Hewlett Packard Enterprise
ProLiant DL560 Gen9
(2.20 GHz, Intel Xeon E5-4660 v4)

Test Sponsor: HPE
Hardware Availability: Jul-2016
Software Availability: Dec-2015

CPU2006 license: 3
Test date: Jul-2016
Tested by: HPE

SPECfp2006 = 118
SPECfp_base2006 = 112

### Hardware
CPU Name: Intel Xeon E5-4660 v4
CPU Characteristics: Intel Turbo Boost Technology up to 3.00 GHz
CPU MHz: 2200
FPU: Integrated
CPU(s) enabled: 64 cores, 4 chips, 16 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

### 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: Yes
File System: xfs
System State: Run level 3 (multi-user)
## SPEC CFP2006 Result

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**Test sponsor:** HPE  
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**L3 Cache:** 40 MB I+D on chip per chip  
**Other Cache:** None  
**Memory:** 512 GB (32 x 16 GB 2Rx4 PC4-2400T-R)  
**Disk Subsystem:** 1 x 400 GB SAS SSD, RAID 0  
**Other Hardware:** None  
**Base Pointers:** 32/64-bit  
**Peak Pointers:** 32/64-bit  
**Software Availability:** Dec-2015  
**Test date:** Jul-2016  
**Hardware Availability:** Jul-2016  
**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

### Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Seconds</th>
<th>Ratio</th>
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</tbody>
</table>

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:**  
- HP Power Profile set to Custom  
- HP Power Regulator to HP Static High Performance Mode  
- Minimum Processor Idle Power Core C-State set to CLE State  
- Minimum Processor Idle Power Package C-State set to No Package State  
- QPI Snoop Configuration set to Home Snoop  
- Collaborative Power Control set to Disabled  
- Thermal Configuration set to Maximum Cooling

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**SPEC CFP2006 Result**

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**SPECfp2006 = 118**

**SPECfp_base2006 = 112**

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**CPU2006 license:** 3

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**Platform Notes (Continued)**

Processor Power and Utilization Monitoring set to Disabled
Memory Refresh Rate set to 1x Refresh
Intel Hyper Threading set to Disabled

Sysinfo program /home/custom_binaries/cpu2006/config/sysinfo.rev6914
$Rev: 6914 $ $Date:: 2014-06-25 #$ e3fbb8667b5a285932ceab81e28219el
running on sles12biswadl560 Thu Jul 28 06:52:13 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 E5-4660 v4 @ 2.20GHz
- 4 "physical id"s (chips)
- 64 "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 : 16
  - siblings : 16
  - physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
  - physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
  - physical 2: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
  - physical 3: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
- cache size : 40960 KB

From /proc/meminfo

- MemTotal: 529309212 kB
- HugePages_Total: 0
- Hugepagesize: 2048 kB

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

uname -a:

(8d714a0) x86_64 x86_64 x86_64 GNU/Linux

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Platform Notes (Continued)

run-level 3 Jul 28 06:46
SPEC is set to: /home/custom_binaries/cpu2006
Filesystem     Type  Size  Used Avail Use% Mounted on
/dev/sda4      xfs   331G  109G  222G  33% /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 P85 07/01/2016
Memory:
16x UNKNOWN NOT AVAILABLE
32x UNKNOWN NOT AVAILABLE 16 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"
OMP_NUM_THREADS = "64"
LD_LIBRARY_PATH = */home/custom_binaries/cpu2006/1ibs/32:/home/custom_binaries/cpu2006/1ibs/64:/home/custom_binaries/cpu2006/sh*

Binaries compiled on a system with 1x Intel Xeon E5-2260 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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Peak Compiler Invocation

C benchmarks:
icc  -m64

C++ benchmarks:
icpc  -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 -parallel -opt-prefetch
-ansi-alias -qopt-prefetch-issue-excl-hint -auto-ilp32

C++ benchmarks:
-xCORE-AVX2 -ipo -O3 -no-prec-div -static -opt-prefetch -ansi-alias
-quot-calloc

Fortran benchmarks:
-xCORE-AVX2 -ipo -O3 -no-prec-div -static -parallel -opt-prefetch
-fp-model fast=2
-qopt-prefetch-issue-excl-hint

Benchmarks using both Fortran and C:
-xCORE-AVX2 -ipo -O3 -no-prec-div -static -parallel -opt-prefetch
-ansi-alias -qopt-prefetch-issue-excl-hint -auto-ilp32
-fp-model fast=2

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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

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

433.milc: basepeak = yes
470.lbm: basepeak = yes
482.sphinx3: -xCORE-AVX2 -ipo -O3 -no-prec-div -static -parallel
                -opt-prefetch -ansi-alias
                -fp-model fast=2
                -qopt-prefetch-issue-excl-hint -funroll-all-loops

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-
### Peak Optimization Flags (Continued)

- **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  
  -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/HP-Compiler-Flags-Intel-V1.2-HSW-revF.html](http://www.spec.org/cpu2006/flags/HP-Compiler-Flags-Intel-V1.2-HSW-revF.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-HSW-revF.xml](http://www.spec.org/cpu2006/flags/HP-Compiler-Flags-Intel-V1.2-HSW-revF.xml)
- [http://www.spec.org/cpu2006/flags/HP-Platform-Flags-Intel-V1.2-HSW-revE.xml](http://www.spec.org/cpu2006/flags/HP-Platform-Flags-Intel-V1.2-HSW-revE.xml)

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