**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
ProLiant ML350 Gen9  
(2.20 GHz, Intel Xeon E5-2699 v4)  

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Result (Threads)</th>
</tr>
</thead>
<tbody>
<tr>
<td>603.bwaves_s</td>
<td>44</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>44</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>44</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>44</td>
</tr>
<tr>
<td>627.cam4_s</td>
<td>44</td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>44</td>
</tr>
<tr>
<td>638.imagick_s</td>
<td>44</td>
</tr>
<tr>
<td>644.nab_s</td>
<td>44</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>44</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>44</td>
</tr>
</tbody>
</table>

**Hardware**  
- **CPU Name:** Intel Xeon E5-2699 v4  
- **Max MHz.:** 3600  
- **Nominal:** 2200  
- **Enabled:** 44 cores, 2 chips  
- **Orderable:** 1,2 chips  
- **Cache L1:** 32 KB I + 32 KB D on chip per core  
- **L2:** 256 KB I+D on chip per core  
- **L3:** 55 MB I+D on chip per core  
- **Memory:** 256 GB (16 x 16 GB 2Rx4 PC4-2400T-R)  
- **Storage:** 1 x 800 GB SAS SSD, RAID 0  
- **Other:** None

**Software**  
- **OS:** SUSE Linux Enterprise Server 12 (x86_64) SP1  
- **Kernel:** 3.12.49-11-default  
- **Compiler:** C/C++: Version 17.0.0.098 of Intel C/C++  
- **Compiler for Linux:** Fortran: Version 17.0.0.098 of Intel Fortran  
- **Compiler for Linux:**  
- **Firmware:** P92 v2.20 04/12/2016  
- **File System:** xfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 32/64-bit  
- **Other:** Microquill SmartHeap V10.2
Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant ML350 Gen9
(2.20 GHz, Intel Xeon E5-2699 v4)

SPEC CPU2017 Floating Point Speed Result
Copyright 2017-2018 Standard Performance Evaluation Corporation

SPECspeed2017_fp_base = 6.16
SPECspeed2017_fp_peak = 7.61

CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Test Date: Oct-2016
Hardware Availability: Apr-2016
Software Availability: Sep-2016

Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>603.bwaves_s</td>
<td>44</td>
<td>1832</td>
<td>32.2</td>
<td>1870</td>
<td>31.5</td>
<td>1834</td>
<td>32.2</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>44</td>
<td>3775</td>
<td>4.42</td>
<td>3952</td>
<td>4.22</td>
<td>3753</td>
<td>4.44</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>44</td>
<td>1959</td>
<td>2.67</td>
<td>1958</td>
<td>2.67</td>
<td>1993</td>
<td>2.63</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>44</td>
<td>1451</td>
<td>9.11</td>
<td>1430</td>
<td>9.25</td>
<td><strong>1433</strong></td>
<td><strong>9.23</strong></td>
</tr>
<tr>
<td>627.cam4_s</td>
<td>44</td>
<td>2028</td>
<td>4.37</td>
<td>2039</td>
<td>4.35</td>
<td>2021</td>
<td>4.39</td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>44</td>
<td>2234</td>
<td>5.31</td>
<td><strong>2236</strong></td>
<td><strong>5.31</strong></td>
<td>2236</td>
<td>5.31</td>
</tr>
<tr>
<td>638.imagick_s</td>
<td>44</td>
<td>7071</td>
<td>2.04</td>
<td>7089</td>
<td>2.03</td>
<td>7064</td>
<td>2.04</td>
</tr>
<tr>
<td>644.nab_s</td>
<td>44</td>
<td>1953</td>
<td>8.95</td>
<td>1951</td>
<td>8.96</td>
<td>1958</td>
<td>8.92</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>44</td>
<td>1149</td>
<td>7.93</td>
<td><strong>1123</strong></td>
<td><strong>8.12</strong></td>
<td>1121</td>
<td>8.13</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>44</td>
<td>2322</td>
<td>6.78</td>
<td><strong>2404</strong></td>
<td><strong>6.55</strong></td>
<td>2408</td>
<td>6.54</td>
</tr>
</tbody>
</table>

SPECspeed2017_fp_base = 6.16
SPECspeed2017_fp_peak = 7.61

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 by default

General Notes
Environment variables set by runcpu before the start of the run:
KMP_AFFINITY = "granularity=fine,compact"
LD_LIBRARY_PATH = "/home/specuser/cpu2006/cpu2017/1ib/ia32:/home/specuser/cpu2006/cpu2017/1ib/intel64:/home/specuser/cpu2006/cpu2017/sh10.2"
OMP_NUM_THREADS = "%{cores}" 
OMP_STACKSIZE = "192M"

Binaries compiled on a system with 1x Intel Core i7-4790K CPU + 32GB RAM memory using Redhat Enterprise Linux 7.2

Platform Notes
BIOS Configuration:
  Intel Hyperthreading Option set to Disabled
  Power Profile set to Balanced Power and Performance
  Collaborative Power Control set to Disabled
  QPI Snoop Configuration set to Home Snoop
  Thermal Configuration set to Maximum Cooling
  Processor Power and Utilization Monitoring set to Disabled
  Memory Double Refresh Rate set to 1x Refresh
Sysinfo program /home/specuser/cpu2006/cpu2017/Docs/sysinfo
r4696 of 2016-07-28 da95b61906f345a0d9942e915810c155
running on linux-szds Mon Oct 17 09:13:02 2016

(Continued on next page)
Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant ML350 Gen9
(2.20 GHz, Intel Xeon E5-2699 v4)

SPECspeed2017_fp_base = 6.16
SPECspeed2017_fp_peak = 7.61

CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Platform Notes (Continued)

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/cpu2017/Docs/config.html#sysinfo

From /proc/cpuinfo
model name : Intel(R) Xeon(R) CPU E5-2699 v4 @ 2.20GHz
2 "physical id"s (chips)
44 "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 : 22
siblings : 22
physical 0: cores 0 2 3 4 8 10 11 12 16 17 18 19 20 21 24 25 26 27 28
physical 1: cores 0 2 3 4 8 10 11 12 16 17 18 19 20 21 24 25 26 27 28
cache size : 56320 KB

From /proc/meminfo
MemTotal: 264326744 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:
(8d714a0) x86_64 x86_64 x86_64 GNU/Linux

(Continued on next page)
Platform Notes (Continued)

run-level 3 Oct 17 09:12

SPEC is set to: /home/specuser/cpu2006/cpu2017

Filesystem     Type  Size  Used Avail Use% Mounted on
/dev/sda4      xfs   703G  214G  489G  31% /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 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 256 GB and the dmidecode description should have one line reading as:
  16x UNKNOWN NOT AVAILABLE 16 GB 2 rank 2400 MHz

Compiler Version Notes

==============================================================================
CC   607.cactuBSSN_s(base, peak) 619.1hm_s(base, peak) 621.wrf_s(base, peak)  
  627.cam4_s(base, peak) 628.pop2_s(base, peak) 638.imagick_s(base, peak)  
  644.nab_s(base, peak)
==============================================================================

icc (ICC) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation. All rights reserved.

==============================================================================
CXXC 607.cactuBSSN_s(base, peak)
==============================================================================
icpc (ICC) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation. All rights reserved.

==============================================================================
FC   603.bwaves_s(base, peak) 607.cactuBSSN_s(base, peak) 621.wrf_s(base,  
  peak) 627.cam4_s(base, peak) 628.pop2_s(base, peak) 649.fotonik3d_s(base,  
  peak) 654.roms_s(base, peak)
==============================================================================

ifort (IFORT) 17.0.0 20160721

(Continued on next page)
Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant ML350 Gen9
(2.20 GHz, Intel Xeon E5-2699 v4)

SPECspeed2017_fp_base = 6.16
SPECspeed2017_fp_peak = 7.61

CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Test Date: Oct-2016
Hardware Availability: Apr-2016
Software Availability: Sep-2016

Compiler Version Notes (Continued)
Copyright (C) 1985-2016 Intel Corporation. All rights reserved.
------------------------------------------------------------------

Base Compiler Invocation

C benchmarks:
icc -m64 -std=c11

Fortran benchmarks:
ifort -m64

Benchmarks using both Fortran and C:
ifort -m64 icc -m64 -std=c11

Benchmarks using Fortran, C, and C++:
icpc -m64 icc -m64 -std=c11 ifort -m64

Base Portability Flags

603.bwaves_s: -DSPEC_LP64
607.cactusBSSN_s: -DSPEC_LP64
619.lbm_s: -DSPEC_LP64
621.wrf_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
627.cam4_s: -DSPEC_LP64 -DSPEC_CASE_FLAG
628.pop2_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
-assume byterecl
638.imagick_s: -DSPEC_LP64
644.nab_s: -DSPEC_LP64
649.fotonik3d_s: -DSPEC_LP64
654.roms_s: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-qopt-prefetch -qopt-mem-layout-trans=3 -DSPEC_SUPPRESS_OPENMP

Fortran benchmarks:
-DSPEC_SUPPRESS_OPENMP -qopt-prefetch -qopt-mem-layout-trans=3
-nostandard-realloc-lhs

(Continued on next page)
SPEC CPU2017 Floating Point Speed Result
Copyright 2017-2018 Standard Performance Evaluation Corporation

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant ML350 Gen9
(2.20 GHz, Intel Xeon E5-2699 v4)

| SPECspeed2017_fp_base | 6.16 |
| SPECspeed2017_fp_peak | 7.61 |

CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Test Date: Oct-2016
Hardware Availability: Apr-2016
Software Availability: Sep-2016

Base Optimization Flags (Continued)

Benchmarks using both Fortran and C:
-qopt-prefetch -qopt-mem-layout-trans=3 -DSPEC_SUPPRESS_OPENMP
-nostandard-realloc-lhs

Benchmarks using Fortran, C, and C++:
-W1,-z,muldefs -qopt-prefetch -qopt-mem-layout-trans=3
-DSPEC_SUPPRESS_OPENMP -nostandard-realloc-lhs -L/sh10.2 -lsmartheap64

Peak Compiler Invocation

C benchmarks:
icc -m64 -std=c11

Fortran benchmarks:
ifort -m64

Benchmarks using both Fortran and C:
ifort -m64 icc -m64 -std=c11

Benchmarks using Fortran, C, and C++:
icpc -m64 icc -m64 -std=c11 ifort -m64

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:
-prof-gen(pass 1) -prof-use(pass 2) -O2 -xCORE-AVX2 -auto-p32 -ipo
-qopt-prefetch -O3 -no-prec-div -qopt-mem-layout-trans=3
-DSPEC_SUPPRESS_OPENMP

Fortran benchmarks:
-prof-gen(pass 1) -prof-use(pass 2) -DSPEC_SUPPRESS_OPENMP -O2
-xCORE-AVX2 -qopt-prefetch -ipo -O3 -qopt-mem-layout-trans=3
-no-prec-div -nostandard-realloc-lhs

Benchmarks using both Fortran and C:
-prof-gen(pass 1) -prof-use(pass 2) -O2 -xCORE-AVX2 -auto-p32 -ipo

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

Benchmarks using both Fortran and C (continued):

- `--qopt-prefetch -O3 -no-prec-div -qopt-mem-layout-trans=3`
- `--DSPEC_SUPPRESS_OPENMP -nostandard-realloc-lhs`

Benchmarks using Fortran, C, and C++:

- `--Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -O2 -xCORE-AVX2`
- `--auto-p32 -ipo -qopt-prefetch -O3 -no-prec-div`
- `--qopt-mem-layout-trans=3 -DSPEC_SUPPRESS_OPENMP -nostandard-realloc-lhs`
- `--L/sh10.2 -lsmartheap64`

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:

- [http://www.spec.org/cpu2017/flags/HP-Platform-Flags-Intel-V1.2-HSW-revE.xml](http://www.spec.org/cpu2017/flags/HP-Platform-Flags-Intel-V1.2-HSW-revE.xml)