SPEC CPU®2017 Floating Point Rate Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

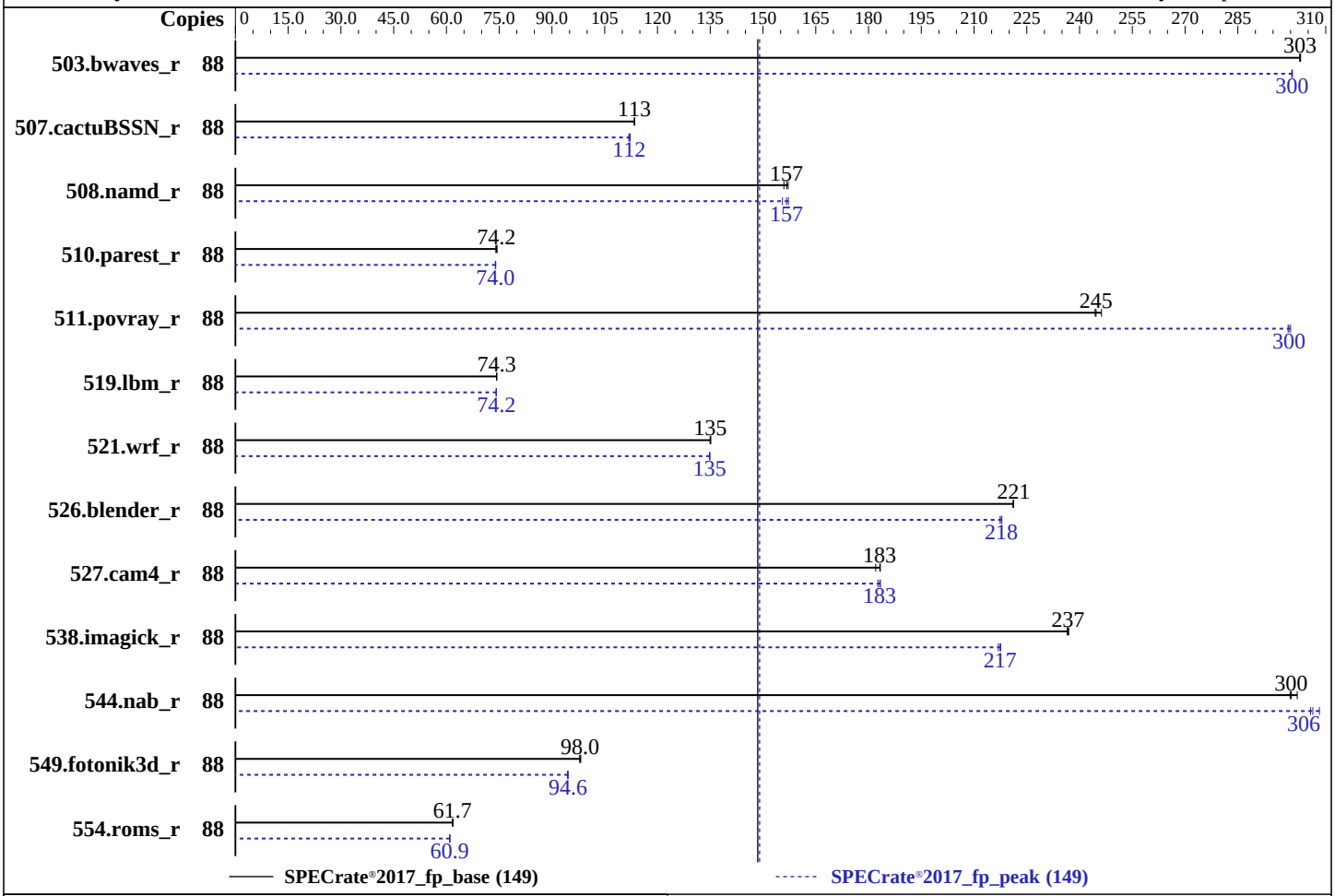
ProLiant DL360 Gen9
(2.40 GHz, Intel Xeon E5-2699A v4)

SPECrate®2017_fp_base = 149

SPECrate®2017_fp_peak = 149

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

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



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:	btrfs
System State:	Run level 5 (multi-user, w/GUI)
Base Pointers:	32/64-bit
Peak Pointers:	32/64-bit
Other:	Microquill SmartHeap V10.2
Power Management:	--

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Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
503.bwaves_r	88	2916	303	2914	303	**2915**	**303**	88	2937	301	2938	300	**2937**	**300**
507.cactuBSSN_r	88	**982**	**113**	981	114	983	113	88	**995**	**112**	996	112	992	112
508.namd_r	88	**533**	**157**	536	156	532	157	88	532	157	**534**	**157**	538	156
510.parest_r	88	**3103**	**74.2**	3094	74.4	3109	74.0	88	3115	73.9	3111	74.0	**3111**	**74.0**
511.povray_r	88	834	246	**840**	**245**	841	244	88	685	300	687	299	**686**	**300**
519.lbm_r	88	1249	74.3	**1249**	**74.3**	1249	74.3	88	1250	74.2	1252	74.1	**1250**	**74.2**
521.wrf_r	88	1461	135	1458	135	**1460**	**135**	88	**1462**	**135**	1461	135	1462	135
526.blender_r	88	606	221	606	221	**606**	**221**	88	**615**	**218**	615	218	616	217
527.cam4_r	88	839	183	**840**	**183**	845	182	88	**840**	**183**	843	183	839	183
538.imagick_r	88	924	237	926	236	**924**	**237**	88	**1007**	**217**	1006	218	1009	217
544.nab_r	88	**493**	**300**	491	302	494	300	88	485	306	**483**	**306**	481	308
549.fotonik3d_r	88	**3500**	**98.0**	3492	98.2	3503	97.9	88	**3627**	**94.6**	3632	94.4	3627	94.6
554.roms_r	88	2267	61.7	**2265**	**61.7**	2259	61.9	88	2296	60.9	**2295**	**60.9**	2292	61.0

SPECrate®2017_fp_base = 149

SPECrate®2017_fp_peak = 149

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 = "/cpu2017/lib/ia32:/cpu2017/lib/intel64:/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)

Platform Notes (Continued)

```
   Power Regulator set to Static High Performance Mode
   Minimum Processor Idle Power Core C-State set to C6 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 Double Refresh Rate set to 1x Refresh
   Energy Performance Bias set to Maximum Performance
 Sysinfo program /cpu2017/Docs/sysinfo
 Rev: r5007 of 2016-11-15 fc8dc82f217779bedfed4d694d580ba9
 running on linux-mzur Wed Dec  7 10:54:07 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: 128920 MB
   node 0 free: 114735 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: 119637 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: 119994 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: 129275 MB
```

(Continued on next page)

Platform Notes (Continued)

```
  node 3 free: 120071 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:       529153016 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 linux-mzur 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 5 Dec 6 20:38

SPEC is set to: /cpu2017
   Filesystem     Type   Size  Used Avail Use% Mounted on
   /dev/sdb3      btrfs  369G  271G   97G  74% /

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
```

(Continued on next page)

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)
   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
```

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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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
```

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Compiler Version Notes (Continued)

```
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)
------------------------------------------------------------------------------
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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.
------------------------------------------------------------------------------

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

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Compiler Version Notes (Continued)

```
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.
------------------------------------------------------------------------------

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

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Base Compiler Invocation (Continued)

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

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

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Base Optimization Flags (Continued)

Benchmarks using both C and C++:
`-Wl,-z,muldefs -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 -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`

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Peak Optimization Flags (Continued)

C++ benchmarks:
-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

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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