SPEC CPU2006 SPECint_rate performance on Red Hat Enterprise Linux 5.2 Intel-based servers

Executive summary

Red Hat®, Inc. (Red Hat) commissioned Principled Technologies (PT) to measure the SPEC® CPU2006 SPECint®_rate performance of the following two configurations:

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

KEY FINDING

- Red Hat Enterprise Linux 5.2 guest on an Intel Xeon X7460-based server achieved 98 percent of the performance of running native on Red Hat Enterprise Linux 5.2 (see Figure 1).
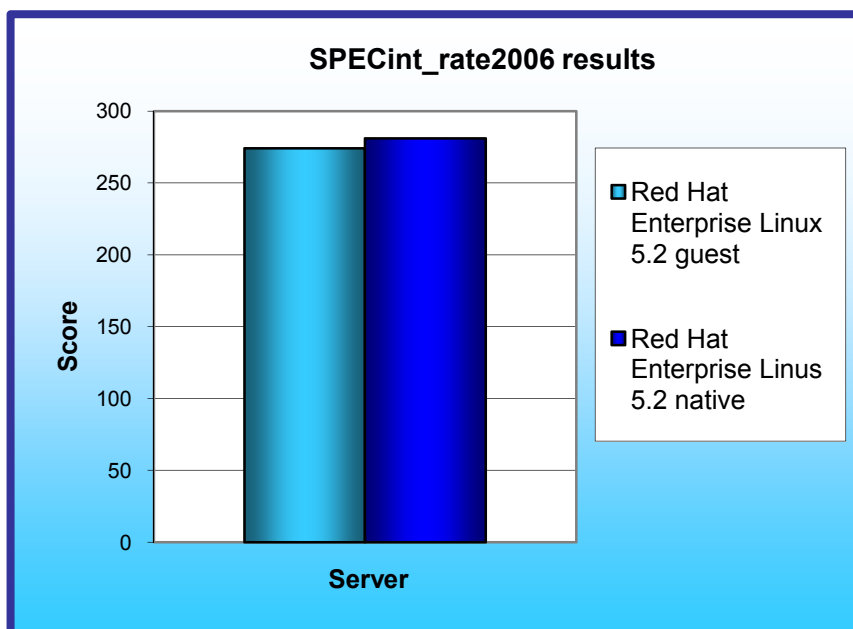
SPEC CPU2006 is an industry-standard benchmark created by the Standard Performance Evaluation Corp. (SPEC) to measure a server's compute-intensive performance. The benchmark consequently stresses the CPU and memory subsystems of the system under test. (For more information on SPEC CPU2006 and other SPEC benchmarks, see www.spec.org.)

The SPEC CPU2006 benchmark consists of two benchmark suites, each of which focuses on a different aspect of compute-intensive performance. CINT2006 measures and compares compute-intensive integer performance, while CFP2006 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 ran the CINT2006 SPECint_rate benchmark. We configured the benchmark to utilize all of the cores of the Intel Xeon 7460 processor running both native and as a guest on Red Hat Enterprise Linux 5.2.

In this section, we discuss the best results for each server. For complete details of the performance of each server, see the Test results section.

Figure 1 shows the SPECint_rate2006 peak performance of each configuration. Each result is the median peak score of three runs of the benchmark. See the Test results section for complete set of results. A higher SPECint_rate2006 score indicates the server can handle a greater load.

The Red Hat Enterprise Linux 5.2 guest on Red Hat Enterprise Linux 5.2 configuration achieved a score of 274, which is 98 percent of the performance of running native on Red Hat Enterprise Linux 5.2. That configuration achieved a score of 281.

Figure 1: SPECint_rate2006 results of the test configurations on an Intel Xeon X7460-based server . Higher numbers are better.

Workload

The SPEC CPU2006 workload includes two benchmark suites: CINT2006 and CFP2006. (Note: SPEC and the SPECint are trademarks of the Standard Performance Evaluation Corporation.) We ran only the CINT2006 benchmark, which focuses on measuring and comparing compute-intensive integer performance. Specifically, we measured the SPECint_rate2006 results for the test servers with 24 users.

Generally, a system achieves the best SPECint_rate2006 score using the same number of users as execution units for a given server. The optimum user count for our testing on both systems was 24, the number of execution units (logical or physical processors) on those servers.

Figure 2 lists the 12 applications that compose the CINT2006 benchmark. SPEC wrote nine of the applications in C and three (471.omnetpp, 473.astar, 483.xalancbmk) in C++.

Name	Application area
400.perlbench	Programming language
401.bzip2	Compression
403.gcc	C compiler
429.mcf	Combinatorial optimization
445.gobmk	Artificial intelligence: Go
456.hmmer	Search gene sequence
458.sjeng	Artificial intelligence: chess
462.libquantum	Physics/quantum computing
464.h264ref	Video compression
471.omnetpp	Discrete event simulation
473.astar	Path-finding algorithms
483.xalancbmk	XML processing

Figure 2: The applications that make up the CINT2006 benchmark.

A CINT2006 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.

Test results

Figure 3 details the results of our tests with 24 users for SPECint_rate2006. We determined the number of users based on the number of execution units in a given server. We used the same number of SPECint_rate2006 users as processor execution units, so there is a one-to-one ratio.

SPECint_rate2006 performs three runs of each benchmark in the test suite and records the median, so the final score is a median of three runs. Higher scores are better.

Server	SPECint_rate_base2006 results	SPECint_rate2006 results
Red Hat Enterprise Linux 5.2 server: Intel Xeon X7460-based server	258	281
Red Hat Enterprise Linux 5.2 guest on Red Hat Enterprise Linux 5.2 server: Intel Xeon X7460-based server	255	274

Figure 3: SPECint_rate2006 results for the two systems under test. Higher numbers are better.

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Test methodology

Red Hat configured and provided the test system.

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

With the following exceptions, we used the default BIOS settings on each server: enabled AHCI and Intel Virtualization Technology.

SPECCPU2006 configuration

Intel compiled and provided the SPEC CINT2006 executables, but followed SPEC's standard instructions for building the executables using the following software tools:

- Intel C/C++ Compiler 11.0.042

The benchmark requires configuration files. The configuration files used appear in Appendix B.

To begin the benchmark, we performed the following steps:

- Open a command prompt.
- Change to the cpu2006 directory.
- Type ". ./shrc" at the command prompt.
- Enter "runspec -c <config file name> -r 24 -T base -v 10 int" where
  - <config file name> = name of the configuration file
  - Where 24 = number of users

When the run completes, the benchmark puts the results in the directory \cpu2006\result. The result file names are of the form CINT2006.<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., CINT2006.002. asc and log.002.

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Appendix A – Test system configuration information

This appendix provides detailed configuration information about the test server.

Server	Red Hat Enterprise Linux 5.2 server on the Intel Xeon X7460-based server	Red Hat Enterprise Linux 5.2 guest on Red Hat Enterprise Linux 5.2 server on the Intel Xeon X7460-based server
General processor setup		
Number of processor packages	4	4
Number of cores per processor package	6	6
Number of hardware threads per core	1	1
CPU		
Vendor	Intel	Intel
Name	Intel Xeon X7460	Intel Xeon X7460
Stepping	1	1
Socket type	Socket P (478)	Socket P (478)
Core frequency (GHz)	2.66	2.66
Front-side bus frequency (MHz)	1,066	1,066
L1 cache	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)
L2 cache	3 x 3 MB (each 3 MB shared by 2 cores)	3 x 3 MB (each 3 MB shared by 2 cores)
L3 cache	16 MB	16 MB
Platform		
Vendor and model number	Intel	Intel
Motherboard model number	S7000FC4UR	S7000FC4UR
Motherboard chipset	Intel ID3600	Intel ID3600
Motherboard revision number	01	01
BIOS name and version	Intel SFC4UR.86B.01.00.S005 06/05/2008	Intel SFC4UR.86B.01.00.S005 06/05/2008
BIOS settings	- Enabled AHCI - Enabled Intel® Virtualization Technology	- Enabled AHCI - Enabled Intel® Virtualization Technology
Memory module(s)		
Vendor and model number	Samsung M395T5750EZ4	Samsung M395T5750EZ4
Type	PC2-5300 FB-DDR2	PC2-5300 FB-DDR2
Speed (MHz)	667	667
Speed in the system currently running @ (MHz)	667	667
Timing/Latency (tCL-tRCD-iRP-tRASmin)	5-5-5-11	5-5-5-11
Size	32,768 MB*	30,720 MB*
Number of RAM modules	16	16
Chip organization	Double-sided	Double-sided
Hard disk		
Vendor and model number	Seagate ST973401SS	Seagate ST973401SS
Number of disks in system	1	1
Size	73.4 GB	73.4 GB
Buffer size	8 MB	8 MB
RPM	10,000	10,000
Type	SAS	SAS

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

Figure 4: Detailed system configuration information for the three test servers.

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

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Appendix B – SPECint_rate_base2006 configuration files

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

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

```
# Invocation command line:
# /data1/cpu2006-1.1/bin/runspec --rate 24 -c cpu2006.1.1.ic11.0.linux64.dgt.rate.cfg --flagsurl=Intel-ic11.0-int-linux64-revA.xml,Intel-Linux64-
Platform.xml --define dgt4p24cores -v 7 -T all -o asc int
# output_root was not used for this run
################################################################################
################################################################################
# This is a sample config file. It was tested with:
#
#     Compiler name/version:     Intel Compiler 11.0
#     Operating system version:   64-Bit  LINUX Enterprise Server 10 or later
#     Hardware:               Intel Core 2 and compatible Intel processors
#                          supporting Intel 64 and SSE4.1
#
################################################################################
# SPEC CPU2006 Intel Linux64 config file
# July 2008 Intel Compiler 11.0 for Linux64
################################################################################
action     = validate
tune       = base
ext        = cpu2006.1.1.ic11.0.linux64.dgt.rate
PATHSEP    = /
check_md5=1
reportable=1

#
# These are listed as benchmark-tuning-extension-machine
#
default=default=default=default:
CC  = icc
CXX = icpc
FC=ifort
OBJ = .o
SMARTHEAP_DIR = /spec/cpu2006.1.1/lib

submit= MYMASK=`printf '0x%x' \$((1<<\$SPECCOPYNUM))`; taskset \$MYMASK $command


#########################################################################
# Compiler options
# for Dunnington use -xSSE4.1
# for processors prior to dunnington, replace -xSSE4.1 with -xSSSE3
#########################################################################

SSE        = -xSSE4.1
FAST       = $(SSE) -ipo -O3 -no-prec-div -static
FASTNOSTATIC = $(SSE) -ipo -O3 -no-prec-div


###################################################################
#
# portability & libraries
#
################### Portability Flags and Notes #####################

400.perlbench=default:
CPORTABILITY=    -DSPEC_CPU_LINUX_IA32

403.gcc=default:
EXTRA_CFLAGS=    -Dalloca=_alloca

462.libquantum=default:
CPORTABILITY=    -DSPEC_CPU_LINUX

483.xalancbmk=default:
```

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```
CXXPORTABILITY=   -DSPEC_CPU_LINUX

fp=default:
PORTABILITY = -DSPEC_CPU_LP64

435.gromacs=default=default=default:
LDPORTABILITY = -nofor_main

436.cactusADM=default=default=default:
LDPORTABILITY = -nofor_main

454.calculix=default=default=default:
LDPORTABILITY = -nofor_main

481.wrf=default=default=default:
CPORTABILITY = -DSPEC_CPU_CASE_FLAG -DSPEC_CPU_LINUX


# Tuning Flags
###################################################################

#
# Base tuning default optimization
# Feedback directed optimization not allowed in baseline for CPU2006
# However there is no limit on the number of flags as long as the same
# flags are used in the same order for all benchmarks of a given language

471.omnetpp,473.astar,483.xalancbmk=default:
EXTRA_LIBS=  -L$(SMARTHEAP_DIR) -lsmartheap
EXTRA_LDFLAGS= -Wl,-z,muldefs

int=base=default=default:
COPTIMIZE=    $(FAST) -inline-calloc -opt-malloc-options=3  -opt-prefetch
CXXOPTIMIZE=  $(FASTNOSTATIC)  -opt-prefetch

fp=base=default=default:
OPTIMIZE=   $(FAST)  -opt-prefetch

###################################################################
# Peak Tuning Flags int 2006 fast
###################################################################
int=peak=default:
COPTIMIZE=      $(FAST) -opt-prefetch
CXXOPTIMIZE=    $(FASTNOSTATIC)  -opt-prefetch
PASS1_CFLAGS =  -prof-gen
PASS2_CFLAGS =  -prof-use
PASS1_CXXFLAGS = -prof-gen
PASS2_CXXFLAGS = -prof-use
PASS1_LDFLAGS =  -prof-gen
PASS2_LDFLAGS =  -prof-use

400.perlbench=peak=default:
COPTIMIZE= $(FAST) -ansi-alias -opt-prefetch

401.bzip2=peak=default:
CC= /opt/intel/Compiler/11.0/042/bin/intel64/icc -L/opt/intel/Compiler/11.0/042/ipp/em64t/lib -I/opt/intel/Compiler/11.0/042/ipp/em64t/include
CPORTABILITY= -DSPEC_CPU_LP64
COPTIMIZE= $(FAST) -opt-prefetch -ansi-alias

403.gcc=peak=default:
COPTIMIZE = $(FAST) -inline-calloc -opt-malloc-options=3
feedback=0

429.mcf=peak=default:
COPTIMIZE= $(FAST) -opt-prefetch

445.gobmk=peak=default:
COPTIMIZE= $(SSE) -O2 -ipo -no-prec-div -ansi-alias
```

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456.hmmer=peak=default:
CC= /opt/intel/Compiler/11.0/042/bin/intel64/icc -L/opt/intel/Compiler/11.0/042/ipp/em64t/lib -I/opt/intel/Compiler/11.0/042/ipp/em64t/include
CPORTABILITY= -DSPEC_CPU_LP64
COPTIMIZE= $(FAST) -unroll2 -ansi-alias
feedback=no

458.sjeng=peak=default:
COPTIMIZE= $(FAST) -unroll4

462.libquantum=peak=default:
COPTIMIZE= $(FAST) -opt-malloc-options=3 -parallel -par-runtime-control -opt-prefetch
feedback=no
copies=1
submit=

464.h264ref=peak=default:
COPTIMIZE= $(FAST) -unroll2 -ansi-alias

471.omnetpp=peak=default:
CXXOPTIMIZE= $(FASTNOSTATIC) -ansi-alias -opt-ra-region-strategy=block

473.astar=peak=default:
CXXOPTIMIZE= $(FASTNOSTATIC) -ansi-alias -opt-ra-region-strategy=routine

483.xalancbmk=peak=default:
basepeak=yes

##
Peak Tuning Flags for FP
##
fp=peak=default:
OPTIMIZE= $(FAST)
COPTIMIZE=   -auto-ilp32
CXXOPTIMIZE= -auto-ilp32
PASS1_CFLAGS =   -prof-gen
PASS2_CFLAGS =   -prof-use
PASS1_CXXFLAGS = -prof-gen
PASS2_CXXFLAGS = -prof-use
PASS1_FFLAGS =   -prof-gen
PASS2_FFLAGS =   -prof-use
PASS1_LDFLAGS = -prof-gen
PASS2_LDFLAGS = -prof-use

410.bwaves=peak=default:
OPTIMIZE= $(FAST) -opt-prefetch
feedback=0
###
###################
%ifdef %{stoakleydp8cores}
copies=4
submit= if `test $SPECCOPYNUM -le 1`; then taskset -c $SPECCOPYNUM $command ; else taskset -c `expr $SPECCOPYNUM + 4`
$command ; fi
%endif
###
###################

416.gamess=peak=default:
OPTIMIZE= $(FAST) -unroll2 –Ob0 -ansi-alias -scalar-rep-

433.milc=peak=default:
OPTIMIZE= $(FAST) -fno-alias
COPTIMIZE=

435.gromacs=peak=default:
OPTIMIZE= $(FAST) -opt-prefetch

436.cactusADM=peak=default:
OPTIMIZE= $(FAST) -unroll2 -opt-prefetch -parallel

```
copies=1
submit=

437.leslie3d=peak=default:
PORTABILITY =
FC= /opt/intel/Compiler/11.0/042/bin/ia32/ifort -L/opt/intel/Compiler/11.0/042/ipp/ia32/lib -I/opt/intel/Compiler/11.0/042/ipp/ia32/include
OPTIMIZE=   $(FAST)  -opt-malloc-options=3 -opt-prefetch
##############################################################################################################
##################
%ifdef %{stoakleydp8cores}
copies=4
submit= if `test $SPECCOPYNUM -le 1`; then  taskset -c $SPECCOPYNUM $command ; else taskset -c `expr $SPECCOPYNUM + 4`
$command ; fi
%endif
##############################################################################################################
##################

444.namd=peak=default:
CXXOPTIMIZE= $(FAST) -fno-alias -auto-ilp32

447.dealII=peak=default:
CXXOPTIMIZE= $(FAST) -unroll2 -ansi-alias -scalar-rep-

450.soplex=peak=default:
PORTABILITY =
CXX= /opt/intel/Compiler/11.0/042/bin/ia32/icpc -L/opt/intel/Compiler/11.0/042/ipp/ia32/lib -I/opt/intel/Compiler/11.0/042/ipp/ia32/include
OPTIMIZE= $(FAST) -opt-malloc-options=3
CXXOPTIMIZE=

453.povray=peak=default:
CXXOPTIMIZE= $(FAST) -unroll4 -ansi-alias

454.calculix=peak=default:
OPTIMIZE= $(FAST)
feedback=0

459.GemsFDTD=peak=default:
OPTIMIZE= $(FAST)  -unroll2 -Ob0 -opt-prefetch

465.tonto=peak=default:
OPTIMIZE= $(FAST) -unroll4 -auto

470.lbm=peak=default:
OPTIMIZE=   $(FAST)  -opt-prefetch
feedback=no


##############################################################################################################
##################
%ifdef %{bensleydp8cores}
copies=2
submit= if `test $SPECCOPYNUM -le 0`; then  taskset -c $SPECCOPYNUM $command ; else taskset -c `expr $SPECCOPYNUM + 4`
$command ; fi
%endif

%ifdef %{stoakleydp8cores}
copies=4
submit= if `test $SPECCOPYNUM -le 1`; then  taskset -c $SPECCOPYNUM $command ; else taskset -c `expr $SPECCOPYNUM + 4`
$command ; fi
%endif

%ifdef %{tgt4p16cores}
copies=8
submit= if `test $SPECCOPYNUM -le 3`; then  taskset -c $SPECCOPYNUM $command ; else taskset -c `expr $SPECCOPYNUM + 8`
$command ; fi
%endif

%ifdef %{dgt4p24cores}
copies=12
submit= $[top]/mysubmit.pl $SPECCOPYNUM "$command"
```

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```
%endif

%ifdef %{dgt4p16cores}
copies=8
submit= $[top]/mysubmit.pl $SPECCOPYNUM "$command"
%endif
##############################################################################################################
####################
481.wrf=peak=default:
basepeak=yes

482.sphinx3=peak=default:
PORTABILITY =
CC= /opt/intel/Compiler/11.0/042/bin/ia32/icc -L/opt/intel/Compiler/11.0/042/ipp/ia32/lib -I/opt/intel/Compiler/11.0/042/ipp/ia32/include
COPTIMIZE= -unroll2
feedback=no

##############################################################################################################
####################
%ifdef %{stoakleydp8cores}
copies=4
submit= if `test $SPECCOPYNUM -le 1`; then  taskset -c $SPECCOPYNUM $command ; else taskset -c `expr $SPECCOPYNUM + 4`
$command ; fi
%endif

%ifdef %{tgt4p16cores}
copies=8
submit= if `test $SPECCOPYNUM -le 3`; then  taskset -c $SPECCOPYNUM $command ; else taskset -c `expr $SPECCOPYNUM + 8`
$command ; fi
%endif

%ifdef %{dgt4p24cores}
copies=12
submit= $[top]/mysubmit.pl $SPECCOPYNUM "$command"
%endif

%ifdef %{dgt4p16cores}
copies=8
submit= $[top]/mysubmit.pl $SPECCOPYNUM "$command"
%endif
##############################################################################################################
####################




##################################################################
# (Edit this to match your system)
##################################################################

default=default=default=default:
license_num      = 3184
test_sponsor     = Intel Corporation
hw_avail         = Sep-2008
sw_avail         = Sep-2008
tester           = Principled Technologies
hw_cpu_name      = Intel Xeon X7460
hw_cpu_char      =
hw_cpu_mhz       = 2666
hw_disk          = 73.4 GB SATA, 10,000RPM
hw_fpu           = Integrated
hw_memory        = 32 GB
hw_model         = Intel Server Board
hw_ncpuorder     = 1,2,4 chips
hw_ncores        = 24
```

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```
hw_nchips      = 4
hw_ncoresperchip = 6
hw_nthreadspercore = 1
hw_other       = None
hw_pcache      = 32 KB I + 32 KB D on chip per core
hw_scache      = 9 MB I+D on chip per core, 3 MB shared / 2 cores
hw_tcache      = 16 MB
hw_ocache      = None
hw_vendor      = Intel Corporation
prepared_by    = PT
sw_file        = ext3
sw_os000       = Red Hat Enterprise Linux Server release 5.2
sw_os001 = Kernel 2.6.18-92.el5 x86_64
sw_state       = Run level 3 (multi-user)
sw_other000    = Microquill SmartHeap V8.1
sw_other001    = Binutils 2.18.50.0.7.20080502


int=default=default=default:
sw_compiler000   = Intel C++ Compiler 11.0 for Linux
sw_compiler001   = Build 20080730 Package ID: l_cc_b_11.0.042
sw_base_ptrsize  = 32-bit
sw_peak_ptrsize  = 32/64-bit
notes_000        = All benchmarks compiled in 32-bit mode except 401.bzip2 and 456.hmmer,
notes_005        = for peak, are compiled in 64-bit mode
notes_010        = taskset was used to bind processes to cores except
notes_015        = for 462.libquantum peak
notes_020        = OMP_NUM_THREADS set to number of processors
notes_025        = KMP_AFFINITY set to "physical,0"
notes_030        = KMP_STACKSIZE set to 64M
notes_035 = 'ulimit -s unlimited' was used to set the stacksize to unlimited prior to run


fp=default=default=default:
sw_compiler001   = Intel C++ and Fortran Compiler 11.0 for Linux
sw_compiler002   = Build 20080730 Package ID: l_cc_b_11.0.042, l_fc_b_11.0.042
sw_base_ptrsize  = 64-bit
sw_peak_ptrsize  = 32/64-bit
notes_020        = All benchmarks compiled in 64-bit mode except 437.leslie3d, 450.soplex
notes_025        = and 482.sphinx3, at peak, are compiled in 32-bit mode
notes_026        = taskset was used to bind processes to cores except
notes_027        = for 436.cactusADM peak
notes_028        = OMP_NUM_THREADS set to number of processors
notes_029        = KMP_AFFINITY set to "physical,0"
notes_030        = KMP_STACKSIZE set to 64M




# The following section was added automatically, and contains settings that
# did not appear in the original configuration file, but were added to the
# raw file after the run.
default:
flagsurl000 = Intel-ic11.0-int-linux64-revA.xml
flagsurl001 = Intel-Linux64-Platform.xml
```

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

```
# Invocation command line:
# /data1/cpu2006-1.1/bin/runspec --rate 24 -c cpu2006.1.1.ic11.0.linux64.dgt.rate.cfg --flagsurl=Intel-ic11.0-int-linux64-revA.xml,Intel-Linux64-
Platform.xml --define dgt4p24cores -v 7 -T all -o asc int
# output_root was not used for this run
################################################################################
################################################################################
# This is a sample config file. It was tested with:
#
#     Compiler name/version:     Intel Compiler 11.0
#     Operating system version:   64-Bit  LINUX Enterprise Server 10 or later
#     Hardware:                 Intel Core 2 and compatible Intel processors
#                              supporting Intel 64 and SSE4.1
#
################################################################################
# SPEC CPU2006 Intel Linux64 config file
# July 2008 Intel Compiler 11.0 for Linux64
################################################################################
action     = validate
tune       = base
ext        = cpu2006.1.1.ic11.0.linux64.dgt.rate
PATHSEP    = /
check_md5=1
reportable=1


#
# These are listed as benchmark-tuning-extension-machine
#
default=default=default=default:
CC  = icc
CXX = icpc
FC=ifort
OBJ = .o
SMARTHEAP_DIR = /spec/cpu2006.1.1/lib

submit= MYMASK=`printf '0x%x' \$((1<<\$SPECCOPYNUM))`; taskset \$MYMASK $command

#########################################################################
# Compiler options
# for Dunnington use -xSSE4.1
# for processors prior to dunnington, replace -xSSE4.1 with -xSSSE3
#########################################################################

SSE        = -xSSE4.1
FAST       = $(SSE) -ipo -O3 -no-prec-div -static
FASTNOSTATIC = $(SSE) -ipo -O3 -no-prec-div


###############################################################
#
# portability & libraries
#
#################### Portability Flags and Notes #####################

400.perlbench=default:
CPORTABILITY=     -DSPEC_CPU_LINUX_IA32

403.gcc=default:
EXTRA_CFLAGS=     -Dalloca=_alloca

462.libquantum=default:
CPORTABILITY=     -DSPEC_CPU_LINUX

483.xalancbmk=default:
CXXPORTABILITY=   -DSPEC_CPU_LINUX

fp=default:
PORTABILITY = -DSPEC_CPU_LP64
```

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Enterprise Linux 5.2 Intel-based servers

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```
435.gromacs=default=default=default:
LDPORTABILITY = -nofor_main

436.cactusADM=default=default=default:
LDPORTABILITY = -nofor_main

454.calculix=default=default=default:
LDPORTABILITY = -nofor_main

481.wrf=default=default=default:
CPORTABILITY = -DSPEC_CPU_CASE_FLAG -DSPEC_CPU_LINUX



# Tuning Flags
##################################################################

#
# Base tuning default optimization
# Feedback directed optimization not allowed in baseline for CPU2006
# However there is no limit on the number of flags as long as the same
# flags are used in the same order for all benchmarks of a given language

471.omnetpp,473.astar,483.xalancbmk=default:
EXTRA_LIBS=  -L$(SMARTHEAP_DIR) -lsmartheap
EXTRA_LDFLAGS= -Wl,-z,muldefs

int=base=default=default:
COPTIMIZE=    $(FAST) -inline-calloc -opt-malloc-options=3  -opt-prefetch
CXXOPTIMIZE=  $(FASTNOSTATIC)  -opt-prefetch

fp=base=default=default:
OPTIMIZE=   $(FAST)  -opt-prefetch

##################################################################
# Peak Tuning Flags int 2006 fast
##################################################################
int=peak=default:
COPTIMIZE=      $(FAST) -opt-prefetch
CXXOPTIMIZE=    $(FASTNOSTATIC)  -opt-prefetch
PASS1_CFLAGS =  -prof-gen
PASS2_CFLAGS =  -prof-use
PASS1_CXXFLAGS = -prof-gen
PASS2_CXXFLAGS = -prof-use
PASS1_LDFLAGS =  -prof-gen
PASS2_LDFLAGS =  -prof-use

400.perlbench=peak=default:
COPTIMIZE= $(FAST) -ansi-alias -opt-prefetch

401.bzip2=peak=default:
CC= /opt/intel/Compiler/11.0/042/bin/intel64/icc -L/opt/intel/Compiler/11.0/042/ipp/em64t/lib -I/opt/intel/Compiler/11.0/042/ipp/em64t/include
CPORTABILITY= -DSPEC_CPU_LP64
COPTIMIZE= $(FAST) -opt-prefetch -ansi-alias

403.gcc=peak=default:
COPTIMIZE = $(FAST) -inline-calloc -opt-malloc-options=3
feedback=0

429.mcf=peak=default:
COPTIMIZE= $(FAST) -opt-prefetch

445.gobmk=peak=default:
COPTIMIZE= $(SSE) -O2 -ipo -no-prec-div -ansi-alias

456.hmmer=peak=default:
CC= /opt/intel/Compiler/11.0/042/bin/intel64/icc -L/opt/intel/Compiler/11.0/042/ipp/em64t/lib -I/opt/intel/Compiler/11.0/042/ipp/em64t/include
CPORTABILITY= -DSPEC_CPU_LP64
COPTIMIZE=  $(FAST) -unroll2 -ansi-alias
```

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```
feedback=no

458.sjeng=peak=default:
COPTIMIZE= $(FAST) -unroll4

462.libquantum=peak=default:
COPTIMIZE= $(FAST) -opt-malloc-options=3 -parallel -par-runtime-control -opt-prefetch
feedback=no
copies=1
submit=

464.h264ref=peak=default:
COPTIMIZE= $(FAST) -unroll2 -ansi-alias

471.omnetpp=peak=default:
CXXOPTIMIZE=  $(FASTNOSTATIC) -ansi-alias -opt-ra-region-strategy=block

473.astar=peak=default:
CXXOPTIMIZE=  $(FASTNOSTATIC)  -ansi-alias -opt-ra-region-strategy=routine

483.xalancbmk=peak=default:
basepeak=yes

###################################################################
# Peak Tuning Flags for FP
###################################################################
fp=peak=default:
OPTIMIZE=    $(FAST)
COPTIMIZE=   -auto-ilp32
CXXOPTIMIZE= -auto-ilp32
PASS1_CFLAGS =   -prof-gen
PASS2_CFLAGS =   -prof-use
PASS1_CXXFLAGS = -prof-gen
PASS2_CXXFLAGS = -prof-use
PASS1_FFLAGS =   -prof-gen
PASS2_FFLAGS =   -prof-use
PASS1_LDFLAGS = -prof-gen
PASS2_LDFLAGS = -prof-use

410.bwaves=peak=default:
OPTIMIZE=   $(FAST) -opt-prefetch
feedback=0
########################################################################################################
###################
%ifdef %{stoakleydp8cores}
copies=4
submit= if `test $SPECCOPYNUM -le 1`; then  taskset -c $SPECCOPYNUM $command ; else taskset -c `expr $SPECCOPYNUM + 4`
$command ; fi
%endif
########################################################################################################
###################

416.gamess=peak=default:
OPTIMIZE= $(FAST) -unroll2 -Ob0 -ansi-alias -scalar-rep-

433.milc=peak=default:
OPTIMIZE= $(FAST) -fno-alias
COPTIMIZE=

435.gromacs=peak=default:
OPTIMIZE=   $(FAST) -opt-prefetch

436.cactusADM=peak=default:
OPTIMIZE= $(FAST) -unroll2 -opt-prefetch  -parallel
copies=1
submit=

437.leslie3d=peak=default:
PORTABILITY =
```

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```
FC= /opt/intel/Compiler/11.0/042/bin/ia32/ifort -L/opt/intel/Compiler/11.0/042/ipp/ia32/lib -I/opt/intel/Compiler/11.0/042/ipp/ia32/include
OPTIMIZE=    $(FAST)  -opt-malloc-options=3 -opt-prefetch
###############################################################################################################
####################
%ifdef %{stoakleydp8cores}
copies=4
submit= if `test $SPECCOPYNUM -le 1`; then  taskset -c $SPECCOPYNUM $command ; else taskset -c `expr $SPECCOPYNUM + 4`
$command ; fi
%endif
###############################################################################################################
####################

444.namd=peak=default:
CXXOPTIMIZE= $(FAST) -fno-alias -auto-ilp32

447.dealII=peak=default:
CXXOPTIMIZE= $(FAST) -unroll2 -ansi-alias -scalar-rep-

450.soplex=peak=default:
PORTABILITY =
CXX= /opt/intel/Compiler/11.0/042/bin/ia32/icpc -L/opt/intel/Compiler/11.0/042/ipp/ia32/lib -I/opt/intel/Compiler/11.0/042/ipp/ia32/include
OPTIMIZE= $(FAST) -opt-malloc-options=3
CXXOPTIMIZE=

453.povray=peak=default:
CXXOPTIMIZE= $(FAST) -unroll4 -ansi-alias

454.calculix=peak=default:
OPTIMIZE= $(FAST)
feedback=0

459.GemsFDTD=peak=default:
OPTIMIZE= $(FAST)  -unroll2 -Ob0 -opt-prefetch

465.tonto=peak=default:
OPTIMIZE= $(FAST) -unroll4 -auto

470.lbm=peak=default:
OPTIMIZE=   $(FAST) -opt-prefetch
feedback=no


###############################################################################################################
####################
%ifdef %{bensleydp8cores}
copies=2
submit= if `test $SPECCOPYNUM -le 0`; then  taskset -c $SPECCOPYNUM $command ; else taskset -c `expr $SPECCOPYNUM + 4`
$command ; fi
%endif

%ifdef %{stoakleydp8cores}
copies=4
submit= if `test $SPECCOPYNUM -le 1`; then  taskset -c $SPECCOPYNUM $command ; else taskset -c `expr $SPECCOPYNUM + 4`
$command ; fi
%endif

%ifdef %{tgt4p16cores}
copies=8
submit= if `test $SPECCOPYNUM -le 3`; then  taskset -c $SPECCOPYNUM $command ; else taskset -c `expr $SPECCOPYNUM + 8`
$command ; fi
%endif

%ifdef %{dgt4p24cores}
copies=12
submit= $[top]/mysubmit.pl $SPECCOPYNUM "$command"
%endif

%ifdef %{dgt4p16cores}
copies=8
submit= $[top]/mysubmit.pl $SPECCOPYNUM "$command"
```

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```
%endif
###########################################################################################################
##################
```

481.wrf=peak=default:
basepeak=yes

482.sphinx3=peak=default:
PORTABILITY =
CC= /opt/intel/Compiler/11.0/042/bin/ia32/icc -L/opt/intel/Compiler/11.0/042/ipp/ia32/lib -I/opt/intel/Compiler/11.0/042/ipp/ia32/include
COPTIMIZE= -unroll2
feedback=no

```
###########################################################################################################
##################
%ifdef %{stoakleydp8cores}
copies=4
submit= if `test $SPECCOPYNUM -le 1`; then  taskset -c $SPECCOPYNUM $command ; else taskset -c `expr $SPECCOPYNUM + 4`
$command ; fi
%endif

%ifdef %{tgt4p16cores}
copies=8
submit= if `test $SPECCOPYNUM -le 3`; then  taskset -c $SPECCOPYNUM $command ; else taskset -c `expr $SPECCOPYNUM + 8`
$command ; fi
%endif

%ifdef %{dgt4p24cores}
copies=12
submit= $[top]/mysubmit.pl $SPECCOPYNUM "$command"
%endif

%ifdef %{dgt4p16cores}
copies=8
submit= $[top]/mysubmit.pl $SPECCOPYNUM "$command"
%endif
###########################################################################################################
##################
```

```
####################################################################
# (Edit this to match your system)
####################################################################
```

default=default=default=default:
license_num   = 3184
test_sponsor   = Intel Corporation
hw_avail   = Sep-2008
sw_avail   = Sep-2008
tester   = Principled Technologies
hw_cpu_name   = Intel Xeon X7460
hw_cpu_char   =
hw_cpu_mhz   = 2666
hw_disk   = 146 GB SATA, 10,000RPM
hw_fpu   = Integrated
hw_memory   = 30 GB
hw_model   = Intel Server Board
hw_ncpuorder   = 1,2,4 chips
hw_ncores   = 24
hw_nchips   = 4
hw_ncoresperchip = 6
hw_nthreadspercore = 1
hw_other   = None
hw_pcache   = 32 KB I + 32 KB D on chip per core

```
hw_scache      = 9 MB I+D on chip per core, 3 MB shared / 2 cores
hw_tcache      = 16 MB
hw_ocache      = None
hw_vendor      = Intel Corporation
prepared_by    = PT
sw_file        = ext3
sw_os000       = Red Hat Enterprise Linux Server release 5.2
sw_os001 = Kernel 2.6.18-92.el5xen x86_64
sw_state       = Run level 3 (multi-user)
sw_other000    = Microquill SmartHeap V8.1
sw_other001    = Binutils 2.18.50.0.7.20080502

int=default=default=default:
sw_compiler000   = Intel C++ Compiler 11.0 for Linux
sw_compiler001   = Build 20080730 Package ID: l_cc_b_11.0.042
sw_base_ptrsize  = 32-bit
sw_peak_ptrsize  = 32/64-bit
notes_000        = All benchmarks compiled in 32-bit mode except 401.bzip2 and 456.hmmer,
notes_005        = for peak, are compiled in 64-bit mode
notes_010        = taskset was used to bind processes to cores except
notes_015        = for 462.libquantum peak
notes_020        = OMP_NUM_THREADS set to number of processors
notes_025        = KMP_AFFINITY set to "physical,0"
notes_030        = KMP_STACKSIZE set to 64M
notes_035 = 'ulimit -s unlimited' was used to set the stacksize to unlimited prior to run

fp=default=default=default:
sw_compiler001   = Intel C++ and Fortran Compiler 11.0 for Linux
sw_compiler002   = Build 20080730 Package ID: l_cc_b_11.0.042, l_fc_b_11.0.042
sw_base_ptrsize  = 64-bit
sw_peak_ptrsize  = 32/64-bit
notes_020        = All benchmarks compiled in 64-bit mode except 437.leslie3d, 450.soplex
notes_025        = and 482.sphinx3, at peak, are compiled in 32-bit mode
notes_026        = taskset was used to bind processes to cores except
notes_027        = for 436.cactusADM peak
notes_028        = OMP_NUM_THREADS set to number of processors
notes_029        = KMP_AFFINITY set to "physical,0"
notes_030        = KMP_STACKSIZE set to 64M



# The following section was added automatically, and contains settings that
# did not appear in the original configuration file, but were added to the
# raw file after the run.
default:
flagsurl000 = Intel-ic11.0-int-linux64-revA.xml
flagsurl001 = Intel-Linux64-Platform.xml
```
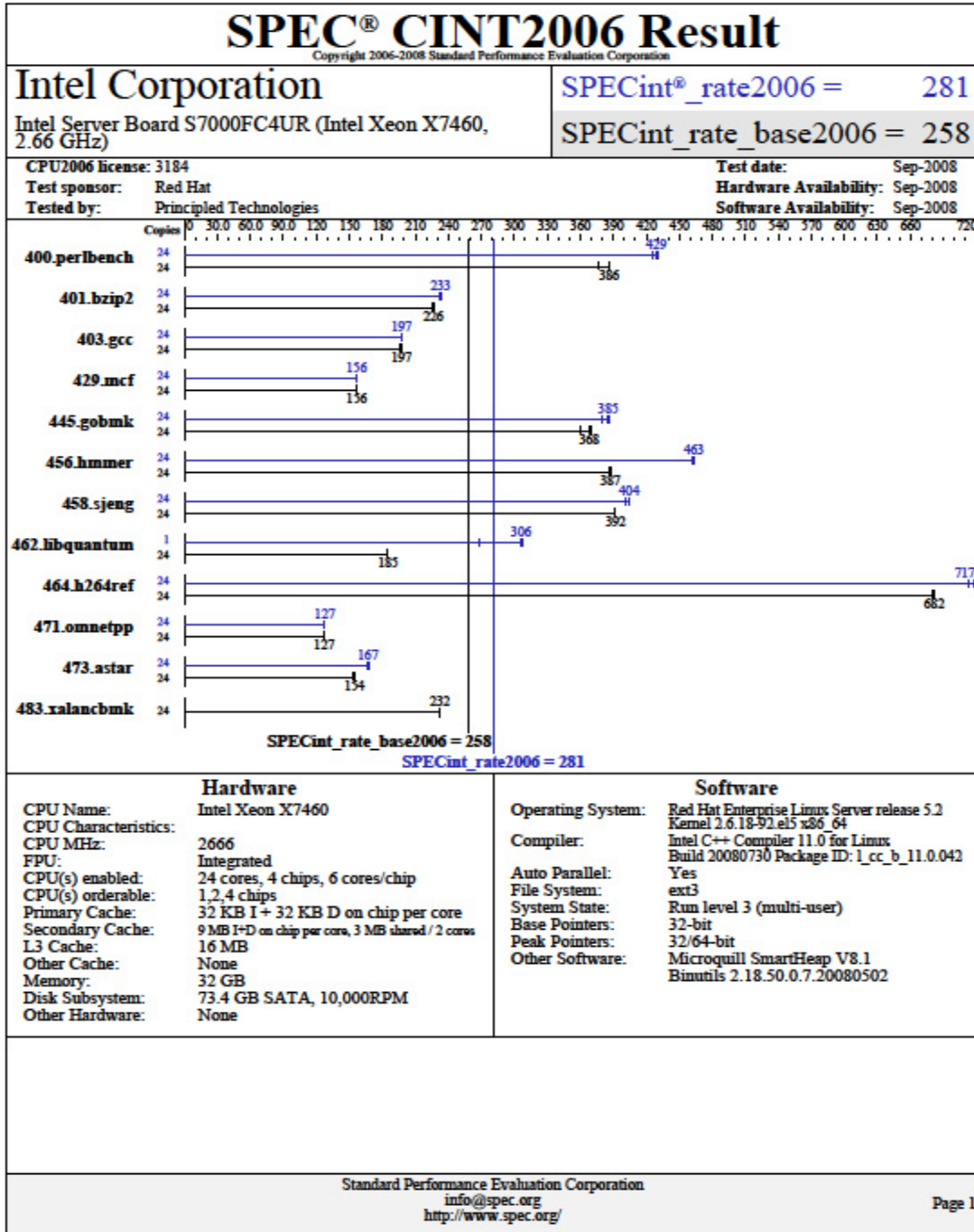
Appendix C – SPECint_rate2006 output

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

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

SPEC® CINT2006 Result
Copyright 2006-2008 Standard Performance Evaluation Corporation

Intel Corporation

Intel Server Board S7000FC4UR (Intel Xeon X7460, 2.66 GHz)

SPECint®_rate2006 = 281

SPECint_rate_base2006 = 258

CPU2006 license:	3184	
Test sponsor:	Red Hat	
Tested by:	Principled Technologies	

Test date:	Sep-2008
Hardware Availability:	Sep-2008
Software Availability:	Sep-2008

Copies

Benchmark	Copies	Value
400.perlbench	24	429
	24	386
401.bzip2	24	233
	24	226
403.gcc	24	197
	24	197
429.mcf	24	156
	24	156
445.gobmk	24	385
	24	368
456.hmmer	24	463
	24	387
458.sjeng	24	404
	24	392
462.libquantum	1	306
	24	185
464.h264ref	24	717
	24	682
471.omnetpp	24	127
	24	127
473.astar	24	167
	24	154
483.xalancbmk	24	232

SPECint_rate_base2006 = 258
SPECint_rate2006 = 281

Hardware

CPU Name:	Intel Xeon X7460
CPU Characteristics:	
CPU MHz:	2666
FPU:	Integrated
CPU(s) enabled:	24 cores, 4 chips, 6 cores/chip
CPU(s) orderable:	1,2,4 chips
Primary Cache:	32 KB I + 32 KB D on chip per core
Secondary Cache:	9 MB I+D on chip per core, 3 MB shared / 2 cores
L3 Cache:	16 MB
Other Cache:	None
Memory:	32 GB
Disk Subsystem:	73.4 GB SATA, 10,000RPM
Other Hardware:	None

Software

Operating System:	Red Hat Enterprise Linux Server release 5.2 Kernel 2.6.18-92.el5 x86_64
Compiler:	Intel C++ Compiler 11.0 for Linux Build 20080730 Package ID: l_cc_b_11.0.042
Auto Parallel:	Yes
File System:	ext3
System State:	Run level 3 (multi-user)
Base Pointers:	32-bit
Peak Pointers:	32/64-bit
Other Software:	Microquill SmartHeap V8.1 Binutils 2.18.50.0.7.20080502

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SPEC CINT2006 Result

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Intel Corporation

Intel Server Board S7000FC4UR (Intel Xeon X7460, 2.66 GHz)

SPECint_rate2006 =	281
SPECint_rate_base2006 =	258

CPU2006 license: 3184		Test date:	Sep-2008
Test sponsor:	Red Hat	Hardware Availability:	Sep-2008
Tested by:	Principled Technologies	Software Availability:	Sep-2008

Results Table

Benchmark		Base							Peak					
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
400.perlbench	24	**608**	**386**	623	377	607	386	24	550	426	544	431	**547**	**429**
401.bzip2	24	**1025**	**226**	1018	228	1027	225	24	995	233	992	233	**995**	**233**
403.gcc	24	**981**	**197**	987	196	979	197	24	980	197	976	198	**980**	**197**
429.mcf	24	1398	157	**1399**	**156**	1400	156	24	**1400**	**156**	1400	156	1402	156
445.gobmk	24	682	369	**684**	**368**	698	360	24	653	386	662	380	**654**	**385**
456.hmmer	24	578	388	**579**	**387**	580	386	24	**484**	**463**	483	464	484	463
458.sjeng	24	**741**	**392**	741	392	742	391	24	724	401	718	404	**718**	**404**
462.libquantum	24	**2688**	**185**	2689	185	2688	185	1	77.5	267	67.5	307	**67.7**	**306**
464.h264ref	24	782	680	**779**	**682**	779	682	24	745	713	**741**	**717**	740	718
471.omnetpp	24	1184	127	**1182**	**127**	1182	127	24	1177	127	1178	127	**1177**	**127**
473.astar	24	1090	155	**1092**	**154**	1096	154	24	1006	167	1014	166	**1011**	**167**
483.xalancbmk	24	712	233	715	232	**713**	**232**	24	712	233	715	232	**713**	**232**

Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

Submit Notes

The config file option 'submit' was used.

General Notes

All benchmarks compiled in 32-bit mode except 401.bzip2 and 456.hmmer, for peak, are compiled in 64-bit mode
taskset was used to bind processes to cores except
for 462.libquantum peak
OMP_NUM_THREADS set to number of processors
KMP_AFFINITY set to "physical,0"
KMP_STACKSIZE set to 64M
'ulimit -s unlimited' was used to set the stacksize to unlimited prior to run

Base Compiler Invocation

C benchmarks:
    icc

C++ benchmarks:
    icpc

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SPEC CINT2006 Result

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Intel Corporation	SPECint_rate2006 =	281
Intel Server Board S7000FC4UR (Intel Xeon X7460, 2.66 GHz)	SPECint_rate_base2006 =	258

CPU2006 license: 3184		Test date:	Sep-2008
Test sponsor: Red Hat		Hardware Availability:	Sep-2008
Tested by: Principled Technologies		Software Availability:	Sep-2008

Base Portability Flags

```
400.perlbench: -DSPEC_CPU_LINUX_IA32
462.libquantum: -DSPEC_CPU_LINUX
483.xalancbmk: -DSPEC_CPU_LINUX
```

Base Optimization Flags

C benchmarks:
```
-xSSE4.1 -ipo -O3 -no-prec-div -static -inline-calloc
-opt-malloc-options=3 -opt-prefetch
```

C++ benchmarks:
```
-xSSE4.1 -ipo -O3 -no-prec-div -opt-prefetch -Wl,-z,muldefs
-L/spec/cpu2006.1.1/lib -lsmartheap
```

Base Other Flags

C benchmarks:
```
403.gcc: -Dalloca=_alloca
```

Peak Compiler Invocation

C benchmarks (except as noted below):
```
icc
```
```
401.bzip2: /opt/intel/Compiler/11.0/042/bin/intel64/icc
           -L/opt/intel/Compiler/11.0/042/ipp/em64t/lib
           -I/opt/intel/Compiler/11.0/042/ipp/em64t/include

456.hmmer: /opt/intel/Compiler/11.0/042/bin/intel64/icc
           -L/opt/intel/Compiler/11.0/042/ipp/em64t/lib
           -I/opt/intel/Compiler/11.0/042/ipp/em64t/include
```

C++ benchmarks:
```
icpc
```

Peak Portability Flags

```
400.perlbench: -DSPEC_CPU_LINUX_IA32
401.bzip2: -DSPEC_CPU_LP64
456.hmmer: -DSPEC_CPU_LP64
```

Continued on next page

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SPEC CINT2006 Result

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Intel Corporation	SPECint_rate2006 =	281
Intel Server Board S7000FC4UR (Intel Xeon X7460, 2.66 GHz)	SPECint_rate_base2006 =	258

CPU2006 license: 3184		Test date:	Sep-2008
Test sponsor:	Red Hat	Hardware Availability:	Sep-2008
Tested by:	Principled Technologies	Software Availability:	Sep-2008

Peak Portability Flags (Continued)

462.libquantum: -DSPEC_CPU_LINUX
483.xalancbmk: -DSPEC_CPU_LINUX

Peak Optimization Flags

C benchmarks:

400.perlbench: -prof-gen(pass 1) -prof-use(pass 2) -xSSE4.1 -ipo -O3
-no-prec-div -static -ansi-alias -opt-prefetch

401.bzip2: -prof-gen(pass 1) -prof-use(pass 2) -xSSE4.1 -ipo -O3
-no-prec-div -static -opt-prefetch -ansi-alias

403.gcc: -xSSE4.1 -ipo -O3 -no-prec-div -static -inline-calloc
-opt-malloc-options=3

429.mcf: -prof-gen(pass 1) -prof-use(pass 2) -xSSE4.1 -ipo -O3
-no-prec-div -static -opt-prefetch

445.gobmk: -prof-gen(pass 1) -prof-use(pass 2) -xSSE4.1 -O2 -ipo
-no-prec-div -ansi-alias

456.hmmer: -xSSE4.1 -ipo -O3 -no-prec-div -static -unroll2
-ansi-alias

458.sjeng: -prof-gen(pass 1) -prof-use(pass 2) -xSSE4.1 -ipo -O3
-no-prec-div -static -unroll4

462.libquantum: -xSSE4.1 -ipo -O3 -no-prec-div -static
-opt-malloc-options=3 -parallel -par-runtime-control
-opt-prefetch

464.h264ref: -prof-gen(pass 1) -prof-use(pass 2) -xSSE4.1 -ipo -O3
-no-prec-div -static -unroll2 -ansi-alias

C++ benchmarks:

471.omnetpp: -prof-gen(pass 1) -prof-use(pass 2) -xSSE4.1 -ipo -O3
-no-prec-div -ansi-alias -opt-ra-region-strategy-block
-Wl,-z,muldefs -L/spec/cpu2006.1.1/lib -lsmartheap

473.astar: -prof-gen(pass 1) -prof-use(pass 2) -xSSE4.1 -ipo -O3
-no-prec-div -ansi-alias -opt-ra-region-strategy-routine
-Wl,-z,muldefs -L/spec/cpu2006.1.1/lib -lsmartheap

483.xalancbmk: basepeak = yes

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SPEC CINT2006 Result

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Intel Corporation

Intel Server Board S7000FC4UR (Intel Xeon X7460, 2.66 GHz)

SPECint_rate2006 =	281
SPECint_rate_base2006 =	258

CPU2006 license: 3184		Test date:	Sep-2008
Test sponsor:	Red Hat	Hardware Availability:	Sep-2008
Tested by:	Principled Technologies	Software Availability:	Sep-2008

Peak Other Flags
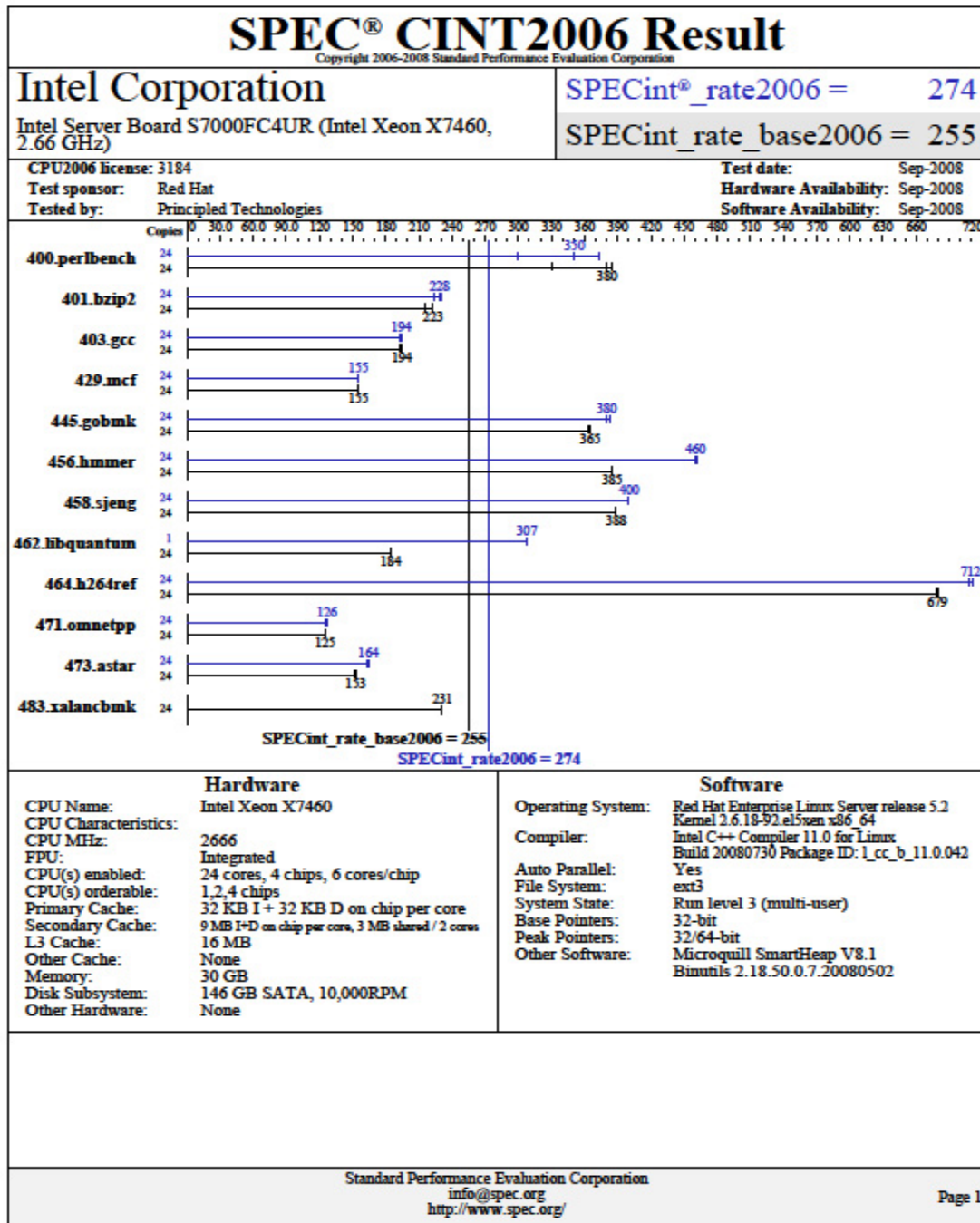
Same as Base Other Flags

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Tested with SPEC CPU2006 v1.1.
Report generated on Wed Sep 10 12:36:26 2008 by SPEC CPU2006 PS/PDF formatter v6128.

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SPEC® CINT2006 Result

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Intel Corporation

Intel Server Board S7000FC4UR (Intel Xeon X7460, 2.66 GHz)

SPECint®_rate2006 =	274
SPECint_rate_base2006 =	255

CPU2006 license: 3184		Test date:	Sep-2008
Test sponsor:	Red Hat	Hardware Availability:	Sep-2008
Tested by:	Principled Technologies	Software Availability:	Sep-2008

Copies — bar chart (scale 0 to 720)

- 400.perlbench: 24 / 24 — 350, 380
- 401.bzip2: 24 / 24 — 228, 223
- 403.gcc: 24 / 24 — 194, 194
- 429.mcf: 24 / 24 — 155, 155
- 445.gobmk: 24 / 24 — 380, 365
- 456.hmmer: 24 / 24 — 460, 385
- 458.sjeng: 24 / 24 — 400, 388
- 462.libquantum: 1 / 24 — 307, 184
- 464.h264ref: 24 / 24 — 712, 679
- 471.omnetpp: 24 / 24 — 126, 125
- 473.astar: 24 / 24 — 164, 133
- 483.xalancbmk: 24 — 231

SPECint_rate_base2006 = 255

SPECint_rate2006 = 274

Hardware

CPU Name:	Intel Xeon X7460
CPU Characteristics:	
CPU MHz:	2666
FPU:	Integrated
CPU(s) enabled:	24 cores, 4 chips, 6 cores/chip
CPU(s) orderable:	1,2,4 chips
Primary Cache:	32 KB I + 32 KB D on chip per core
Secondary Cache:	9 MB I+D on chip per core, 3 MB shared / 2 cores
L3 Cache:	16 MB
Other Cache:	None
Memory:	30 GB
Disk Subsystem:	146 GB SATA, 10,000RPM
Other Hardware:	None

Software

Operating System:	Red Hat Enterprise Linux Server release 5.2 Kernel 2.6.18-92.el5xen x86_64
Compiler:	Intel C++ Compiler 11.0 for Linux Build 20080730 Package ID: l_cc_b_11.0.042
Auto Parallel:	Yes
File System:	ext3
System State:	Run level 3 (multi-user)
Base Pointers:	32-bit
Peak Pointers:	32/64-bit
Other Software:	Microquill SmartHeap V8.1 Binutils 2.18.50.0.7.20080502

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SPEC CINT2006 Result

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Intel Corporation

Intel Server Board S7000FC4UR (Intel Xeon X7460, 2.66 GHz)

SPECint_rate2006 =	274
SPECint_rate_base2006 =	255

CPU2006 license: 3184	**Test date:**	Sep-2008
Test sponsor: Red Hat	**Hardware Availability:**	Sep-2008
Tested by: Principled Technologies	**Software Availability:**	Sep-2008

Results Table

Benchmark	Copies	Base Seconds	Base Ratio	Base Seconds	Base Ratio	Base Seconds	Base Ratio	Copies	Peak Seconds	Peak Ratio	Peak Seconds	Peak Ratio	Peak Seconds	Peak Ratio
400.perlbench	24	610	384	**617**	**380**	708	331	24	784	299	**669**	**350**	629	373
401.bzip2	24	1072	216	**1040**	**223**	1040	223	24	1035	224	**1015**	**228**	1007	230
403.gcc	24	999	193	**994**	**194**	991	195	24	**996**	**194**	1004	193	995	194
429.mcf	24	1411	155	**1411**	**155**	1412	155	24	1418	154	1411	155	**1413**	**155**
445.gobmk	24	690	365	**690**	**365**	692	364	24	**663**	**380**	664	379	658	383
456.hmmer	24	**582**	**385**	582	385	581	385	24	**487**	**460**	485	461	487	460
458.sjeng	24	**748**	**388**	748	388	748	388	24	726	400	**726**	**400**	727	399
462.libquantum	24	**2699**	**184**	2702	184	2696	184	1	**67.4**	**307**	67.4	308	67.5	307
464.h264ref	24	**782**	**679**	783	678	781	680	24	746	712	750	709	**746**	**712**
471.omnetpp	24	**1201**	**125**	1201	125	1196	125	24	1192	126	**1187**	**126**	1185	127
473.astar	24	1097	154	**1105**	**153**	1106	152	24	**1027**	**164**	1018	166	1028	164
483.xalancbmk	24	721	230	**717**	**231**	716	231	24	721	230	**717**	**231**	716	231

Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

Submit Notes

The config file option 'submit' was used.

General Notes

All benchmarks compiled in 32-bit mode except 401.bzip2 and 456.hmmer, for peak, are compiled in 64-bit mode
taskset was used to bind processes to cores except for 462.libquantum peak
OMP_NUM_THREADS set to number of processors
KMP_AFFINITY set to "physical,0"
KMP_STACKSIZE set to 64M
'ulimit -s unlimited' was used to set the stacksize to unlimited prior to run

Base Compiler Invocation

C benchmarks:
    icc

C++ benchmarks:
    icpc

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SPEC CINT2006 Result

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Intel Corporation

Intel Server Board S7000FC4UR (Intel Xeon X7460, 2.66 GHz)

| SPECint_rate2006 = | 274 |
| SPECint_rate_base2006 = | 255 |

CPU2006 license: 3184		**Test date:**	Sep-2008
Test sponsor: Red Hat		**Hardware Availability:**	Sep-2008
Tested by: Principled Technologies		**Software Availability:**	Sep-2008

Base Portability Flags

```
400.perlbench: -DSPEC_CPU_LINUX_IA32
462.libquantum: -DSPEC_CPU_LINUX
483.xalancbmk: -DSPEC_CPU_LINUX
```

Base Optimization Flags

C benchmarks:
```
-xSSE4.1 -ipo -O3 -no-prec-div -static -inline-calloc
-opt-malloc-options=3 -opt-prefetch
```

C++ benchmarks:
```
-xSSE4.1 -ipo -O3 -no-prec-div -opt-prefetch -Wl,-z,muldefs
-L/spec/cpu2006.1.1/lib -lsmartheap
```

Base Other Flags

C benchmarks:
```
403.gcc: -Dalloca=_alloca
```

Peak Compiler Invocation

C benchmarks (except as noted below):
```
icc
```
```
401.bzip2: /opt/intel/Compiler/11.0/042/bin/intel64/icc
           -L/opt/intel/Compiler/11.0/042/ipp/em64t/lib
           -I/opt/intel/Compiler/11.0/042/ipp/em64t/include

456.hmmer: /opt/intel/Compiler/11.0/042/bin/intel64/icc
           -L/opt/intel/Compiler/11.0/042/ipp/em64t/lib
           -I/opt/intel/Compiler/11.0/042/ipp/em64t/include
```

C++ benchmarks:
```
icpc
```

Peak Portability Flags

```
400.perlbench: -DSPEC_CPU_LINUX_IA32
401.bzip2: -DSPEC_CPU_LP64
456.hmmer: -DSPEC_CPU_LP64
```

Continued on next page

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SPEC CINT2006 Result

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Intel Corporation	SPECint_rate2006 =	274
Intel Server Board S7000FC4UR (Intel Xeon X7460, 2.66 GHz)	SPECint_rate_base2006 = 255	

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Test sponsor:	Red Hat	Hardware Availability:	Sep-2008
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Peak Portability Flags (Continued)

462.libquantum: -DSPEC_CPU_LINUX
483.xalancbmk: -DSPEC_CPU_LINUX

Peak Optimization Flags

C benchmarks:

400.perlbench: -prof-gen(pass 1) -prof-use(pass 2) -xSSE4.1 -ipo -O3
-no-prec-div -static -ansi-alias -opt-prefetch

401.bzip2: -prof-gen(pass 1) -prof-use(pass 2) -xSSE4.1 -ipo -O3
-no-prec-div -static -opt-prefetch -ansi-alias

403.gcc: -xSSE4.1 -ipo -O3 -no-prec-div -static -inline-calloc
-opt-malloc-options=3

429.mcf: -prof-gen(pass 1) -prof-use(pass 2) -xSSE4.1 -ipo -O3
-no-prec-div -static -opt-prefetch

445.gobmk: -prof-gen(pass 1) -prof-use(pass 2) -xSSE4.1 -O2 -ipo
-no-prec-div -ansi-alias

456.hmmer: -xSSE4.1 -ipo -O3 -no-prec-div -static -unroll2
-ansi-alias

458.sjeng: -prof-gen(pass 1) -prof-use(pass 2) -xSSE4.1 -ipo -O3
-no-prec-div -static -unroll4

462.libquantum: -xSSE4.1 -ipo -O3 -no-prec-div -static
-opt-malloc-options=3 -parallel -par-runtime-control
-opt-prefetch

464.h264ref: -prof-gen(pass 1) -prof-use(pass 2) -xSSE4.1 -ipo -O3
-no-prec-div -static -unroll2 -ansi-alias

C++ benchmarks:

471.omnetpp: -prof-gen(pass 1) -prof-use(pass 2) -xSSE4.1 -ipo -O3
-no-prec-div -ansi-alias -opt-ra-region-strategy-block
-Wl,-z,muldefs -L/spec/cpu2006.1.1/lib -lsmartheap

473.astar: -prof-gen(pass 1) -prof-use(pass 2) -xSSE4.1 -ipo -O3
-no-prec-div -ansi-alias -opt-ra-region-strategy-routine
-Wl,-z,muldefs -L/spec/cpu2006.1.1/lib -lsmartheap

483.xalancbmk: basepeak - yes

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SPEC CINT2006 Result
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Intel Corporation	SPECint_rate2006 =	274
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CPU2006 license: 3184		Test date:	Sep-2008
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Peak Other Flags

Same as Base Other Flags

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