SPEC CPU®2017 Floating Point Rate Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL380 Gen9
(2.40 GHz, Intel Xeon E5-2699A v4)

$SPECrate®2017\_fp\_base = 147$
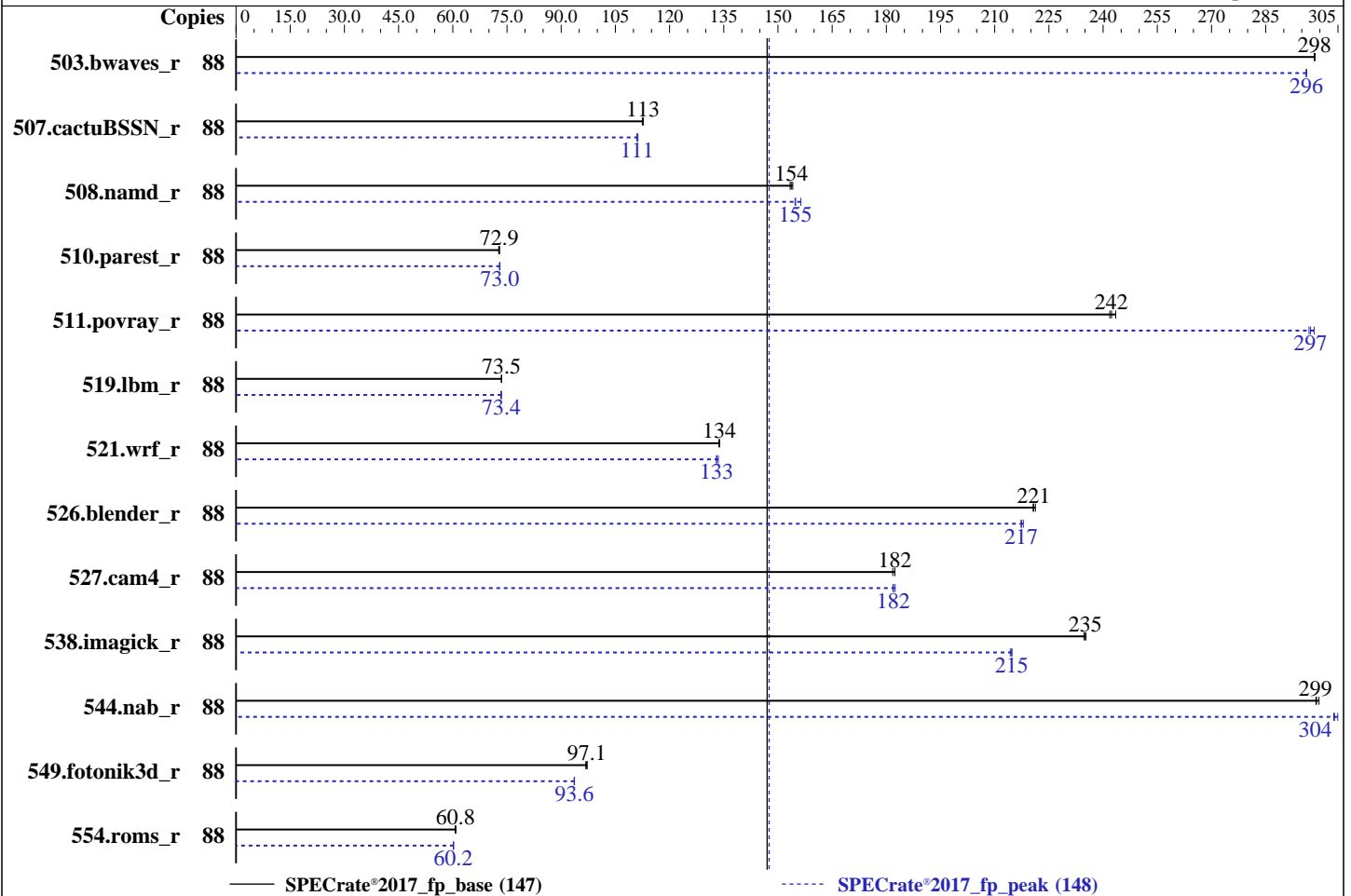
$SPECrate®2017\_fp\_peak = 148$

CPU2017 License: 3   **Test Date:** Dec-2016

Test Sponsor: HPE   **Hardware Availability:** Oct-2016

Tested by: HPE   **Software Availability:** Sep-2016

Benchmark	Copies	base	peak
503.bwaves_r	88	298	296
507.cactuBSSN_r	88	113	111
508.namd_r	88	154	155
510.parest_r	88	72.9	73.0
511.povray_r	88	242	297
519.lbm_r	88	73.5	73.4
521.wrf_r	88	134	133
526.blender_r	88	221	217
527.cam4_r	88	182	182
538.imagick_r	88	235	215
544.nab_r	88	299	304
549.fotonik3d_r	88	97.1	93.6
554.roms_r	88	60.8	60.2

SPECrate®2017_fp_base (147)

SPECrate®2017_fp_peak (148)

Hardware

CPU Name: Intel Xeon E5-2699A v4
Max MHz: 3600
Nominal: 2400
Enabled: 44 cores, 2 chips, 2 threads/core
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 chip
Other: None
Memory: 512 GB (16 x 32 GB 2Rx4 PC4-2400T-R)
Storage: 1 x 400 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
Parallel: No
Firmware: P89 v2.30 9/12/16
File System: xfs
System State: Run level 3 (multi-user)
Base Pointers: 32/64-bit
Peak Pointers: 32/64-bit
Other: Microquill SmartHeap V10.2
Power Management: --

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SPECrate®2017_fp_peak = 148

CPU2017 License: 3	**Test Date:** Dec-2016
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Tested by: HPE	**Software Availability:** Sep-2016

Results Table

Benchmark	Base						Peak					
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
503.bwaves_r	88	2957	298	2955	299	**2956**	**298**	88	2979	296	2978	296	**2979**	**296**
507.cactuBSSN_r	88	989	113	**989**	**113**	991	112	88	1001	111	**1004**	**111**	1004	111
508.namd_r	88	545	153	**544**	**154**	543	154	88	**540**	**155**	535	156	540	155
510.parest_r	88	3157	72.9	**3158**	**72.9**	3166	72.7	88	**3153**	**73.0**	3158	72.9	3151	73.1
511.povray_r	88	850	242	844	243	**848**	**242**	88	**691**	**297**	689	298	692	297
519.lbm_r	88	**1262**	**73.5**	1262	73.5	1262	73.5	88	1263	73.4	1265	73.3	**1263**	**73.4**
521.wrf_r	88	**1473**	**134**	1473	134	1475	134	88	1477	133	**1482**	**133**	1482	133
526.blender_r	88	607	221	606	221	**607**	**221**	88	**617**	**217**	615	218	617	217
527.cam4_r	88	**844**	**182**	844	182	847	182	88	844	182	**846**	**182**	847	182
538.imagick_r	88	**931**	**235**	930	235	932	235	88	**1019**	**215**	1019	215	1021	214
544.nab_r	88	**495**	**299**	494	300	495	299	88	486	305	487	304	**487**	**304**
549.fotonik3d_r	88	3543	96.8	**3533**	**97.1**	3529	97.2	88	3661	93.7	3664	93.6	**3663**	**93.6**
554.roms_r	88	**2301**	**60.8**	2298	60.8	2305	60.7	88	2325	60.2	**2324**	**60.2**	2321	60.2
SPECrate®2017_fp_base =	**147**											
SPECrate®2017_fp_peak =	**148**											

Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

Submit Notes

```
The config file option 'submit' was used.
```

Operating System Notes

```
 Stack size set to unlimited using "ulimit -s unlimited"
 Transparent Huge Pages enabled by default
 Filesystem page cache cleared with:
  echo 1 >        /proc/sys/vm/drop_caches
 runcpu command invoked through numactl i.e.:
  numactl --interleave=all runcpu <etc>
```

General Notes

```
Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = "/home/cpu2017/lib/ia32:/home/cpu2017/lib/intel64:/home/cpu2017/sh10.2"

 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:
   Power Profile set to Custom
```

(Continued on next page)

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$SPECrate^{®}2017\_fp\_base = 147$

$SPECrate^{®}2017\_fp\_peak = 148$

CPU2017 License: 3
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Hardware Availability: Oct-2016
Software Availability: Sep-2016

Platform Notes (Continued)

```
    Power Regulator set to Static High Performance Mode
    Minimum Processor Idle Power Core C-State set to C3 State
    Minimum Processor Idle Power Package C-State set to No Package State
    Collaborative Power Control set to Disabled
    QPI Snoop Configuration set to Cluster On Die
    Thermal Configuration set to Maximum Cooling
    Processor Power and Utilization Monitoring set to Disabled
    Memory Refresh Rate set to 1x Refresh
    Energy Performance Bias set to Balanced Performance
Sysinfo program /home/cpu2017/Docs/sysinfo
Rev: r5007 of 2016-11-15 fc8dc82f217779bedfed4d694d580ba9
running on dl380-gen9-2699a Sat Dec 10 00:28:29 2016

This section contains SUT (System Under Test) info as seen by some common
utilities.
For more information on this section, see
http://www.spec.org/cpu2017/Docs/config.html#sysinfo

From /proc/cpuinfo
   model name : Intel(R) Xeon(R) CPU E5-2699A v4 @ 2.40GHz
      2 "physical id"s (chips)
      88 "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  : 44
      physical 0: cores 0 1 2 3 4 5 8 9 10 11 12 16 17 18 19 20 21 24 25 26 27
      28
      physical 1: cores 0 1 2 3 4 5 8 9 10 11 12 16 17 18 19 20 21 24 25 26 27
      28
    cache size : 28160 KB

The view from numactl --hardware follows.  WARNING: a numactl 'node' might or
might not correspond to a physical chip.
   available: 4 nodes (0-3)
   node 0 cpus: 0 1 2 3 4 5 6 7 8 9 10 44 45 46 47 48 49 50 51 52 53 54
   node 0 size: 128869 MB
   node 0 free: 128230 MB
   node 1 cpus: 11 12 13 14 15 16 17 18 19 20 21 55 56 57 58 59 60 61 62 63 64 65
   node 1 size: 129277 MB
   node 1 free: 128701 MB
   node 2 cpus: 22 23 24 25 26 27 28 29 30 31 32 66 67 68 69 70 71 72 73 74 75 76
   node 2 size: 129277 MB
   node 2 free: 128714 MB
   node 3 cpus: 33 34 35 36 37 38 39 40 41 42 43 77 78 79 80 81 82 83 84 85 86 87
   node 3 size: 129133 MB
```

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SPECrate®2017_fp_base = 147

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SPECrate®2017_fp_peak = 148

CPU2017 License: 3
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Tested by: HPE

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

Platform Notes (Continued)

```
   node 3 free: 128592 MB
   node distances:
   node   0   1   2   3
     0:  10  21  31  31
     1:  21  10  31  31
     2:  31  31  10  21
     3:  31  31  21  10

 From /proc/meminfo
    MemTotal:       528955384 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:
    Linux dl380-gen9-2699a 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 Dec 10 00:25

 SPEC is set to: /home/cpu2017
    Filesystem      Type  Size  Used Avail Use% Mounted on
    /dev/sda4       xfs   331G  137G  194G  42% /home

 Additional information from dmidecode follows.  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
```

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Platform Notes (Continued)

```
 SMBIOS" standard.
   BIOS HP P89 09/12/2016
   Memory:
    8x UNKNOWN NOT AVAILABLE
    16x UNKNOWN NOT AVAILABLE 32 GB 2 rank 2400 MHz

 (End of data from sysinfo program)
```

Compiler Version Notes

```
==============================================================================
C                  | 519.lbm_r(base, peak) 538.imagick_r(base, peak)
                   | 544.nab_r(base, peak)
------------------------------------------------------------------------------
icc (ICC) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------


==============================================================================
C++                | 508.namd_r(base, peak) 510.parest_r(base, peak)
------------------------------------------------------------------------------
icpc (ICC) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------


==============================================================================
C++, C             | 511.povray_r(base pass 0, base pass 0, peak pass 1, peak
                   | pass 1, peak pass 2, peak pass 2) 526.blender_r(base pass
                   | 0, base pass 0, peak pass 1, peak pass 1, peak pass 2, peak
                   | pass 2)
------------------------------------------------------------------------------
icc (ICC) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------


==============================================================================
C++, C             | 507.cactuBSSN_r(base pass 0, peak pass 1) 511.povray_r(base
                   | pass 0, base pass 0, peak pass 1, peak pass 1, peak pass 2,
                   | peak pass 2) 526.blender_r(base pass 0, base pass 0, peak
                   | pass 1, peak pass 1, peak pass 2, peak pass 2)
------------------------------------------------------------------------------
icpc (ICC) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------


==============================================================================
```

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Tested by: HPE

Test Date: Dec-2016

Hardware Availability: Oct-2016

Software Availability: Sep-2016

Compiler Version Notes (Continued)

```
C++, C           | 511.povray_r(base pass 0, base pass 0, peak pass 1, peak
                 | pass 1, peak pass 2, peak pass 2) 526.blender_r(base pass
                 | 0, base pass 0, peak pass 1, peak pass 1, peak pass 2, peak
                 | pass 2)
-------------------------------------------------------------------------------
icc (ICC) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
-------------------------------------------------------------------------------


===============================================================================
C++, C           | 507.cactuBSSN_r(base pass 0, peak pass 1) 511.povray_r(base
                 | pass 0, base pass 0, peak pass 1, peak pass 1, peak pass 2,
                 | peak pass 2) 526.blender_r(base pass 0, base pass 0, peak
                 | pass 1, peak pass 1, peak pass 2, peak pass 2)
-------------------------------------------------------------------------------
icpc (ICC) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
-------------------------------------------------------------------------------


===============================================================================
C++, C, Fortran | 507.cactuBSSN_r(base pass 0, peak pass 1, peak pass 2)
-------------------------------------------------------------------------------
icc (ICC) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
-------------------------------------------------------------------------------


===============================================================================
C++, C, Fortran | 507.cactuBSSN_r(peak pass 2)
-------------------------------------------------------------------------------
icpc (ICC) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
-------------------------------------------------------------------------------


===============================================================================
C++, C, Fortran | 507.cactuBSSN_r(base pass 0, peak pass 1, peak pass 2)
-------------------------------------------------------------------------------
ifort (IFORT) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
-------------------------------------------------------------------------------


===============================================================================
C++, C, Fortran | 507.cactuBSSN_r(base pass 0, peak pass 1, peak pass 2)
-------------------------------------------------------------------------------
icc (ICC) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
-------------------------------------------------------------------------------
```

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CPU2017 License: 3
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Tested by: HPE

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Hardware Availability: Oct-2016
Software Availability: Sep-2016

Compiler Version Notes (Continued)

```
==============================================================================
C++, C, Fortran | 507.cactuBSSN_r(peak pass 2)
------------------------------------------------------------------------------
icpc (ICC) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------


==============================================================================
C++, C, Fortran | 507.cactuBSSN_r(base pass 0, peak pass 1, peak pass 2)
------------------------------------------------------------------------------
ifort (IFORT) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------


==============================================================================
C++, C, Fortran | 507.cactuBSSN_r(base pass 0, peak pass 1, peak pass 2)
------------------------------------------------------------------------------
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Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------


==============================================================================
C++, C, Fortran | 507.cactuBSSN_r(peak pass 2)
------------------------------------------------------------------------------
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Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------


==============================================================================
C++, C, Fortran | 507.cactuBSSN_r(base pass 0, peak pass 1, peak pass 2)
------------------------------------------------------------------------------
ifort (IFORT) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------


==============================================================================
Fortran         | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak)
                | 554.roms_r(base, peak)
------------------------------------------------------------------------------
ifort (IFORT) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------


==============================================================================
Fortran, C      | 521.wrf_r(base pass 0, base pass 0, peak pass 1, peak pass
                | 1, peak pass 2, peak pass 2) 527.cam4_r(base pass 0, base
                | pass 0, peak pass 1, peak pass 1, peak pass 2, peak pass 2)
```

(Continued on next page)

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Software Availability: Sep-2016

Compiler Version Notes (Continued)

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


==========================================================================
Fortran, C        | 521.wrf_r(base pass 0, base pass 0, peak pass 1, peak pass
                  | 1, peak pass 2, peak pass 2) 527.cam4_r(base pass 0, base
                  | pass 0, peak pass 1, peak pass 1, peak pass 2, peak pass 2)
--------------------------------------------------------------------------
ifort (IFORT) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
--------------------------------------------------------------------------


==========================================================================
Fortran, C        | 521.wrf_r(base pass 0, base pass 0, peak pass 1, peak pass
                  | 1, peak pass 2, peak pass 2) 527.cam4_r(base pass 0, base
                  | pass 0, peak pass 1, peak pass 1, peak pass 2, peak pass 2)
--------------------------------------------------------------------------
icc (ICC) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
--------------------------------------------------------------------------


==========================================================================
Fortran, C        | 521.wrf_r(base pass 0, base pass 0, peak pass 1, peak pass
                  | 1, peak pass 2, peak pass 2) 527.cam4_r(base pass 0, base
                  | pass 0, peak pass 1, peak pass 1, peak pass 2, peak pass 2)
--------------------------------------------------------------------------
ifort (IFORT) 17.0.0 20160721
Copyright (C) 1985-2016 Intel Corporation.  All rights reserved.
--------------------------------------------------------------------------
```

Base Compiler Invocation

C benchmarks:
```
icc -m64 -std=c11
```

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

Fortran benchmarks:
```
ifort -m64
```

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

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SPECrate®2017_fp_peak = 148

Base Compiler Invocation (Continued)

Benchmarks using both C and C++:
```
icpc -m64 icc -m64 -std=c11
```

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

Base Portability Flags

```
503.bwaves_r: -DSPEC_LP64
507.cactuBSSN_r: -DSPEC_LP64
508.namd_r: -DSPEC_LP64
510.parest_r: -DSPEC_LP64
511.povray_r: -DSPEC_LP64
519.lbm_r: -DSPEC_LP64
521.wrf_r: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
526.blender_r: -DSPEC_LP64 -DSPEC_LINUX -funsigned-char
527.cam4_r: -DSPEC_LP64 -DSPEC_CASE_FLAG
538.imagick_r: -DSPEC_LP64
544.nab_r: -DSPEC_LP64
549.fotonik3d_r: -DSPEC_LP64
554.roms_r: -DSPEC_LP64
```

Base Optimization Flags

C benchmarks:
```
-xCORE-AVX2 -ipo -O3 -no-prec-div -auto-p32 -qopt-prefetch
-qopt-mem-layout-trans=3
```

C++ benchmarks:
```
-Wl,-z,muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div -auto-p32
-qopt-prefetch -qopt-mem-layout-trans=3 -L/sh10.2 -lsmartheap64
```

Fortran benchmarks:
```
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-qopt-mem-layout-trans=3 -nostandard-realloc-lhs
```

Benchmarks using both Fortran and C:
```
-xCORE-AVX2 -ipo -O3 -no-prec-div -auto-p32 -qopt-prefetch
-qopt-mem-layout-trans=3 -nostandard-realloc-lhs
```

Benchmarks using both C and C++:
```
-Wl,-z,muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div -auto-p32
```

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Base Optimization Flags (Continued)

Benchmarks using both C and C++ (continued):
```
-qopt-prefetch -qopt-mem-layout-trans=3 -L/sh10.2 -lsmartheap64
```

Benchmarks using Fortran, C, and C++:
```
-Wl,-z,muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div -auto-p32
-qopt-prefetch -qopt-mem-layout-trans=3 -nostandard-realloc-lhs
-L/sh10.2 -lsmartheap64
```

Peak Compiler Invocation

C benchmarks:
```
icc -m64 -std=c11
```

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

Fortran benchmarks:
```
ifort -m64
```

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

Benchmarks using both C and C++:
```
icpc -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) -xCORE-AVX2 -ipo -O3
-no-prec-div -auto-p32 -qopt-prefetch -qopt-mem-layout-trans=3
```

C++ benchmarks:
```
-Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX2 -ipo
```

(Continued on next page)

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Tested by:	HPE	**Software Availability:**	Sep-2016

Peak Optimization Flags (Continued)

C++ benchmarks (continued):
```
-O3 -no-prec-div -auto-p32 -qopt-prefetch -qopt-mem-layout-trans=3
-L/sh10.2 -lsmartheap64
```

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

Benchmarks using both Fortran and C:
```
-prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX2 -ipo -O3
-no-prec-div -auto-p32 -qopt-prefetch -qopt-mem-layout-trans=3
-nostandard-realloc-lhs
```

Benchmarks using both C and C++:
```
-Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX2 -ipo
-O3 -no-prec-div -auto-p32 -qopt-prefetch -qopt-mem-layout-trans=3
-L/sh10.2 -lsmartheap64
```

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

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/Intel-ic17.0-official-linux64-revD.html
http://www.spec.org/cpu2017/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/cpu2017/flags/Intel-ic17.0-official-linux64-revD.xml
http://www.spec.org/cpu2017/flags/HP-Platform-Flags-Intel-V1.2-HSW-revE.xml

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