Cisco Systems
Cisco UCS C220 M4 (Intel Xeon E5-2660 v4, 2.00 GHz)

<table>
<thead>
<tr>
<th>SPECfp²006 = 117</th>
<th>SPECfp_base²006 = 110</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU2006 license: 9019</td>
<td>Test date: Jul-2016</td>
</tr>
<tr>
<td>Test sponsor: Cisco Systems</td>
<td>Hardware Availability: Apr-2016</td>
</tr>
<tr>
<td>Tested by: Cisco Systems</td>
<td>Software Availability: Dec-2015</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>SPECfp²006</th>
<th>SPECfp_base²006</th>
</tr>
</thead>
<tbody>
<tr>
<td>410.bwaves</td>
<td>42.6</td>
<td>75.0</td>
</tr>
<tr>
<td>416.gamess</td>
<td>33.1</td>
<td>201</td>
</tr>
<tr>
<td>433.milc</td>
<td>42.9</td>
<td></td>
</tr>
<tr>
<td>434.zeusmp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>435.gromacs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>436.cactusADM</td>
<td>800</td>
<td></td>
</tr>
<tr>
<td>437.leslie3d</td>
<td>334</td>
<td></td>
</tr>
<tr>
<td>444.namd</td>
<td>29.0</td>
<td>63.0</td>
</tr>
<tr>
<td>447.dealII</td>
<td>28.2</td>
<td>48.0</td>
</tr>
<tr>
<td>450.soplex</td>
<td>64.3</td>
<td>57.1</td>
</tr>
<tr>
<td>453.povray</td>
<td>52.3</td>
<td></td>
</tr>
<tr>
<td>454.calculix</td>
<td></td>
<td></td>
</tr>
<tr>
<td>459.GemsFDTD</td>
<td>276</td>
<td>233</td>
</tr>
<tr>
<td>465.tonto</td>
<td>54.1</td>
<td>38.6</td>
</tr>
<tr>
<td>470.lbm</td>
<td>113</td>
<td></td>
</tr>
<tr>
<td>481.wrf</td>
<td></td>
<td></td>
</tr>
<tr>
<td>482.sphinx3</td>
<td>67.8</td>
<td></td>
</tr>
</tbody>
</table>

**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:** 28 cores, 2 chips, 14 cores/chip
- **CPU(s) orderable:** 1.2 chips
- **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 SP1 (x86_64) 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)
Cisco Systems
Cisco UCS C220 M4 (Intel Xeon E5-2660 v4, 2.00 GHz)

SPECfp2006 = 117
SPECfp_base2006 = 110

CPU2006 license: 9019
Test sponsor: Cisco Systems
Tested by: Cisco Systems

L3 Cache: 35 MB I+D on chip per chip
Other Cache: None
Memory: 256 GB (16 x 16 GB 2Rx4 PC4-2400T-R)
Disk Subsystem: 1 x 960 GB SAS HDD
Other Hardware: None

Base Pointers: 64-bit
Peak Pointers: 32/64-bit
Other Software: 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>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>410.bwaves</td>
<td>22.0</td>
<td>616</td>
<td>21.5</td>
<td>633</td>
<td>22.0</td>
<td>618</td>
<td>22.0</td>
<td>616</td>
<td>21.5</td>
<td>633</td>
</tr>
<tr>
<td>416.gamess</td>
<td>591</td>
<td>33.1</td>
<td>591</td>
<td>33.1</td>
<td>463</td>
<td>42.3</td>
<td>459</td>
<td>42.6</td>
<td>459</td>
<td>42.7</td>
</tr>
<tr>
<td>433.milc</td>
<td>122</td>
<td>75.1</td>
<td>122</td>
<td>75.0</td>
<td>122</td>
<td>75.0</td>
<td>122</td>
<td>75.1</td>
<td>122</td>
<td>75.0</td>
</tr>
<tr>
<td>434.xeusmp</td>
<td>45.2</td>
<td>201</td>
<td>45.3</td>
<td>201</td>
<td>45.2</td>
<td>201</td>
<td>45.3</td>
<td>201</td>
<td>45.3</td>
<td>201</td>
</tr>
<tr>
<td>435.gromacs</td>
<td>162</td>
<td>44.0</td>
<td>167</td>
<td>42.9</td>
<td>166</td>
<td>42.9</td>
<td>162</td>
<td>44.0</td>
<td>167</td>
<td>42.9</td>
</tr>
<tr>
<td>436.cactusADM</td>
<td>14.9</td>
<td>800</td>
<td>15.3</td>
<td>781</td>
<td>14.9</td>
<td>805</td>
<td>14.9</td>
<td>800</td>
<td>15.3</td>
<td>781</td>
</tr>
<tr>
<td>437.leslie3d</td>
<td>28.2</td>
<td>334</td>
<td>30.1</td>
<td>312</td>
<td>27.6</td>
<td>341</td>
<td>28.2</td>
<td>334</td>
<td>30.1</td>
<td>312</td>
</tr>
<tr>
<td>444.namd</td>
<td>285</td>
<td>28.2</td>
<td>285</td>
<td>28.1</td>
<td>285</td>
<td>28.2</td>
<td>277</td>
<td>29.0</td>
<td>276</td>
<td>29.0</td>
</tr>
<tr>
<td>447.dealII</td>
<td>182</td>
<td>63.0</td>
<td>182</td>
<td>62.9</td>
<td>181</td>
<td>63.2</td>
<td>182</td>
<td>63.0</td>
<td>182</td>
<td>62.9</td>
</tr>
<tr>
<td>450.soplex</td>
<td>174</td>
<td>47.9</td>
<td>174</td>
<td>48.0</td>
<td>174</td>
<td>48.0</td>
<td>174</td>
<td>47.9</td>
<td>174</td>
<td>48.0</td>
</tr>
<tr>
<td>453.povray</td>
<td>93.8</td>
<td>56.7</td>
<td>93.2</td>
<td>57.1</td>
<td>92.9</td>
<td>57.2</td>
<td>82.7</td>
<td>64.3</td>
<td>82.8</td>
<td>64.2</td>
</tr>
<tr>
<td>454.calculix</td>
<td>157</td>
<td>52.4</td>
<td>158</td>
<td>52.1</td>
<td>158</td>
<td>52.3</td>
<td>143</td>
<td>57.6</td>
<td>144</td>
<td>57.3</td>
</tr>
<tr>
<td>459.GemsFDTD</td>
<td>45.2</td>
<td>234</td>
<td>49.1</td>
<td>216</td>
<td>45.6</td>
<td>233</td>
<td>38.6</td>
<td>275</td>
<td>38.4</td>
<td>276</td>
</tr>
<tr>
<td>465.tonto</td>
<td>253</td>
<td>38.8</td>
<td>256</td>
<td>38.5</td>
<td>255</td>
<td>38.6</td>
<td>182</td>
<td>53.9</td>
<td>182</td>
<td>54.2</td>
</tr>
<tr>
<td>470.lbm</td>
<td>15.9</td>
<td>865</td>
<td>16.0</td>
<td>861</td>
<td>16.8</td>
<td>817</td>
<td>15.9</td>
<td>865</td>
<td>16.0</td>
<td>861</td>
</tr>
<tr>
<td>481.wrf</td>
<td>104</td>
<td>107</td>
<td>99.3</td>
<td>113</td>
<td>98.8</td>
<td>113</td>
<td>104</td>
<td>107</td>
<td>99.3</td>
<td>113</td>
</tr>
<tr>
<td>482.sphinx3</td>
<td>287</td>
<td>67.8</td>
<td>287</td>
<td>67.8</td>
<td>287</td>
<td>67.8</td>
<td>287</td>
<td>67.8</td>
<td>287</td>
<td>67.8</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"

Platform Notes

BIOS Settings:
Intel Hyper-Threading Technology option set to Disabled
CPU performance set to Enterprise
Power Technology set to Energy Efficient
Energy Performance BIAS setting set to Balanced Performance
Memory RAS configuration set to Maximum Performance
Memory Power Saving Mode set to Disabled
QPI Snoop Mode set to Home Directory Snoop with OSB
Sysinfo program /opt/cpu2006-1.2/config/sysinfo.rev6914
$Rev: 6914 $ $Date:: 2014-06-25 #$ e3fbb8667b5a285932ceab81e28219e1
Continued on next page
Cisco Systems

Cisco UCS C220 M4 (Intel Xeon E5-2660 v4, 2.00 GHz)

| SPECfp2006 | 117 |
| SPECfp_base2006 | 110 |

CPU2006 license: 9019
Test sponsor: Cisco Systems
Tested by: Cisco Systems

Platform Notes (Continued)

running on linux-40jf Tue Jul 12 14:14:51 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
 2 "physical id"s (chips)
 28 "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 1 2 3 4 5 6 8 9 10 11 12 13 14
physical 1: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 14
```

cache size : 35840 KB

From /proc/meminfo

```
MemTotal:       264568500 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:
```
Linux linux-40jf 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 3 Jul 12 08:17

SPEC is set to: /opt/cpu2006-1.2

```
Filesystem     Type  Size  Used Avail Use% Mounted on
/dev/sda1      xfs   893G  14G  880G   2%  /
```

Additional information from dmidecode:

Continued on next page
Cisco Systems
Cisco UCS C220 M4 (Intel Xeon E5-2660 v4, 2.00 GHz)

SPECfp2006 = 117
SPECfp_base2006 = 110

CPU2006 license: 9019
Test sponsor: Cisco Systems
Tested by: Cisco Systems

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 Cisco Systems, Inc. C220M4.2.0.10c.0.0.032320160810 03/23/2016
Memory:
16x 0xCE00 M393A2G40EB1-CRC 16 GB 2 rank 2400 MHz
8x NO DIMM NO DIMM

(End of data from sysinfo program)

General Notes
Environment variables set by runspec before the start of the run:
KMP_AFFINITY = "granularity=fine,compact"
LD_LIBRARY_PATH = "/opt/cpu2006-1.2/libs/32:/opt/cpu2006-1.2/libs/64:/opt/cpu2006-1.2/sh"
OMP_NUM_THREADS = "28"

Binaries compiled on a system with 1x Intel Core i5-4670K CPU + 32GB memory using RedHat EL 7.1
Transparent Huge Pages enabled with:
echo always > /sys/kernel/mm/transparent_hugepage/enabled

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
435.gromacs: -DSPEC_CPU_LP64 -nofor_main
436.cactusADM: -DSPEC_CPU_LP64 -nofor_main
Cisco Systems
Cisco UCS C220 M4 (Intel Xeon E5-2660 v4, 2.00 GHz)

CPU2006 license: 9019
Test sponsor: Cisco Systems
Tested by: Cisco Systems

SPECfp2006 = 117
SPECfp_base2006 = 110

Test date: Jul-2016
Hardware Availability: Apr-2016
Software Availability: Dec-2015

Base Portability Flags (Continued)

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 -parallel -opt-prefetch
-ansi-alias

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

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

Benchmarks using both Fortran and C:
-xCORE-AVX2 -ipo -O3 -no-prec-div -parallel -opt-prefetch
-ansi-alias

Peak Compiler Invocation

C benchmarks:
icc -m64

C++ benchmarks:
icpc -m64

Fortran benchmarks:
ifort -m64

Benchmarks using both Fortran and C:
icc -m64 ifort -m64
Cisco Systems
Cisco UCS C220 M4 (Intel Xeon E5-2660 v4, 2.00 GHz)

SPECfp2006 = 117
SPECfp_base2006 = 110

CPU2006 license: 9019
Test date: Jul-2016
Test sponsor: Cisco Systems
Hardware Availability: Apr-2016
Tested by: Cisco Systems
Software Availability: Dec-2015

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
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

Continued on next page
## Peak Optimization Flags (Continued)

465.tonto (continued):
- `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:


You can also download the XML flags sources by saving the following links: