Hewlett Packard Enterprise
(Hewlett Packard Enterprise)
ProLiant ML110 Gen9
(2.00 GHz, Intel Xeon E5-2660 v4)

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

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

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>410.bwaves</td>
<td>347</td>
</tr>
<tr>
<td>416.gamess</td>
<td>33.2</td>
</tr>
<tr>
<td>433.milc</td>
<td>76.7</td>
</tr>
<tr>
<td>434.zeusmp</td>
<td>238</td>
</tr>
<tr>
<td>435.gromacs</td>
<td>44.7</td>
</tr>
<tr>
<td>436.cactusADM</td>
<td>719</td>
</tr>
<tr>
<td>437.leslie3d</td>
<td>269</td>
</tr>
<tr>
<td>444.namd</td>
<td>28.4</td>
</tr>
<tr>
<td>447.dealII</td>
<td>63.0</td>
</tr>
<tr>
<td>450.soplex</td>
<td>47.8</td>
</tr>
<tr>
<td>453.povray</td>
<td>57.3</td>
</tr>
<tr>
<td>454.calculix</td>
<td>57.7</td>
</tr>
<tr>
<td>459.GemsFDTD</td>
<td>195</td>
</tr>
<tr>
<td>465.tonto</td>
<td>182</td>
</tr>
<tr>
<td>470.lbm</td>
<td>41.5</td>
</tr>
<tr>
<td>481.wrf</td>
<td>119</td>
</tr>
<tr>
<td>482.sphinx3</td>
<td>69.0</td>
</tr>
</tbody>
</table>

**SPECfp®2006 = 107**  
**SPECfp_base2006 = 102**

### Hardware
- **CPU Name:** Intel Xeon E5-2660 v4
- **CPU Characteristics:** Intel Turbo Boost Technology up to 3.20 GHz
- **CPU MHz:** 2000
- **FPU:** Integrated
- **CPU(s) enabled:** 14 cores, 1 chip, 14 cores/chip
- **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:** Yes
- **File System:** xfs

Continued on next page
Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant ML110 Gen9
(2.00 GHz, Intel Xeon E5-2660 v4)

SPEC CFP2006 Result
Copyright 2006-2016 Standard Performance Evaluation Corporation

SPECfp2006 = 107
SPECfp_base2006 = 102

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

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

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

L3 Cache: 35 MB I+D on chip per chip
Other Cache: None
Memory: 128 GB (4 x 32 GB 2Rx4 PC4-2400T-R)
Disk Subsystem: 1 x 400 GB SAS SSD, RAID 0
Other Hardware: None

Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>410.bwaves</td>
<td>39.8</td>
<td>342</td>
<td>39.2</td>
<td>347</td>
<td>38.6</td>
<td>352</td>
</tr>
<tr>
<td>416.game3s</td>
<td>588</td>
<td>33.3</td>
<td>591</td>
<td>33.2</td>
<td>590</td>
<td>33.2</td>
</tr>
<tr>
<td>433.milc</td>
<td>120</td>
<td>76.6</td>
<td>120</td>
<td>76.7</td>
<td>119</td>
<td>77.1</td>
</tr>
<tr>
<td>434.zeusmp</td>
<td>38.2</td>
<td>238</td>
<td>38.0</td>
<td>240</td>
<td>38.2</td>
<td>238</td>
</tr>
<tr>
<td>435.gromacs</td>
<td>160</td>
<td>44.7</td>
<td>160</td>
<td>44.7</td>
<td>160</td>
<td>44.6</td>
</tr>
<tr>
<td>436.cactusADM</td>
<td>16.5</td>
<td>723</td>
<td>16.8</td>
<td>711</td>
<td>16.6</td>
<td>719</td>
</tr>
<tr>
<td>437.leslie3d</td>
<td>35.0</td>
<td>269</td>
<td>34.5</td>
<td>273</td>
<td>34.9</td>
<td>269</td>
</tr>
<tr>
<td>444.namd</td>
<td>283</td>
<td>28.3</td>
<td>283</td>
<td>28.4</td>
<td>283</td>
<td>28.4</td>
</tr>
<tr>
<td>447.dealII</td>
<td>182</td>
<td>62.9</td>
<td>181</td>
<td>63.2</td>
<td>182</td>
<td>63.0</td>
</tr>
<tr>
<td>450.soplex</td>
<td>174</td>
<td>47.8</td>
<td>177</td>
<td>47.2</td>
<td>175</td>
<td>47.8</td>
</tr>
<tr>
<td>453.povray</td>
<td>93.0</td>
<td>57.2</td>
<td>92.6</td>
<td>57.4</td>
<td>92.9</td>
<td>57.3</td>
</tr>
<tr>
<td>454.calculix</td>
<td>153</td>
<td>54.0</td>
<td>153</td>
<td>53.9</td>
<td>153</td>
<td>54.1</td>
</tr>
<tr>
<td>459.GemsFDTD</td>
<td>58.2</td>
<td>182</td>
<td>58.0</td>
<td>183</td>
<td>58.2</td>
<td>182</td>
</tr>
<tr>
<td>465.tonto</td>
<td>237</td>
<td>41.6</td>
<td>237</td>
<td>41.5</td>
<td>238</td>
<td>41.4</td>
</tr>
<tr>
<td>470.lbm</td>
<td>30.2</td>
<td>454</td>
<td>30.1</td>
<td>457</td>
<td>30.2</td>
<td>455</td>
</tr>
<tr>
<td>481.wrf</td>
<td>94.6</td>
<td>118</td>
<td>94.2</td>
<td>119</td>
<td>94.0</td>
<td>119</td>
</tr>
<tr>
<td>482.sphinx3</td>
<td>281</td>
<td>69.4</td>
<td>283</td>
<td>68.8</td>
<td>282</td>
<td>69.0</td>
</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 C6 State
Minimum Processor Idle Power Package C-State set to C6 (retention) State
Collaborative Power Control set to Disabled
Thermal Configuration set to Maximum Cooling
Processor Power and Utilization Monitoring set to Disabled
Continued on next page
SPEC CFP2006 Result
Copyright 2006-2016 Standard Performance Evaluation Corporation

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant ML110 Gen9
(2.00 GHz, Intel Xeon E5-2660 v4)

SPECfp2006 = 107
SPECfp_base2006 = 102

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

Platform Notes (Continued)

Memory Refresh Rate set to 1x Refresh
Intel Hyperthreading set to Disabled

Sysinfo program /home/cpu2006/config/sysinfo.rev6914
$Rev: 6914 $ $Date:: 2014-06-25 #$ e3fbb8667b5a285932ceab81e28219e1
running on localhost.localdomain Fri Mar 4 12:19:04 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 E5-2660 v4@ 2.00GHz
  1 "physical id"s (chips)
  14 "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 : 14
  siblings : 14
  physical 0: cores 0 2 4 5 6 8 9 10 11 12 13 14
  cache size : 35840 KB

From /proc/meminfo
MemTotal:       131601688 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:
Linux localhost.localdomain 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 Mar 4 11:20

SPEC is set to: /home/cpu2006
Filesystem    Type    Size    Used    Avail    Use%    Mounted on
/dev/sda5     xfs      411G    66G    346G    16% /home

Additional information from dmidecode:
Continued on next page
### Platform Notes (Continued)

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 P99 02/22/2016**  
**Memory:**  
4x UNKNOWN NOT AVAILABLE  
4x 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 128 GB and the dmidecode description should have one line reading as:  
4x UNKNOWN NOT AVAILABLE 32 GB 2 rank 2400 MHz

### General Notes

Environment variables set by runspec before the start of the run:  
- KMP_AFFINITY = "granularity=fine,compact,1,0"  
- LD_LIBRARY_PATH = ":/home/cpu2006/libs/32:/home/cpu2006/libs/64:/home/cpu2006/sh"  
- OMP_NUM_THREADS = "14"

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

### Base Portability Flags

- 410.bwaves: -DSPEC_CPU_LP64  
- 416.gamess: -DSPEC_CPU_LP64  
- 433.milc: -DSPEC_CPU_LP64  
- 434.zeusmp: -DSPEC_CPU_LP64

Continued on next page
SPEC CFP2006 Result

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant ML110 Gen9
(2.00 GHz, Intel Xeon E5-2660 v4)

SPECfp2006 = 107
SPECfp_base2006 = 102

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

Base Portability Flags (Continued)

435.gromacs: -DSPEC_CPU_LP64 -nofor_main
436.cactusADM: -DSPEC_CPU_LP64 -nofor_main
437.leslie3d: -DSPEC_CPU_LP64
444.namd: -DSPEC_CPU_LP64 -nofor_main
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 -fp-model fast=2
-qopt-prefetch-issue-excl-hint

C++ benchmarks:
-xCORE-AVX2 -ipo -O3 -no-prec-div -static -opt-prefetch -ansi-alias
-fp-model fast=2
-qopt-prefetch-issue-excl-hint

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 -fp-model fast=2
-qopt-prefetch-issue-excl-hint

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:

```
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: 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
```
Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant ML110 Gen9
(2.00 GHz, Intel Xeon E5-2660 v4)

SPECfp2006 = 107
SPECfp_base2006 = 102

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

Peak Optimization Flags (Continued)

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-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

SPEC and SPECfp are registered trademarks of the Standard Performance Evaluation Corporation. All other brand and product names appearing in this result are trademarks or registered trademarks of their respective holders.

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

Tested with SPEC CPU2006 v1.2.
Originally published on 19 April 2016.