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

ProLiant BL460c Gen9
(2.10 GHz, Intel Xeon E5-2695 v4)

$SPECfp^{®}\_rate2006 =$ 993
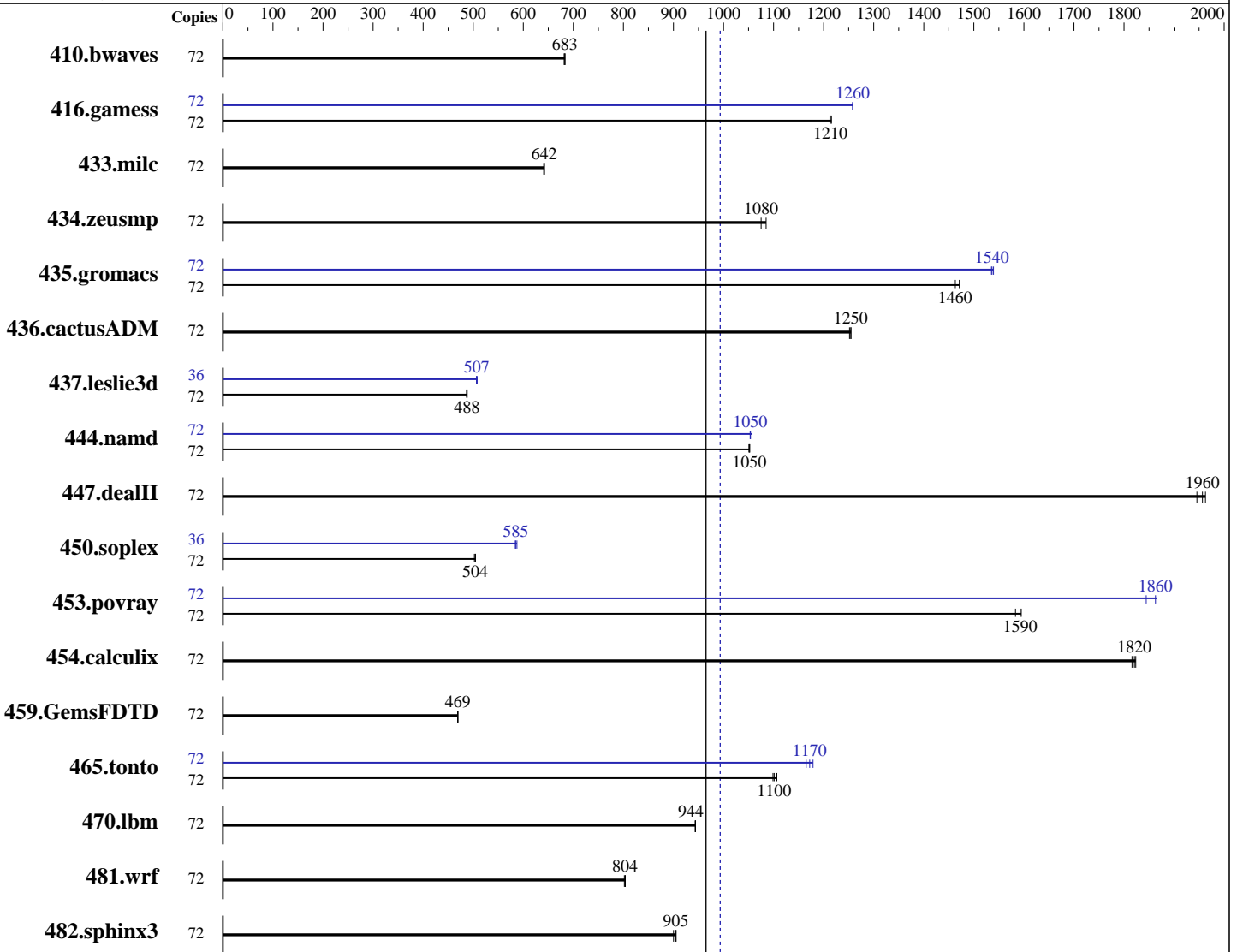
$SPECfp\_rate\_base2006 =$ 965

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

**Test date:** Mar-2016
**Hardware Availability:** Mar-2016
**Software Availability:** Dec-2015



| Copies | |
|---|---|
| 410.bwaves | 72 — 683 |
| 416.gamess | 72 — 1260 / 72 — 1210 |
| 433.milc | 72 — 642 |
| 434.zeusmp | 72 — 1080 |
| 435.gromacs | 72 — 1540 / 72 — 1460 |
| 436.cactusADM | 72 — 1250 |
| 437.leslie3d | 36 — 507 / 72 — 488 |
| 444.namd | 72 — 1050 / 72 — 1050 |
| 447.dealII | 72 — 1960 |
| 450.soplex | 36 — 585 / 72 — 504 |
| 453.povray | 72 — 1860 / 72 — 1590 |
| 454.calculix | 72 — 1820 |
| 459.GemsFDTD | 72 — 469 |
| 465.tonto | 72 — 1170 / 72 — 1100 |
| 470.lbm | 72 — 944 |
| 481.wrf | 72 — 804 |
| 482.sphinx3 | 72 — 905 |

**SPECfp_rate_base2006 = 965**

**SPECfp_rate2006 = 993**

## Hardware

CPU Name: Intel Xeon E5-2695 v4
CPU Characteristics: Intel Turbo Boost Technology up to 3.30 GHz
CPU MHz: 2100
FPU: Integrated
CPU(s) enabled: 36 cores, 2 chips, 18 cores/chip, 2 threads/core
CPU(s) orderable: 1,2 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: SUSE Linux Enterprise Server 12 (x86_64) SP1
Kernel 3.12.49-11-default
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
System State: Run level 3 (multi-user)
**Continued on next page**

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| | | | |
|---|---|---|---|
| L3 Cache: | 45 MB I+D on chip per chip | Base Pointers: | 32/64-bit |
| Other Cache: | None | Peak Pointers: | 32/64-bit |
| Memory: | 256 GB (8 x 32 GB 2Rx4 PC4-2400T-R) | Other Software: | None |
| Disk Subsystem: | 2 x 500 GB SAS HDD 10 K, RAID 1 | | |
| Other Hardware: | None | | |

## Results Table

| Benchmark | Copies | Base Seconds | Ratio | Seconds | Ratio | Seconds | Ratio | Copies | Peak Seconds | Ratio | Seconds | Ratio | Seconds | Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 410.bwaves | 72 | 1436 | 682 | 1431 | 684 | **1433** | **683** | 72 | 1436 | 682 | 1431 | 684 | **1433** | **683** |
| 416.gamess | 72 | 1160 | 1220 | 1163 | 1210 | **1162** | **1210** | 72 | **1121** | **1260** | 1120 | 1260 | 1121 | 1260 |
| 433.milc | 72 | **1030** | **642** | 1031 | 641 | 1029 | 642 | 72 | **1030** | **642** | 1031 | 641 | 1029 | 642 |
| 434.zeusmp | 72 | 613 | 1070 | **609** | **1080** | 604 | 1090 | 72 | 613 | 1070 | **609** | **1080** | 604 | 1090 |
| 435.gromacs | 72 | 349 | 1470 | 352 | 1460 | **351** | **1460** | 72 | **335** | **1540** | 334 | 1540 | 335 | 1540 |
| 436.cactusADM | 72 | **686** | **1250** | 686 | 1250 | 687 | 1250 | 72 | **686** | **1250** | 686 | 1250 | 687 | 1250 |
| 437.leslie3d | 72 | 1391 | 487 | 1387 | 488 | **1388** | **488** | 36 | 666 | 508 | **668** | **507** | 668 | 507 |
| 444.namd | 72 | **549** | **1050** | 549 | 1050 | 550 | 1050 | 72 | 547 | 1060 | 548 | 1050 | **548** | **1050** |
| 447.dealII | 72 | 420 | 1960 | **421** | **1960** | 423 | 1950 | 72 | 420 | 1960 | **421** | **1960** | 423 | 1950 |
| 450.soplex | 72 | 1190 | 504 | 1195 | 502 | **1191** | **504** | 36 | 511 | 587 | 514 | 584 | **513** | **585** |
| 453.povray | 72 | 240 | 1590 | 242 | 1580 | **241** | **1590** | 72 | **206** | **1860** | 208 | 1840 | 205 | 1870 |
| 454.calculix | 72 | **326** | **1820** | 326 | 1820 | 327 | 1820 | 72 | **326** | **1820** | 326 | 1820 | 327 | 1820 |
| 459.GemsFDTD | 72 | 1629 | 469 | 1627 | 469 | **1628** | **469** | 72 | 1629 | 469 | 1627 | 469 | **1628** | **469** |
| 465.tonto | 72 | **643** | **1100** | 645 | 1100 | 640 | 1110 | 72 | **604** | **1170** | 608 | 1170 | 601 | 1180 |
| 470.lbm | 72 | **1048** | **944** | 1048 | 944 | 1048 | 944 | 72 | **1048** | **944** | 1048 | 944 | 1048 | 944 |
| 481.wrf | 72 | 1000 | 804 | 1003 | 802 | **1001** | **804** | 72 | 1000 | 804 | 1003 | 802 | **1001** | **804** |
| 482.sphinx3 | 72 | 1559 | 900 | **1551** | **905** | 1550 | 905 | 72 | 1559 | 900 | **1551** | **905** | 1550 | 905 |

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 =     965

**CPU2006 license:** 3
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**Tested by:**     HPE

**Test date:**     Mar-2016
**Hardware Availability:** Mar-2016
**Software Availability:** Dec-2015

## Platform Notes

```
BIOS Configuration:
Intel Hyperthreading Option set to Enabled
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 Cluster on Die
Thermal Configuration set to Maximum Cooling
Processor Power and Utilization Monitoring set to Disabled
Memory Refresh Rate set to 1x Refresh
Sysinfo program /home/cpuv1.3/cpu2006/config/sysinfo.rev6914
$Rev: 6914 $ $Date:: 2014-06-25 #$ e3fbb8667b5a285932ceab81e28219e1
running on bl460c2-gen9-b Tue Mar  8 16:55:03 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 E5-2695 v4 @ 2.10GHz
      2 "physical id"s (chips)
      72 "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 : 18
      siblings  : 36
      physical 0: cores 0 1 2 3 4 8 9 10 11 16 17 18 19 20 24 25 26 27
      physical 1: cores 0 1 2 3 4 8 9 10 11 16 17 18 19 20 24 25 26 27
   cache size : 23040 KB

From /proc/meminfo
   MemTotal:      264322528 kB
   HugePages_Total:       0
   Hugepagesize:       2048 kB

/usr/bin/lsb_release -d
   SUSE Linux Enterprise Server 12 SP1

From /etc/*release* /etc/*version*
   SuSE-release:
      SUSE Linux Enterprise Server 12 (x86_64)
      VERSION = 12
      PATCHLEVEL = 1
      # This file is deprecated and will be removed in a future service pack or
      release.
      # Please check /etc/os-release for details about this release.
   os-release:
      NAME="SLES"
      VERSION="12-SP1"
      VERSION_ID="12.1"
```
<div align="center">Continued on next page</div>

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## Platform Notes (Continued)

```
        PRETTY_NAME="SUSE Linux Enterprise Server 12 SP1"
        ID="sles"
        ANSI_COLOR="0;32"
        CPE_NAME="cpe:/o:suse:sles:12:sp1"

  uname -a:
     Linux bl460c2-gen9-b 3.12.49-11-default #1 SMP Wed Nov 11 20:52:43 UTC 2015
     (8d714a0) x86_64 x86_64 x86_64 GNU/Linux

  run-level 5 Mar 8 15:01

  SPEC is set to: /home/cpuv1.3/cpu2006
     Filesystem      Type  Size  Used Avail Use% Mounted on
     /dev/sda4       xfs   424G  149G  276G  36% /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 I36 02/22/2016
   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/cpuv1.3/cpu2006/libs/32:/home/cpuv1.3/cpu2006/libs/64:/home/cpuv1.3/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

Continued on next page

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# Base Compiler Invocation (Continued)

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

# 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
-qopt-prefetch-issue-excl-hint -auto-p32 -ansi-alias
-opt-mem-layout-trans=3
```

C++ benchmarks:
```
-xCORE-AVX2 -ipo -O3 -no-prec-div -static -opt-prefetch
-qopt-prefetch-issue-excl-hint -auto-p32 -ansi-alias
-opt-mem-layout-trans=3
```

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
-qopt-prefetch-issue-excl-hint -auto-p32 -ansi-alias
-opt-mem-layout-trans=3
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## 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/compiler/lib/ia32_lin

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:

Continued on next page

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# Peak Optimization Flags (Continued)

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

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

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# Peak Optimization Flags (Continued)

436.cactusADM: basepeak = yes

454.calculix: basepeak = yes

481.wrf: basepeak = yes

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

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For other inquiries, please contact webmaster@spec.org.

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