Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant BL460c Gen9
(2.20 GHz, Intel Xeon E5-2698 v4)

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

SPECfp₀\rate2006 = 1050
SPECfp\_rate_base2006 = 1020

Copies

**Hardware**
- CPU Name: Intel Xeon E5-2698 v4
- CPU Characteristics: Intel Turbo Boost Technology up to 3.60 GHz
- CPU MHz: 2200
- FPU: Integrated
- CPU(s) enabled: 40 cores, 2 chips, 20 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

**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

Continued on next page
Hewlett Packard Enterprise
ProLiant BL460c Gen9
(2.20 GHz, Intel Xeon E5-2698 v4)

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SPEC CFP2006 Result

SPECfp_rate2006 = 1050
SPECfp_rate_base2006 = 1020

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

L3 Cache: 50 MB I+D on chip per chip
Other Cache: None
Memory: 256 GB (8 x 32 GB 2Rx4 PC4-2400T-R)
Disk Subsystem: 1 x 400 GB SAS SSD, RAID 0
Other Hardware: None

System State: Run level 3 (multi-user)
Base Pointers: 32/64-bit
Peak Pointers: 32/64-bit
Other Software: None

Results Table

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</tbody>
</table>

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>
SPEC CFP2006 Result

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(2.20 GHz, Intel Xeon E5-2698 v4)

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SPECfp_rate_base2006 = 1020

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

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

Platform Notes

BIOS Configuration:
  HP Power Profile set to Custom
  HP Power Regulator to HP 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
  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
  Intel Hyperthreading Option set to Enabled
  Sysinfo program /home/cpuv1.5/cpu2006/config/sysinfo.rev6914
  $Rev: 6914 $ $Date:: 2014-06-25 #$ e3fbb8667b5a285932ceab81e28219e1

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 E5-2698 v4 @ 2.20GHz
  2 "physical id"s (chips)
    80 "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 : 20
    siblings : 40
    physical 0: cores 0 1 2 3 4 8 9 10 11 12 16 17 18 19 20 24 25 26 27 28
    physical 1: cores 0 1 2 3 4 8 9 10 11 12 16 17 18 19 20 24 25 26 27 28
  cache size : 25600 KB

From /proc/meminfo
  MemTotal:       263835064 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)

uname -a:

Continued on next page
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SPECfp_rate_base2006 = 1020

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Hardware Availability: Mar-2016
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Platform Notes (Continued)

Linux BL460c-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 Apr 13 10:12

SPEC is set to: /home/cpuv1.5/cpu2006
Filesystem Type Size Used Avail Use% Mounted on
/dev/sda5 xfs 314G 191G 124G 61% /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/cpuv1.5/cpu2006/libs/32:/home/cpuv1.5/cpu2006/libs/64:/home/cpuv1.5/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
### SPEC CFP2006 Result

**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
ProLiant BL460c Gen9  
(2.20 GHz, Intel Xeon E5-2698 v4)  

<table>
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<th>SPECfp_rate2006 = 1050</th>
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- **CPU2006 license:** 3  
- **Test date:** Mar-2016  
- **Test sponsor:** HPE  
- **Hardware Availability:** Mar-2016  
- **Tested by:** HPE  
- **Software Availability:** Nov-2015

### Base Portability Flags

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<tr>
<th>Benchmark</th>
<th>Flags</th>
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<td>410.bwaves</td>
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<td>-DSPEC_CPU_LP64</td>
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<td>433.milc</td>
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<td>-DSPEC_CPU_LP64 -nofor_main</td>
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<td>436.cactusADM</td>
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<td>482.sphinx3</td>
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### 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`
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
33.milc: -DSPEC_CPU_LP64
343.milc: -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:threadsafepass 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-ilkp32

447.dealII: basepeak = yes
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
SPEC CFP2006 Result

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(2.20 GHz, Intel Xeon E5-2698 v4)

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SPECfp\_rate\_base2006 = 1020

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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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