SPEC® CFP2006 Result
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Hewlett Packard Enterprise
(Test Sponsor: HPE)

ProLiant ML350 Gen9
(1.70 GHz, Intel Xeon E5-2650L v4)
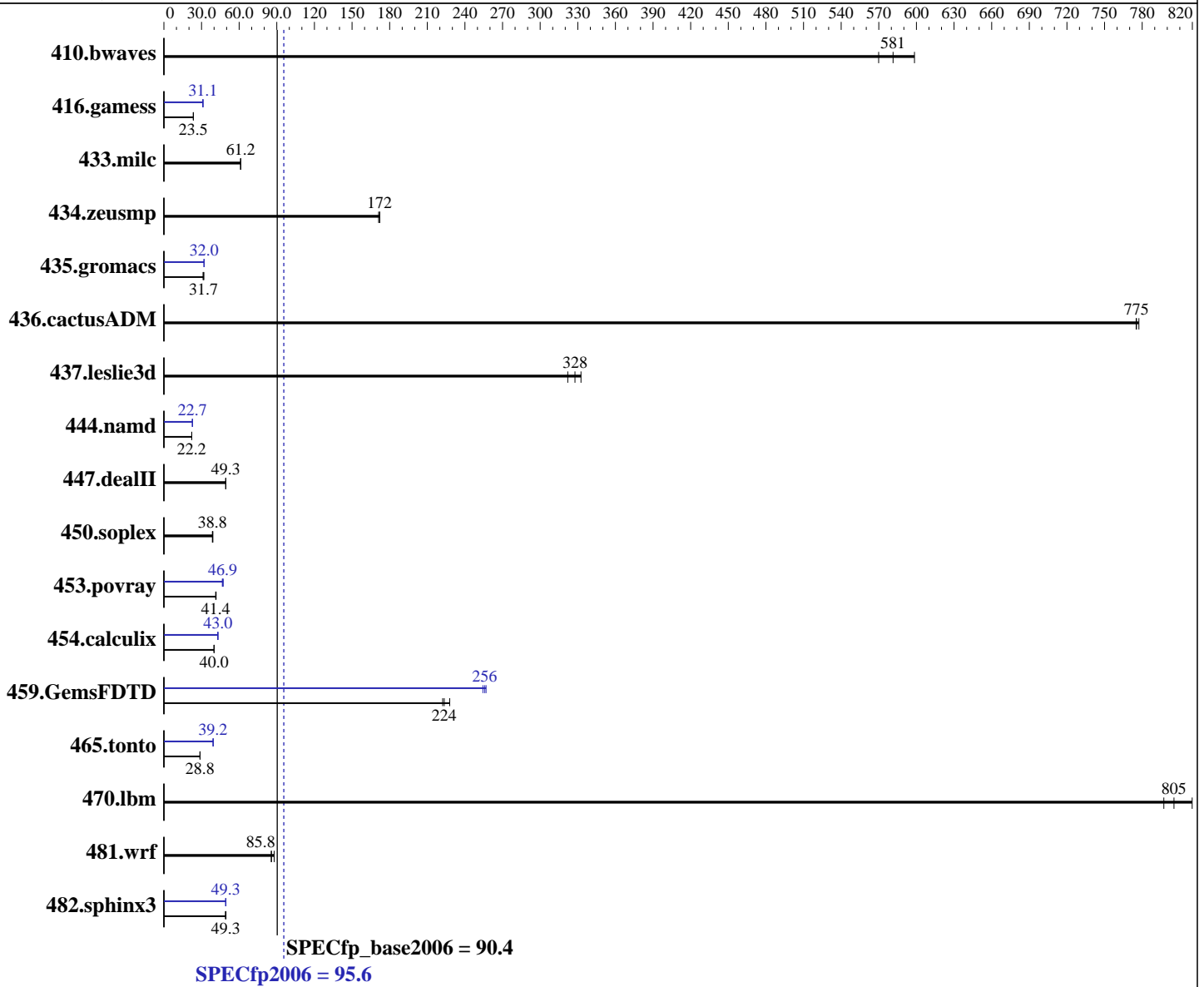
$SPECfp^®2006 =$ 95.6

$SPECfp\_base2006 =$ 90.4

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

Results chart, with scale 0 to 820:

- **410.bwaves**: 581
- **416.gamess**: 31.1 / 23.5
- **433.milc**: 61.2
- **434.zeusmp**: 172
- **435.gromacs**: 32.0 / 31.7
- **436.cactusADM**: 775
- **437.leslie3d**: 328
- **444.namd**: 22.7 / 22.2
- **447.dealII**: 49.3
- **450.soplex**: 38.8
- **453.povray**: 46.9 / 41.4
- **454.calculix**: 43.0 / 40.0
- **459.GemsFDTD**: 256 / 224
- **465.tonto**: 39.2 / 28.8
- **470.lbm**: 805
- **481.wrf**: 85.8
- **482.sphinx3**: 49.3 / 49.3

SPECfp_base2006 = 90.4
SPECfp2006 = 95.6

Hardware

CPU Name:	Intel Xeon E5-2650L v4
CPU Characteristics:	Intel Turbo Boost Technology up to 2.50 GHz
CPU MHz:	1700
FPU:	Integrated
CPU(s) enabled:	28 cores, 2 chips, 14 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

Continued on next page

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)

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L3 Cache:	35 MB I+D on chip per chip	Base Pointers:	64-bit
Other Cache:	None	Peak Pointers:	32/64-bit
Memory:	512 GB (16 x 32 GB 2Rx4 PC4-2400T-R)	Other Software:	None
Disk Subsystem:	1 x 800 GB SAS SSD, RAID 0		
Other Hardware:	None		

Results Table

Benchmark	Base						Peak					
	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
410.bwaves	22.7	598	23.8	570	**23.4**	**581**	22.7	598	23.8	570	**23.4**	**581**
416.gamess	834	23.5	**834**	**23.5**	834	23.5	**629**	**31.1**	628	31.2	632	31.0
433.milc	**150**	**61.2**	150	61.3	150	61.1	**150**	**61.2**	150	61.3	150	61.1
434.zeusmp	**52.9**	**172**	52.9	172	53.2	171	**52.9**	**172**	52.9	172	53.2	171
435.gromacs	224	31.8	229	31.2	**226**	**31.7**	223	32.0	223	32.0	**223**	**32.0**
436.cactusADM	15.4	775	**15.4**	**775**	15.4	777	15.4	775	**15.4**	**775**	15.4	777
437.leslie3d	29.2	322	**28.7**	**328**	28.3	333	29.2	322	**28.7**	**328**	28.3	333
444.namd	361	22.2	361	22.2	**361**	**22.2**	**353**	**22.7**	353	22.7	353	22.7
447.dealII	**232**	**49.3**	232	49.4	232	49.3	**232**	**49.3**	232	49.4	232	49.3
450.soplex	214	39.1	216	38.7	**215**	**38.8**	214	39.1	216	38.7	**215**	**38.8**
453.povray	129	41.3	**128**	**41.4**	128	41.6	**114**	**46.9**	112	47.3	114	46.6
454.calculix	206	40.0	206	40.0	**206**	**40.0**	192	43.0	**192**	**43.0**	192	43.1
459.GemsFDTD	47.7	222	**47.5**	**224**	46.6	228	41.3	257	**41.5**	**256**	41.7	254
465.tonto	**342**	**28.8**	342	28.8	341	28.8	251	39.2	250	39.4	**251**	**39.2**
470.lbm	17.2	797	**17.1**	**805**	16.8	820	17.2	797	**17.1**	**805**	16.8	820
481.wrf	131	85.5	**130**	**85.8**	127	87.9	131	85.5	**130**	**85.8**	127	87.9
482.sphinx3	394	49.5	397	49.1	**396**	**49.3**	**395**	**49.3**	396	49.2	394	49.5

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:
  Intel Hyperthreading Option set to Enabled
  Power Profile set to Custom
  Power Regulator set to 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
  Collaborative Power Control set to Disabled
  QPI Snoop Configuration set to Home Snoop
```

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Test date: May-2016
Hardware Availability: Mar-2016
Software Availability: Dec-2015

Platform Notes (Continued)

```
   Thermal Configuration set to Maximum Cooling
   Processor Power and Utilization Monitoring set to Disabled
   Memory Double Refresh Rate set to 1x Refresh
   Energy Performance Bias set to Maximum Performance
Sysinfo program
/home/specuser/cpu2006/HP_compiled_binaries_latest/cpu2006/config/sysinfo.rev6914
$Rev: 6914 $ $Date:: 2014-06-25 #$ e3fbb8667b5a285932ceab81e28219e1
running on linux-7m51 Wed May 25 00:37:15 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 E5-2650L v4@ 1.70GHz
      2 "physical id"s (chips)
      56 "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  : 28
      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:       529090788 kB
   HugePages_Total:        0
   Hugepagesize:        2048 kB

/usr/bin/lsb_release -d
   SUSE Linux Enterprise Server 12 SP1

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:
```

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CPU2006 license: 3	**Test date:** May-2016
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Platform Notes (Continued)

```
    Linux linux-7m51 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 May 25 00:36

  SPEC is set to: /home/specuser/cpu2006/HP_compiled_binaries_latest/cpu2006
    Filesystem      Type  Size  Used Avail Use% Mounted on
    /dev/sda4       xfs   703G  236G  468G  34% /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 P92 04/12/2016
    Memory:
    8x UNKNOWN NOT AVAILABLE
    16x 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 512 GB and the dmidecode description should have one line reading as:
  16x 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"
  OMP_NUM_THREADS = "28"
  LD_LIBRARY_PATH = "/home/specuser/cpu2006/HP_compiled_binaries_latest/cpu2006/libs/32:/home/specuser/cpu2006/HP_compiled_binaries_latest/cpu2006/libs/64:/home/specuser/cpu2006/HP_compiled_binaries_latest/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

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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
```

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

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
    -fp-model fast=2
```

Peak Compiler Invocation

C benchmarks:
```
    icc   -m64
```

C++ benchmarks:
```
    icpc  -m64
```

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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`   `-nofor-main`
        `-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-`

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 fast=2   -nofor-main
-qopt-prefetch-issue-excl-hint -funroll-all-loops
-auto-ilp32

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

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