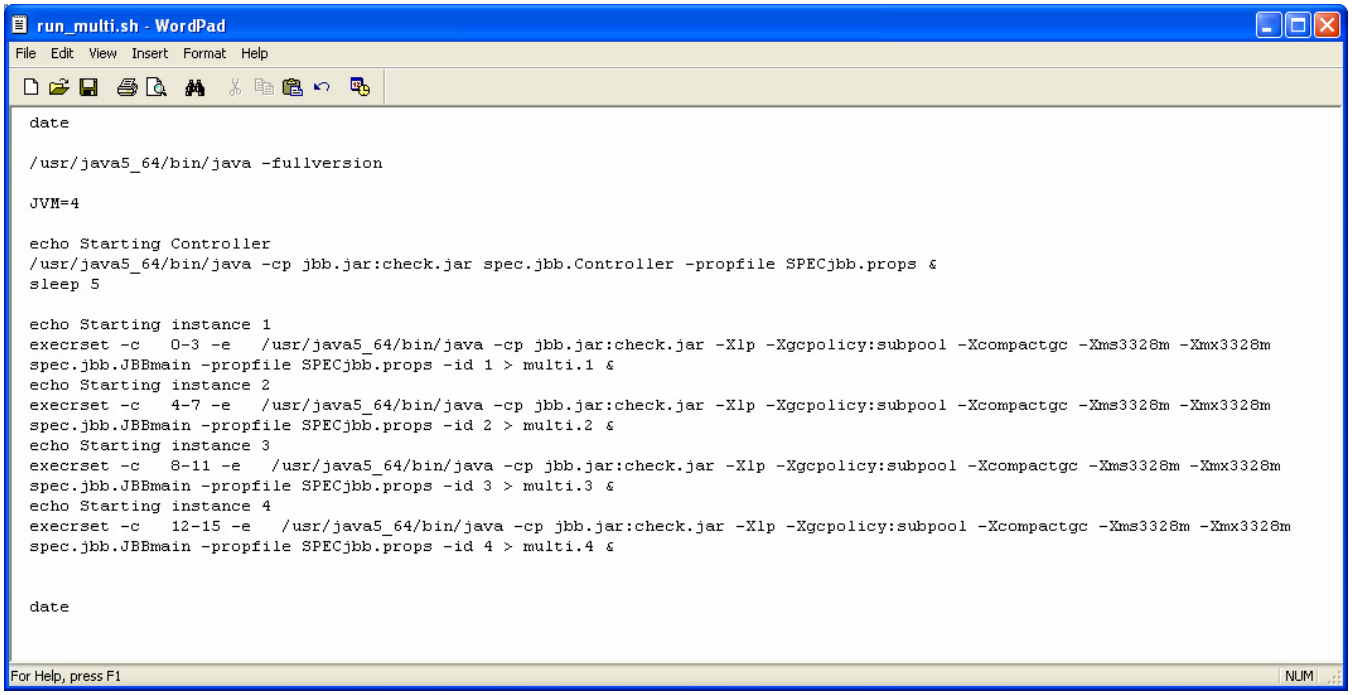


Figure 13: The text of the shell script we used to execute the SPECjbb2005 benchmark on the IBM System p5 550Q POWER5+ processor-based server.

In the script file we set the Java options that control the performance of the JVM. Intel specified the following Java option settings:

- *-Xms3828m* This option 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 3828MB.

- *-Xmx3828m* This option sets the maximum heap size.
- *-Xlp* This option sets the Java Heap to use 16MB large pages.
- *-Xgcpolicy:subpool* This specifies the garbage collection settings.
- *-Xcompactgc* This option compacts on all garbage collection.

Figure 14 shows the contents of the script file we used on the Intel Itanium 2 processor 9050-based server.

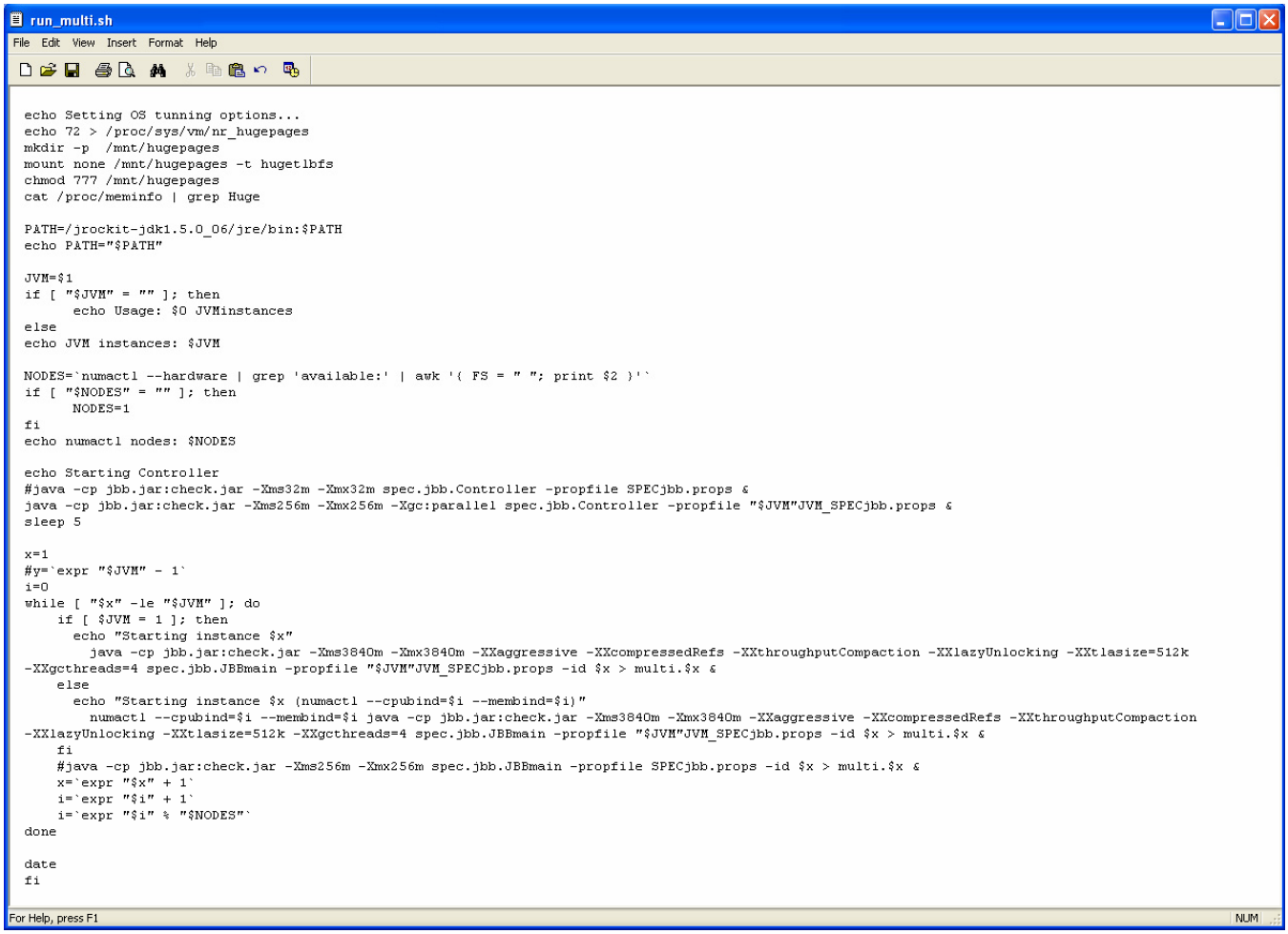


Figure 14: The text of the shell script we used to execute the SPECjbb2005 benchmark on the Intel Itanium 2 processor 9050-based server.

In the script file we set the Java options that control the performance of the JVM. Intel specified the following Java option settings:

- *-Xms3840m* This option 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 3840MB.
- *-Xmx3840m* This option sets the maximum heap size.
- *-XXaggressive* This option basically tells the JVM to perform at maximum speed.
- *-XXcompressedRefs* This option turns on compressed references.
- *-XXthroughputCompaction* This option adjusts the compaction ratio dynamically based on live data in the heap.
- *-XXlazyUnlocking* This option affects when the JVM releases locks.
- *-XXtlasize512k* This option sets the thread-local area size the JVM uses.
- *-XXgcthreads* This option specifies how many garbage collections threads the garbage collector uses.

SPEC CPU2000 configuration

We followed SPEC's standard instructions for building the CINT2000 and CFP2000 executables. After studying the best results for this benchmark on the SPEC Web site for systems of each of these types, we chose the following software tools:

For the IBM System p5 550Q POWER5+ processor-based server:

- XL C/C++ Enterprise Edition version 8.0 for AIX
- XL Fortran Enterprise Edition version 10.1 for AIX

For the Intel Itanium 2 processor 9050-based server:

- Intel C++ Compiler for Linux 9.1.040 (Build 20061105)
- Intel Fortran Compiler for Linux 9.1.045 (Build 20061105)

The benchmark requires configuration files. From the SPEC Web site we chose the most recent (as of the testing for this report) SPEC CPU2000 results available for each server. We copied the configuration files for those results and used them, with modifications to reflect the appropriate system information about the server under test, in our testing. The configuration file we used for SPECfp appears in Appendix B, and the one we used for SPECint appears in Appendix D.

We report only the base metrics for both the SPECint_rate test and the SPECfp_rate test. SPEC requires the base metrics for all reported results and sets compilation guidelines that testers must follow in building the executables for such tests.

To begin the benchmark, we performed the following steps:

- Change to the SPECCPU2000v1.3 directory.
- Type "sh" to make sure you're in a Bourne compatible shell
- Type ". ./shrc" at the prompt.
- **For SPECfp:** Enter "runspec -c <config file name> --reportable -T base –r -u <#> fp"
  For SPECint: Enter "runspec -c <config file name> --reportable -T base –r -u <#> int", where
  - <config file name> = name of the configuration file
  - <#> = is the number of users

When the run completes, the benchmark puts the results in the directory \SPECCPU2000v1.3\result. The result file names for SPECfp_rate_base are of the form CFP2000.<number>.<suffix>. The suffixes are html, asc. raw, and pdf. The number is three digits and associates a result file with its log, e.g. CFP2000.002. asc and log.002. The result file names for SPECint_rate_base are of the form CINT2000.<number>.<suffix>. The suffixes are the same as for the CFP2000 test, and the number is also three digits and associates a result file with its log, e.g. CINT2000.002. asc and log.002.

Appendix A – Test server configuration information

This appendix provides detailed configuration information about each of the test server systems.

Processors	Intel Itanium 2 processor 9050	IBM System p5 550Q POWER5+ processor
General processor setup		
Number of processor packages	4	2
Number of cores per processor package	2	4
Number of hardware threads per core	2	2
CPU		
Vendor	Intel	IBM
Name	Itanium 2 processor 9050	Power 5+
Stepping	C1	NA
Socket type	611	NA
Core frequency (GHz)	1.60 GHz	1.65 GHz
Front-side bus frequency (MHz)	533 MHz	NA
L1 Cache	Itanium 2	NA
L2 Cache	2.5 MB	3.8 MB
L3 Cache	24 MB	72 MB
Platform		
Vendor and model number	Hitachi Cold Fusion 3e	IBM System p5 550Q
Motherboard model number	1HBW01201-B	683037
Motherboard chipset	NA	NA
Motherboard revision number	C	2006-10-18
Motherboard serial number	635609	10N6472YL14HA6AJ065
BIOS name and version	NA	NA
BIOS settings	Disabled multithreading for SPECint and SPECfp benchmarks	NA
Memory module(s)		
Vendor and model number	Elpida EBE10RD4AGFA-6E-E	Samsung M338T5750CZ3
Type	DDR2-667	DDR2-533
Speed (MHz)	667 MHz	533 MHz
Speed in the system currently running @ (MHz)	533	NA
Timing/Latency (tCL-tRCD-tRP-tRASmin)	4-4-4	4-4-4
Size	1 GB	2 GB
Number of sticks	32	16
Chip organization	Dual sided	Dual sided
Hard disk		
Vendor and model number	Fujitsu MAX3073RC	IBM HUS103073FL3800
Number of disks in system	1	1
Size	73.5 GB	73 GB
Buffer Size	16 MB	8 MB
RPM	15,000	10,000
Type	SAS	Ultra 320 SCSI
Controller	NA	PCI-X Dual Channel Ultra320 SCSI adapter

Controller Driver	NA	NA
Operating system		
Name	Red Hat Enterprise Linux AS release 4	IBM AIX 5L
Build number	ia64	5.3.0.0
File system	ext3	Jfs2
Kernel	2.6.9-34.EL	AIX 3 5 000D6280D600
Language	English	English
Graphics		
Vendor and model number	ATI ES10000	POWER GXT135P
Type	Integrated	PCI
Memory size	NA	16 MB
Resolution	1024 x 768	1024 x 768
Driver	NA	NA
Network card/subsystem		
Vendor and model number	NA	Dual port Ethernet 10/100/1000 Mbps controller
Type	Integrated	Integrated
Driver	e100	NA
Other Network Card Information	/dev/eth0	NA
Optical drive		
Vendor and model number	TEAC DV-28E-N	NA
Type	DVD/CD-ROM	DVD-ROM
Interface	Internal IDE	Internal IDE
USB ports		
Number	6	2
Type	NA	NA

Figure 15: Detailed system configuration information for the test servers.

Appendix B – SPECfp configuration files

This appendix contains the benchmark configuration files we used to test the servers.

IBM System p5 550Q POWER5+ processor-based server

```
# Invocation command line:
# /usr/cpu2000/bin/runspec -c p5_fp.cfg -r -u 16 -T base fp
##############################################################################
# Invocation command line:
# /spec/cpu2000/bin/runspec -v 10 -r -u 16 -c B60++.fp_rate.cfg -n 5 -T all -i ref fp
##############################################################################
# Invocation command line:
# /spec/cpu2000/bin/runspec -v 10 -r -u 4 -c L4+.publish.cfg -n 3 -T all -i ref fp
##############################################################################
##############################################################################
##############################################################################
##############################################################################################################
#
#       Config-file to benchmark the .... with the SPEC cpu2000 V1.3 suite.
#
##############################################################################################################

#
# Global options for runspec
#
runlist                 = all
action                  = validate
iterations              = 3
output_format           = all
ignore_errors           = 0
reportable              = 1
mean_anyway             = 1
size                    = ref
tune                    = base,peak
ext                     = 570
env_vars                = 1
deletework              = 0
users                   = 16

#       For rate-runs, invoke with "-r -u $USERS".

#
#       The following commands cause the process thread to bind to a corresponding
#       CPU. This improves performance by removing the overhead of threads "drifting"
#       between CPU's.
#
#       The form below causes threads to bind to even-numbered CPU's if there are
#       half as many threads as CPU's. Otherwise the remaining threads bind to the
#       odd-numbered CPU's. This is to ensure 1 thread per core if SMT is anabled.
#       In this example there are 16 CPU's labeled [0..15].
#
# submit = bindprocessor \$\$ \$SPECUSERNUM; $command
submit = let "MYCPU=2*\$SPECUSERNUM"; if (("\$MYCPU > 15")) then let "MYCPU-=15"; fi; bindprocessor \$\$
\$MYCPU; $command
use_submit_for_speed = 1



#
#============================================================================
# How the compilers are called
#============================================================================
# To remove all the warning messages that are put out, you can append the following
#   compile time message suppression flag to the compiler invocation lines:
#
#               -w -qinfo=noinl -qsuppress=1500-036
#
#   To suppress the Fortran function compilation messages, add to the FC/F77/FXLF
```

```
#       lines:
#              -qsuppress=cmpmsg
#
#
#       To speed builds with ipa, use "-qipa=noobject" to suppress code generation
#       until the final IPA link step.
#       To speed builds with ipa, use "-qipa=threads:n" to direct ipa to use n threads.
#============================================================================
#
C_COMPILER =
F_COMPILER =


int=default=default=default:
CC    = ${C_COMPILER}/usr/vac/bin/cc
CCXLC = ${C_COMPILER}/usr/vac/bin/xlc
CXX   = ${C_COMPILER}/usr/vacpp/bin/xlC


fp=default=default=default:
CC    = ${C_COMPILER}/usr/vac/bin/xlc
FC    = ${F_COMPILER}/usr/bin/xlf90
F77   = ${F_COMPILER}/usr/bin/xlf90
FXLF  = ${F_COMPILER}/usr/bin/xlf







#
#       The next line set up parallel make, the value of j is the number of threads.
#
#makeflags = -j8
#
#       galgel & facerec do not have dependency rules to allow parallel make's. The
#       easiest way to handle them is to add "makeflags = -j1" to their portability

#       flags section.
#


#
#
#       SPECint2000 portability flags. These are required to make the programs
#       work with the given compilers and are not optimizations.
#
164.gzip=default=default=default:

175.vpr=default=default=default:

176.gcc=default=default=default:
EXTRA_CFLAGS=-ma -DHOST_WORDS_BIG_ENDIAN

181.mcf=default=default=default:

186.crafty=default=default=default:
EXTRA_CFLAGS=-DAIX

197.parser=default=default=default:

252.eon=default=default=default:

253.perlbmk=default=default=default:
EXTRA_CFLAGS=-DSPEC_CPU2000_AIX

254.gap=default=default=default:
EXTRA_CFLAGS=-DSYS_IS_BSD -DSYS_STRING_H -DSYS_HAS_MALLOC_PROTO -DSYS_HAS_CALLOC_PROTO
```

```
255.vortex=default=default=default:

256.bzip2=default=default=default:

300.twolf=default=default=default:
EXTRA_CFLAGS=-DHAVE_SIGNED_CHAR



#
#       SPECint2000 base-level optimizations. These confirm to a 4-flag
#       count. Note that the flags vary between languages (C & C++ in
#       this case).
#
int=base=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS    = -qpdf1 -O5 -blpdata -D_ILS_MACROS
PASS1_LDCFLAGS  = -qpdf1 -O5 -blpdata -D_ILS_MACROS
PASS2_CFLAGS    = -qpdf2 -O5 -blpdata -D_ILS_MACROS
PASS2_LDCFLAGS  = -qpdf2 -O5 -blpdata -D_ILS_MACROS


#
#       Combination used with "eon" (i.e. C++ base).
#
252.eon=base=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vacpp/bin/cleanpdf
PASS1_CXXFLAGS = -qpdf1 -O4 -qalign=natural
PASS1_LDCXXFLAGS= -qpdf1 -O4 -qalign=natural
PASS2_CXXFLAGS = -qpdf2 -O4 -qalign=natural
PASS2_LDCXXFLAGS= -qpdf2 -O4 -qalign=natural


#
#
#       SPECint2000 peak-level optimizations.
#
164.gzip=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS    = -qpdf1 -O4 -qfdpr -blpdata
PASS1_LDCFLAGS  = -qpdf1 -O4 -qfdpr -blpdata
PASS2_CFLAGS    = -qpdf2 -O4 -qfdpr -blpdata
PASS2_LDCFLAGS  = -qpdf2 -O4 -qfdpr -blpdata

fdo_run2        = fdpr -q -O3 -p $commandexe -x $command
fdo_post2       = cp ${baseexe}.fdpr $baseexe



175.vpr=peak=default=default:
basepeak=1




176.gcc=peak=default=default:
basepeak=1



181.mcf=peak=default=default:
fdo_pre0          = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS     = -qpdf1 -O5 -blpdata -qalign=natural -qhot=arraypad -qfdpr -Q -qmaxmem=-1
PASS1_LDCFLAGS   = -qpdf1 -O5 -blpdata -qalign=natural -qhot=arraypad -qfdpr -Q -qmaxmem=-1
PASS2_CFLAGS     = -qpdf2 -O5 -blpdata -qalign=natural -qhot=arraypad -qfdpr -Q -qmaxmem=-1
PASS2_LDCFLAGS   = -qpdf2 -O5 -blpdata -qalign=natural -qhot=arraypad -qfdpr -Q -qmaxmem=-1
fdo_run2         = fdpr -q -O3 -p $commandexe -x $command
fdo_post2        = cp ${baseexe}.fdpr $baseexe
```

```
186.crafty=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS   = -qpdf1 -O4 -qalign=natural -q64 -lhmu -blpdata
PASS1_LDCFLAGS = -qpdf1 -O4 -qalign=natural -q64 -lhmu -blpdata
PASS2_CFLAGS   = -qpdf2 -O4 -qalign=natural -q64 -lhmu -blpdata
PASS2_LDCFLAGS = -qpdf2 -O4 -qalign=natural -q64 -lhmu -blpdata



197.parser=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS   = -qpdf1 -O4 -qfdpr -D_ILS_MACROS -blpdata
PASS1_LDCFLAGS = -qpdf1 -O4 -qfdpr -D_ILS_MACROS -blpdata
PASS2_CFLAGS   = -qpdf2 -O4 -qfdpr -D_ILS_MACROS -blpdata
PASS2_LDCFLAGS = -qpdf2 -O4 -qfdpr -D_ILS_MACROS -blpdata

fdo_run2        = fdpr -q -O3 -p $commandexe -x $command
fdo_post2       = cp ${baseexe}.fdpr $baseexe



252.eon=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CXXFLAGS      = -qpdf1 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural
PASS1_LDCXXFLAGS    = -qpdf1 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural
PASS2_CXXFLAGS      = -qpdf2 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural
PASS2_LDCXXFLAGS    = -qpdf2 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural



253.perlbmk=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS   = -qpdf1 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata -lhmu
PASS1_LDCFLAGS = -qpdf1 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata -lhmu
PASS2_CFLAGS   = -qpdf2 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata -lhmu
PASS2_LDCFLAGS = -qpdf2 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata -lhmu



254.gap=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS    = -qpdf1 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata
PASS1_LDCFLAGS  = -qpdf1 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata
PASS2_CFLAGS    = -qpdf2 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata
PASS2_LDCFLAGS  = -qpdf2 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata



255.vortex=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS   = -qpdf1 -O4 -qfdpr -lhmu -blpdata
PASS1_LDCFLAGS = -qpdf1 -O4 -qfdpr -lhmu -blpdata
PASS2_CFLAGS   = -qpdf2 -O4 -qfdpr -lhmu -blpdata
PASS2_LDCFLAGS = -qpdf2 -O4 -qfdpr -lhmu -blpdata

fdo_run2        = fdpr -q -O3 -p $commandexe -x $command
fdo_post2       = cp ${baseexe}.fdpr $baseexe



256.bzip2=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS   = -qpdf1 -O5 -qfdpr -blpdata
PASS1_LDCFLAGS = -qpdf1 -O5 -qfdpr -blpdata
PASS2_CFLAGS   = -qpdf2 -O5 -qfdpr -blpdata
PASS2_LDCFLAGS = -qpdf2 -O5 -qfdpr -blpdata

fdo_run2        = fdpr -q -O3 -p $commandexe -x $command
fdo_post2       = cp ${baseexe}.fdpr $baseexe
```

```
300.twolf=peak=default=default:
COPTIMIZE       = -O5 -qfdpr -blpdata

fdo_run2        = fdpr -q -O3 -p $commandexe -x $command
fdo_post2       = cp ${baseexe}.fdpr $baseexe


#
#
#       Notes for the Integer benchmarks.
#
int=default=default=default:
notes000=  Portability Flags:
notes005=    176.gcc:      -ma -DHOST_WORDS_BIG_ENDIAN
notes010=    186.crafty:   -DAIX
notes025=    253.perlbmk:  -DSPEC_CPU2000_AIX
notes030=    254.gap:      -DSYS_IS_BSD -DSYS_STRING_H
notes035=                  -DSYS_HAS_MALLOC_PROTO -DSYS_HAS_CALLOC_PROTO
notes040=    300.twolf:    -DHAVE_SIGNED_CHAR
notes045=
notes050=  Base Optimization Flags:
notes055=    C:    -qpdf1/pdf2
notes060=          -O5 -blpdata -D_ILS_MACROS
notes065=    C++:  -qpdf1/pdf2
notes070=          -O4 -qalign=natural
notes075=
notes080=  Peak Optimization Flags
notes085=    164.gzip:     -qpdf1/pdf2
notes090=                  -O4 -qfdpr -blpdata
notes095=                  fdpr -q -O3
notes100=    175.vpr:      -qpdf1/pdf2
notes105=                  -O5 -qfdpr -blpdata
notes110=                  fdpr -q -O3
notes115=    176.gcc:      -qpdf1/pdf2
notes120=                  -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata
notes125=    181.mcf:      -qpdf1/pdf2
notes127=                  -O4 -qalign=natural -blpdata
notes130=    186.crafty:   -qpdf1/pdf2
notes135=                  -O4 -qalign=natural -q64 -lhmu -blpdata
notes140=    197.parser:   -qpdf1/pdf2
notes145=                  -O4 -qfdpr -D_ILS_MACROS -blpdata
notes150=                  fdpr -q -O3
notes155=    252.eon:      -qpdf1/pdf2
notes160=                  -O4 -qalign=natural
notes165=    253.perlbmk:  -qpdf1/pdf2
notes170=                  -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata -lhmu
notes175=    254.gap:      -qpdf1/pdf2
notes180=                  -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata
notes185=    255.vortex:   -qpdf1/pdf2
notes190=                  -O4 -qfdpr -lhmu -blpdata
notes195=                  fdpr -q -O3
notes200=    256.bzip2:    -qpdf1/pdf2
notes205=                  -O5 -qfdpr -blpdata
notes210=                  fdpr -q -O3
notes215=    300.twolf:    -O5 -qfdpr -blpdata
notes225=                  fdpr -q -O3
notes230=


#
#
#       SPECfp2000 portability flags. These are required to make the programs
#       work with the given compilers and are not optimizations.
#
#       First, the F90 benchmarks:
#
178.galgel=default=default=default:
EXTRA_FFLAGS=-qfixed -qsuffix=f=f90
```

```
187.facerec=default=default=default:
EXTRA_FFLAGS=-qsuffix=f=f90

189.lucas=default=default=default:
EXTRA_FFLAGS=-qsuffix=f=f90

191.fma3d=default=default=default:
EXTRA_FFLAGS= -qsuffix=f=f90


#
#       The F77 benchmarks compile with FC for "base" and F77 for "peak", so
#       we need to assign the portability-flags differently between them.
#
168.wupwise=base=default=default:
EXTRA_FFLAGS   = -qfixed

168.wupwise=peak=default=default:
EXTRA_F77FLAGS = -qfixed

171.swim=base=default=default:
EXTRA_FFLAGS   = -qfixed

171.swim=peak=default=default:
EXTRA_F77FLAGS = -qfixed

172.mgrid=base=default=default:
EXTRA_FFLAGS   = -qfixed

172.mgrid=peak=default=default:
EXTRA_F77FLAGS = -qfixed

173.applu=base=default=default:
EXTRA_FFLAGS   = -qfixed

173.applu=peak=default=default:
EXTRA_F77FLAGS = -qfixed

200.sixtrack=base=default=default:
EXTRA_FFLAGS   = -qfixed

200.sixtrack=peak=default=default:
EXTRA_F77FLAGS = -qfixed

301.apsi=base=default=default:
EXTRA_FFLAGS   = -qfixed

301.apsi=peak=default=default:
EXTRA_F77FLAGS = -qfixed


#
#
#       SPECfp2000 base-level optimizations. These confirm to a 4-flag
#       count. Note that the flags vary between languages (C & Fortran
#       in this case). We also use feedback for C and not Fortran.
#
fp=base=default=default:
FOPTIMIZE         = -O5 -lhmu -blpdata -lmass
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS    = -qpdf1 -O5 -blpdata -qalign=natural
PASS1_LDCFLAGS  = -qpdf1 -O5 -blpdata -qalign=natural
PASS2_CFLAGS    = -qpdf2 -O5 -blpdata -qalign=natural
PASS2_LDCFLAGS  = -qpdf2 -O5 -blpdata -qalign=natural
feedback        = 0


177.mesa=base=default=default:
feedback        = 1

179.art=base=default=default:
```

```
feedback        = 1

183.equake=base=default=default:
feedback        = 1

188.ammp=base=default=default:
feedback        = 1



#
#
#       SPECfp2000 peak-level optimizations.
#
168.wupwise=peak=default=default:
F77OPTIMIZE         = -O5 -qsave -blpdata -lhmu -lmass



171.swim=peak=default=default:
basepeak=1



172.mgrid=peak=default=default:
PASS1_F77FLAGS    = -qpdf1 -O4 -qipa=partition=large -q64 -blpdata
PASS1_LDF77FLAGS  = -qpdf1 -O4 -qipa=partition=large -q64 -blpdata
PASS2_F77FLAGS    = -qpdf2 -O4 -qipa=partition=large -q64 -blpdata
PASS2_LDF77FLAGS  = -qpdf2 -O4 -qipa=partition=large -q64 -blpdata



173.applu=peak=default=default:
# F77OPTIMIZE         = -O5 -qarch=pwr3 -qtune=pwr3 -qalign=struct=natural -qfdpr -q64 -blpdata
F77OPTIMIZE       = -q64 -blpdata -O3 -qarch=auto -qtune=auto -qfdpr
fdo_run1          = fdpr -q -O3 -p $commandexe -x $command
fdo_post1         = cp ${baseexe}.fdpr $baseexe



177.mesa=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS      = -qpdf1 -O4 -qfdpr
PASS1_LDCFLAGS    = -qpdf1 -O4 -qfdpr
PASS2_CFLAGS      = -qpdf2 -O4 -qfdpr
PASS2_LDCFLAGS    = -qpdf2 -O4 -qfdpr

fdo_run2          = fdpr -q -O3 -p $commandexe -x $command
fdo_post2         = cp ${baseexe}.fdpr $baseexe



178.galgel=peak=default=default:


users = 8
OPTIMIZE          = -O5 -qfdpr -lhmu -blpdata -lmass -qessl -lessl
fdo_run2          = fdpr -q -O3 -p $commandexe -x $command
fdo_post2         = cp ${baseexe}.fdpr $baseexe



179.art=peak=default=default:

COPTIMIZE         = -O5 -lhmu -blpdata



183.equake=peak=default=default:
users = 8
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
```

```
PASS1_CFLAGS    = -qpdf1 -O3 -qarch=auto -qtune=auto -qipa=level=2 -blpdata
PASS1_LDCFLAGS  = -qpdf1 -O3 -qarch=auto -qtune=auto -qipa=level=2 -blpdata
PASS2_CFLAGS    = -qpdf2 -O3 -qarch=auto -qtune=auto -qipa=level=2 -blpdata
PASS2_LDCFLAGS  = -qpdf2 -O3 -qarch=auto -qtune=auto -qipa=level=2 -blpdata



187.facerec=peak=default=default:
FOPTIMIZE         = -O5 -qsave -blpdata



188.ammp=peak=default=default:
basepeak=1



189.lucas=peak=default=default:
basepeak=1
users = 8



191.fma3d=peak=default=default:
PASS1_FFLAGS      = -qpdf1 -O3 -qarch=auto -qtune=auto -qipa=level=2 -q64 -lhmu -blpdata -lmass
PASS1_LDFFLAGS    = -qpdf1 -O3 -qarch=auto -qtune=auto -qipa=level=2 -q64 -lhmu -blpdata -lmass
PASS2_FFLAGS      = -qpdf2 -O3 -qarch=auto -qtune=auto -qipa=level=2 -q64 -lhmu -blpdata -lmass
PASS2_LDFFLAGS    = -qpdf2 -O3 -qarch=auto -qtune=auto -qipa=level=2 -q64 -lhmu -blpdata -lmass



200.sixtrack=peak=default=default:
PASS1_F77FLAGS      = -qpdf1 -O5 -qfdpr -qalign=struct=natural
PASS1_LDF77FLAGS    = -qpdf1 -O5 -qfdpr -qalign=struct=natural
PASS2_F77FLAGS      = -qpdf2 -O5 -qfdpr -qalign=struct=natural
PASS2_LDF77FLAGS    = -qpdf2 -O5 -qfdpr -qalign=struct=natural
fdo_run2          = fdpr -q -O3 -p $commandexe -x $command
fdo_post2         = cp ${baseexe}.fdpr $baseexe



301.apsi=peak=default=default:
F77OPTIMIZE       = -O5


#
#
#       Notes for the Floating-Point benchmarks.
#
fp=default=default=default:
notes000=  Portability Flags:
notes005=       -qfixed used in:        168.wupwise, 171.swim, 172.mgrid, 173.applu,
notes010=                               178.galgel, 200.sixtrack, 301.apsi
notes015=       -qsuffix=f=f90 used in: 178.galgel, 187.facerec, 189.lucas, 191.fma3d
notes020=
notes025=  Base Optimization Flags:
notes030=    Fortran:    -O5 -lhmu -blpdata -lmass
notes035=    C:          -qpdf1/pdf2
notes040=                -O5 -blpdata -qalign=natural
notes045=
notes050=  Peak Optimization Flags
notes055=    168.wupwise:  -O5 -qsave -blpdata -lhmu -lmass
notes075=    171.swim:     basepeak=1
notes095=    172.mgrid:    -qpdf1/pdf2
notes100=                  -O4 -qipa=partition=large -q64 -blpdata
notes115=    173.applu:    -O5 -qarch=pwr3 -qtune=pwr3 -qalign=struct=natural -qfdpr -q64 -blpdata
notes120=                   fdpr -q -O3
notes135=    177.mesa:     -qpdf1/pdf2
notes140=                   -O5 -qfdpr
notes145=                   fdpr -q -O3
```

```
notes150=    178.galgel:   -qpdf1/pdf2
notes155=                  -O5 -qfdpr -lhmu -blpdata -lmass -qessl -lessl
notes160=                  fdpr -q -O3
notes175=    179.art:      -qpdf1/pdf2
notes180=                  -O5 -qhot=arraypad -Q -qalign=natural -blpdata -lhmu
notes195=    183.equake:   -qpdf1/pdf2
notes200=                  -O3 -qarch=auto -qtune=auto -qipa=level=2 -blpdata
notes215=    187.facerec:  -O5 -qsave -blpdata
notes235=    188.ammp:     -O5 -qalign=natural -qfdpr -blpdata -lhmu
notes240=                  fdpr -q -O3
notes255=    189.lucas:    -O3 -qarch=auto -qtune=auto -qfdpr -blpdata -qessl -lessl
notes260=                  fdpr -q -O3
notes275=    191.fma3d:    -qpdf1/pdf2
notes280=                  -O3 -qarch=auto -qtune=auto -qipa=level=2 -q64 -lhmu -blpdata -lmass
notes295=    200.sixtrack: -qpdf1/pdf2
notes300=                  -O4 -qfdpr
notes305=                  fdpr -q -O3
notes310=    301.apsi:     -O5
notes315=


#
#
#       Global options for reports
#
default=default=default=default:

company_name   =IBM Corporation
license_num           =#11
tester_name           =IBM
test_site             =Austin, TX
test_date             =Dec-2005



#
#       Information you need to fill in for each platform.
#
hw_avail       =Feb-2006
hw_vendor      =IBM Corporation
hw_model       =IBM OpenPower 570 (2200 MHz, 4 CPU)
hw_cpu         =Power5+
hw_cpu_mhz     =2200
hw_fpu         =Integrated
hw_ncpu        =4 cores, 2 chips, 2 cores/chip (SMT on)
hw_ncpuorder=4,8,12,16
hw_pcache      =64KBI+32KBD (on chip)/core
hw_scache      =1920KB unified (on chip)/core
hw_tcache      =36MB unified (off-chip)/DCM, 2 DCM/SUT
hw_ocache      =None
hw_memory      =8x2GB
hw_disk        =1x73GB SCSI, 15K RPM
hw_other       =None
machine_name=peanut
hw_parallel    =no

sw_avail       =Feb-2006
sw_parallel    =no
sw_os          =AIX 5L V5.3
sw_compiler0   =XL C/C++ Enterprise Edition Version 8.0 for AIX
sw_compiler1   =XL Fortran Enterprise Edition Version 10.1 for AIX
sw_compiler2   =Other Software: ESSL 4.2.0.3
sw_file               =AIX/JFS2
sw_state              =Multi-user



#
#       Closing notes on the sytem configuration.
#
notes320=
```

```
notes330=  The installed OS level is AIX 5L for POWER version 5.3 with the 5300-04 Recommended
Maintenence package.
notes335=
notes340=  SMT:  Acronym for "Simultaneous Multi-Threading". A processor technology that allows
notes345=        the simultaneous execution of multiple thread contexts within a single processor
notes350=        core. (Enabled by default)
notes355=  DCM:  Acronym for "Dual-Chip Module" (one dual-core processor chip + one L3-cache chip)
notes360=  SUT:  Acronym for "System Under Test"
notes370=  ESSL: Engineering and Scientific Subroutine Library
notes375=
notes380=  Extended C:     IBM XL C for AIX invoked as cc
notes381=  ANSI C89:       IBM XL C for AIX invoked as xlc
notes385=  C++:            IBM XL C for AIX invoked as xlC
notes390=  Fortran 77:     IBM XL Fortran for AIX invoked as xlf90 unless explicitly reassigned
notes395=  Fortran 90:     IBM XL Fortran for AIX invoked as xlf
notes400=
notes405=  ulimits set to unlimited.
notes410=  Large page mode and memory affinity were set as follows:
int=default=default=default:
notes415=      vmo -r -o lgpg_regions=800 -o lgpg_size=16777216
fp=default=default=default:
notes415=      vmo -r -o lgpg_regions=800 -o lgpg_size=16777216
default=default=default=default:
notes420=      chuser capabilities=CAP_BYPASS_RAC_VMM,CAP_PROPAGATE $USER
notes425=      reboot -q
notes430=      export MEMORY_AFFINITY=MCM
notes435=
notes440=  The following config-file entry was used to assign each benchmark process to a core:
notes445=       submit = bindprocessor \$\$ \$SPECUSERNUM; $command
notes450=  The "bindprocessor" AIX command binds a process to a CPU core.
notes460=
```

Intel Itanium 2 processor 9050-based server

```
# Invocation command line:
# /cpu2000/bin/runspec --config=ColdFusion_rate --reportable --tune=base --rate --users=8 fp
################################################################################
# SPEC2000 HITACHI IPF Linux64 config file for Itanium 2
# HITACHI Cold Fusion
# December 2006. Intel Compiler 9.1 for Linux64

license_num=3184
tester_name=PT
test_date=Aug-2006

company_name=Principled Technologies
hw_vendor=Hitachi
machine_name=Hitachi Cold Fusion 3e (DC, 1.60GHz/24MB Itanium 2, FSB 400MHz)
hw_model=Hitachi Cold Fusion 3e (DC, 1.60GHz/24MB Itanium 2, FSB 400MHz)
hw_cpu=Intel Itanium 2 Dual-Core 1600 MHz
hw_cpu_mhz=1600
hw_fpu=Integrated
hw_ncpu=8 cores, 4 chips, 2 cores/chip (Multi Threading disabled)
hw_ncpuorder= 2,4,8,16
hw_parallel=No
hw_pcache=16KBI + 16KBD on chip, per core
hw_scache=1MBI + 256KBD on chip, per core
hw_tcache=12.0MB(I+D) on chip, per core
hw_ocache=N/A
hw_memory=32GB (1GB DIMM x 32)
hw_disk= 1 x 73GB SATA HDD
hw_other=None
hw_avail=

sw_os=Red Hat Enterprise Linux AS 4 update 4
sw_file=ext3
sw_state=Multi-user run level 3
sw_avail=Aug-2006
```

```
ext=cpu2000.v1.3.ic91p.ipf.linux64.hitachi
action=validate
size=ref
tune=all
input=ref
teeout=yes
teerunout=yes;
feedback=1
check_md5=1

fp=default=default=default:
sw_compiler000=Intel(R) Fortran Compiler for Linux 9.1.040 (Build 20061105)
sw_compiler001=Intel(R) C++ Compiler for Linux 9.1.045 (Build 20061105)

int=default=default=default:
sw_compiler000=Intel(R) C++ Compiler for Linux 9.1.045 (Build 20061105)

default=default=default=default:
FC=ifort
F77=ifort
CC=icc
CXX=icpc

fp=base=default=default:
PASS1_FFLAGS=    -prof_gen
PASS2_FFLAGS=    -prof_use
PASS1_CFLAGS=    -prof_gen
PASS2_CFLAGS=    -prof_use
PASS1_LDFLAGS=   -prof_gen
PASS2_LDFLAGS=   -prof_use
FOPTIMIZE = -fast -IPF_fp_relaxed
COPTIMIZE = -fast -ansi_alias -IPF_fp_relaxed

fp=default=default=default:
notes010= Base tuning flags:
notes011=  Fortran : -fast -IPF_fp_relaxed +FDO
notes015=        C : -fast -ansi_alias -IPF_fp_relaxed +FDO
notes020= +FDO: PASS1=-prof_gen  PASS2=-prof_use
notes023=
notes025= Portability flags:
notes030=  178.galgel : -FI
notes035 =
notes040 = Multi Threading disabled by EFI firmware.

int=base=default=default:
PASS1_CXXFLAGS=    -prof_gen
PASS2_CXXFLAGS=    -prof_use
PASS1_CFLAGS=    -prof_gen
PASS2_CFLAGS=    -prof_use
PASS1_LDFLAGS=   -prof_gen
PASS2_LDFLAGS=   -prof_use
CXXOPTIMIZE = -fast -auto_ilp32 -IPF_fp_relaxed
COPTIMIZE = -fast -auto_ilp32

int=default=default=default:
notes010 = Base tuning flags:
notes015 =      C   : -fast -auto_ilp32 +FDO
notes020 =      C++ : -fast -auto_ilp32 -IPF_fp_relaxed +FDO
notes025 =
notes030 = +FDO: PASS1=-prof_gen  PASS2=-prof_use
notes035 =
notes040 = Portability flags:
notes045 =   176.gcc: -DSPEC_CPU2000_LP64 -Dalloca=_alloca
notes050 =   186.crafty: -DLINUX_i386
notes055 =   252.eon: -DSPEC_CPU2000_LP64 -DHAS_ERRLIST fmax_errno src.alt
notes060 =   253.perlbmk: -DSPEC_CPU2000_LP64 -DSPEC_CPU2000_NEED_BOOL
notes065 =                -DSPEC_CPU2000_LINUX_IA64 -DSPEC_CPU2000_GLIBC22
notes070 =   254.gap: -DSPEC_CPU2000_LP64 -DSYS_HAS_CALLOC_PROTO -DSYS_IS_USG
notes075 =            -DSYS_HAS_IOCTL_PROTO -DSYS_HAS_TIME_PROTO -DSYS_HAS_SIGNAL_PROTO
notes076 =            -include unistd.h
notes080 =   255.vortex: -DSPEC_CPU2000_LP64 closed_files src.alt
```

```
notes085 =   300.twolf: stdfree src.alt
notes090 =
notes095 = Multi Threading disabled by EFI firmware.

#
#       int flags
#
176.gcc=default=default=default:
CPORTABILITY = -DSPEC_CPU2000_LP64 -Dalloca=_alloca

186.crafty=default=default=default:
CPORTABILITY =   -DLINUX_i386

252.eon=default=default=default:
CXXPORTABILITY = -DSPEC_CPU2000_LP64 -DHAS_ERRLIST
# Enable 252.eon errno src.alt
srcalt=fmax_errno

253.perlbmk=default=default=default:
CPORTABILITY = -DSPEC_CPU2000_LP64 -DSPEC_CPU2000_NEED_BOOL -DSPEC_CPU2000_LINUX_IA64 -
DSPEC_CPU2000_GLIBC22

254.gap=default=default=default:
CPORTABILITY = -include unistd.h -DSPEC_CPU2000_LP64 -DSYS_HAS_CALLOC_PROTO -DSYS_IS_USG -
DSYS_HAS_IOCTL_PROTO -DSYS_HAS_TIME_PROTO -DSYS_HAS_SIGNAL_PROTO

255.vortex=default=default=default:
CPORTABILITY = -DSPEC_CPU2000_LP64
srcalt=closed_files

300.twolf=default=default=default:
srcalt=stdfree

#
#       fp flags
#
178.galgel=default=default=default:
FPORTABILITY= -FI
```

Appendix C – SPECfp output

This appendix provides the output of the benchmark for the tests with 4, 8, and 16 users on each test server.

IBM System p5 550Q POWER5+ processor-based server (4 users)

CFP2000 Result

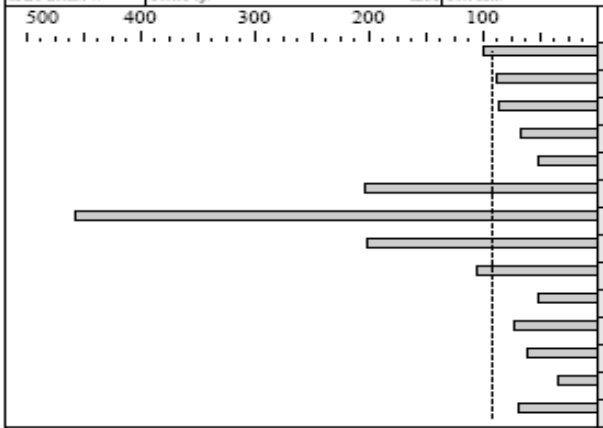
IBM Corporation

IBM OpenPower 570 (2200 MHz, 4 CPU)

SPECfp_rate2000 = --

SPECfp_rate_base2000 = 90.5

SPEC license #: | Tested by: IBM | Test date: Dec-2005 | Hardware Avail: Feb-2006 | Software Avail: Feb-2006



Benchmark	Base Copies	Base Runtime	Base Ratio	Copies	Runtime	Ratio
168.wupwise	4	74.3	99.9			
171.swim	4	164	87.5			
172.mgrid	4	98.5	84.8			
173.applu	4	147	66.1			
177.mesa	4	127	51.2			
178.galgel	4	66.6	202			
179.art	4	26.5	456			
183.equake	4	29.9	202			
187.facerec	4	84.3	105			
188.ammp	4	201	50.8			
189.lucas	4	129	72.2			
191.fma3d	4	163	59.7			
200.sixtrack	4	152	33.6			
301.apsi	4	177	68.3			

Hardware

CPU:	Power5+
CPU MHz:	2200
FPU:	Integrated
CPU(s) enabled:	4 cores, 2 chips, 2 cores/chip (SMT on)
CPU(s) orderable:	4,8,12,16
Parallel:	no
Primary Cache:	64KBI+32KBD (on chip)/core
Secondary Cache:	1920KB unified (on chip)/core
L3 Cache:	36MB unified (off-chip)/DCM, 2 DCM/SUT
Other Cache:	None
Memory:	8x2GB
Disk Subsystem:	1x73GB SCSI, 15K RPM
Other Hardware:	None

Software

Operating System:	AIX 5L V5.3
Compiler:	XL C/C++ Enterprise Edition Version 8.0 for AIX XL Fortran Enterprise Edition Version 10.1 for AIX
	Other Software: ESSL 4.2.0.3
File System:	AIX/JFS2
System State:	Multi-user

Notes/Tuning Information

```
Portability Flags:
     -qfixed used in:        168.wupwise, 171.swim, 172.mgrid, 173.applu,
                             178.galgel, 200.sixtrack, 301.apsi
     -qsuffix=f=f90 used in: 178.galgel, 187.facerec, 189.lucas, 191.fma3d

Base Optimization Flags:
  Fortran:    -O5 -lhmu -blpdata -lmass
  C:          -qpdf1/pdf2
              -O5 -blpdata -qalign=natural

Peak Optimization Flags
  168.wupwise:  -O5 -qsave -blpdata -lhmu -lmass
  171.swim:     basepeak=1
  172.mgrid:    -qpdf1/pdf2
                -O4 -qipa=partition=large -q64 -blpdata
  173.applu:    -O5 -qarch=pwr3 -qtune=pwr3 -qalign=struct=natural -qfdpr -q64 -blpdata
                fdpr -q -O3
```

Standard Performance Evaluation Corporation
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http://www.spec.org/

CFP2000 Result

IBM Corporation

IBM OpenPower 570 (2200 MHz, 4 CPU)

SPECfp_rate2000 = --

SPECfp_rate_base2000 = 90.5

SPEC license # | Tested by: IBM | Test date: Dec-2005 | Hardware Avail: Feb-2006 | Software Avail: Feb-2006

Notes/Tuning Information (Continued)

```
      177.mesa:      -qpdf1/pdf2
                      -O5 -qfdpr
                      fdpr -q -O3
      178.galgel:    -qpdf1/pdf2
                     -O5 -qfdpr -lhmu -blpdata -lmass -qessl -lessl
                     fdpr -q -O3
      179.art:       -qpdf1/pdf2
                     -O5 -qhot=arraypad -Q -qalign=natural -blpdata -lhmu
      183.equake:    -qpdf1/pdf2
                     -O3 -qarch=auto -qtune=auto -qipa=level=2 -blpdata
      187.facerec:   -O5 -qsave -blpdata
      188.ammp:      -O5 -qalign=natural -qfdpr -blpdata -lhmu
                     fdpr -q -O3
      189.lucas:     -O3 -qarch=auto -qtune=auto -qfdpr -blpdata -qessl -lessl
                     fdpr -q -O3
      191.fma3d:     -qpdf1/pdf2
                    -O3 -qarch=auto -qtune=auto -qipa=level=2 -q64 -lhmu -blpdata -lmass
      200.sixtrack: -qpdf1/pdf2
                     -O4 -qfdpr
                     fdpr -q -O3
      301.apsi:      -O5

    The installed OS level is AIX 5L for POWER version 5.3 with the 5300-04 Recommended Maintenance package.

    SMT:  Acronym for "Simultaneous Multi-Threading". A processor technology that allows
          the simultaneous execution of multiple thread contexts within a single processor
          core. (Enabled by default)
    DCM:  Acronym for "Dual-Chip Module" (one dual-core processor chip + one L3-cache chip)
    SUT:  Acronym for "System Under Test"
    ESSL: Engineering and Scientific Subroutine Library

    Extended C:      IBM XL C for AIX invoked as cc
    ANSI C89:        IBM XL C for AIX invoked as xlc
    C++:             IBM XL C for AIX invoked as xlC
    Fortran 77:     IBM XL Fortran for AIX invoked as xlf90 unless explicitly reassigned
    Fortran 90:      IBM XL Fortran for AIX invoked as xlf

    ulimits set to unlimited.
    Large page mode and memory affinity were set as follows:
        vmo -r -o lgpg_regions=800 -o lgpg_size=16777216
        chuser capabilities=CAP_BYPASS_RAC_VMM,CAP_PROPAGATE $USER
        reboot -q
        export MEMORY_AFFINITY=MCM

    The following config-file entry was used to assign each benchmark process to a core:
         submit = bindprocessor \$\$ \$SPECUSERNUM; $command
    The "bindprocessor" AIX command binds a process to a CPU core.
```

IBM System p5 550Q POWER5+ processor-based server (8 users)

CFP2000 Result

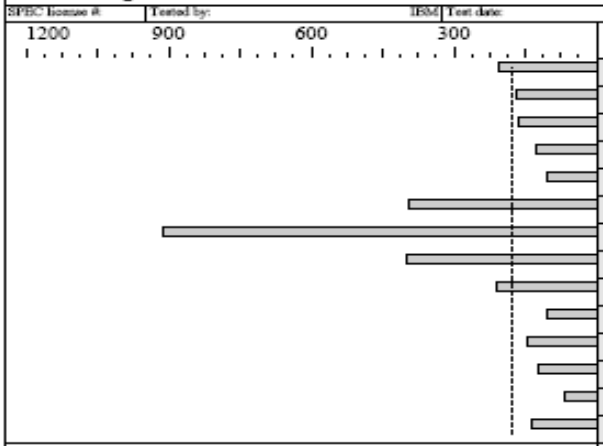
IBM Corporation

IBM OpenPower 570 (2200 MHz, 4 CPU)

SPECfp_rate2000 = --

SPECfp_rate_base2000 = 180

SPEC license #: | Tested by: IBM | Test date: Dec-2005 | Hardware Avail: Feb-2006 | Software Avail: Feb-2006



Benchmark	Base Copies	Base Runtime	Base Ratio	Copies	Runtime	Ratio
168.wupwise	8	72.5	205			
171.swim	8	170	170			
172.mgrid	8	101	166			
173.applu	8	151	129			
177.mesa	8	128	102			
178.galgel	8	67.8	397			
179.art	8	26.5	911			
183.equake	8	30.1	401			
187.facerec	8	84.8	208			
188.ammp	8	201	102			
189.lucas	8	129	143			
191.fma3d	8	162	120			
200.sixtrack	8	152	67.0			
301.apsi	8	179	135			

Hardware

CPU:	Power5+
CPU MHz:	2200
FPU:	Integrated
CPU(s) enabled:	4 cores, 2 chips, 2 cores/chip (SMT on)
CPU(s) orderable:	4,8,12,16
Parallel:	no
Primary Cache:	64KBI+32KBD (on chip)/core
Secondary Cache:	1920KB unified (on chip)/core
L3 Cache:	36MB unified (off-chip)/DCM, 2 DCM/SUT
Other Cache:	None
Memory:	8x2GB
Disk Subsystem:	1x73GB SCSI, 15K RPM
Other Hardware:	None

Software

Operating System:	AIX 5L V5.3
Compiler:	XL C/C++ Enterprise Edition Version 8.0 for AIX XL Fortran Enterprise Edition Version 10.1 for AIX Other Software: ESSL 4.2.0.3
File System:	AIX/JFS2
System State:	Multi-user

Notes/Tuning Information

```
Portability Flags:
     -qfixed used in:        168.wupwise, 171.swim, 172.mgrid, 173.applu,
                             178.galgel, 200.sixtrack, 301.apsi
     -qsuffix=f=f90 used in: 178.galgel, 187.facerec, 189.lucas, 191.fma3d

Base Optimization Flags:
  Fortran:    -O5 -lhmu -blpdata -lmass
  C:          -qpdf1/pdf2
              -O5 -blpdata -qalign=natural

Peak Optimization Flags
  168.wupwise:  -O5 -qsave -blpdata -lhmu -lmass
  171.swim:     basepeak=1
  172.mgrid:    -qpdf1/pdf2
                -O4 -qipa=partition=large -q64 -blpdata
  173.applu:    -O5 -qarch=pwr3 -qtune=pwr3 -qalign=struct=natural -qfdpr -q64 -blpdata
                fdpr -q -O3
```

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http://www.spec.org/

CFP2000 Result

IBM Corporation

IBM OpenPower 570 (2200 MHz, 4 CPU)

SPECfp_rate2000 = --

SPECfp_rate_base2000 = 180

SPEC license # | Tested by: IBM | Test date: Dec-2005 | Hardware Avail: Feb-2006 | Software Avail: Feb-2006

Notes/Tuning Information (Continued)

```
    177.mesa:      -qpdf1/pdf2
                    -O5 -qfdpr
                    fdpr -q -O3
    178.galgel:    -qpdf1/pdf2
                   -O5 -qfdpr -lhmu -blpdata -lmass -qessl -lessl
                   fdpr -q -O3
    179.art:       -qpdf1/pdf2
                   -O5 -qhot=arraypad -Q -qalign=natural -blpdata -lhmu
    183.equake:    -qpdf1/pdf2
                   -O3 -qarch=auto -qtune=auto -qipa=level=2 -blpdata
    187.facerec:   -O5 -qsave -blpdata
    188.ammp:      -O5 -qalign=natural -qfdpr -blpdata -lhmu
                   fdpr -q -O3
    189.lucas:     -O3 -qarch=auto -qtune=auto -qfdpr -blpdata -qessl -lessl
                   fdpr -q -O3
    191.fma3d:     -qpdf1/pdf2
                   -O3 -qarch=auto -qtune=auto -qipa=level=2 -q64 -lhmu -blpdata -lmass
    200.sixtrack: -qpdf1/pdf2
                   -O4 -qfdpr
                   fdpr -q -O3
    301.apsi:      -O5


The installed OS level is AIX 5L for POWER version 5.3 with the 5300-04 Recommended Maintenance package.

SMT:  Acronym for "Simultaneous Multi-Threading". A processor technology that allows
      the simultaneous execution of multiple thread contexts within a single processor
      core. (Enabled by default)
DCM:  Acronym for "Dual-Chip Module" (one dual-core processor chip + one L3-cache chip)
SUT:  Acronym for "System Under Test"
ESSL: Engineering and Scientific Subroutine Library

Extended C:     IBM XL C for AIX invoked as cc
ANSI C89:       IBM XL C for AIX invoked as xlc
C++:            IBM XL C for AIX invoked as xlC
Fortran 77:     IBM XL Fortran for AIX invoked as xlf90 unless explicitly reassigned
Fortran 90:     IBM XL Fortran for AIX invoked as xlf

ulimits set to unlimited.
Large page mode and memory affinity were set as follows:
    vmo -r -o lgpg_regions=800 -o lgpg_size=16777216
    chuser capabilities=CAP_BYPASS_RAC_VMM,CAP_PROPAGATE $USER
    reboot -q
    export MEMORY_AFFINITY=MCM

The following config-file entry was used to assign each benchmark process to a core:
     submit = bindprocessor \$\$ \$SPECUSERNUM; $command
The "bindprocessor" AIX command binds a process to a CPU core.
```

IBM System p5 550Q POWER5+ processor-based server (16 users)

CFP2000 Result

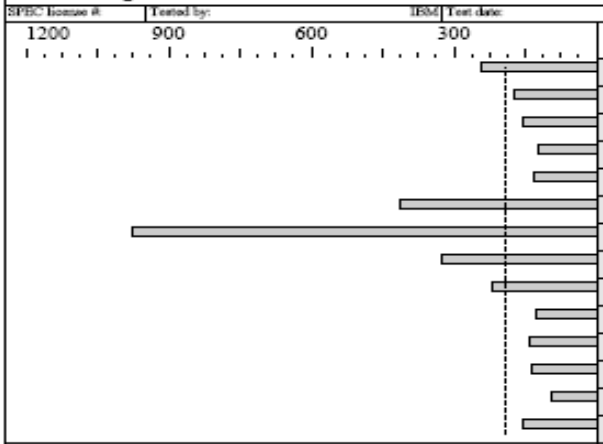
IBM Corporation

IBM OpenPower 570 (2200 MHz, 4 CPU)

SPECfp_rate2000 = --

SPECfp_rate_base2000 = 194

SPEC license #: | Tested by: | IBM | Test date: Dec-2005 | Hardware Avail: Feb-2006 | Software Avail: Feb-2006



Benchmark	Base Copies	Base Runtime	Base Ratio	Copies	Runtime	Ratio
168.wupwise	16	124	240			
171.swim	16	335	172			
172.mgrid	16	216	155			
173.applu	16	324	120			
177.mesa	16	197	132			
178.galgel	16	130	413			
179.art	16	49.4	976			
183.equake	16	73.9	327			
187.facerec	16	160	221			
188.ammp	16	318	128			
189.lucas	16	268	139			
191.fma3d	16	287	136			
200.sixtrack	16	213	96.1			
301.apsi	16	313	154			

Hardware

CPU:	Power5+
CPU MHz:	2200
FPU:	Integrated
CPU(s) enabled:	4 cores, 2 chips, 2 cores/chip (SMT on)
CPU(s) orderable:	4,8,12,16
Parallel:	no
Primary Cache:	64KBI+32KBD (on chip)/core
Secondary Cache:	1920KB unified (on chip)/core
L3 Cache:	36MB unified (off-chip)/DCM, 2 DCM/SUT
Other Cache:	None
Memory:	8x2GB
Disk Subsystem:	1x73GB SCSI, 15K RPM
Other Hardware:	None

Software

Operating System:	AIX 5L V5.3
Compiler:	XL C/C++ Enterprise Edition Version 8.0 for AIX XL Fortran Enterprise Edition Version 10.1 for AIX Other Software: ESSL 4.2.0.3
File System:	AIX/JFS2
System State:	Multi-user

Notes/Tuning Information

```
Portability Flags:
     -qfixed used in:          168.wupwise, 171.swim, 172.mgrid, 173.applu,
                               178.galgel, 200.sixtrack, 301.apsi
     -qsuffix=f=f90 used in: 178.galgel, 187.facerec, 189.lucas, 191.fma3d

Base Optimization Flags:
  Fortran:    -O5 -lhmu -blpdata -lmass
  C:          -qpdf1/pdf2
              -O5 -blpdata -qalign=natural

Peak Optimization Flags
  168.wupwise:  -O5 -qsave -blpdata -lhmu -lmass
  171.swim:     basepeak=1
  172.mgrid:    -qpdf1/pdf2
                -O4 -qipa=partition=large -q64 -blpdata
  173.applu:   -O5 -qarch=pwr3 -qtune=pwr3 -qalign=struct=natural -qfdpr -q64 -blpdata
                 fdpr -q -O3
```

Standard Performance Evaluation Corporation
info@spec.org
http://www.spec.org/

CFP2000 Result

IBM Corporation	SPECfp_rate2000 = --
IBM OpenPower 570 (2200 MHz, 4 CPU)	SPECfp_rate_base2000 = 194

SPEC license #	Tested by: IBM	Test date: Dec-2005	Hardware Avail: Feb-2006	Software Avail: Feb-2006

Notes/Tuning Information (Continued)

```
    177.mesa:      -qpdf1/pdf2
                    -O5 -qfdpr
                    fdpr -q -O3
    178.galgel:    -qpdf1/pdf2
                   -O5 -qfdpr -lhmu -blpdata -lmass -qessl -lessl
                   fdpr -q -O3
    179.art:       -qpdf1/pdf2
                   -O5 -qhot=arraypad -Q -qalign=natural -blpdata -lhmu
    183.equake:    -qpdf1/pdf2
                   -O3 -qarch=auto -qtune=auto -qipa=level=2 -blpdata
    187.facerec:   -O5 -qsave -blpdata
    188.ammp:      -O5 -qalign=natural -qfdpr -blpdata -lhmu
                   fdpr -q -O3
    189.lucas:     -O3 -qarch=auto -qtune=auto -qfdpr -blpdata -qessl -lessl
                   fdpr -q -O3
    191.fma3d:     -qpdf1/pdf2
                  -O3 -qarch=auto -qtune=auto -qipa=level=2 -q64 -lhmu -blpdata -lmass
    200.sixtrack: -qpdf1/pdf2
                   -O4 -qfdpr
                   fdpr -q -O3
    301.apsi:      -O5


The installed OS level is AIX 5L for POWER version 5.3 with the 5300-04 Recommended Maintenance package.

SMT:  Acronym for "Simultaneous Multi-Threading". A processor technology that allows
      the simultaneous execution of multiple thread contexts within a single processor
      core. (Enabled by default)
DCM:  Acronym for "Dual-Chip Module" (one dual-core processor chip + one L3-cache chip)
SUT:  Acronym for "System Under Test"
ESSL: Engineering and Scientific Subroutine Library

Extended C:      IBM XL C for AIX invoked as cc
ANSI C89:        IBM XL C for AIX invoked as xlc
C++:             IBM XL C for AIX invoked as xlC
Fortran 77:      IBM XL Fortran for AIX invoked as xlf90 unless explicitly reassigned
Fortran 90:      IBM XL Fortran for AIX invoked as xlf

ulimits set to unlimited.
Large page mode and memory affinity were set as follows:
    vmo -r -o lgpg_regions=800 -o lgpg_size=16777216
    chuser capabilities=CAP_BYPASS_RAC_VMM,CAP_PROPAGATE $USER
    reboot -q
    export MEMORY_AFFINITY=MCM

The following config-file entry was used to assign each benchmark process to a core:
     submit = bindprocessor \$\$ \$SPECUSERNUM; $command
The "bindprocessor" AIX command binds a process to a CPU core.
```

Intel Itanium 2 processor 9050-based server (4 users)

CFP2000 Result

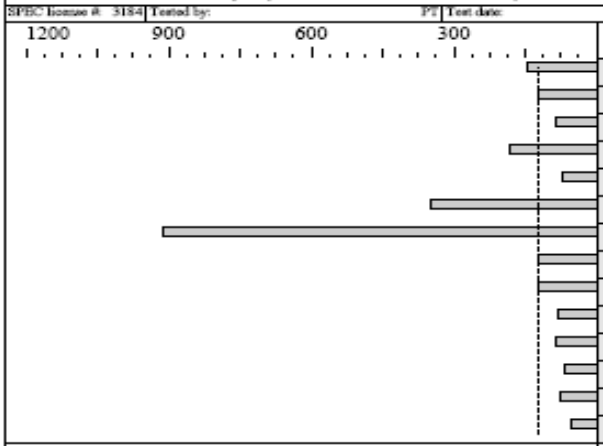
Hitachi

Hitachi Cold Fusion 3e (DC, 1.60GHz/24MB Itanium 2, FSB 400MHz)

SPECfp_rate2000 = --

SPECfp_rate_base2000 = 122

SPEC license #: 3184 | Tested by: | PT | Test date: Aug-2006 | Hardware Avail: | Software Avail: Aug-2006



Benchmark	Base Copies	Base Runtime	Base Ratio	Copies	Runtime	Ratio
168.wupwise	4	51.8	143			
171.swim	4	119	120			
172.mgrid	4	100.0	83.5			
173.applu	4	53.7	181			
177.mesa	4	93.1	69.8			
178.galgel	4	38.6	349			
179.art	4	13.2	911			
183.equake	4	48.6	124			
187.facerec	4	72.6	121			
188.ammp	4	125	81.4			
189.lucas	4	109	85.1			
191.fma3d	4	144	67.5			
200.sixtrack	4	68.4	74.6			
301.apsi	4	231	52.2			

Hardware

CPU:	Intel Itanium 2 Dual-Core 1600 MHz
CPU MHz:	1600
FPU:	Integrated
CPU(s) enabled:	8 cores, 4 chips, 2 cores/chip (Multi Threading disabled)
CPU(s) orderable:	2,4,8,16
Parallel:	No
Primary Cache:	16KBI + 16KBD on chip, per core
Secondary Cache:	1MBI + 256KBD on chip, per core
L3 Cache:	12.0MB(I+D) on chip, per core
Other Cache:	N/A
Memory:	32GB (1GB DIMM x 32)
Disk Subsystem:	1 x 73GB SATA HDD
Other Hardware:	None

Software

Operating System:	Red Hat Enterprise Linux AS 4 update 4
Compiler:	Intel(R) Fortran Compiler for Linux 9.1.040 (Build 20061105) Intel(R) C++ Compiler for Linux 9.1.045 (Build 20061105)
File System:	ext3
System State:	Multi-user run level 3

Notes/Tuning Information

```
Tested by Principled Technologies
 Base tuning flags:
  Fortran : -fast -IPF_fp_relaxed +FDO
        C : -fast -ansi_alias -IPF_fp_relaxed +FDO
 +FDO: PASS1=-prof_gen  PASS2=-prof_use

 Portability flags:
  178.galgel : -FI

 Multi Threading disabled by EFI firmware.
```

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http://www.spec.org/

Intel Itanium 2 processor 9050-based server (8 users)

CFP2000 Result

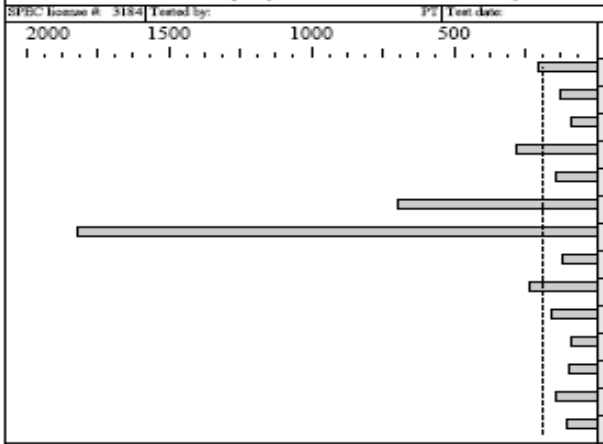
Hitachi

Hitachi Cold Fusion 3e (DC, 1.60GHz/24MB Itanium 2, FSB 400MHz)

SPECfp_rate2000 = --

SPECfp_rate_base2000 = 188

SPEC license #: 3184 | Tested by: | PT | Test date: Aug-2006 | Hardware Avail: | Software Avail: Aug-2006



Benchmark	Base Copies	Base Runtime	Base Ratio	Copies	Runtime	Ratio
168.wupwise	8	73.1	203			
171.swim	8	231	124			
172.mgrid	8	182	91.7			
173.applu	8	70.1	278			
177.mesa	8	93.0	140			
178.galgel	8	38.8	694			
179.art	8	13.2	1822			
183.equake	8	98.1	123			
187.facerec	8	75.8	233			
188.ammp	8	127	161			
189.lucas	8	203	91.5			
191.fma3d	8	200	97.2			
200.sixtrack	8	70.1	146			
301.apsi	8	240	100			

Hardware

CPU:	Intel Itanium 2 Dual-Core 1600 MHz
CPU MHz:	1600
FPU:	Integrated
CPU(s) enabled:	8 cores, 4 chips, 2 cores/chip (Multi Threading disabled)
CPU(s) orderable:	2,4,8,16
Parallel:	No
Primary Cache:	16KBI + 16KBD on chip, per core
Secondary Cache:	1MBI + 256KBD on chip, per core
L3 Cache:	12.0MB(I+D) on chip, per core
Other Cache:	N/A
Memory:	32GB (1GB DIMM x 32)
Disk Subsystem:	1 x 73GB SATA HDD
Other Hardware:	None

Software

Operating System:	Red Hat Enterprise Linux AS 4 update 4
Compiler:	Intel(R) Fortran Compiler for Linux 9.1.040 (Build 20061105) Intel(R) C++ Compiler for Linux 9.1.045 (Build 20061105)
File System:	ext3
System State:	Multi-user run level 3

Notes/Tuning Information

```
Tested by Principled Technologies
 Base tuning flags:
  Fortran : -fast -IPF_fp_relaxed +FDO
        C : -fast -ansi_alias -IPF_fp_relaxed +FDO
 +FDO: PASS1=-prof_gen  PASS2=-prof_use

 Portability flags:
  178.galgel : -FI

 Multi Threading disabled by EFI firmware.
```

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Intel Itanium 2 processor 9050-based server (16 users)

CFP2000 Result

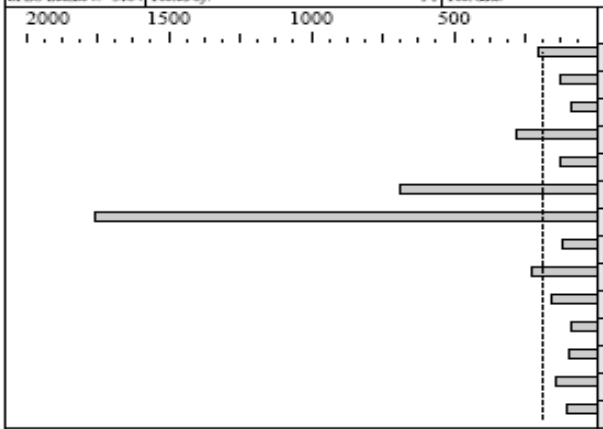
Hitachi

Hitachi Cold Fusion 3e (DC, 1.60GHz/24MB Itanium 2, FSB 400MHz)

SPECfp_rate2000 = --

SPECfp_rate_base2000 = 185

SPEC license #: 3184 | Tested by: | Test date: Aug-2006 | Hardware Avail: | Software Avail: Aug-2006



Benchmark	Base Copies	Base Runtime	Base Ratio	Copies	Runtime	Ratio
168.wupwise	16	146	204			
171.swim	16	463	124			
172.mgrid	16	364	91.7			
173.applu	16	140	279			
177.mesa	16	201	129			
178.galgel	16	78.4	687			
179.art	16	27.4	1759			
183.equake	16	197	122			
187.facerec	16	157	224			
188.ammp	16	258	158			
189.lucas	16	407	91.1			
191.fma3d	16	409	95.2			
200.sixtrack	16	146	140			
301.apsi	16	470	103			

Hardware

CPU:	Intel Itanium 2 Dual-Core 1600 MHz
CPU MHz:	1600
FPU:	Integrated
CPU(s) enabled:	8 cores, 4 chips, 2 cores/chip (Multi Threading disabled)
CPU(s) orderable:	2,4,8,16
Parallel:	No
Primary Cache:	16KBI + 16KBD on chip, per core
Secondary Cache:	1MBI + 256KBD on chip, per core
L3 Cache:	12.0MB(I+D) on chip, per core
Other Cache:	N/A
Memory:	32GB (1GB DIMM x 32)
Disk Subsystem:	1 x 73GB SATA HDD
Other Hardware:	None

Software

Operating System:	Red Hat Enterprise Linux AS 4 update 4
Compiler:	Intel(R) Fortran Compiler for Linux 9.1.040 (Build 20061105) Intel(R) C++ Compiler for Linux 9.1.045 (Build 20061105)
File System:	ext3
System State:	Multi-user run level 3

Notes/Tuning Information

```
Tested by Principled Technologies
 Base tuning flags:
  Fortran : -fast -IPF_fp_relaxed +FDO
        C : -fast -ansi_alias -IPF_fp_relaxed +FDO
 +FDO: PASS1=-prof_gen  PASS2=-prof_use

 Portability flags:
  178.galgel : -FI

 Multi Threading disabled by EFI firmware.
```

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Appendix D – SPECint configuration files

This appendix contains the SPECint benchmark configuration files we used to test the servers.

IBM System p5 550Q POWER5+ processor-based server

```
# Invocation command line:
# /usr/cpu2000/bin/runspec -c p5_int.cfg -r -u 16 -T base int
##############################################################################
# Invocation command line:
# /spec/cpu2000/bin/runspec -v 10 -r -u 16 -c B70++.submit.cfg -n 3 -T all -i ref int
##############################################################################
# Invocation command line:
# /spec/cpu2000/bin/runspec -v 10 -r -u 4 -c L4+.publish.cfg -n 3 -T all -i ref fp
##############################################################################
##############################################################################
##############################################################################
##############################################################################################################
#
#       Config-file to benchmark the .... with the SPEC cpu2000 V1.3 suite.
#
##############################################################################################################

#
# Global options for runspec
#
runlist               = all
action                = validate
iterations            = 3
output_format         = all
ignore_errors         = 0
reportable            = 1
mean_anyway           = 1
size                  = ref
tune                  = base,peak
ext                   = 570
env_vars              = 1
deletework            = 0

#       For rate-runs, invoke with "-r -u $USERS".

#
#       The following commands cause the process thread to bind to a corresponding
#       CPU. This improves performance by removing the overhead of threads "drifting"
#       between CPU's.
#
#       The form below causes threads to bind to even-numbered CPU's if there are
#       half as many threads as CPU's. Otherwise the remaining threads bind to the
#       odd-numbered CPU's. This is to ensure 1 thread per core if SMT is anabled.
#       In this example there are 8 CPU's labeled [0..3].
#
#submit = bindprocessor \$\$ \$SPECUSERNUM; $command
submit = let "MYCPU=2*\$SPECUSERNUM"; if (("\$MYCPU > 15")) then let "MYCPU-=15"; fi; bindprocessor \$\$
\$MYCPU; $command
use_submit_for_speed = 1



#
#============================================================================
# How the compilers are called
#============================================================================
# To remove all the warning messages that are put out, you can append the following
#   compile time message suppression flag to the compiler invocation lines:
#
#               -w -qinfo=noinl -qsuppress=1500-036
#
#   To suppress the Fortran function compilation messages, add to the FC/F77/FXLF
#       lines:
```

```
#              -qsuppress=cmpmsg
#
#
#       To speed builds with ipa, use "-qipa=noobject" to suppress code generation
#       until the final IPA link step.
#       To speed builds with ipa, use "-qipa=threads:n" to direct ipa to use n threads.
#============================================================================
#
C_COMPILER =
F_COMPILER =


int=default=default=default:
CC    = ${C_COMPILER}/usr/vac/bin/cc
CCXLC = ${C_COMPILER}/usr/vac/bin/xlc
CXX   = ${C_COMPILER}/usr/vacpp/bin/xlC


fp=default=default=default:
CC    = ${C_COMPILER}/usr/vac/bin/xlc
FC    = ${F_COMPILER}/usr/bin/xlf90
F77   = ${F_COMPILER}/usr/bin/xlf90
FXLF  = ${F_COMPILER}/usr/bin/xlf









#
#       The next line set up parallel make, the value of j is the number of threads.
#
#makeflags = -j8
#
#       galgel & facerec do not have dependency rules to allow parallel make's. The
#       easiest way to handle them is to add "makeflags = -j1" to their portability

#       flags section.
#


#
#
#       SPECint2000 portability flags. These are required to make the programs
#       work with the given compilers and are not optimizations.
#
164.gzip=default=default=default:

175.vpr=default=default=default:

176.gcc=default=default=default:
EXTRA_CFLAGS=-ma -DHOST_WORDS_BIG_ENDIAN

181.mcf=default=default=default:

186.crafty=default=default=default:
EXTRA_CFLAGS=-DAIX

197.parser=default=default=default:

252.eon=default=default=default:

253.perlbmk=default=default=default:
EXTRA_CFLAGS=-DSPEC_CPU2000_AIX

254.gap=default=default=default:
EXTRA_CFLAGS=-DSYS_IS_BSD -DSYS_STRING_H -DSYS_HAS_MALLOC_PROTO -DSYS_HAS_CALLOC_PROTO

255.vortex=default=default=default:
```

```
256.bzip2=default=default=default:

300.twolf=default=default=default:
EXTRA_CFLAGS=-DHAVE_SIGNED_CHAR



#
#       SPECint2000 base-level optimizations. These confirm to a 4-flag
#       count. Note that the flags vary between languages (C & C++ in
#       this case).
#
int=base=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS    = -qpdf1 -O5 -blpdata -D_ILS_MACROS
PASS1_LDCFLAGS  = -qpdf1 -O5 -blpdata -D_ILS_MACROS
PASS2_CFLAGS    = -qpdf2 -O5 -blpdata -D_ILS_MACROS
PASS2_LDCFLAGS  = -qpdf2 -O5 -blpdata -D_ILS_MACROS


#
#       Combination used with "eon" (i.e. C++ base).
#
252.eon=base=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vacpp/bin/cleanpdf
PASS1_CXXFLAGS = -qpdf1 -O4 -qalign=natural
PASS1_LDCXXFLAGS= -qpdf1 -O4 -qalign=natural
PASS2_CXXFLAGS = -qpdf2 -O4 -qalign=natural
PASS2_LDCXXFLAGS= -qpdf2 -O4 -qalign=natural


#
#
#       SPECint2000 peak-level optimizations.
#
164.gzip=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS    = -qpdf1 -O4 -qfdpr -blpdata
PASS1_LDCFLAGS  = -qpdf1 -O4 -qfdpr -blpdata
PASS2_CFLAGS    = -qpdf2 -O4 -qfdpr -blpdata
PASS2_LDCFLAGS  = -qpdf2 -O4 -qfdpr -blpdata

fdo_run2        = fdpr -q -O3 -p $commandexe -x $command
fdo_post2       = cp ${baseexe}.fdpr $baseexe



175.vpr=peak=default=default:
basepeak=1




176.gcc=peak=default=default:
basepeak=1



181.mcf=peak=default=default:
fdo_pre0          = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS     = -qpdf1 -O5 -blpdata -qalign=natural -qhot=arraypad -qfdpr -Q -qmaxmem=-1
PASS1_LDCFLAGS   = -qpdf1 -O5 -blpdata -qalign=natural -qhot=arraypad -qfdpr -Q -qmaxmem=-1
PASS2_CFLAGS     = -qpdf2 -O5 -blpdata -qalign=natural -qhot=arraypad -qfdpr -Q -qmaxmem=-1
PASS2_LDCFLAGS   = -qpdf2 -O5 -blpdata -qalign=natural -qhot=arraypad -qfdpr -Q -qmaxmem=-1
fdo_run2         = fdpr -q -O3 -p $commandexe -x $command
fdo_post2        = cp ${baseexe}.fdpr $baseexe
```

```
186.crafty=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS   = -qpdf1 -O4 -qalign=natural -q64 -lhmu -blpdata
PASS1_LDCFLAGS = -qpdf1 -O4 -qalign=natural -q64 -lhmu -blpdata
PASS2_CFLAGS   = -qpdf2 -O4 -qalign=natural -q64 -lhmu -blpdata
PASS2_LDCFLAGS = -qpdf2 -O4 -qalign=natural -q64 -lhmu -blpdata



197.parser=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS   = -qpdf1 -O4 -qfdpr -D_ILS_MACROS -blpdata
PASS1_LDCFLAGS = -qpdf1 -O4 -qfdpr -D_ILS_MACROS -blpdata
PASS2_CFLAGS   = -qpdf2 -O4 -qfdpr -D_ILS_MACROS -blpdata
PASS2_LDCFLAGS = -qpdf2 -O4 -qfdpr -D_ILS_MACROS -blpdata

fdo_run2        = fdpr -q -O3 -p $commandexe -x $command
fdo_post2       = cp ${baseexe}.fdpr $baseexe



252.eon=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CXXFLAGS      = -qpdf1 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural
PASS1_LDCXXFLAGS    = -qpdf1 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural
PASS2_CXXFLAGS      = -qpdf2 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural
PASS2_LDCXXFLAGS    = -qpdf2 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural



253.perlbmk=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS   = -qpdf1 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata -lhmu
PASS1_LDCFLAGS = -qpdf1 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata -lhmu
PASS2_CFLAGS   = -qpdf2 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata -lhmu
PASS2_LDCFLAGS = -qpdf2 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata -lhmu



254.gap=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS    = -qpdf1 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata
PASS1_LDCFLAGS  = -qpdf1 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata
PASS2_CFLAGS    = -qpdf2 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata
PASS2_LDCFLAGS  = -qpdf2 -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata



255.vortex=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS   = -qpdf1 -O4 -qfdpr -lhmu -blpdata
PASS1_LDCFLAGS = -qpdf1 -O4 -qfdpr -lhmu -blpdata
PASS2_CFLAGS   = -qpdf2 -O4 -qfdpr -lhmu -blpdata
PASS2_LDCFLAGS = -qpdf2 -O4 -qfdpr -lhmu -blpdata

fdo_run2        = fdpr -q -O3 -p $commandexe -x $command
fdo_post2       = cp ${baseexe}.fdpr $baseexe



256.bzip2=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS   = -qpdf1 -O5 -qfdpr -blpdata
PASS1_LDCFLAGS = -qpdf1 -O5 -qfdpr -blpdata
PASS2_CFLAGS   = -qpdf2 -O5 -qfdpr -blpdata
PASS2_LDCFLAGS = -qpdf2 -O5 -qfdpr -blpdata

fdo_run2        = fdpr -q -O3 -p $commandexe -x $command
fdo_post2       = cp ${baseexe}.fdpr $baseexe
```

```
300.twolf=peak=default=default:
COPTIMIZE       = -O5 -qfdpr -blpdata

fdo_run2        = fdpr -q -O3 -p $commandexe -x $command
fdo_post2       = cp ${baseexe}.fdpr $baseexe


#
#
#       Notes for the Integer benchmarks.
#
int=default=default=default:
notes000=  Portability Flags:
notes005=    176.gcc:      -ma -DHOST_WORDS_BIG_ENDIAN
notes010=    186.crafty:   -DAIX
notes025=    253.perlbmk:  -DSPEC_CPU2000_AIX
notes030=    254.gap:      -DSYS_IS_BSD -DSYS_STRING_H
notes035=                  -DSYS_HAS_MALLOC_PROTO -DSYS_HAS_CALLOC_PROTO
notes040=    300.twolf:    -DHAVE_SIGNED_CHAR
notes045=
notes050=  Base Optimization Flags:
notes055=    C:    -qpdf1/pdf2
notes060=          -O5 -blpdata -D_ILS_MACROS
notes065=    C++:  -qpdf1/pdf2
notes070=          -O4 -qalign=natural
notes075=
notes080=  Peak Optimization Flags
notes085=    164.gzip:     -qpdf1/pdf2
notes090=                  -O4 -qfdpr -blpdata
notes095=                  fdpr -q -O3
notes100=    175.vpr:      -qpdf1/pdf2
notes105=                  -O5 -qfdpr -blpdata
notes110=                  fdpr -q -O3
notes115=    176.gcc:      -qpdf1/pdf2
notes120=                  -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata
notes125=    181.mcf:      -qpdf1/pdf2
notes127=                  -O4 -qalign=natural -blpdata
notes130=    186.crafty:   -qpdf1/pdf2
notes135=                  -O4 -qalign=natural -q64 -lhmu -blpdata
notes140=    197.parser:   -qpdf1/pdf2
notes145=                  -O4 -qfdpr -D_ILS_MACROS -blpdata
notes150=                  fdpr -q -O3
notes155=    252.eon:      -qpdf1/pdf2
notes160=                  -O4 -qalign=natural
notes165=    253.perlbmk:  -qpdf1/pdf2
notes170=                  -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata -lhmu
notes175=    254.gap:      -qpdf1/pdf2
notes180=                  -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata
notes185=    255.vortex:   -qpdf1/pdf2
notes190=                  -O4 -qfdpr -lhmu -blpdata
notes195=                  fdpr -q -O3
notes200=    256.bzip2:    -qpdf1/pdf2
notes205=                  -O5 -qfdpr -blpdata
notes210=                  fdpr -q -O3
notes215=    300.twolf:    -O5 -qfdpr -blpdata
notes225=                  fdpr -q -O3
notes230=


#
#
#       SPECfp2000 portability flags. These are required to make the programs
#       work with the given compilers and are not optimizations.
#
#       First, the F90 benchmarks:
#
178.galgel=default=default=default:
EXTRA_FFLAGS=-qfixed -qsuffix=f=f90

187.facerec=default=default=default:
```

```
EXTRA_FFLAGS=-qsuffix=f=f90

189.lucas=default=default=default:
EXTRA_FFLAGS=-qsuffix=f=f90

191.fma3d=default=default=default:
EXTRA_FFLAGS= -qsuffix=f=f90


#
#       The F77 benchmarks compile with FC for "base" and F77 for "peak", so
#       we need to assign the portability-flags differently between them.
#
168.wupwise=base=default=default:
EXTRA_FFLAGS   = -qfixed

168.wupwise=peak=default=default:
EXTRA_F77FLAGS = -qfixed

171.swim=base=default=default:
EXTRA_FFLAGS   = -qfixed

171.swim=peak=default=default:
EXTRA_F77FLAGS = -qfixed

172.mgrid=base=default=default:
EXTRA_FFLAGS   = -qfixed

172.mgrid=peak=default=default:
EXTRA_F77FLAGS = -qfixed

173.applu=base=default=default:
EXTRA_FFLAGS   = -qfixed

173.applu=peak=default=default:
EXTRA_F77FLAGS = -qfixed

200.sixtrack=base=default=default:
EXTRA_FFLAGS   = -qfixed

200.sixtrack=peak=default=default:
EXTRA_F77FLAGS = -qfixed

301.apsi=base=default=default:
EXTRA_FFLAGS   = -qfixed

301.apsi=peak=default=default:
EXTRA_F77FLAGS = -qfixed


#
#
#       SPECfp2000 base-level optimizations. These confirm to a 4-flag
#       count. Note that the flags vary between languages (C & Fortran
#       in this case). We also use feedback for C and not Fortran.
#
fp=base=default=default:
FOPTIMIZE         = -O5 -lhmu -blpdata -lmass
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS    = -qpdf1 -O5 -blpdata -qalign=natural
PASS1_LDCFLAGS  = -qpdf1 -O5 -blpdata -qalign=natural
PASS2_CFLAGS    = -qpdf2 -O5 -blpdata -qalign=natural
PASS2_LDCFLAGS  = -qpdf2 -O5 -blpdata -qalign=natural
feedback        = 0


177.mesa=base=default=default:
feedback        = 1

179.art=base=default=default:
feedback        = 1
```

```
183.equake=base=default=default:
feedback        = 1

188.ammp=base=default=default:
feedback        = 1



#
#
#       SPECfp2000 peak-level optimizations.
#
168.wupwise=peak=default=default:
F77OPTIMIZE         = -O5 -qsave -blpdata -lhmu -lmass



171.swim=peak=default=default:
basepeak=1



172.mgrid=peak=default=default:
PASS1_F77FLAGS    = -qpdf1 -O4 -qipa=partition=large -q64 -blpdata
PASS1_LDF77FLAGS  = -qpdf1 -O4 -qipa=partition=large -q64 -blpdata
PASS2_F77FLAGS    = -qpdf2 -O4 -qipa=partition=large -q64 -blpdata
PASS2_LDF77FLAGS  = -qpdf2 -O4 -qipa=partition=large -q64 -blpdata



173.applu=peak=default=default:
F77OPTIMIZE         = -O5 -qarch=pwr3 -qtune=pwr3 -qalign=struct=natural -qfdpr -q64 -blpdata
fdo_run1          = fdpr -q -O3 -p $commandexe -x $command
fdo_post1         = cp ${baseexe}.fdpr $baseexe



177.mesa=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
PASS1_CFLAGS      = -qpdf1 -O5 -qfdpr
PASS1_LDCFLAGS    = -qpdf1 -O5 -qfdpr
PASS2_CFLAGS      = -qpdf2 -O5 -qfdpr
PASS2_LDCFLAGS    = -qpdf2 -O5 -qfdpr

fdo_run2          = fdpr -q -O3 -p $commandexe -x $command
fdo_post2         = cp ${baseexe}.fdpr $baseexe



178.galgel=peak=default=default:


PASS1_FFLAGS      = -qpdf1 -O5 -qfdpr -qalign=struct=natural -lhmu -blpdata -lmass -qessl -lessl
PASS1_LDFFLAGS    = -qpdf1 -O5 -qfdpr -qalign=struct=natural -lhmu -blpdata -lmass -qessl -lessl
PASS2_FFLAGS      = -qpdf2 -O5 -qfdpr -qalign=struct=natural -lhmu -blpdata -lmass -qessl -lessl
PASS2_LDFFLAGS    = -qpdf2 -O5 -qfdpr -qalign=struct=natural -lhmu -blpdata -lmass -qessl -lessl

fdo_run2          = fdpr -q -O3 -p $commandexe -x $command
fdo_post2         = cp ${baseexe}.fdpr $baseexe



179.art=peak=default=default:

COPTIMIZE         = -O5 -lhmu -blpdata



183.equake=peak=default=default:
fdo_pre0        = ${C_COMPILER}/usr/vac/bin/cleanpdf
```

```
PASS1_CFLAGS    = -qpdf1 -O3 -qarch=auto -qtune=auto -qipa=level=2 -blpdata
PASS1_LDCFLAGS  = -qpdf1 -O3 -qarch=auto -qtune=auto -qipa=level=2 -blpdata
PASS2_CFLAGS    = -qpdf2 -O3 -qarch=auto -qtune=auto -qipa=level=2 -blpdata
PASS2_LDCFLAGS  = -qpdf2 -O3 -qarch=auto -qtune=auto -qipa=level=2 -blpdata



187.facerec=peak=default=default:
FOPTIMIZE         = -O5 -qsave -blpdata



188.ammp=peak=default=default:
COPTIMIZE         = -O5 -qalign=natural -qfdpr -blpdata -lhmu
fdo_run1          = fdpr -q -O3 -p $commandexe -x $command
fdo_post1         = cp ${baseexe}.fdpr $baseexe



189.lucas=peak=default=default:
FOPTIMIZE         = -O3 -qarch=auto -qtune=auto -qfdpr -blpdata -qessl -lessl
fdo_run1          = fdpr -q -O3 -p $commandexe -x $command
fdo_post1         = cp ${baseexe}.fdpr $baseexe



191.fma3d=peak=default=default:
PASS1_FFLAGS      = -qpdf1 -O3 -qarch=auto -qtune=auto -qipa=level=2 -q64 -lhmu -blpdata -lmass
PASS1_LDFFLAGS    = -qpdf1 -O3 -qarch=auto -qtune=auto -qipa=level=2 -q64 -lhmu -blpdata -lmass
PASS2_FFLAGS      = -qpdf2 -O3 -qarch=auto -qtune=auto -qipa=level=2 -q64 -lhmu -blpdata -lmass
PASS2_LDFFLAGS    = -qpdf2 -O3 -qarch=auto -qtune=auto -qipa=level=2 -q64 -lhmu -blpdata -lmass



200.sixtrack=peak=default=default:

F77OPTIMIZE         = -O3 -qarch=auto -qtune=auto -qfdpr
fdo_run1          = fdpr -q -O3 -p $commandexe -x $command
fdo_post1         = cp ${baseexe}.fdpr $baseexe



301.apsi=peak=default=default:
F77OPTIMIZE       = -O5


#
#
#       Notes for the Floating-Point benchmarks.
#
fp=default=default=default:
notes000=  Portability Flags:
notes005=       -qfixed used in:        168.wupwise, 171.swim, 172.mgrid, 173.applu,
notes010=                               178.galgel, 200.sixtrack, 301.apsi
notes015=       -qsuffix=f=f90 used in: 178.galgel, 187.facerec, 189.lucas, 191.fma3d
notes020=
notes025=  Base Optimization Flags:
notes030=    Fortran:    -O5 -lhmu -blpdata -lmass
notes035=    C:          -qpdf1/pdf2
notes040=                -O5 -blpdata -qalign=natural
notes045=
notes050=  Peak Optimization Flags
notes055=    168.wupwise:  -O5 -qsave -blpdata -lhmu -lmass
notes075=    171.swim:     basepeak=1
notes095=    172.mgrid:    -qpdf1/pdf2
notes100=                  -O4 -qipa=partition=large -q64 -blpdata
notes115=    173.applu:    -O5 -qarch=pwr3 -qtune=pwr3 -qalign=struct=natural -qfdpr -q64 -blpdata
notes120=                   fdpr -q -O3
notes135=    177.mesa:     -qpdf1/pdf2
```

```
notes140=                    -O5 -qfdpr
notes145=                    fdpr -q -O3
notes150=    178.galgel:    -qpdf1/pdf2
notes155=                   -O5 -qfdpr -lhmu -blpdata -lmass -qessl -lessl
notes160=                   fdpr -q -O3
notes175=    179.art:       -qpdf1/pdf2
notes180=                   -O5 -qhot=arraypad -Q -qalign=natural -blpdata -lhmu
notes195=    183.equake:    -qpdf1/pdf2
notes200=                   -O3 -qarch=auto -qtune=auto -qipa=level=2 -blpdata
notes215=    187.facerec:   -O5 -qsave -blpdata
notes235=    188.ammp:      -O5 -qalign=natural -qfdpr -blpdata -lhmu
notes240=                   fdpr -q -O3
notes255=    189.lucas:     -O3 -qarch=auto -qtune=auto -qfdpr -blpdata -qessl -lessl
notes260=                   fdpr -q -O3
notes275=    191.fma3d:     -qpdf1/pdf2
notes280=                   -O3 -qarch=auto -qtune=auto -qipa=level=2 -q64 -lhmu -blpdata -lmass
notes295=    200.sixtrack:  -qpdf1/pdf2
notes300=                   -O4 -qfdpr
notes305=                   fdpr -q -O3
notes310=    301.apsi:      -O5
notes315=


#
#
#       Global options for reports
#
default=default=default=default:

company_name   =IBM Corporation
license_num            =#11
tester_name            =IBM
test_site              =Austin, TX
test_date              =Dec-2005



#
#       Information you need to fill in for each platform.
#
hw_avail       =Feb-2006
hw_vendor      =IBM Corporation
hw_model       =IBM OpenPower 570 (2200 MHz, 4 CPU)
hw_cpu         =Power5+
hw_cpu_mhz     =2200
hw_fpu         =Integrated
hw_ncpu        =4 cores, 2 chips, 2 cores/chip (SMT on)
hw_ncpuorder=4,8,12,16
hw_pcache      =64KBI+32KBD (on chip)/core
hw_scache      =1920KB unified (on chip)/core
hw_tcache      =36MB unified (off-chip)/DCM, 2 DCM/SUT
hw_ocache      =None
hw_memory      =8x2GB
hw_disk        =1x73GB SCSI, 15K RPM
hw_other       =None
machine_name=peanut
hw_parallel    =no

sw_avail       =Feb-2006
sw_parallel    =no
sw_os          =AIX 5L V5.3
sw_compiler0   =XL C/C++ Enterprise Edition Version 8.0 for AIX
sw_compiler1   =XL Fortran Enterprise Edition Version 10.1 for AIX
sw_compiler2   =Other Software: ESSL 4.2.0.3
sw_file                =AIX/JFS2
sw_state               =Multi-user



#
#       Closing notes on the sytem configuration.
```

```
#
notes320=
notes330=  The installed OS level is AIX 5L for POWER version 5.3 with the 5300-04 Recommended
Maintenence package.
notes335=
notes340=  SMT:  Acronym for "Simultaneous Multi-Threading". A processor technology that allows
notes345=        the simultaneous execution of multiple thread contexts within a single processor
notes350=        core. (Enabled by default)
notes355=  DCM:  Acronym for "Dual-Chip Module" (one dual-core processor chip + one L3-cache chip)
notes360=  SUT:  Acronym for "System Under Test"
notes370=  ESSL: Engineering and Scientific Subroutine Library
notes375=
notes380=  Extended C:     IBM XL C for AIX invoked as cc
notes381=  ANSI C89:       IBM XL C for AIX invoked as xlc
notes385=  C++:            IBM XL C for AIX invoked as xlC
notes390=  Fortran 77:     IBM XL Fortran for AIX invoked as xlf90 unless explicitly reassigned
notes395=  Fortran 90:     IBM XL Fortran for AIX invoked as xlf
notes400=
notes405=  ulimits set to unlimited.
notes410=  Large page mode and memory affinity were set as follows:
int=default=default=default:
notes415=      vmo -r -o lgpg_regions=800 -o lgpg_size=16777216
fp=default=default=default:
notes415=      vmo -r -o lgpg_regions=800 -o lgpg_size=16777216
default=default=default=default:
notes420=      chuser capabilities=CAP_BYPASS_RAC_VMM,CAP_PROPAGATE $USER
notes425=      reboot -q
notes430=      export MEMORY_AFFINITY=MCM
notes435=
notes440=  The following config-file entry was used to assign each benchmark process to a core:
notes445=       submit = bindprocessor \$\$ \$SPECUSERNUM; $command
notes450=  The "bindprocessor" AIX command binds a process to a CPU core.
notes460=
```

Intel Itanium 2 processor 9050-based server

```
# Invocation command line:
# /cpu2000/bin/runspec --config=ColdFusion_rate --reportable --tune=base --rate --users=8 int
################################################################################
# SPEC2000 HITACHI IPF Linux64 config file for Itanium 2
# HITACHI Cold Fusion
# December 2006. Intel Compiler 9.1 for Linux64

license_num=3184
tester_name=PT
test_date=Aug-2006

company_name=Principled Technologies
hw_vendor=Hitachi
machine_name=Hitachi Cold Fusion 3e (DC, 1.60GHz/24MB Itanium 2, FSB 400MHz)
hw_model=Hitachi Cold Fusion 3e (DC, 1.60GHz/24MB Itanium 2, FSB 400MHz)
hw_cpu=Intel Itanium 2 Dual-Core 1600 MHz
hw_cpu_mhz=1600
hw_fpu=Integrated
hw_ncpu=8 cores, 4 chips, 2 cores/chip (Multi Threading disabled)
hw_ncpuorder= 2,4,8,16
hw_parallel=No
hw_pcache=16KBI + 16KBD on chip, per core
hw_scache=1MBI + 256KBD on chip, per core
hw_tcache=12.0MB(I+D) on chip, per core
hw_ocache=N/A
hw_memory=32GB (1GB DIMM x 32)
hw_disk= 1 x 73GB SATA HDD
hw_other=None
hw_avail=

sw_os=Red Hat Enterprise Linux AS 4 update 4
sw_file=ext3
sw_state=Multi-user run level 3
sw_avail=Aug-2006
```

```
ext=cpu2000.v1.3.ic91p.ipf.linux64.hitachi
action=validate
size=ref
tune=all
input=ref
teeout=yes
teerunout=yes;
feedback=1
check_md5=1

fp=default=default=default:
sw_compiler000=Intel(R) Fortran Compiler for Linux 9.1.040 (Build 20061105)
sw_compiler001=Intel(R) C++ Compiler for Linux 9.1.045 (Build 20061105)

int=default=default=default:
sw_compiler000=Intel(R) C++ Compiler for Linux 9.1.045 (Build 20061105)

default=default=default=default:
FC=ifort
F77=ifort
CC=icc
CXX=icpc

fp=base=default=default:
PASS1_FFLAGS=    -prof_gen
PASS2_FFLAGS=    -prof_use
PASS1_CFLAGS=    -prof_gen
PASS2_CFLAGS=    -prof_use
PASS1_LDFLAGS=   -prof_gen
PASS2_LDFLAGS=   -prof_use
FOPTIMIZE = -fast -IPF_fp_relaxed
COPTIMIZE = -fast -ansi_alias -IPF_fp_relaxed

fp=default=default=default:
notes010= Base tuning flags:
notes011=  Fortran : -fast -IPF_fp_relaxed +FDO
notes015=        C : -fast -ansi_alias -IPF_fp_relaxed +FDO
notes020= +FDO: PASS1=-prof_gen  PASS2=-prof_use
notes023=
notes025= Portability flags:
notes030=  178.galgel : -FI
notes035 =
notes040 = Multi Threading disabled by EFI firmware.

int=base=default=default:
PASS1_CXXFLAGS=    -prof_gen
PASS2_CXXFLAGS=    -prof_use
PASS1_CFLAGS=    -prof_gen
PASS2_CFLAGS=    -prof_use
PASS1_LDFLAGS=   -prof_gen
PASS2_LDFLAGS=   -prof_use
CXXOPTIMIZE = -fast -auto_ilp32 -IPF_fp_relaxed
COPTIMIZE = -fast -auto_ilp32

int=default=default=default:
notes010 = Base tuning flags:
notes015 =      C   : -fast -auto_ilp32 +FDO
notes020 =      C++ : -fast -auto_ilp32 -IPF_fp_relaxed +FDO
notes025 =
notes030 = +FDO: PASS1=-prof_gen  PASS2=-prof_use
notes035 =
notes040 = Portability flags:
notes045 =   176.gcc: -DSPEC_CPU2000_LP64 -Dalloca=_alloca
notes050 =   186.crafty: -DLINUX_i386
notes055 =   252.eon: -DSPEC_CPU2000_LP64 -DHAS_ERRLIST fmax_errno src.alt
notes060 =   253.perlbmk: -DSPEC_CPU2000_LP64 -DSPEC_CPU2000_NEED_BOOL
notes065 =               -DSPEC_CPU2000_LINUX_IA64 -DSPEC_CPU2000_GLIBC22
notes070 =   254.gap: -DSPEC_CPU2000_LP64 -DSYS_HAS_CALLOC_PROTO -DSYS_IS_USG
notes075 =            -DSYS_HAS_IOCTL_PROTO -DSYS_HAS_TIME_PROTO -DSYS_HAS_SIGNAL_PROTO
notes076 =            -include unistd.h
```

```
notes080 =   255.vortex: -DSPEC_CPU2000_LP64 closed_files src.alt
notes085 =   300.twolf: stdfree src.alt
notes090 =
notes095 = Multi Threading disabled by EFI firmware.

#
#       int flags
#
176.gcc=default=default=default:
CPORTABILITY = -DSPEC_CPU2000_LP64 -Dalloca=_alloca

186.crafty=default=default=default:
CPORTABILITY =   -DLINUX_i386

252.eon=default=default=default:
CXXPORTABILITY = -DSPEC_CPU2000_LP64 -DHAS_ERRLIST
# Enable 252.eon errno src.alt
srcalt=fmax_errno

253.perlbmk=default=default=default:
CPORTABILITY = -DSPEC_CPU2000_LP64 -DSPEC_CPU2000_NEED_BOOL -DSPEC_CPU2000_LINUX_IA64 -
DSPEC_CPU2000_GLIBC22

254.gap=default=default=default:
CPORTABILITY = -include unistd.h -DSPEC_CPU2000_LP64 -DSYS_HAS_CALLOC_PROTO -DSYS_IS_USG -
DSYS_HAS_IOCTL_PROTO -DSYS_HAS_TIME_PROTO -DSYS_HAS_SIGNAL_PROTO

255.vortex=default=default=default:
CPORTABILITY = -DSPEC_CPU2000_LP64
srcalt=closed_files

300.twolf=default=default=default:
srcalt=stdfree

#
#       fp flags
#
178.galgel=default=default=default:
FPORTABILITY= -FI
```

Appendix E – SPECint output

This appendix provides the output of the SPECint benchmark for the tests with 4, 8, and 16 users on each test server.

IBM System p5 550Q POWER5+ processor-based server (4 users)

CINT2000 Result

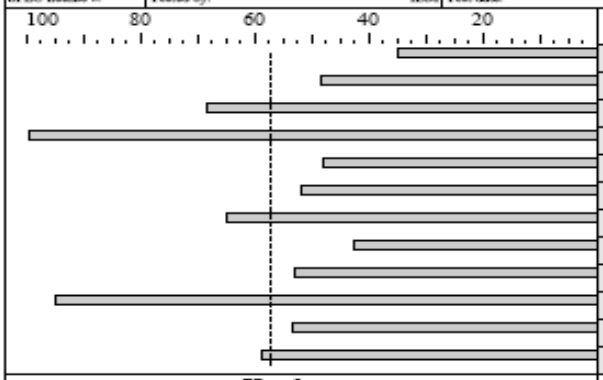
IBM Corporation

IBM OpenPower 570 (2200 MHz, 4 CPU)

SPECint_rate2000 = --

SPECint_rate_base2000 = 57.2

SPEC license # | Tested by: IBM | Test date: Dec-2005 | Hardware Avail: Feb-2006 | Software Avail: Feb-2006



Benchmark	Base Copies	Base Runtime	Base Ratio	Copies	Runtime	Ratio
164.gzip	4	186	34.9			
175.vpr	4	135	48.1			
176.gcc	4	74.9	68.1			
181.mcf	4	84.2	99.2			
186.crafty	4	96.6	48.1			
197.parser	4	161	51.7			
252.eon	4	92.9	64.9			
253.perlbmk	4	196	42.7			
254.gap	4	96.8	52.7			
255.vortex	4	92.9	94.9			
256.bzip2	4	131	53.2			
300.twolf	4	238	58.5			

Hardware

CPU:	Power5+
CPU MHz:	2200
FPU:	Integrated
CPU(s) enabled:	4 cores, 2 chips, 2 cores/chip (SMT on)
CPU(s) orderable:	4,8,12,16
Parallel:	no
Primary Cache:	64KBI+32KBD (on chip)/core
Secondary Cache:	1920KB unified (on chip)/core
L3 Cache:	36MB unified (off-chip)/DCM, 2 DCM/SUT
Other Cache:	None
Memory:	8x2GB
Disk Subsystem:	1x73GB SCSI, 15K RPM
Other Hardware:	None

Software

Operating System:	AIX 5L V5.3
Compiler:	XL C/C++ Enterprise Edition Version 8.0 for AIX XL Fortran Enterprise Edition Version 10.1 for AIX Other Software: ESSL 4.2.0.3
File System:	AIX/JFS2
System State:	Multi-user

Notes/Tuning Information

```
Portability Flags:
  176.gcc:      -ma -DHOST_WORDS_BIG_ENDIAN
  186.crafty:   -DAIX
  253.perlbmk:  -DSPEC_CPU2000_AIX
  254.gap:      -DSYS_IS_BSD -DSYS_STRING_H
                -DSYS_HAS_MALLOC_PROTO -DSYS_HAS_CALLOC_PROTO
  300.twolf:    -DHAVE_SIGNED_CHAR

Base Optimization Flags:
  C:    -qpdf1/pdf2
        -O5 -blpdata -D_ILS_MACROS
  C++:  -qpdf1/pdf2
        -O4 -qalign=natural

Peak Optimization Flags
  164.gzip:     -qpdf1/pdf2
                -O4 -qfdpr -blpdata
                fdpr -q -O3
  175.vpr:      -qpdf1/pdf2
                -O5 -qfdpr -blpdata
```

Standard Performance Evaluation Corporation
info@spec.org
http://www.spec.org/

CINT2000 Result

IBM Corporation

IBM OpenPower 570 (2200 MHz, 4 CPU)

SPECint_rate2000 = --

SPECint_rate_base2000 = 57.2

SPEC license # | Tested by: IBM | Test date: Dec-2005 | Hardware Avail: Feb-2006 | Software Avail: Feb-2006

Notes/Tuning Information (Continued)

```
                fdpr -q -O3
   176.gcc:     -qpdf1/pdf2
                -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata
   181.mcf:     -qpdf1/pdf2
                -O4 -qalign=natural -blpdata
   186.crafty:  -qpdf1/pdf2
                -O4 -qalign=natural -q64 -lhmu -blpdata
   197.parser:  -qpdf1/pdf2
                -O4 -qfdpr -D_ILS_MACROS -blpdata
                fdpr -q -O3
   252.eon:     -qpdf1/pdf2
                -O4 -qalign=natural
   253.perlbmk: -qpdf1/pdf2
                -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata -lhmu
   254.gap:     -qpdf1/pdf2
                -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata
   255.vortex:  -qpdf1/pdf2
                -O4 -qfdpr -lhmu -blpdata
                fdpr -q -O3
   256.bzip2:   -qpdf1/pdf2
                -O5 -qfdpr -blpdata
                fdpr -q -O3
   300.twolf:   -O5 -qfdpr -blpdata
                fdpr -q -O3

The installed OS level is AIX 5L for POWER version 5.3 with the 5300-04 Recommended Maintenance package.

SMT:  Acronym for "Simultaneous Multi-Threading". A processor technology that allows
      the simultaneous execution of multiple thread contexts within a single processor
      core. (Enabled by default)
DCM:  Acronym for "Dual-Chip Module" (one dual-core processor chip + one L3-cache chip)
SUT:  Acronym for "System Under Test"
ESSL: Engineering and Scientific Subroutine Library

Extended C:     IBM XL C for AIX invoked as cc
ANSI C89:       IBM XL C for AIX invoked as xlc
C++:            IBM XL C for AIX invoked as xlC
Fortran 77:     IBM XL Fortran for AIX invoked as xlf90 unless explicitly reassigned
Fortran 90:     IBM XL Fortran for AIX invoked as xlf

ulimits set to unlimited.
Large page mode and memory affinity were set as follows:
    vmo -r -o lgpg_regions=800 -o lgpg_size=16777216
    chuser capabilities=CAP_BYPASS_RAC_VMM,CAP_PROPAGATE $USER
    reboot -q
    export MEMORY_AFFINITY=MCM

The following config-file entry was used to assign each benchmark process to a core:
     submit = bindprocessor \$\$ \$SPECUSERNUM; $command
The "bindprocessor" AIX command binds a process to a CPU core.
```

Standard Performance Evaluation Corporation
info@spec.org
http://www.spec.org/

IBM System p5 550Q POWER5+ processor-based server (8 users)

CINT2000 Result

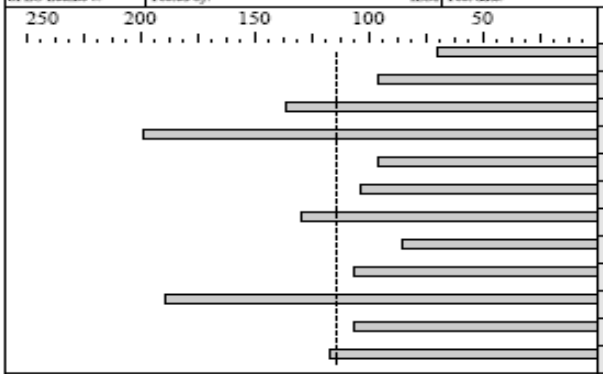
IBM Corporation

IBM OpenPower 570 (2200 MHz, 4 CPU)

SPECint_rate2000 = --

SPECint_rate_base2000 = 114

SPEC license #: | Tested by: IBM | Test date: Dec-2005 | Hardware Avail: Feb-2006 | Software Avail: Feb-2006



Benchmark	Base Copies	Base Runtime	Base Ratio	Copies	Runtime	Ratio
164.gzip	8	186	69.8			
175.vpr	8	136	95.8			
176.gcc	8	75.1	136			
181.mcf	8	84.0	199			
186.crafty	8	96.7	96.0			
197.parser	8	162	103			
252.eon	8	93.0	130			
253.perlbmk	8	196	85.2			
254.gap	8	96.0	106			
255.vortex	8	93.3	189			
256.bzip2	8	131	107			
300.twolf	8	238	117			

Hardware

CPU:	Power5+
CPU MHz:	2200
FPU:	Integrated
CPU(s) enabled:	4 cores, 2 chips, 2 cores/chip (SMT on)
CPU(s) orderable:	4,8,12,16
Parallel:	no
Primary Cache:	64KBI+32KBD (on chip)/core
Secondary Cache:	1920KB unified (on chip)/core
L3 Cache:	36MB unified (off-chip)/DCM, 2 DCM/SUT
Other Cache:	None
Memory:	8x2GB
Disk Subsystem:	1x73GB SCSI, 15K RPM
Other Hardware:	None

Software

Operating System:	AIX 5L V5.3
Compiler:	XL C/C++ Enterprise Edition Version 8.0 for AIX XL Fortran Enterprise Edition Version 10.1 for AIX Other Software: ESSL 4.2.0.3
File System:	AIX/JFS2
System State:	Multi-user

Notes/Tuning Information

```
Portability Flags:
  176.gcc:       -ma -DHOST_WORDS_BIG_ENDIAN
  186.crafty:    -DAIX
  253.perlbmk:   -DSPEC_CPU2000_AIX
  254.gap:       -DSYS_IS_BSD -DSYS_STRING_H
                 -DSYS_HAS_MALLOC_PROTO -DSYS_HAS_CALLOC_PROTO
  300.twolf:     -DHAVE_SIGNED_CHAR

Base Optimization Flags:
  C:     -qpdf1/pdf2
         -O5 -blpdata -D_ILS_MACROS
  C++:   -qpdf1/pdf2
         -O4 -qalign=natural

Peak Optimization Flags
  164.gzip:      -qpdf1/pdf2
                 -O4 -qfdpr -blpdata
                 fdpr -q -O3
  175.vpr:       -qpdf1/pdf2
                 -O5 -qfdpr -blpdata
```

CINT2000 Result

IBM Corporation

IBM OpenPower 570 (2200 MHz, 4 CPU)

SPECint_rate2000 = --

SPECint_rate_base2000 = 114

SPEC license #	Tested by:	IBM	Test date:	Dec-2005	Hardware Avail:	Feb-2006	Software Avail:	Feb-2006

Notes/Tuning Information (Continued)

```
                fdpr -q -O3
   176.gcc:     -qpdf1/pdf2
                -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata
   181.mcf:     -qpdf1/pdf2
                -O4 -qalign=natural -blpdata
   186.crafty:  -qpdf1/pdf2
                -O4 -qalign=natural -q64 -lhmu -blpdata
   197.parser:  -qpdf1/pdf2
                -O4 -qfdpr -D_ILS_MACROS -blpdata
                fdpr -q -O3
   252.eon:     -qpdf1/pdf2
                -O4 -qalign=natural
   253.perlbmk: -qpdf1/pdf2
                -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata -lhmu
   254.gap:     -qpdf1/pdf2
                -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata
   255.vortex:  -qpdf1/pdf2
                -O4 -qfdpr -lhmu -blpdata
                fdpr -q -O3
   256.bzip2:   -qpdf1/pdf2
                -O5 -qfdpr -blpdata
                fdpr -q -O3
   300.twolf:   -O5 -qfdpr -blpdata
                fdpr -q -O3


The installed OS level is AIX 5L for POWER version 5.3 with the 5300-04 Recommended Maintenance package.

SMT:  Acronym for "Simultaneous Multi-Threading". A processor technology that allows
      the simultaneous execution of multiple thread contexts within a single processor
      core. (Enabled by default)
DCM:  Acronym for "Dual-Chip Module" (one dual-core processor chip + one L3-cache chip)
SUT:  Acronym for "System Under Test"
ESSL: Engineering and Scientific Subroutine Library

Extended C:     IBM XL C for AIX invoked as cc
ANSI C89:       IBM XL C for AIX invoked as xlc
C++:            IBM XL C for AIX invoked as xlC
Fortran 77:     IBM XL Fortran for AIX invoked as xlf90 unless explicitly reassigned
Fortran 90:     IBM XL Fortran for AIX invoked as xlf

ulimits set to unlimited.
Large page mode and memory affinity were set as follows:
    vmo -r -o lgpg_regions=800 -o lgpg_size=16777216
    chuser capabilities=CAP_BYPASS_RAC_VMM,CAP_PROPAGATE $USER
    reboot -q
    export MEMORY_AFFINITY=MCM

The following config-file entry was used to assign each benchmark process to a core:
     submit = bindprocessor \$\$ \$SPECUSERNUM; $command
The "bindprocessor" AIX command binds a process to a CPU core.
```

IBM System p5 550Q POWER5+ processor-based server (16 users)

CINT2000 Result

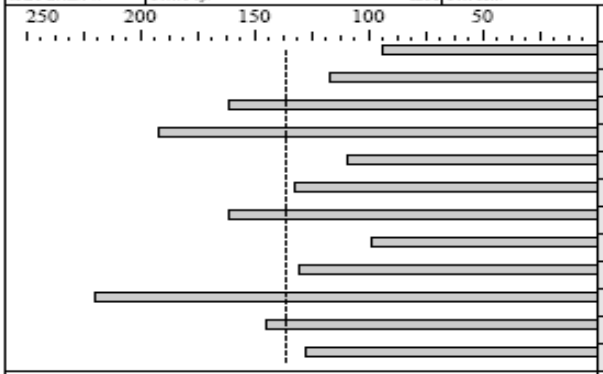
IBM Corporation

IBM OpenPower 570 (2200 MHz, 4 CPU)

SPECint_rate2000 = --

SPECint_rate_base2000 = 136

SPEC license #: | Tested by: IBM | Test date: Dec-2005 | Hardware Avail: Feb-2006 | Software Avail: Feb-2006



Benchmark	Base Copies	Base Runtime	Base Ratio	Copies	Runtime	Ratio
164.gzip	16	277	93.9			
175.vpr	16	223	117			
176.gcc	16	127	161			
181.mcf	16	174	192			
186.crafty	16	170	109			
197.parser	16	253	132			
252.eon	16	150	161			
253.perlbmk	16	339	98.6			
254.gap	16	156	131			
255.vortex	16	161	219			
256.bzip2	16	192	145			
300.twolf	16	438	127			

Hardware

CPU:	Power5+
CPU MHz:	2200
FPU:	Integrated
CPU(s) enabled:	4 cores, 2 chips, 2 cores/chip (SMT on)
CPU(s) orderable:	4,8,12,16
Parallel:	no
Primary Cache:	64KBI+32KBD (on chip)/core
Secondary Cache:	1920KB unified (on chip)/core
L3 Cache:	36MB unified (off-chip)/DCM, 2 DCM/SUT
Other Cache:	None
Memory:	8x2GB
Disk Subsystem:	1x73GB SCSI, 15K RPM
Other Hardware:	None

Software

Operating System:	AIX 5L V5.3
Compiler:	XL C/C++ Enterprise Edition Version 8.0 for AIX XL Fortran Enterprise Edition Version 10.1 for AIX Other Software: ESSL 4.2.0.3
File System:	AIX/JFS2
System State:	Multi-user

Notes/Tuning Information

```
Portability Flags:
  176.gcc:       -ma -DHOST_WORDS_BIG_ENDIAN
  186.crafty:    -DAIX
  253.perlbmk:   -DSPEC_CPU2000_AIX
  254.gap:       -DSYS_IS_BSD -DSYS_STRING_H
                 -DSYS_HAS_MALLOC_PROTO -DSYS_HAS_CALLOC_PROTO
  300.twolf:     -DHAVE_SIGNED_CHAR

Base Optimization Flags:
  C:     -qpdf1/pdf2
         -O5 -blpdata -D_ILS_MACROS
  C++:   -qpdf1/pdf2
         -O4 -qalign=natural

Peak Optimization Flags
  164.gzip:      -qpdf1/pdf2
                 -O4 -qfdpr -blpdata
                 fdpr -q -O3
  175.vpr:       -qpdf1/pdf2
                 -O5 -qfdpr -blpdata
```

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http://www.spec.org/

CINT2000 Result

IBM Corporation

IBM OpenPower 570 (2200 MHz, 4 CPU)

SPECint_rate2000 = --

SPECint_rate_base2000 = 136

SPEC license #	Tested by:	IBM	Test date:	Dec-2005	Hardware Avail:	Feb-2006	Software Avail:	Feb-2006

Notes/Tuning Information (Continued)

```
                fdpr -q -O3
   176.gcc:     -qpdf1/pdf2
                -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata
   181.mcf:     -qpdf1/pdf2
                -O4 -qalign=natural -blpdata
   186.crafty:  -qpdf1/pdf2
                -O4 -qalign=natural -q64 -lhmu -blpdata
   197.parser:  -qpdf1/pdf2
                -O4 -qfdpr -D_ILS_MACROS -blpdata
                fdpr -q -O3
   252.eon:     -qpdf1/pdf2
                -O4 -qalign=natural
   253.perlbmk: -qpdf1/pdf2
                -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata -lhmu
   254.gap:     -qpdf1/pdf2
                -O4 -qarch=pwr4 -qtune=pwr4 -qalign=natural -blpdata
   255.vortex:  -qpdf1/pdf2
                -O4 -qfdpr -lhmu -blpdata
                fdpr -q -O3
   256.bzip2:   -qpdf1/pdf2
                -O5 -qfdpr -blpdata
                fdpr -q -O3
   300.twolf:   -O5 -qfdpr -blpdata
                fdpr -q -O3


The installed OS level is AIX 5L for POWER version 5.3 with the 5300-04 Recommended Maintenance package.

SMT:  Acronym for "Simultaneous Multi-Threading". A processor technology that allows
      the simultaneous execution of multiple thread contexts within a single processor
      core. (Enabled by default)
DCM:  Acronym for "Dual-Chip Module" (one dual-core processor chip + one L3-cache chip)
SUT:  Acronym for "System Under Test"
ESSL: Engineering and Scientific Subroutine Library

Extended C:     IBM XL C for AIX invoked as cc
ANSI C89:       IBM XL C for AIX invoked as xlc
C++:            IBM XL C for AIX invoked as xlC
Fortran 77:     IBM XL Fortran for AIX invoked as xlf90 unless explicitly reassigned
Fortran 90:     IBM XL Fortran for AIX invoked as xlf

ulimits set to unlimited.
Large page mode and memory affinity were set as follows:
    vmo -r -o lgpg_regions=800 -o lgpg_size=16777216
    chuser capabilities=CAP_BYPASS_RAC_VMM,CAP_PROPAGATE $USER
    reboot -q
    export MEMORY_AFFINITY=MCM

The following config-file entry was used to assign each benchmark process to a core:
     submit = bindprocessor \$\$ \$SPECUSERNUM; $command
The "bindprocessor" AIX command binds a process to a CPU core.
```

Intel Itanium 2 processor 9050-based server (4 users)

CINT2000 Result

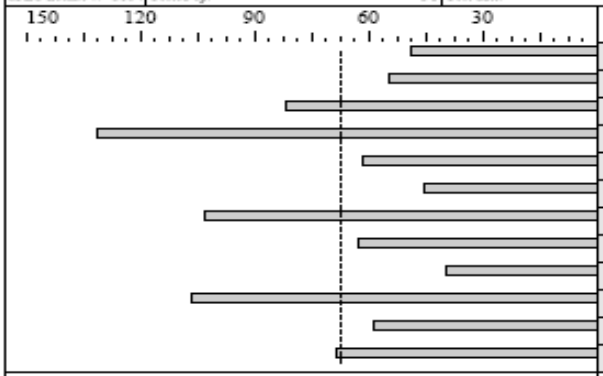
Hitachi

Hitachi Cold Fusion 3e (DC, 1.60GHz/24MB Itanium 2, FSB 400MHz)

SPECint_rate2000 = --

SPECint_rate_base2000 = 67.2

SPEC license #: 3184 | Tested by: | PT | Test date: Aug-2006 | Hardware Avail: | Software Avail: Aug-2006



Benchmark	Base Copies	Base Runtime	Base Ratio	Copies	Runtime	Ratio
164.gzip	4	134	48.6			
175.vpr	4	119	54.8			
176.gcc	4	62.7	81.5			
181.mcf	4	63.7	131			
186.crafty	4	75.7	61.3			
197.parser	4	185	45.3			
252.eon	4	58.7	103			
253.perlbmk	4	133	62.7			
254.gap	4	129	39.6			
255.vortex	4	83.0	106			
256.bzip2	4	119	58.3			
300.twolf	4	203	68.5			

Hardware

CPU:	Intel Itanium 2 Dual-Core 1600 MHz
CPU MHz:	1600
FPU:	Integrated
CPU(s) enabled:	8 cores, 4 chips, 2 cores/chip (Multi Threading disabled)
CPU(s) orderable:	2,4,8,16
Parallel:	No
Primary Cache:	16KBI + 16KBD on chip, per core
Secondary Cache:	1MBI + 256KBD on chip, per core
L3 Cache:	12.0MB(I+D) on chip, per core
Other Cache:	N/A
Memory:	32GB (1GB DIMM x 32)
Disk Subsystem:	1 x 73GB SATA HDD
Other Hardware:	None

Software

Operating System:	Red Hat Enterprise Linux AS 4 update 4
Compiler:	Intel(R) C++ Compiler for Linux 9.1.045 (Build 20061105)
File System:	ext3
System State:	Multi-user run level 3

Notes/Tuning Information

```
Tested by Principled Technologies
 Base tuning flags:
      C   : -fast -auto_ilp32 +FDO
      C++ : -fast -auto_ilp32 -IPF_fp_relaxed +FDO

 +FDO: PASS1=-prof_gen  PASS2=-prof_use

 Portability flags:
   176.gcc: -DSPEC_CPU2000_LP64 -Dalloca=_alloca
   186.crafty: -DLINUX_IA64
   252.eon: -DSPEC_CPU2000_LP64 -DHAS_ERRLIST fmax_errno src.alt
   253.perlbmk: -DSPEC_CPU2000_LP64 -DSPEC_CPU2000_NEED_BOOL
                 -DSPEC_CPU2000_LINUX_IA64 -DSPEC_CPU2000_GLIBC22
   254.gap: -DSPEC_CPU2000_LP64 -DSYS_HAS_CALLOC_PROTO -DSYS_IS_USG
            -DSYS_HAS_IOCTL_PROTO -DSYS_HAS_TIME_PROTO -DSYS_HAS_SIGNAL_PROTO
            -include unistd.h
   255.vortex: -DSPEC_CPU2000_LP64 closed_files src.alt
   300.twolf: stdfree src.alt

 Multi Threading disabled by EFI firmware.
```

Intel Itanium 2 processor 9050-based server (8 users)

CINT2000 Result

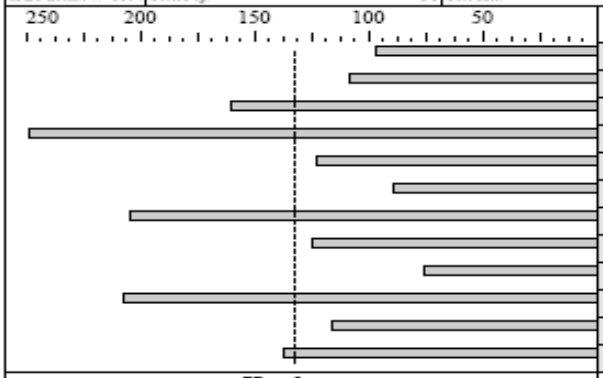
Hitachi

Hitachi Cold Fusion 3e (DC, 1.60GHz/24MB Itanium 2, FSB 400MHz)

SPECint_rate2000 = --

SPECint_rate_base2000 = 132

SPEC license #: 3184 | Tested by: | PT | Test date: Aug-2006 | Hardware Avail: | Software Avail: Aug-2006



Benchmark	Base Copies	Base Runtime	Base Ratio	Copies	Runtime	Ratio
164.gzip	8	135	96.6			
175.vpr	8	121	108			
176.gcc	8	63.8	160			
181.mcf	8	67.2	248			
186.crafty	8	75.8	122			
197.parser	8	187	89.3			
252.eon	8	58.9	205			
253.perlbmk	8	134	124			
254.gap	8	135	75.8			
255.vortex	8	84.9	208			
256.bzip2	8	120	116			
300.twolf	8	203	137			

Hardware

CPU:	Intel Itanium 2 Dual-Core 1600 MHz
CPU MHz:	1600
FPU:	Integrated
CPU(s) enabled:	8 cores, 4 chips, 2 cores/chip (Multi Threading disabled)
CPU(s) orderable:	2,4,8,16
Parallel:	No
Primary Cache:	16KBI + 16KBD on chip, per core
Secondary Cache:	1MBI + 256KBD on chip, per core
L3 Cache:	12.0MB(I+D) on chip, per core
Other Cache:	N/A
Memory:	32GB (1GB DIMM x 32)
Disk Subsystem:	1 x 73GB SATA HDD
Other Hardware:	None

Software

Operating System:	Red Hat Enterprise Linux AS 4 update 4
Compiler:	Intel(R) C++ Compiler for Linux 9.1.045 (Build 20061105)
File System:	ext3
System State:	Multi-user run level 3

Notes/Tuning Information

```
Tested by Principled Technologies
 Base tuning flags:
      C    : -fast -auto_ilp32 +FDO
      C++  : -fast -auto_ilp32 -IPF_fp_relaxed +FDO

 +FDO: PASS1=-prof_gen  PASS2=-prof_use

 Portability flags:
   176.gcc: -DSPEC_CPU2000_LP64 -Dalloca=_alloca
   186.crafty: -DLINUX_IA64
   252.eon: -DSPEC_CPU2000_LP64 -DHAS_ERRLIST fmax_errno src.alt
   253.perlbmk: -DSPEC_CPU2000_LP64 -DSPEC_CPU2000_NEED_BOOL
                 -DSPEC_CPU2000_LINUX_IA64 -DSPEC_CPU2000_GLIBC22
   254.gap: -DSPEC_CPU2000_LP64 -DSYS_HAS_CALLOC_PROTO -DSYS_IS_USG
            -DSYS_HAS_IOCTL_PROTO -DSYS_HAS_TIME_PROTO -DSYS_HAS_SIGNAL_PROTO
            -include unistd.h
   255.vortex: -DSPEC_CPU2000_LP64 closed_files src.alt
   300.twolf: stdfree src.alt

 Multi Threading disabled by EFI firmware.
```

Intel Itanium 2 processor 9050-based server (16 users)

CINT2000 Result

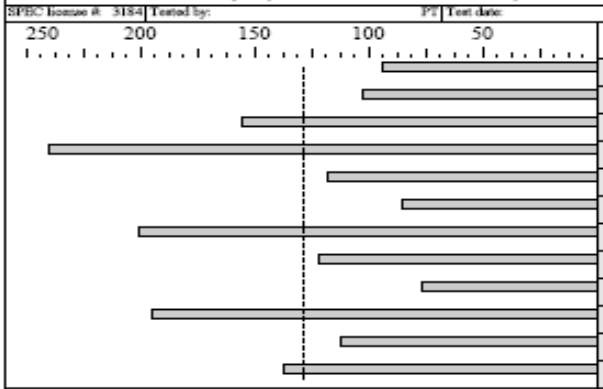
Hitachi

Hitachi Cold Fusion 3e (DC, 1.60GHz/24MB Itanium 2, FSB 400MHz)

SPECint_rate2000 = --

SPECint_rate_base2000 = 128

SPEC license #: 3184 | Tested by: | Test date: Aug-2006 | Hardware Avail: | Software Avail: Aug-2006



Benchmark	Base Copies	Base Runtime	Base Ratio	Copies	Runtime	Ratio
164.gzip	16	276	94.2			
175.vpr	16	255	102			
176.gcc	16	131	156			
181.mcf	16	139	240			
186.crafty	16	158	118			
197.parser	16	393	85.0			
252.eon	16	120	200			
253.perlbmk	16	275	121			
254.gap	16	268	76.3			
255.vortex	16	181	194			
256.bzip2	16	248	112			
300.twolf	16	407	137			

Hardware

CPU:	Intel Itanium 2 Dual-Core 1600 MHz
CPU MHz:	1600
FPU:	Integrated
CPU(s) enabled:	8 cores, 4 chips, 2 cores/chip (Multi Threading disabled)
CPU(s) orderable:	2,4,8,16
Parallel:	No
Primary Cache:	16KBI + 16KBD on chip, per core
Secondary Cache:	1MBI + 256KBD on chip, per core
L3 Cache:	12.0MB(I+D) on chip, per core
Other Cache:	N/A
Memory:	32GB (1GB DIMM x 32)
Disk Subsystem:	1 x 73GB SATA HDD
Other Hardware:	None

Software

Operating System:	Red Hat Enterprise Linux AS 4 update 4
Compiler:	Intel(R) C++ Compiler for Linux 9.1.045 (Build 20061105)
File System:	ext3
System State:	Multi-user run level 3

Notes/Tuning Information

```
Tested by Principled Technologies
 Base tuning flags:
      C    : -fast -auto_ilp32 +FDO
      C++  : -fast -auto_ilp32 -IPF_fp_relaxed +FDO

 +FDO: PASS1=-prof_gen  PASS2=-prof_use

 Portability flags:
   176.gcc: -DSPEC_CPU2000_LP64 -Dalloca=_alloca
   186.crafty: -DLINUX_i386
   252.eon: -DSPEC_CPU2000_LP64 -DHAS_ERRLIST fmax_errno src.alt
   253.perlbmk: -DSPEC_CPU2000_LP64 -DSPEC_CPU2000_NEED_BOOL
                 -DSPEC_CPU2000_LINUX_IA64 -DSPEC_CPU2000_GLIBC22
   254.gap: -DSPEC_CPU2000_LP64 -DSYS_HAS_CALLOC_PROTO -DSYS_IS_USG
            -DSYS_HAS_IOCTL_PROTO -DSYS_HAS_TIME_PROTO -DSYS_HAS_SIGNAL_PROTO
            -include unistd.h
   255.vortex: -DSPEC_CPU2000_LP64 closed_files src.alt
   300.twolf: stdfree src.alt

 Multi Threading disabled by EFI firmware.
```

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Appendix F – SPECjbb2005 output

This appendix provides the output of the SPECjbb2005 benchmark for each of the test servers.

IBM System p5 550Q POWER5+ processor-based server

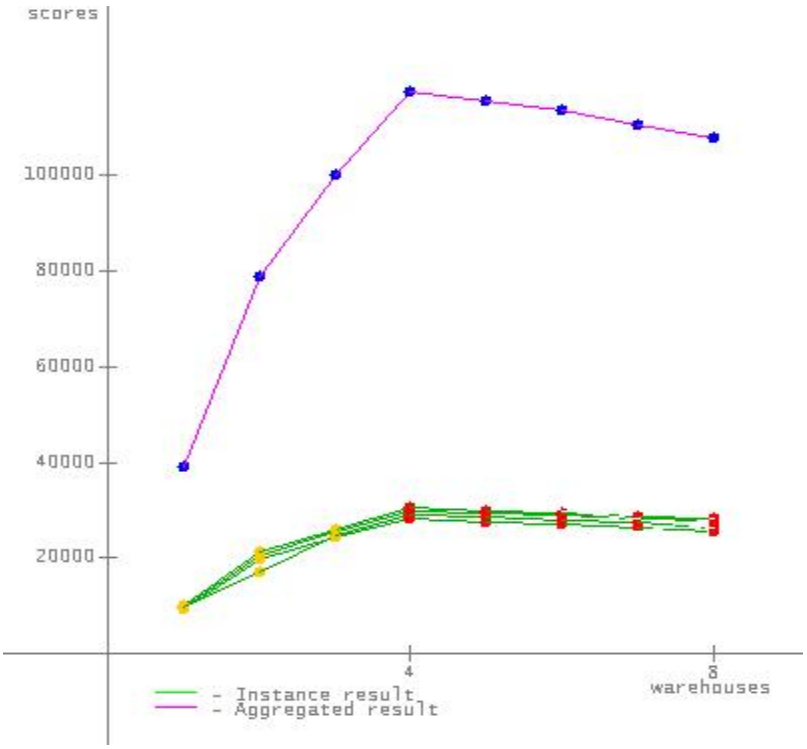
SPECjbb2005

SPECjbb2005 bops = 113145, SPECjbb2005 bops/JVM = 28286

IBM Corporation p5 550

IBM Corporation J2RE 1.5.0 (64-bit) IBM J9 2.3 AIX ppc64-64 j9vmap6423-20061003

JVM run	JVM Scores
1	27046
2	28853
3	29320
4	27926
SPECjbb2005 bops = 113145, SPECjbb2005 bops/JVM = 28286	



Hardware	
Hardware Vendor	IBM Corporation
Vendor URL	http://www.ibm.com
Model	p5 550
Processor	POWER 5
MHz	1650
# of Chips	2
# of Cores	8
# of Cores/Chip	4
HW Threading Enabled?	Yes
Procs Avail to Java	16
Memory (MB)	32768

Software	
Software Vendor	IBM Corporation
Vendor URL	www.ibm.com
JVM Version	J2RE 1.5.0 (64-bit) IBM J9 2.3 AIX ppc64-64 j9vmap6423-20061003
JVM Command Line	execrset -c -e /usr/java5_64/bin/java -cp jbb.jar:check.jar -Xlp -Xgcpolicy:subpool -Xcompactgc -Xms3328m -Xmx3328m spec.jbb.JBBmain -propfile SPECjbb.props -id > multi. &
JVM Initial Heap Memory (MB)	3328
JVM Maximum Heap Memory (MB)	3328

Memory Details	16 x 2GB DDR2 533
Primary cache	
Secondary cache	
Other cache	
Filesystem	JFS2
Disks	1 x 73GB SCSI SCA
Other hardware	

JVM Address bits	64
JVM CLASSPATH	jbb.jar: check.jar
JVM BOOTCLASSPATH	/usr/java5_64/jre/lib/vm.jar: /usr/java5_64/jre/lib/core.jar: /usr/java5_64/jre/lib/charsets.jar: /usr/java5_64/jre/lib/graphics.jar: /usr/java5_64/jre/lib/security.jar: /usr/java5_64/jre/lib/ibmpkcs.jar: /usr/java5_64/jre/lib/ibmorb.jar: /usr/java5_64/jre/lib/ibmcfw.jar: /usr/java5_64/jre/lib/ibmorbapi.jar: /usr/java5_64/jre/lib/ibmjcefw.jar: /usr/java5_64/jre/lib/ibmjgssprovider.jar: /usr/java5_64/jre/lib/ibmjsseprovider2.jar: /usr/java5_64/jre/lib/ibmjaaslm.jar: /usr/java5_64/jre/lib/ibmcertpathprovider.jar: /usr/java5_64/jre/lib/server.jar: /usr/java5_64/jre/lib/xml.jar
OS Version	AIX 5L V5.3
Other software	

Test Information	
Tested by	Principled Technologies, Inc.
SPEC license #	3184
Test location	Durham, NC
Test date	Dec 11, 2006
H/w available	
JVM available	
OS available	
Other s/w available	

AOT Compilation

Tuning

Operating system tunings

- vmo -o lgpg_regions=1600 -o lgpg_size=16777216 -o v_pinshm=1
- export SPINLOOP=1000
- export MEMORY_AFFINITY=MCM

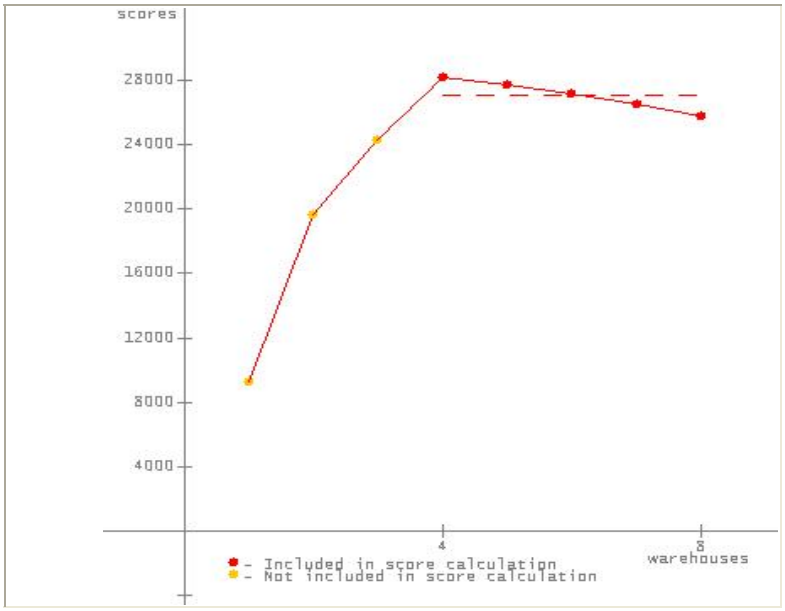
Notes

"Notes here"

JVM 1 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	9235	
2	19612	
3	24299	
4	28192	*
5	27678	*
6	27161	*
7	26483	*
8	25717	*
SPECjbb2005	(from 4 to 8)	27046 SPECjbb2005 bops

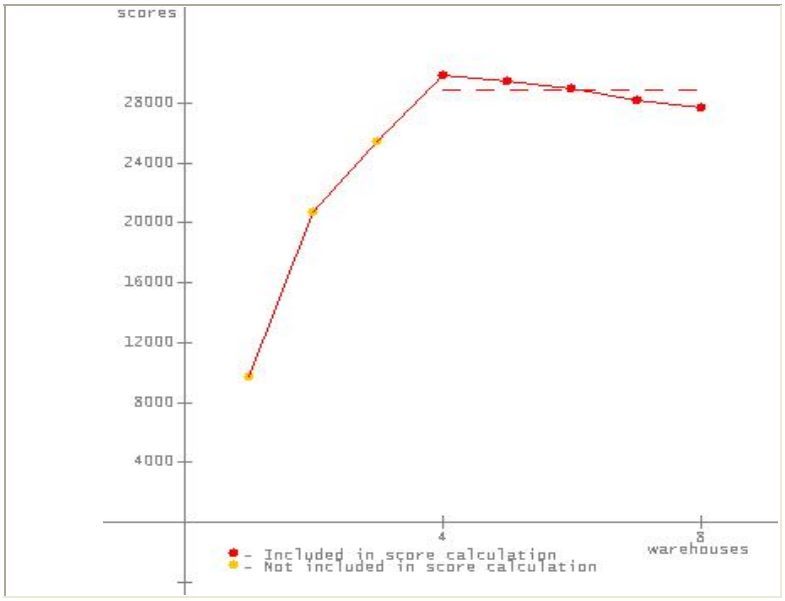


SPEC license # 3184 | **Tested by:** Principled Technologies, Inc. | **Test date:** Dec 11, 2006

JVM 2 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	9763	
2	20688	
3	25395	
4	29894	*
5	29464	*
6	28940	*
7	28230	*
8	27737	*
SPECjbb2005	(from 4 to 8)	28853 SPECjbb2005 bops

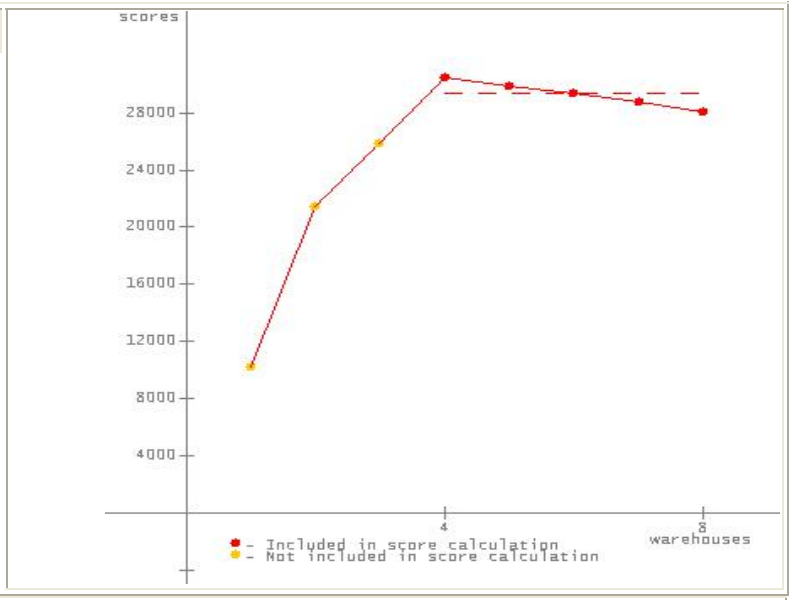


SPEC license # 3184 | **Tested by:** Principled Technologies, Inc. | **Test date:** Dec 11, 2006

JVM 3 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	10219	
2	21422	
3	25836	
4	30502	*
5	29842	*
6	29400	*
7	28777	*
8	28080	*
SPECjbb2005	**(from 4 to 8)**	**29320 SPECjbb2005 bops**

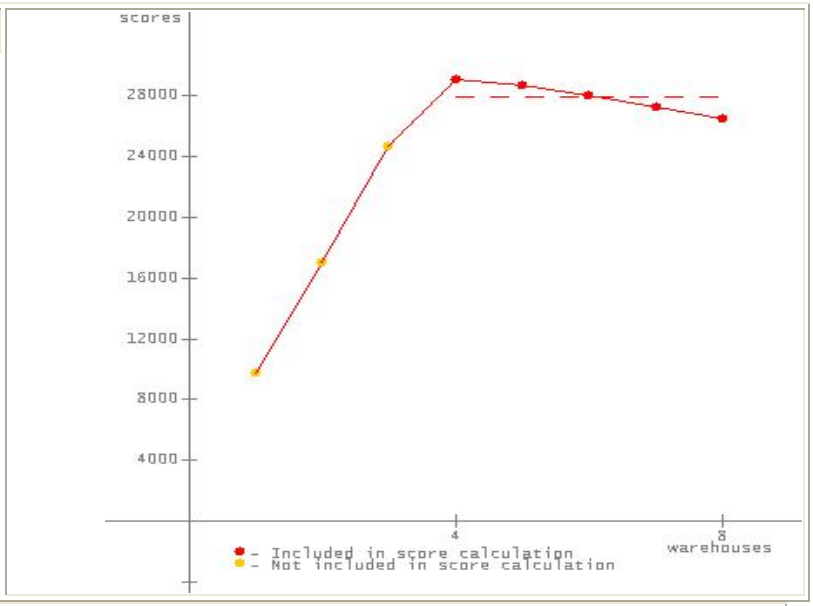


SPEC license # 3184	Tested by: Principled Technologies, Inc.	Test date: Dec 11, 2006

JVM 4 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	9740	
2	17071	
3	24650	
4	29117	*
5	28673	*
6	28045	*
7	27303	*
8	26490	*
SPECjbb2005	**(from 4 to 8)**	**27926 SPECjbb2005 bops**



SPEC license # 3184	Tested by: Principled Technologies, Inc.	Test date: Dec 11, 2006

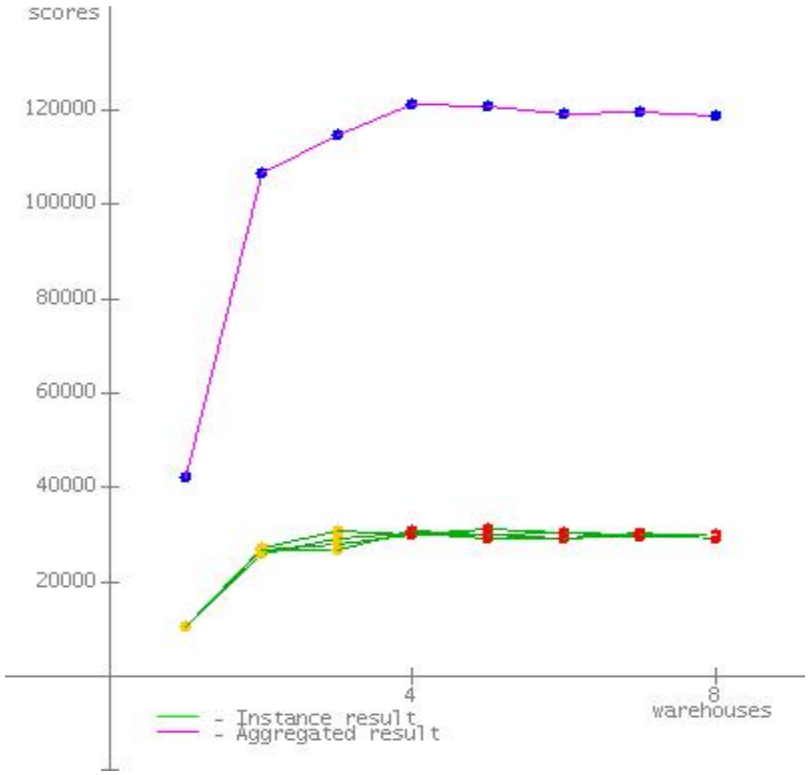
SPECjbb2005 Version: [SPECjbb2005 1.07, March 15, 2006]

SPECjbb2005

SPECjbb2005 bops = 119969, SPECjbb2005 bops/JVM = 29992

Hitachi Hitachi Cold Fusion 3e

BEA Jrockit 5.0, build P26.4.1-12-67782-1.5.0_06-20061003-1620-linux-ia64



JVM run	JVM Scores
1	30089
2	29660
3	30244
4	29976
SPECjbb2005 bops = 119969, SPECjbb2005 bops/JVM = 29992	

Hardware	
Hardware Vendor	Hitachi
Vendor URL	http://www.hitachi.com
Model	Hitachi Cold Fusion 3e
Processor	Itanium2 Processor 9050 (1.60GHz, 533MHz bus)
MHz	1600
# of Chips	4
# of Cores	8
# of Cores/Chip	2
HW Threading Enabled?	Yes
Procs Avail	16

Software	
Software Vendor	BEA
Vendor URL	http://www.bea.com
JVM Version	Jrockit 5.0, build P26.4.1-12-67782-1.5.0_06-20061003-1620-linux-ia64
JVM Command Line	numactl --cpubind=$i --membind=$i java -cp jbb.jar:check.jar -Xms3840m -Xmx3840m -XXaggressive -XXcompressedRefs -XXthroughputCompaction -XXlazyUnlocking -XXtlasize=512k -XXgcthreads=4 -XXhpm spec.jbb.JBBmain -propfile %PROPFILE% -id %I% > multi.%I%
JVM Initial Heap Memory (MB)	3840
JVM Maximum Heap Memory (MB)	3840

to Java	
Memory (MB)	32768
Memory Details	32 x 1GB DDR2-SDRAM PC2-5300 ECC registered
Primary cache	16KB (I) + 16KB (D) on chip per core
Secondary cache	1024 KB (I) + 256KB (D) on chip per core
Other cache	12MB (I+D) on chip per core
Filesystem	ext3
Disks	1 x 73GB SAS 15K RPM
Other hardware	

JVM Address bits	64
JVM CLASSPATH	jbb.jar: check.jar
JVM BOOTCLASSPATH	/jrockit-jdk1.5.0_06/jre/lib/ia64/jrockit/jrockit.jar: /jrockit-jdk1.5.0_06/jre/lib/ia64/jrockit/managementapi.jar: /jrockit-jdk1.5.0_06/jre/lib/managementapi.jar: /jrockit-jdk1.5.0_06/jre/lib/rt.jar: /jrockit-jdk1.5.0_06/jre/lib/i18n.jar: /jrockit-jdk1.5.0_06/jre/lib/sunrsasign.jar: /jrockit-jdk1.5.0_06/jre/lib/jsse.jar: /jrockit-jdk1.5.0_06/jre/lib/jce.jar: /jrockit-jdk1.5.0_06/jre/lib/charsets.jar: /jrockit-jdk1.5.0_06/jre/classes
OS Version	Red Hat Enterprise Linux AS release 4 (Nahant Update 4) - Kernel 2.6.9-42.EL on an ia64
Other software	

Test Information	
Tested by	Principled Technologies
SPEC license #	3184
Test location	Durham, NC
Test date	Dec 1, 2006
H/w available	
JVM available	
OS available	August 2006
Other s/w available	

AOT Compilation

Tuning

Operating system tunings

- echo 72 > /proc/sys/vm/nr_hugepages
- mkdir -p /mnt/hugepages
- mount none /mnt/hugepages -t hugetlbfs
- chmod 777 /mnt/hugepages

Command line switches

- descibed at http://e-docs.bea.com/jrockit/jrdocs/refman/intro.html

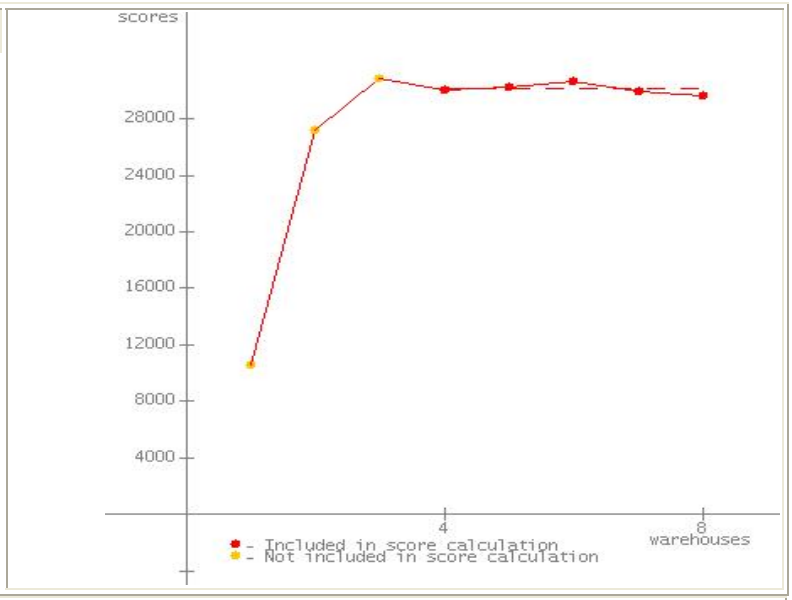
Notes

Enabled "Multithreading" in the BIOS

JVM 1 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	10563	
2	27191	
3	30882	
4	30048	*
5	30229	*
6	30621	*
7	29956	*
8	29592	*
SPECjbb2005	**(from 4 to 8)**	**30089 SPECjbb2005 bops**

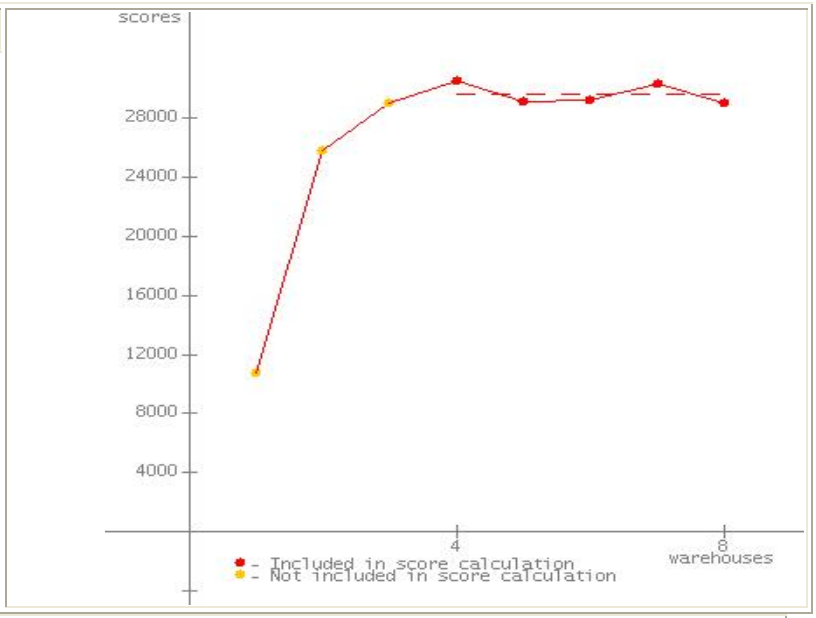


SPEC license # 3184 | **Tested by:** Principled Technologies | **Test date:** Dec 1, 2006

JVM 2 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	10722	
2	25809	
3	29085	
4	30583	*
5	29117	*
6	29209	*
7	30359	*
8	29033	*
SPECjbb2005	**(from 4 to 8)**	**29660 SPECjbb2005 bops**

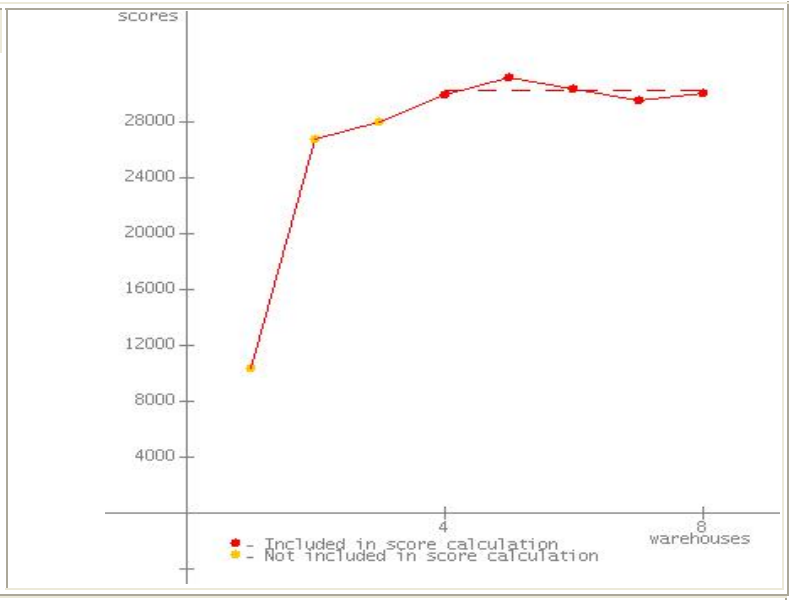


SPEC license # 3184 | **Tested by:** Principled Technologies | **Test date:** Dec 1, 2006

JVM 3 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	10404	
2	26764	
3	27968	
4	29940	*
5	31209	*
6	30406	*
7	29573	*
8	30091	*
SPECjbb2005	**(from 4 to 8)**	**30244 SPECjbb2005 bops**



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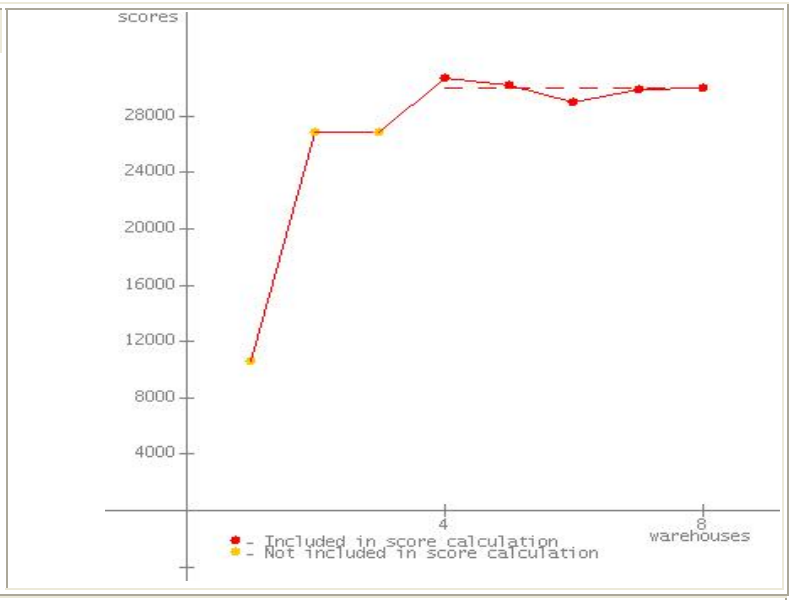
JVM 4 Scores:

No errors. Valid run.

Warehouses	SPECjbb2005 bops	Incl. in metric
1	10594	
2	26891	
3	26865	
4	30744	*
5	30240	*
6	29032	*
7	29910	*
8	29955	*
SPECjbb2005	**(from 4 to 8)**	**29976 SPECjbb2005 bops**



SPEC license # 3184	**Tested by:** Principled Technologies	**Test date:** Dec 1, 2006

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

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