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

ProLiant XL450 Gen9
(2.10 GHz, Intel Xeon E5-2620 v4)

$SPECfp®\_rate2006 =$ 589
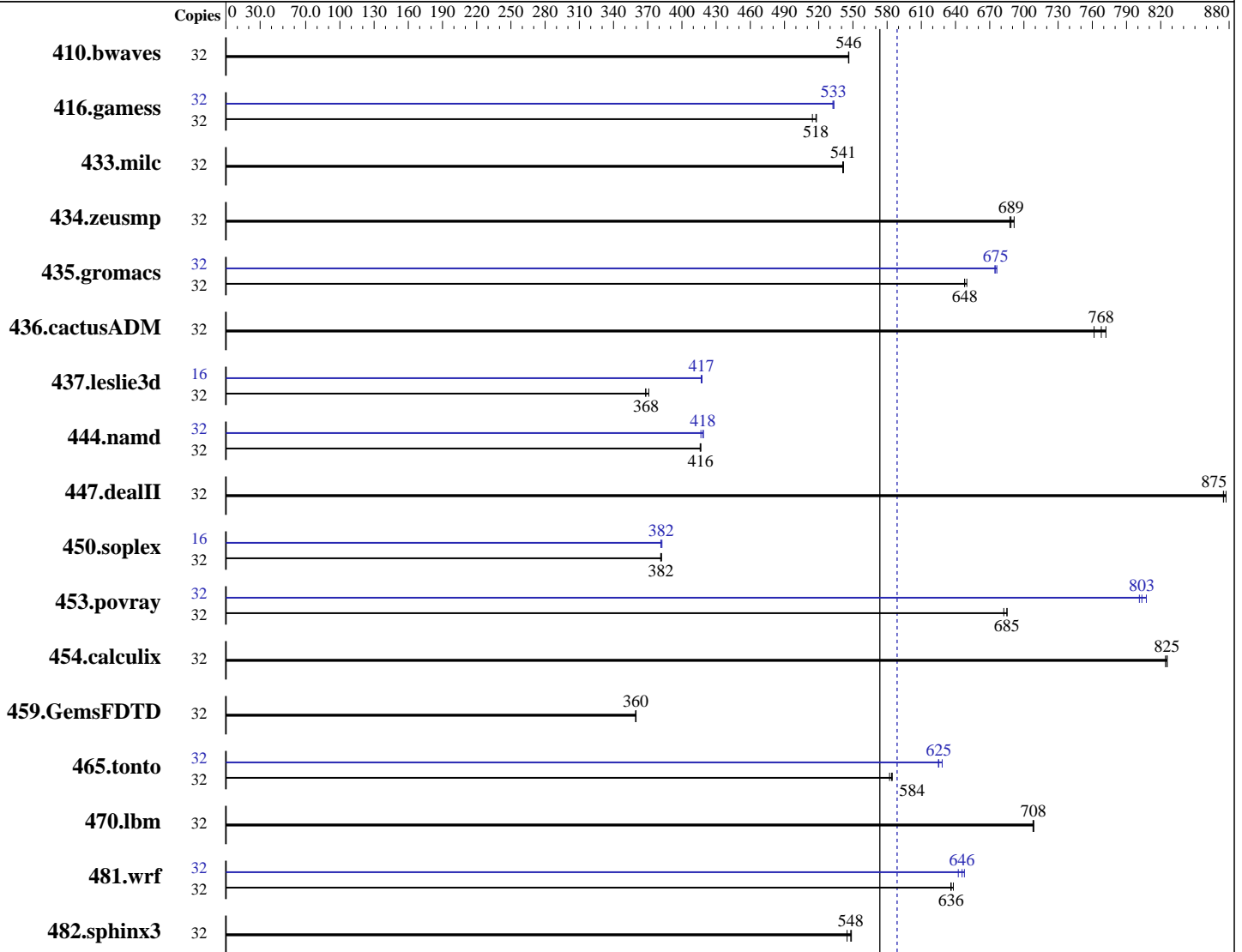
$SPECfp\_rate\_base2006 =$ 574

CPU2006 license:	3	**Test date:**	Apr-2016
Test sponsor:	HPE	**Hardware Availability:**	Mar-2016
Tested by:	HPE	**Software Availability:**	Nov-2015

SPECfp_rate_base2006 = 574

SPECfp_rate2006 = 589

Hardware

CPU Name:	Intel Xeon E5-2620 v4
CPU Characteristics:	Intel Turbo Boost Technology up to 3.00 GHz
CPU MHz:	2100
FPU:	Integrated
CPU(s) enabled:	16 cores, 2 chips, 8 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 3.10.0-327.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:	20 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 (16 x 16 GB 2Rx4 PC4-2400T-R, running at 2133 MHz)	Peak Pointers:	32/64-bit
		Other Software:	None
Disk Subsystem:	2 x 400 GB SATA SSD		
Other Hardware:	None		

Results Table

Benchmark	Copies	Base Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Peak Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
410.bwaves	32	796	546	**796**	**546**	796	546	32	796	546	**796**	**546**	796	546
416.gamess	32	**1211**	**518**	1210	518	1218	514	32	1177	532	1175	533	**1175**	**533**
433.milc	32	542	542	543	541	**543**	**541**	32	542	542	543	541	**543**	**541**
434.zeusmp	32	421	691	**423**	**689**	423	688	32	421	691	**423**	**689**	423	688
435.gromacs	32	352	650	**353**	**648**	353	648	32	**338**	**675**	338	676	339	674
436.cactusADM	32	502	762	495	772	**498**	**768**	32	502	762	495	772	**498**	**768**
437.leslie3d	32	817	368	811	371	**817**	**368**	16	361	417	**360**	**417**	360	418
444.namd	32	616	417	617	416	**616**	**416**	32	613	419	**613**	**418**	616	417
447.dealII	32	418	875	**418**	**875**	417	877	32	418	875	**418**	**875**	417	877
450.soplex	32	698	382	**699**	**382**	700	381	16	349	382	350	382	**349**	**382**
453.povray	32	248	685	249	682	**249**	**685**	32	211	807	212	801	**212**	**803**
454.calculix	32	**320**	**825**	320	826	320	824	32	**320**	**825**	320	826	320	824
459.GemsFDTD	32	**944**	**360**	945	359	944	360	32	**944**	**360**	945	359	944	360
465.tonto	32	**539**	**584**	541	582	539	585	32	504	625	**504**	**625**	501	628
470.lbm	32	621	708	620	709	**621**	**708**	32	621	708	620	709	**621**	**708**
481.wrf	32	562	636	**562**	**636**	560	638	32	556	642	**554**	**646**	552	648
482.sphinx3	32	1137	549	**1138**	**548**	1145	545	32	1137	549	**1138**	**548**	1145	545

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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CPU2006 license: 3
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Test date: Apr-2016
Hardware Availability: Mar-2016
Software Availability: Nov-2015

Platform Notes

```
BIOS Configuration:
  Power Profile set to Maximum Performance
  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

Sysinfo program /home/cpu2006/config/sysinfo.rev6914
$Rev: 6914 $ $Date:: 2014-06-25 #$ e3fbb8667b5a285932ceab81e28219e1
running on Dangerfield3 Thu Apr 28 23:09:57 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 E5-2620 v4 @ 2.10GHz
      2 "physical id"s (chips)
      32 "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 : 8
      siblings  : 16
      physical 0: cores 0 1 2 3 4 5 6 7
      physical 1: cores 0 1 2 3 4 5 6 7
   cache size : 20480 KB

From /proc/meminfo
   MemTotal:       263841956 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

uname -a:
   Linux Dangerfield3 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
```

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Platform Notes (Continued)

```
run-level 3 Apr 28 22:54

SPEC is set to: /home/cpu2006
   Filesystem      Type   Size   Used Avail Use% Mounted on
   /dev/sdb1       xfs    373G    20G  354G   6% /
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:
   16x UNKNOWN NOT AVAILABLE 16 GB 2 rank 2400 MHz, configured at 2133 MHz

(End of data from sysinfo program)
```

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"

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

Base Portability Flags

    410.bwaves: -DSPEC_CPU_LP64

Continued on next page

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Base Portability Flags (Continued)

```
      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
```

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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

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Tested with SPEC CPU2006 v1.2.
Report generated on Tue May 17 16:50:56 2016 by SPEC CPU2006 PS/PDF formatter v6932.
Originally published on 17 May 2016.