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

ProLiant BL660c Gen9
(2.50 GHz, Intel Xeon E5-4655 v4)

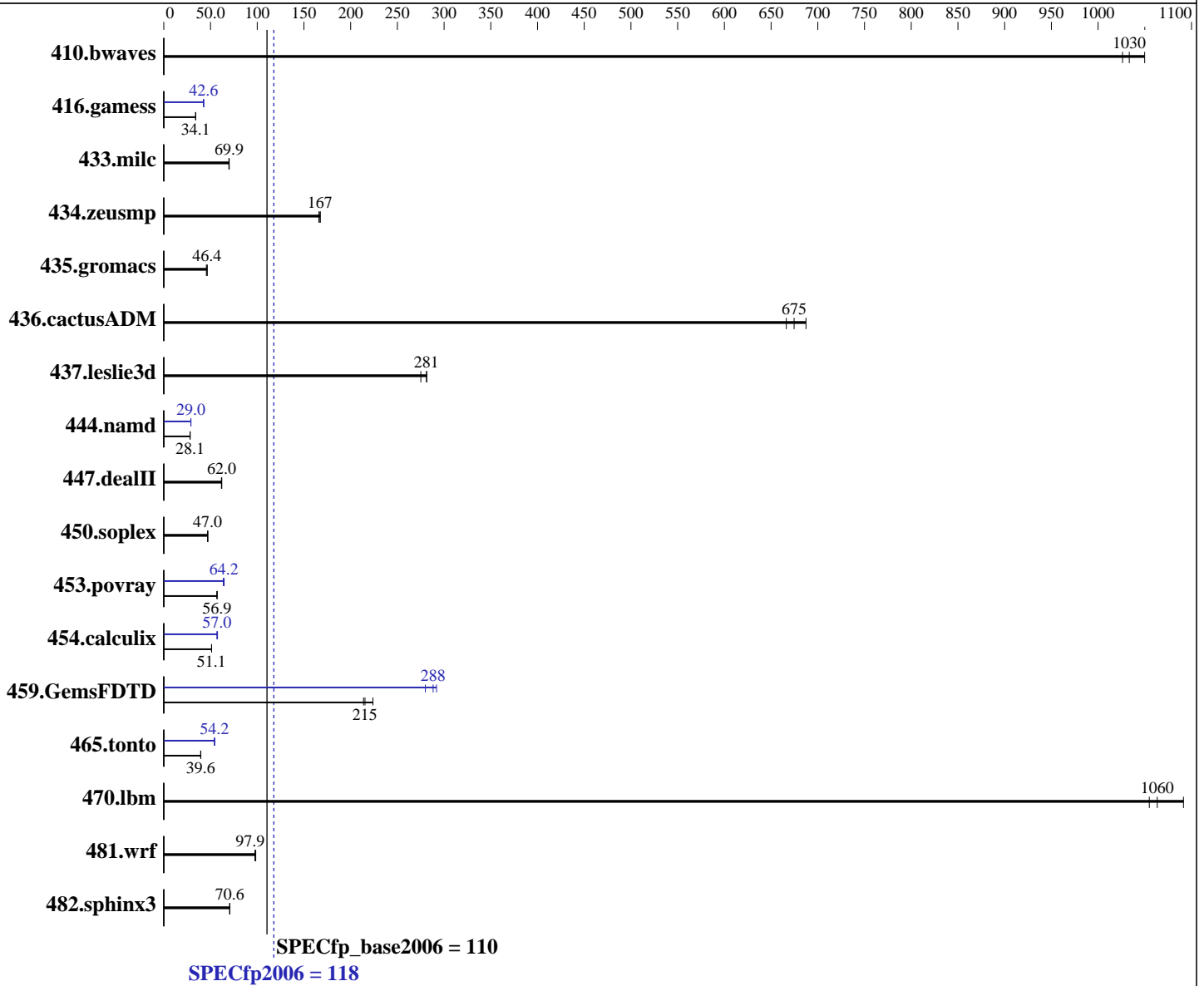$SPECfp^{®}2006 =$ 118

$SPECfp\_base2006 =$ 110

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

Scale: 0 50.0 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1100

- **410.bwaves** — 1030
- **416.gamess** — 42.6 / 34.1
- **433.milc** — 69.9
- **434.zeusmp** — 167
- **435.gromacs** — 46.4
- **436.cactusADM** — 675
- **437.leslie3d** — 281
- **444.namd** — 29.0 / 28.1
- **447.dealII** — 62.0
- **450.soplex** — 47.0
- **453.povray** — 64.2 / 56.9
- **454.calculix** — 57.0 / 51.1
- **459.GemsFDTD** — 288 / 215
- **465.tonto** — 54.2 / 39.6
- **470.lbm** — 1060
- **481.wrf** — 97.9
- **482.sphinx3** — 70.6

SPECfp_base2006 = 110

SPECfp2006 = 118

Hardware

CPU Name:	Intel Xeon E5-4655 v4
CPU Characteristics:	Intel Turbo Boost Technology up to 3.20 GHz
CPU MHz:	2500
FPU:	Integrated
CPU(s) enabled:	32 cores, 4 chips, 8 cores/chip
CPU(s) orderable:	2,4 chip
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:	Yes
File System:	xfs

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L3 Cache:	30 MB I+D on chip per chip	System State:	Run level 3 (multi-user)
Other Cache:	None	Base Pointers:	64-bit
Memory:	512 GB (16 x 32 GB 2Rx4 PC4-2400T-R)	Peak Pointers:	32/64-bit
Disk Subsystem:	1 x 400 GB SAS SSD, RAID 0	Other Software:	None
Other Hardware:	None		

Results Table

Benchmark	Base						Peak					
	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
410.bwaves	13.2	1030	12.9	1050	**13.2**	**1030**	13.2	1030	12.9	1050	**13.2**	**1030**
416.gamess	573	34.2	**574**	**34.1**	574	34.1	458	42.7	**459**	**42.6**	459	42.6
433.milc	131	70.0	**131**	**69.9**	132	69.7	131	70.0	**131**	**69.9**	132	69.7
434.zeusmp	54.8	166	**54.4**	**167**	54.3	167	54.8	166	**54.4**	**167**	54.3	167
435.gromacs	157	45.5	154	46.4	**154**	**46.4**	157	45.5	154	46.4	**154**	**46.4**
436.cactusADM	17.9	666	17.4	687	**17.7**	**675**	17.9	666	17.4	687	**17.7**	**675**
437.leslie3d	**33.4**	**281**	33.4	281	34.2	275	**33.4**	**281**	33.4	281	34.2	275
444.namd	**285**	**28.1**	285	28.1	285	28.1	**277**	**29.0**	277	29.0	277	29.0
447.dealII	185	61.7	185	62.0	**185**	**62.0**	185	61.7	185	62.0	**185**	**62.0**
450.soplex	177	47.1	**178**	**47.0**	178	46.9	177	47.1	**178**	**47.0**	178	46.9
453.povray	**93.5**	**56.9**	93.5	56.9	93.1	57.1	82.3	64.6	**82.8**	**64.2**	83.5	63.7
454.calculix	**161**	**51.1**	161	51.1	161	51.2	145	57.0	**145**	**57.0**	143	57.5
459.GemsFDTD	49.6	214	**49.3**	**215**	47.4	224	37.9	280	36.4	292	**36.8**	**288**
465.tonto	248	39.7	**249**	**39.6**	250	39.4	182	54.2	**181**	**54.2**	180	54.6
470.lbm	12.6	1090	13.0	1050	**12.9**	**1060**	12.6	1090	13.0	1050	**12.9**	**1060**
481.wrf	**114**	**97.9**	114	97.7	113	98.4	**114**	**97.9**	114	97.7	113	98.4
482.sphinx3	276	70.7	**276**	**70.6**	276	70.5	276	70.7	**276**	**70.6**	276	70.5

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

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
```

Platform Notes

```
BIOS Configuration:
Intel Hyperthreading Option set to Disabled
Power Profile set to Custom
Power Regulator set to Static High Performance Mode
Minimum Processor Idle Power Core C-State set to C1E State
Minimum Processor Idle Power Package C-State set to No Package state
Collaborative Power Control set to Disabled
QPI Snoop Configuration set to Home Snoop
```

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Test sponsor:	HPE	**Hardware Availability:**	Jun-2016
Tested by:	HPE	**Software Availability:**	Nov-2015

Platform Notes (Continued)

```
Thermal Configuration set to Maximum Cooling
Processor Power and Utilization Monitoring set to Disabled
Sysinfo program /home/cpu2006/config/sysinfo.rev6914
$Rev: 6914 $ $Date:: 2014-06-25 #$ e3fbb8667b5a285932ceab81e28219e1
running on BL660-Gen9-B Mon May 23 10:48:12 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 E5-4655 v4 @ 2.50GHz
      4 "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  : 8
      physical 0: cores 0 1 3 5 8 10 12 13
      physical 1: cores 0 1 3 5 8 10 12 13
      physical 2: cores 0 1 3 5 8 10 12 13
      physical 3: cores 0 1 2 4 9 11 12 13
   cache size : 30720 KB

From /proc/meminfo
   MemTotal:       528064256 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 BL660-Gen9-B 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 May 23 09:35

SPEC is set to: /home/cpu2006
   Filesystem      Type   Size   Used Avail Use% Mounted on
```

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Platform Notes (Continued)

```
    /dev/sda5      xfs   318G  171G  148G  54% /home
  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 I38 05/05/2016
    Memory:
     16x UNKNOWN NOT AVAILABLE
     16x 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 512 GB and the dmidecode description should have one line reading as:
  32x UNKNOWN NOT AVAILABLE 16 GB 2 rank 2400 MHz
```

General Notes

```
  Environment variables set by runspec before the start of the run:
  KMP_AFFINITY = "granularity=fine,compact"
  LD_LIBRARY_PATH = "/home/cpu2006/libs/32:/home/cpu2006/libs/64:/home/cpu2006/sh"
  OMP_NUM_THREADS = "32"

   Binaries compiled on a system with 1x Intel Core i5-4670K CPU + 32GB
   memory using RedHat EL 7.1
```

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
    416.gamess: -DSPEC_CPU_LP64
```

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Base Portability Flags (Continued)

```
   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 -parallel -opt-prefetch
-ansi-alias
```

C++ benchmarks:

```
-xCORE-AVX2 -ipo -O3 -no-prec-div -opt-prefetch -ansi-alias
```

Fortran benchmarks:

```
-xCORE-AVX2 -ipo -O3 -no-prec-div -parallel -opt-prefetch
```

Benchmarks using both Fortran and C:

```
-xCORE-AVX2 -ipo -O3 -no-prec-div -parallel -opt-prefetch
-ansi-alias
```

Peak 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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Tested by: HPE		**Software Availability:** Nov-2015

Peak Portability Flags

Same as Base Portability Flags

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) -prof-use(pass 2) -fno-alias
          -auto-ilp32

    447.dealII: basepeak = yes

    450.soplex: basepeak = yes

    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) -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) -prof-use(pass 2) -unroll2
          -inline-level=0 -scalar-rep-

    434.zeusmp: basepeak = yes

    437.leslie3d: basepeak = yes

  459.GemsFDTD: -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) -prof-use(pass 2) -unroll2
          -inline-level=0 -opt-prefetch -parallel

      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) -prof-use(pass 2) -inline-calloc

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Peak Optimization Flags (Continued)

465.tonto (continued):
```
-opt-malloc-options=3 -auto -unroll4
```

Benchmarks using both Fortran and C:

435.gromacs: basepeak = yes

436.cactusADM: basepeak = yes

454.calculix: `-xCORE-AVX2 -ipo -O3 -no-prec-div -auto-ilp32 -ansi-alias`

481.wrf: basepeak = yes

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2006/flags/Intel-ic16.0-official-linux64.html
http://www.spec.org/cpu2006/flags/HP-Platform-Flags-Intel-V1.2-HSW-revE.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2006/flags/Intel-ic16.0-official-linux64.xml
http://www.spec.org/cpu2006/flags/HP-Platform-Flags-Intel-V1.2-HSW-revE.xml

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

Tested with SPEC CPU2006 v1.2.
Report generated on Tue Jun 21 18:04:34 2016 by SPEC CPU2006 PS/PDF formatter v6932.
Originally published on 21 June 2016.