SPEC CPU®2017 Floating Point Rate Result

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Cisco Systems

Cisco UCS C220 M5 (Intel Xeon Gold 6238, 2.10GHz)

$SPECrate^{®}2017\_fp\_base = 226$

$SPECrate^{®}2017\_fp\_peak = 229$

CPU2017 License: 9019

Test Sponsor: Cisco Systems

Tested by: Cisco Systems

Test Date: Oct-2019

Hardware Availability: Apr-2019

Software Availability: May-2019

Copies		
503.bwaves_r	88	526 / 526
507.cactuBSSN_r	88	187 / 187
508.namd_r	88	179 / 179
510.parest_r	88	123 / 122
511.povray_r	88	268 / 313
519.lbm_r	88	125 / 125
521.wrf_r	88	226 / 230
526.blender_r	88	247 / 247
527.cam4_r	88	268 / 273
538.imagick_r	88	549 / 550
544.nab_r	88	393 / 394
549.fotonik3d_r	88	167 / 167
554.roms_r	88	101 / 101

——— SPECrate®2017_fp_base (226)   - - - - SPECrate®2017_fp_peak (229)

Hardware

CPU Name: Intel Xeon Gold 6238
  Max MHz: 3700
  Nominal: 2100
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: 1 MB I+D on chip per core
  L3: 30.25 MB I+D on chip per chip
  Other: None
Memory: 768 GB (24 x 32 GB 2Rx4 PC4-2933V-R)
Storage: 1 x 240 GB M.2 SATA SSD
Other: None

Software

OS: SUSE Linux Enterprise Server 15 (x86_64)
4.12.14-23-default
Compiler: C/C++: Version 19.0.4.227 of Intel C/C++
Compiler for Linux;
Fortran: Version 19.0.4.227 of Intel Fortran
Compiler for Linux
Parallel: No
Firmware: Version 4.0.4g released Jul-2019
File System: xfs
System State: Run level 3 (multi-user)
Base Pointers: 64-bit
Peak Pointers: 64-bit
Other: None
Power Management: default

Standard Performance Evaluation Corporation (info@spec.org)
https://www.spec.org/

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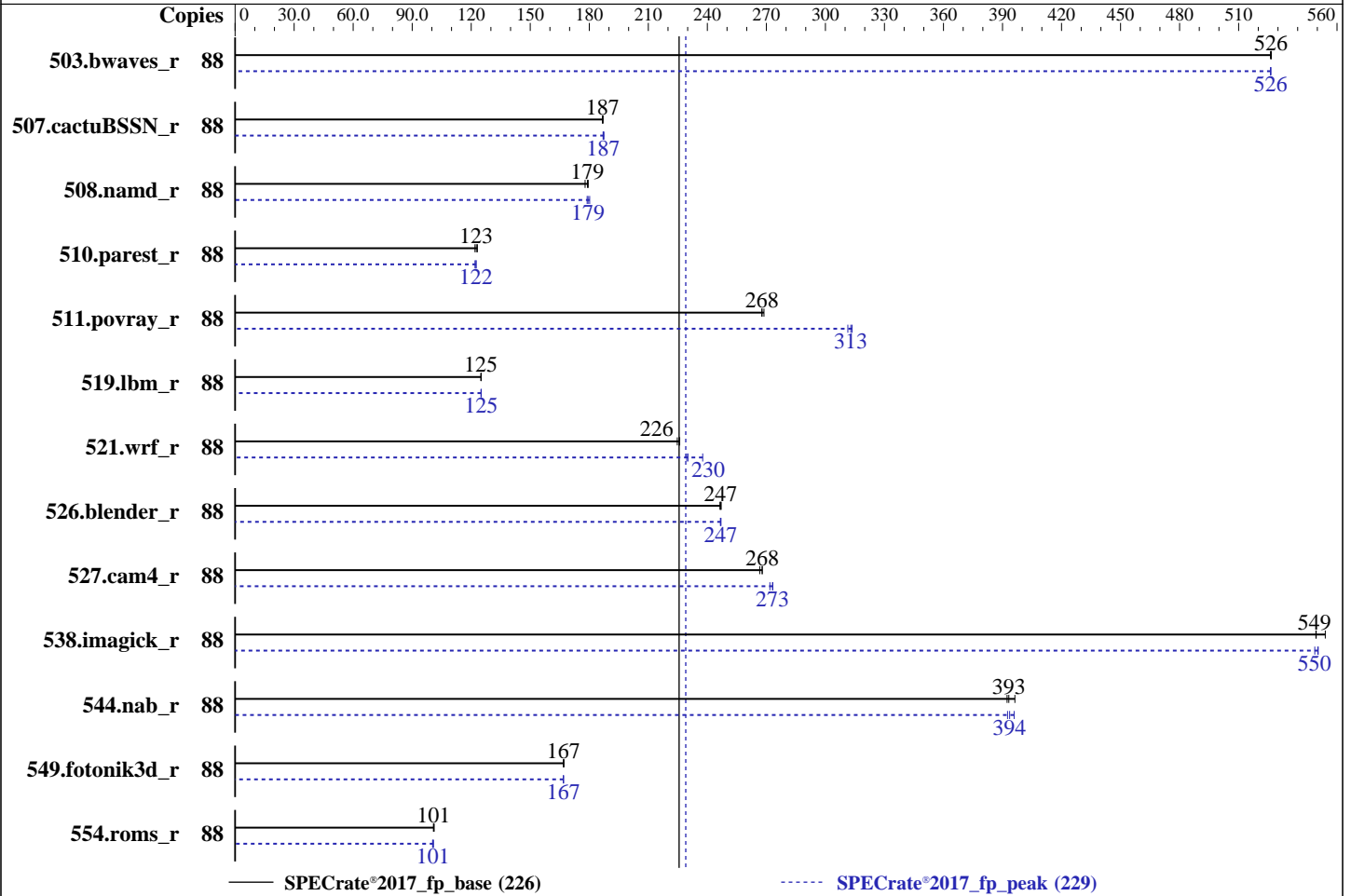SPECrate®2017_fp_peak = 229

CPU2017 License:	9019	**Test Date:**	Oct-2019
Test Sponsor:	Cisco Systems	**Hardware Availability:**	Apr-2019
Tested by:	Cisco Systems	**Software Availability:**	May-2019

Results Table

Benchmark	Base						Peak					
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
503.bwaves_r	88	1676	527	**1676**	**526**	1677	526	88	1677	526	**1677**	**526**	1677	526
507.cactuBSSN_r	88	**596**	**187**	596	187	597	187	88	594	187	**595**	**187**	596	187
508.namd_r	88	**467**	**179**	466	179	470	178	88	467	179	464	180	**466**	**179**
510.parest_r	88	1869	123	**1878**	**123**	1888	122	88	**1880**	**122**	1888	122	1880	122
511.povray_r	88	765	269	**767**	**268**	768	268	88	**657**	**313**	655	314	660	311
519.lbm_r	88	742	125	**742**	**125**	742	125	88	742	125	**742**	**125**	742	125
521.wrf_r	88	872	226	877	225	**873**	**226**	88	829	238	859	230	**856**	**230**
526.blender_r	88	544	246	543	247	**543**	**247**	88	543	247	543	247	**543**	**247**
527.cam4_r	88	577	267	575	268	**575**	**268**	88	566	272	563	273	**564**	**273**
538.imagick_r	88	398	549	395	554	**398**	**549**	88	399	549	**398**	**550**	398	550
544.nab_r	88	**377**	**393**	374	396	377	392	88	374	396	**376**	**394**	377	393
549.fotonik3d_r	88	2053	167	**2054**	**167**	2055	167	88	2055	167	**2055**	**167**	2055	167
554.roms_r	88	1383	101	1387	101	**1384**	**101**	88	1387	101	**1390**	**101**	1393	100

SPECrate®2017_fp_base =   **226**

SPECrate®2017_fp_peak =   **229**

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

Submit Notes

The numactl mechanism was used to bind copies to processors. The config file option 'submit' was used to generate numactl commands to bind each copy to a specific processor. For details, please see the config file.

Operating System Notes

Stack size set to unlimited using "ulimit -s unlimited"

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = "/home/cpu2017/lib/intel64"

General Notes

Binaries compiled on a system with 1x Intel Core i9-7900X CPU + 32GB RAM
memory using Redhat Enterprise Linux 7.5
Transparent Huge Pages enabled by default
Prior to runcpu invocation
Filesystem page cache synced and cleared with:
sync; echo 3>   /proc/sys/vm/drop_caches

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General Notes (Continued)

```
 runcpu command invoked through numactl i.e.:
 numactl --interleave=all runcpu <etc>
NA: The test sponsor attests, as of date of publication, that CVE-2017-5754 (Meltdown)
is mitigated in the system as tested and documented.
Yes: The test sponsor attests, as of date of publication, that CVE-2017-5753 (Spectre variant 1)
is mitigated in the system as tested and documented.
Yes: The test sponsor attests, as of date of publication, that CVE-2017-5715 (Spectre variant 2)
is mitigated in the system as tested and documented.
```

Platform Notes

```
BIOS Settings:
Intel HyperThreading Technology set to Enabled
SNC set to Enabled
IMC Interleaving set to 1-way Interleave
Patrol Scrub set to Disabled

 Sysinfo program /home/cpu2017/bin/sysinfo
 Rev: r6365 of 2019-08-21 295195f888a3d7edb1e6e46a485a0011
 running on linux-jm4k Sat Oct 26 09:31:23 2019

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

 From /proc/cpuinfo
    model name : Intel(R) Xeon(R) Gold 6238 CPU @ 2.10GHz
       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

 From lscpu:
    Architecture:        x86_64
    CPU op-mode(s):      32-bit, 64-bit
    Byte Order:          Little Endian
    CPU(s):              88
    On-line CPU(s) list: 0-87
    Thread(s) per core:  2
    Core(s) per socket:  22
    Socket(s):           2
    NUMA node(s):        4
```

(Continued on next page)

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Platform Notes (Continued)

```
        Vendor ID:              GenuineIntel
        CPU family:             6
        Model:                  85
        Model name:             Intel(R) Xeon(R) Gold 6238 CPU @ 2.10GHz
        Stepping:               7
        CPU MHz:                2100.000
        CPU max MHz:            3700.0000
        CPU min MHz:            1000.0000
        BogoMIPS:               4200.00
        Virtualization:         VT-x
        L1d cache:              32K
        L1i cache:              32K
        L2 cache:               1024K
        L3 cache:               30976K
        NUMA node0 CPU(s):      0-2,6-8,11-13,17,18,44-46,50-52,55-57,61,62
        NUMA node1 CPU(s):      3-5,9,10,14-16,19-21,47-49,53,54,58-60,63-65
        NUMA node2 CPU(s):      22-24,28-30,33-35,39,40,66-68,72-74,77-79,83,84
        NUMA node3 CPU(s):      25-27,31,32,36-38,41-43,69-71,75,76,80-82,85-87
        Flags:                  fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
  pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp
  lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid
  aperfmperf tsc_known_freq pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3
  sdbg fma cx16 xtpr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt
  tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault
  epb cat_l3 cdp_l3 invpcid_single intel_ppin mba tpr_shadow vnmi flexpriority ept
  vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm cqm mpx rdt_a
  avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd avx512bw avx512vl
  xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local
  ibpb ibrs stibp dtherm ida arat pln pts hwp hwp_act_window hwp_epp hwp_pkg_req pku
  ospke avx512_vnni arch_capabilities ssbd

 /proc/cpuinfo cache data
    cache size : 30976 KB

 From numactl --hardware  WARNING: a numactl 'node' might or might not correspond to a
 physical chip.
   available: 4 nodes (0-3)
   node 0 cpus: 0 1 2 6 7 8 11 12 13 17 18 44 45 46 50 51 52 55 56 57 61 62
   node 0 size: 192106 MB
   node 0 free: 179325 MB
   node 1 cpus: 3 4 5 9 10 14 15 16 19 20 21 47 48 49 53 54 58 59 60 63 64 65
   node 1 size: 193501 MB
   node 1 free: 184221 MB
   node 2 cpus: 22 23 24 28 29 30 33 34 35 39 40 66 67 68 72 73 74 77 78 79 83 84
   node 2 size: 193530 MB
   node 2 free: 184248 MB
   node 3 cpus: 25 26 27 31 32 36 37 38 41 42 43 69 70 71 75 76 80 81 82 85 86 87
```

(Continued on next page)

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Platform Notes (Continued)

```
   node 3 size: 193529 MB
   node 3 free: 184340 MB
   node distances:
   node   0   1   2   3
     0:  10  11  21  21
     1:  11  10  21  21
     2:  21  21  10  11
     3:  21  21  11  10

 From /proc/meminfo
    MemTotal:        791211716 kB
    HugePages_Total:         0
    Hugepagesize:         2048 kB

 From /etc/*release* /etc/*version*
    os-release:
       NAME="SLES"
       VERSION="15"
       VERSION_ID="15"
       PRETTY_NAME="SUSE Linux Enterprise Server 15"
       ID="sles"
       ID_LIKE="suse"
       ANSI_COLOR="0;32"
       CPE_NAME="cpe:/o:suse:sles:15"

 uname -a:
    Linux linux-jm4k 4.12.14-23-default #1 SMP Tue May 29 21:04:44 UTC 2018 (cd0437b)
    x86_64 x86_64 x86_64 GNU/Linux

 Kernel self-reported vulnerability status:

 CVE-2018-3620 (L1 Terminal Fault):        No status reported
 Microarchitectural Data Sampling:         No status reported
 CVE-2017-5754 (Meltdown):                 Not affected
 CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled
                                           via prctl and seccomp
 CVE-2017-5753 (Spectre variant 1):        Mitigation: __user pointer sanitization
 CVE-2017-5715 (Spectre variant 2):        Mitigation: Indirect Branch Restricted
                                           Speculation, IBPB, IBRS_FW

 run-level 3 Oct 25 08:23

 SPEC is set to: /home/cpu2017
    Filesystem      Type  Size  Used Avail Use% Mounted on
    /dev/sdb1       xfs   224G   76G  148G  34% /

 From /sys/devices/virtual/dmi/id
```

(Continued on next page)

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Platform Notes (Continued)

```
      BIOS:    Cisco Systems, Inc. C220M5.4.0.4g.0.0712190011 07/12/2019
      Vendor:  Cisco Systems Inc
      Product: UCSC-C220-M5SX
      Serial:  WZP21500B9E

 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 SMBIOS" standard.
   Memory:
     24x 0xCE00 M393A4K40CB2-CVF 32 GB 2 rank 2933, configured at 2934

 (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)
------------------------------------------------------------------------------
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------


==============================================================================
C++              | 508.namd_r(base, peak) 510.parest_r(base, peak)
------------------------------------------------------------------------------
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------


==============================================================================
C++, C           | 511.povray_r(base, peak) 526.blender_r(base, peak)
------------------------------------------------------------------------------
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------


==============================================================================
C++, C, Fortran | 507.cactuBSSN_r(base, peak)
```

(Continued on next page)

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Compiler Version Notes (Continued)

```
--------------------------------------------------------------------------
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
  64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
--------------------------------------------------------------------------


==========================================================================
Fortran         | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak)
                | 554.roms_r(base, peak)
--------------------------------------------------------------------------
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
  64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
--------------------------------------------------------------------------


==========================================================================
Fortran, C      | 521.wrf_r(base, peak) 527.cam4_r(base, peak)
--------------------------------------------------------------------------
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
  64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 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
```

(Continued on next page)

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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-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4
```

C++ benchmarks:
```
-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4
```

Fortran benchmarks:
```
-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -auto
-nostandard-realloc-lhs -align array32byte
```

Benchmarks using both Fortran and C:
```
-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -auto
-nostandard-realloc-lhs -align array32byte
```

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Base Optimization Flags (Continued)

Benchmarks using both C and C++:
```
-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4
```

Benchmarks using Fortran, C, and C++:
```
-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -auto
-nostandard-realloc-lhs -align array32byte
```

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:

```
519.lbm_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX512
-O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4
```

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Peak Optimization Flags (Continued)

538.imagick_r: -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4

544.nab_r: Same as 538.imagick_r

C++ benchmarks:

508.namd_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX512 -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4

510.parest_r: -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4

Fortran benchmarks:

503.bwaves_r: -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs -align array32byte

549.fotonik3d_r: Same as 503.bwaves_r

554.roms_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX512 -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs -align array32byte

Benchmarks using both Fortran and C:
-prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX512 -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs -align array32byte

Benchmarks using both C and C++:

511.povray_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX512 -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4

526.blender_r: -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4

Benchmarks using Fortran, C, and C++:
-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch

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Tested by:	Cisco Systems	**Software Availability:**	May-2019

Peak Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++ (continued):

```
-ffinite-math-only -qopt-mem-layout-trans=4 -auto
-nostandard-realloc-lhs -align array32byte
```

The flags files that were used to format this result can be browsed at

http://www.spec.org/cpu2017/flags/Intel-ic19.0u1-official-linux64.2019-07-09.html
http://www.spec.org/cpu2017/flags/Cisco-Platform-Settings-V1.2-revJ.html

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

http://www.spec.org/cpu2017/flags/Intel-ic19.0u1-official-linux64.2019-07-09.xml
http://www.spec.org/cpu2017/flags/Cisco-Platform-Settings-V1.2-revJ.xml

For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

Tested with SPEC CPU®2017 v1.1.0 on 2019-10-26 00:01:22-0400.
Report generated on 2020-07-23 15:20:38 by CPU2017 PDF formatter v6255.
Originally published on 2019-11-25.