**SPEC® CFP2006 Result**

Hewlett Packard Enterprise  
(Test Sponsor: HPE)  
ProLiant DL560 Gen9  
(2.50 GHz, Intel Xeon E5-4655 v4)

**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

**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)

**Performance Results**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>SPECfp²006</th>
<th>SPECfp_base²006</th>
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</thead>
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<tr>
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**Test Details**
- CPU2006 license: 3
- Test sponsor: HPE
- Tested by: HPE
- Test date: Aug-2016
- Hardware Availability: Jul-2016
- Software Availability: Dec-2015
## SPEC CFP2006 Result

**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
ProLiant DL560 Gen9  
(2.50 GHz, Intel Xeon E5-4655 v4)

| SPECfp2006 | 121 |
| SPECfp_base2006 | 114 |

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

- **L3 Cache:** 30 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

<table>
<thead>
<tr>
<th>Benchmark</th>
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<th>Peak</th>
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<tbody>
<tr>
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### Results Table

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</tr>
</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

Continued on next page
SPEC CFP2006 Result

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL560 Gen9
(2.50 GHz, Intel Xeon E5-4655 v4)

SPECfp2006 = 121
SPECfp_base2006 = 114

CPU2006 license: 3
Test date: Aug-2016
Test sponsor: HPE
Hardware Availability: Jul-2016
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Software Availability: Dec-2015

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/cpu2006/config/sysinfo.rev6914
$Rev: 6914 $ $Date:: 2014-06-25 #$ e3fbb8667b5a285932ceab81e28219e1
running on sles12biswadl560 Mon Aug 15 23:14:29 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 2 4 9 11 12 13
   physical 2: cores 0 1 3 5 8 10 12 13
   physical 3: cores 0 1 3 5 8 10 12 13
   cache size : 30720 KB

From /proc/meminfo
MemTotal:       529313052 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

Continued on next page
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Platform Notes (Continued)

run-level 3 Aug 15 15:15
SPEC is set to: /home/custom/cpu2006
Filesystem     Type  Size  Used Avail Use% Mounted on
/dev/sda4      xfs   331G   52G  280G  16% /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 = "32"
LD_LIBRARY_PATH = "/home/custom/cpu2006/libs/32:/home/custom/cpu2006/libs/64:/home/custom/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
Hewlett Packard Enterprise  
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Test date: Aug-2016  
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### Base Portability Flags

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>410.bwaves</td>
<td>-DSPEC_CPU_LP64</td>
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<td>416.gameSS</td>
<td>-DSPEC_CPU_LP64</td>
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<td>-DSPEC_CPU_LP64 -nofor_main</td>
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<td>459.GemsFDTD</td>
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<td>465.tonto</td>
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<tr>
<td>470.lbm</td>
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<tr>
<td>482.sphinx3</td>
<td>-DSPEC_CPU_LP64</td>
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</table>

### 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  
  -qopt-calloc

Fortran benchmarks:
- xCORE-AVX2  -ipo -O3  -no-prec-div  -static  
  -parallel  -opt-prefetch  
  -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

### Peak Compiler Invocation

C benchmarks:
icc  -m64

C++ benchmarks:
icpc  -m64

Fortran benchmarks:
ifort  -m64

Continued on next page
Peak Compiler Invocation (Continued)

Benchmarks using both Fortran and C:

```plaintext
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  -03  -no-prec-div -static  -parallel
-opt-prefetch -ansi-alias
-fp-model
-qopt-prefetch-issue-excl-hint -funroll-all-loops
-nofor-main

C++ benchmarks:

444.namd: -xCORE-AVX2(pass 2) -prof-gen:threadsafe(pass 1)
-ipo(pass 2) -03(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) -03(pass 2) -no-prec-div(pass 2)
-par-num-threads=1(pass 1) -prof-use(pass 2) -unroll4
-ansi-alias

Fortran benchmarks:

410.bwaves: -xCORE-AVX2 -ipo  -03  -no-prec-div -static  -parallel
-opt-prefetch
-fp-model
-qopt-prefetch-issue-excl-hint -funroll-all-loops

416.gamess: -xCORE-AVX2(pass 2) -prof-gen:threadsafe(pass 1)
-ipo(pass 2) -03(pass 2) -no-prec-div(pass 2)
-par-num-threads=1(pass 1) -prof-use(pass 2) -unroll2
-inline-level=0 -scalar-rep-

Continued on next page
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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: -xCORE-AVX2 -ipo -O3 -no-prec-div -static -parallel
   -opt-prefetch -ansi-alias
   -fp-model
   -qopt-prefetch-issue-excl-hint -funroll-all-loops
   -auto-ilp32
   -nofor-main

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-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-HSW-revF.xml
http://www.spec.org/cpu2006/flags/HP-Platform-Flags-Intel-V1.2-HSW-revE.xml

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