SPEC® CFP2006 Result
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Hewlett Packard Enterprise
(Test Sponsor: HPE)

ProLiant XL450 Gen9
(2.00 GHz, Intel Xeon E5-2660 v4)

$SPECfp®\_rate2006 = 872$
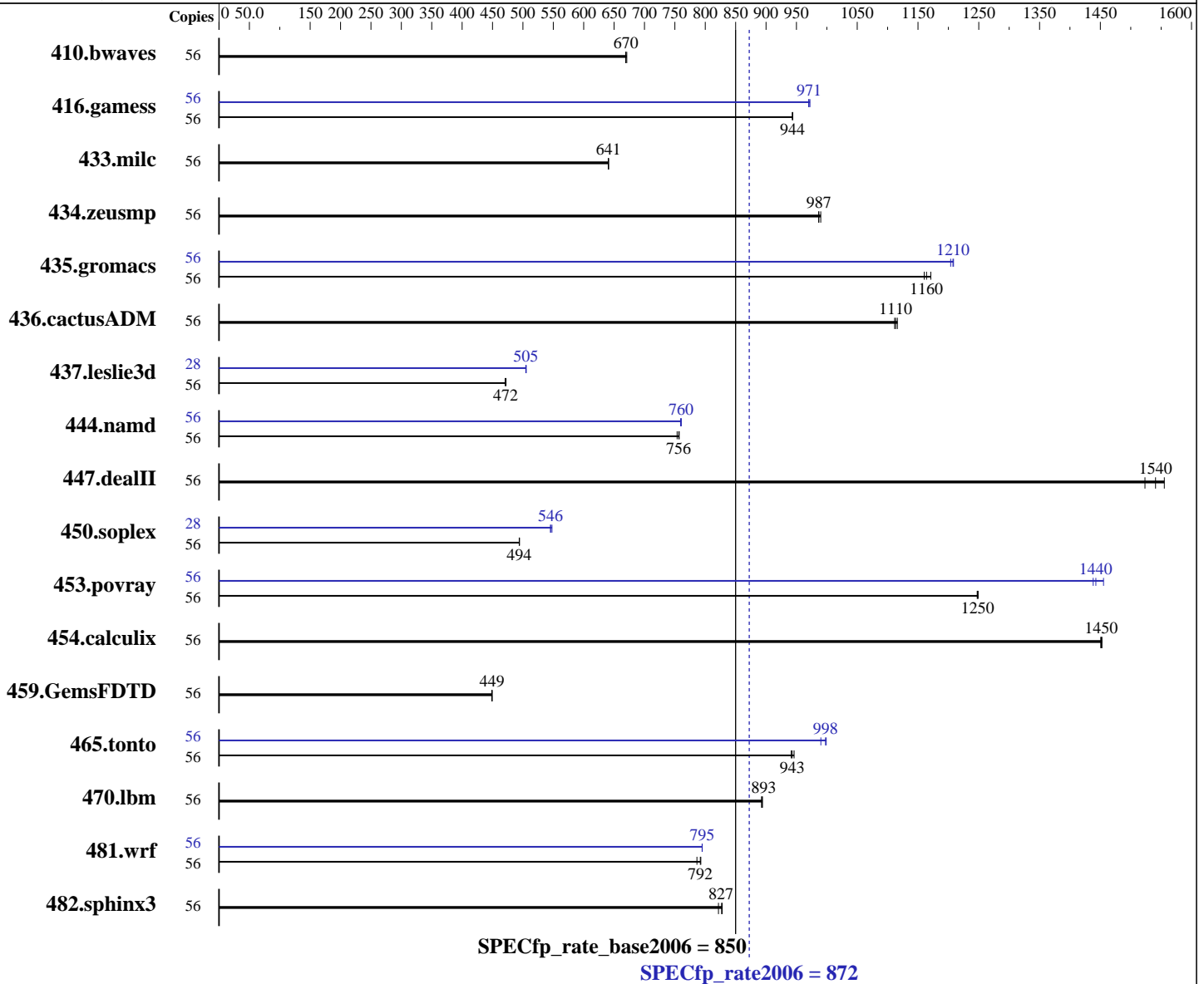
$SPECfp\_rate\_base2006 = 850$

CPU2006 license: 3
Test sponsor: HPE
Tested by: HPE

Test date: Apr-2016
Hardware Availability: Mar-2016
Software Availability: Nov-2015

Copies		
410.bwaves	56	670
416.gamess	56	971
	56	944
433.milc	56	641
434.zeusmp	56	987
435.gromacs	56	1210
	56	1160
436.cactusADM	56	1110
437.leslie3d	28	505
	56	472
444.namd	56	760
	56	756
447.dealII	56	1540
450.soplex	28	546
	56	494
453.povray	56	1440
	56	1250
454.calculix	56	1450
459.GemsFDTD	56	449
465.tonto	56	998
	56	943
470.lbm	56	893
481.wrf	56	795
	56	792
482.sphinx3	56	827

SPECfp_rate_base2006 = 850

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Hardware
CPU Name: Intel Xeon E5-2660 v4
CPU Characteristics: Intel Turbo Boost Technology up to 3.20 GHz
CPU MHz: 2000
FPU: Integrated
CPU(s) enabled: 28 cores, 2 chips, 14 cores/chip, 2 threads/core
CPU(s) orderable: 1,2 chips
Primary Cache: 32 KB I + 32 KB D on chip per core
Secondary Cache: 256 KB I+D on chip per core

Continued on next page

Software
Operating System: Red Hat Enterprise Linux Server release 7.2 (Maipo),
Kernel 3.10.0-229.el7.x86_64
Compiler: C/C++: Version 16.0.0.101 of Intel C++ Studio XE for Linux;
Fortran: Version 16.0.0.101 of Intel Fortran Studio XE for Linux
Auto Parallel: No
File System: xfs

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L3 Cache:	35 MB I+D on chip per chip	System State:	Run level 3 (multi-user)
Other Cache:	None	Base Pointers:	32/64-bit
Memory:	256 GB (8 x 32 GB 2Rx4 PC4-2400T-R)	Peak Pointers:	32/64-bit
Disk Subsystem:	2 x 480 GB SATA SSD, RAID 1	Other Software:	None
Other Hardware:	None		

Results Table

Benchmark	Base Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Peak Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
410.bwaves	56	**1137**	**670**	1138	669	1134	671	56	**1137**	**670**	1138	669	1134	671
416.gamess	56	1162	944	**1162**	**944**	1162	943	56	1130	970	**1129**	**971**	1128	972
433.milc	56	803	640	802	641	**802**	**641**	56	803	640	802	641	**802**	**641**
434.zeusmp	56	515	990	**516**	**987**	516	987	56	515	990	**516**	**987**	516	987
435.gromacs	56	341	1170	345	1160	**344**	**1160**	56	**331**	**1210**	332	1200	331	1210
436.cactusADM	56	602	1110	**601**	**1110**	600	1120	56	602	1110	**601**	**1110**	600	1120
437.leslie3d	56	1115	472	**1116**	**472**	1118	471	28	521	506	**521**	**505**	521	505
444.namd	56	596	754	**594**	**756**	593	757	56	591	761	**591**	**760**	591	759
447.dealII	56	412	1560	421	1520	**416**	**1540**	56	412	1560	421	1520	**416**	**1540**
450.soplex	56	**945**	**494**	946	494	945	494	28	426	548	**428**	**546**	428	546
453.povray	56	**239**	**1250**	239	1250	239	1250	56	205	1460	**207**	**1440**	207	1440
454.calculix	56	318	1450	318	1450	**318**	**1450**	56	318	1450	318	1450	**318**	**1450**
459.GemsFDTD	56	1324	449	**1323**	**449**	1322	449	56	1324	449	**1323**	**449**	1322	449
465.tonto	56	582	946	**584**	**943**	585	941	56	556	990	**552**	**998**	552	999
470.lbm	56	861	894	**861**	**893**	862	893	56	861	894	**861**	**893**	862	893
481.wrf	56	**790**	**792**	789	793	796	786	56	**787**	**795**	787	795	787	795
482.sphinx3	56	**1320**	**827**	1318	828	1328	822	56	**1320**	**827**	1318	828	1328	822

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

Submit Notes

    The numactl mechanism was used to bind copies to processors. The config file option 'submit' was used to generate numactl commands to bind each copy to a specific processor. For details, please see the config file.

Operating System Notes

    Stack size set to unlimited using "ulimit -s unlimited"
Transparent Huge Pages enabled with:
  echo always > /sys/kernel/mm/transparent_hugepage/enabled
Filesystem page cache cleared with:
  echo 1 >   /proc/sys/vm/drop_caches
runspec command invoked through numactl i.e.:
  numactl --interleave=all runspec <etc>

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$SPECfp_rate_base2006 = $ 850

CPU2006 license: 3
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Test date: Apr-2016
Hardware Availability: Mar-2016
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Platform Notes

```
BIOS Configuration:
  Power Profile set to Custom
  Power Regulator set to HP Static High Performance Mode
  Minimum Processor Idle Power Core C-State set to C6 State
  Minimum Processor Idle Power Package C-State set to No Package State
  QPI Snoop Configuration set to Cluster on Die
  Collaborative Power Control set to Disabled
  Thermal Configuration set to Maximum Cooling
  Processor Power and Utilization Monitoring set to Disabled
  Memory Refresh Rate set to 1x Refresh
  Memory Patrol Scrubbing set to Disabled

Sysinfo program /home/cpu2006/config/sysinfo.rev6914
$Rev: 6914 $ $Date:: 2014-06-25 #$ e3fbb8667b5a285932ceab81e28219e1
running on No1-xl450-g9 Thu Apr 28 22:23:41 2016

This section contains SUT (System Under Test) info as seen by
some common utilities.  To remove or add to this section, see:
  http://www.spec.org/cpu2006/Docs/config.html#sysinfo

From /proc/cpuinfo
   model name : Intel(R) Xeon(R) CPU E5-2660 v4@ 2.00GHz
      2 "physical id"s (chips)
      56 "processors"
   cores, siblings (Caution: counting these is hw and system dependent.  The
   following excerpts from /proc/cpuinfo might not be reliable.  Use with
   caution.)
      cpu cores : 14
      siblings  : 28
      physical 0: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 14
      physical 1: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 14
   cache size : 17920 KB

From /proc/meminfo
   MemTotal:        263707188 kB
   HugePages_Total:         0
   Hugepagesize:         2048 kB

From /etc/*release* /etc/*version*
   os-release:
      NAME="Red Hat Enterprise Linux Server"
      VERSION="7.2 (Maipo)"
      ID="rhel"
      ID_LIKE="fedora"
      VERSION_ID="7.2"
      PRETTY_NAME="Red Hat Enterprise Linux Server 7.2 (Maipo)"
      ANSI_COLOR="0;31"
      CPE_NAME="cpe:/o:redhat:enterprise_linux:7.2:GA:server"
   redhat-release: Red Hat Enterprise Linux Server release 7.2 (Maipo)
   system-release: Red Hat Enterprise Linux Server release 7.2 (Maipo)
   system-release-cpe: cpe:/o:redhat:enterprise_linux:7.2:ga:server
```

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SPECfp_rate_base2006 =   850

CPU2006 license: 3
Test sponsor: HPE
Tested by: HPE

Test date: Apr-2016
Hardware Availability: Mar-2016
Software Availability: Nov-2015

Platform Notes (Continued)

```
uname -a:
   Linux No1-xl450-g9 3.10.0-327.el7.x86_64 #1 SMP Thu Oct 29 17:29:29 EDT 2015
   x86_64 x86_64 x86_64 GNU/Linux

run-level 3 Apr 28 22:18

SPEC is set to: /home/cpu2006
   Filesystem     Type  Size  Used Avail Use% Mounted on
   /dev/sda4      xfs   439G   20G  419G   5% /
Additional information from dmidecode:

   Warning: Use caution when you interpret this section. The 'dmidecode' program
   reads system data which is "intended to allow hardware to be accurately
   determined", but the intent may not be met, as there are frequent changes to
   hardware, firmware, and the "DMTF SMBIOS" standard.

   BIOS HP U21 03/10/2016
   Memory:
   8x UNKNOWN NOT AVAILABLE
   8x UNKNOWN NOT AVAILABLE 32 GB 2 rank 2400 MHz

(End of data from sysinfo program)
Regarding the sysinfo display about the memory installed, the correct amount of
memory is 256 GB and the dmidecode description should have one line reading as:
8x UNKNOWN NOT AVAILABLE 32 GB 2 rank 2400 MHz
```

General Notes

```
Environment variables set by runspec before the start of the run:
LD_LIBRARY_PATH = "/home/cpu2006/libs/32:/home/cpu2006/libs/64:/home/cpu2006/sh"

 Binaries compiled on a system with 1x Intel Xeon E5-2660 v4 CPU + 128GB
 memory using RedHat EL 7.2
```

Base Compiler Invocation

C benchmarks:
    icc   -m64

C++ benchmarks:
    icpc -m64

Fortran benchmarks:
    ifort -m64

Benchmarks using both Fortran and C:
    icc   -m64 ifort -m64

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Base Portability Flags

```
    410.bwaves: -DSPEC_CPU_LP64
    416.gamess: -DSPEC_CPU_LP64
      433.milc: -DSPEC_CPU_LP64
    434.zeusmp: -DSPEC_CPU_LP64
   435.gromacs: -DSPEC_CPU_LP64  -nofor_main
 436.cactusADM: -DSPEC_CPU_LP64  -nofor_main
   437.leslie3d: -DSPEC_CPU_LP64
      444.namd: -DSPEC_CPU_LP64
     447.dealII: -DSPEC_CPU_LP64
    450.soplex: -DSPEC_CPU_LP64
    453.povray: -DSPEC_CPU_LP64
   454.calculix: -DSPEC_CPU_LP64  -nofor_main
  459.GemsFDTD: -DSPEC_CPU_LP64
     465.tonto: -DSPEC_CPU_LP64
      470.lbm: -DSPEC_CPU_LP64
       481.wrf: -DSPEC_CPU_LP64 -DSPEC_CPU_CASE_FLAG -DSPEC_CPU_LINUX
    482.sphinx3: -DSPEC_CPU_LP64
```

Base Optimization Flags

C benchmarks:

```
    -xCORE-AVX2 -ipo -O3 -no-prec-div -static -opt-prefetch -auto-ilp32
    -ansi-alias -opt-mem-layout-trans=3 -qopt-prefetch-issue-excl-hint
```

C++ benchmarks:

```
    -xCORE-AVX2 -ipo -O3 -no-prec-div -static -opt-prefetch
    -fp-model fast=2                             -auto-ilp32 -ansi-alias
```

Fortran benchmarks:

```
    -xCORE-AVX2 -ipo -O3 -no-prec-div -static -opt-prefetch
    -qopt-prefetch-issue-excl-hint
```

Benchmarks using both Fortran and C:

```
    -xCORE-AVX2 -ipo -O3 -no-prec-div -static -opt-prefetch -auto-ilp32
    -ansi-alias -opt-mem-layout-trans=3 -qopt-prefetch-issue-excl-hint
```

Peak Compiler Invocation

C benchmarks:

```
    icc   -m64
```

C++ benchmarks (except as noted below):

```
    icpc  -m64
```

```
  450.soplex: icpc -m32 -L/opt/intel/compilers_and_libraries_2016/linux/lib/ia32_lin
```

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Peak Compiler Invocation (Continued)

Fortran benchmarks:
        ifort -m64

Benchmarks using both Fortran and C:
        icc   -m64 ifort -m64

Peak Portability Flags

          410.bwaves: -DSPEC_CPU_LP64
          416.gamess: -DSPEC_CPU_LP64
            433.milc: -DSPEC_CPU_LP64
          434.zeusmp: -DSPEC_CPU_LP64
         435.gromacs: -DSPEC_CPU_LP64 -nofor_main
       436.cactusADM: -DSPEC_CPU_LP64 -nofor_main
         437.leslie3d: -DSPEC_CPU_LP64
            444.namd: -DSPEC_CPU_LP64
           447.dealII: -DSPEC_CPU_LP64
          450.soplex: -D_FILE_OFFSET_BITS=64
          453.povray: -DSPEC_CPU_LP64
         454.calculix: -DSPEC_CPU_LP64 -nofor_main
        459.GemsFDTD: -DSPEC_CPU_LP64
            465.tonto: -DSPEC_CPU_LP64
             470.lbm: -DSPEC_CPU_LP64
             481.wrf: -DSPEC_CPU_LP64 -DSPEC_CPU_CASE_FLAG -DSPEC_CPU_LINUX
          482.sphinx3: -DSPEC_CPU_LP64

Peak Optimization Flags

C benchmarks:

        433.milc: basepeak = yes

        470.lbm: basepeak = yes

        482.sphinx3: basepeak = yes

C++ benchmarks:

        444.namd: -xCORE-AVX2(pass 2) -prof-gen:threadsafe(pass 1)
                -ipo(pass 2) -O3(pass 2) -no-prec-div(pass 2)
                -par-num-threads=1(pass 1) -static(pass 2)
                -opt-mem-layout-trans=3(pass 2) -prof-use(pass 2) -fno-alias
                -auto-ilp32

        447.dealII: basepeak = yes

Continued on next page

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Peak Optimization Flags (Continued)

450.soplex: -xCORE-AVX2(pass 2) -prof-gen:threadsafe(pass 1)
-ipo(pass 2) -O3(pass 2) -no-prec-div(pass 2)
-par-num-threads=1(pass 1) -static(pass 2)
-opt-mem-layout-trans=3(pass 2) -prof-use(pass 2)
-opt-malloc-options=3

453.povray: -xCORE-AVX2(pass 2) -prof-gen:threadsafe(pass 1)
-ipo(pass 2) -O3(pass 2) -no-prec-div(pass 2)
-par-num-threads=1(pass 1) -static(pass 2)
-opt-mem-layout-trans=3(pass 2) -prof-use(pass 2) -unroll4
-ansi-alias

Fortran benchmarks:

410.bwaves: basepeak = yes

416.gamess: -xCORE-AVX2(pass 2) -prof-gen:threadsafe(pass 1)
-ipo(pass 2) -O3(pass 2) -no-prec-div(pass 2)
-par-num-threads=1(pass 1) -static(pass 2) -prof-use(pass 2)
-unroll2 -inline-level=0 -scalar-rep-

434.zeusmp: basepeak = yes

437.leslie3d: -xCORE-AVX2(pass 2) -prof-gen:threadsafe(pass 1)
-ipo(pass 2) -O3(pass 2) -no-prec-div(pass 2)
-par-num-threads=1(pass 1) -static(pass 2) -prof-use(pass 2)
-opt-malloc-options=3 -opt-prefetch

459.GemsFDTD: basepeak = yes

465.tonto: -xCORE-AVX2(pass 2) -prof-gen:threadsafe(pass 1)
-ipo(pass 2) -O3(pass 2) -no-prec-div(pass 2)
-par-num-threads=1(pass 1) -static(pass 2) -prof-use(pass 2)
-unroll4 -auto -inline-calloc -opt-malloc-options=3

Benchmarks using both Fortran and C:

435.gromacs: -xCORE-AVX2(pass 2) -prof-gen:threadsafe(pass 1)
-ipo(pass 2) -O3(pass 2) -no-prec-div(pass 2)
-par-num-threads=1(pass 1) -static(pass 2)
-opt-mem-layout-trans=3(pass 2) -prof-use(pass 2)
-opt-prefetch -auto-ilp32

436.cactusADM: basepeak = yes

454.calculix: basepeak = yes

481.wrf: -xCORE-AVX2 -ipo -O3 -no-prec-div -static -auto-ilp32

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The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2006/flags/HP-Platform-Flags-Intel-V1.2-HSW-revE.html
http://www.spec.org/cpu2006/flags/HP-Compiler-Flags-Intel-V1.2-BDW-revE.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2006/flags/HP-Platform-Flags-Intel-V1.2-HSW-revE.xml
http://www.spec.org/cpu2006/flags/HP-Compiler-Flags-Intel-V1.2-BDW-revE.xml

For questions about this result, please contact the tester.
For other inquiries, please contact webmaster@spec.org.

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