## SPEC CPU®2017 Floating Point Rate Result

### Dell Inc.

**PowerEdge R740xd (Intel Xeon Gold 6242R, 3.10 GHz)**

**CPU2017 License:** 55  
**Test Sponsor:** Dell Inc.  
**Tested by:** Dell Inc.

**SPECrate®2017_fp_peak = 279**  
**SPECrate®2017_fp_base = 263**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>SPECrate®2017_fp_base</th>
<th>SPECrate®2017_fp_peak</th>
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<tbody>
<tr>
<td>503.bwaves_r</td>
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<td>507.cactuBSSN_r</td>
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<td>508.namd_r</td>
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<td>519.lbm_r</td>
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<tr>
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</tr>
<tr>
<td>554.roms_r</td>
<td>40</td>
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</tbody>
</table>

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### Hardware

- **CPU Name:** Intel Xeon Gold 6242R  
- **Max MHz:** 4100  
- **Nominal:** 3100  
- **Enabled:** 40 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:** 35.75 MB I+D on chip per chip  
- **Other:** None  
- **Memory:** 768 GB (24 x 32 GB 2Rx4 PC4-2933V-R, running at 2933)  
- **Storage:** 1 x 1.92 TB SATA SSD  
- **Other:** None

### Software

- **OS:** Red Hat Enterprise Linux 8.1  
  - kernel 4.18.0-147.el8.x86_64  
- **Compiler:** C/C++: Version 19.1.1.217 of Intel C/C++ Compiler for Linux; Fortran: Version 19.1.1.217 of Intel Fortran Compiler for Linux  
- **Parallel:** No  
- **Firmware:** Version 2.7.7 released May-2020  
- **File System:** tmpfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 64-bit  
- **Other:** jemalloc memory allocator V5.0.1  
- **Power Management:** BIOS set to prefer performance at the cost of additional power usage
### Compiler Notes

The inconsistent Compiler version information under Compiler Version section is due to a discrepancy in Intel Compiler. The correct version of C/C++ compiler is: Version 19.1.1.217 Build 20200306 Compiler for Linux. The correct version of Fortran compiler is: Version 19.1.1.217 Build 20200306 Compiler for Linux.

### 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 = "/mnt/ramdisk/cpu2017-ic19.1u1/lib/intel64:/mnt/ramdisk/cpu2017-ic19.1u1/je5.0.1-64"
MALLOC_CONF = "retain:true"
```
Dell Inc. PowerEdge R740xd (Intel Xeon Gold 6242R, 3.10 GHz)

**SPECrate®2017_fp_base** = 263

**SPECrate®2017_fp_peak** = 279

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<td>Hardware Availability: Jul-2020</td>
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</tr>
<tr>
<td>Tested by: Dell Inc.</td>
<td>Software Availability: Apr-2020</td>
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**General Notes**

Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM memory using Redhat Enterprise Linux 8.0

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.

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
runcpu command invoked through numactl i.e.:
numactl --interleave=all runcpu <etc>

Benchmark run from a 225 GB ramdisk created with the cmd; "mount -t tmpfs -o size=225G tmpfs /mnt/ramdisk"
jemalloc, a general purpose malloc implementation
built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5

**Platform Notes**

BIOS settings:
Sub NUMA Cluster enabled
Virtualization Technology disabled
System Profile set to Custom
CPU Performance set to Maximum Performance
C States set to Autonomous
C1E disabled
Uncore Frequency set to Dynamic
Energy Efficiency Policy set to Performance
Logical Processor enabled
CPU Interconnect Bus Link Power Management disabled
PCI ASPM L1 Link Power Management disabled
UPI Prefetch enabled
LLC Prefetch disabled
Dead Line LLC Alloc enabled
Directory AtoS disabled

Sysinfo program /mnt/ramdisk/cpu2017-ic19.1ul/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7eddb1e6e46a485a0011
running on user-pc.spa.lab Sat Jun  6 10:41:47 2020

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

(Continued on next page)
Dell Inc.  

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Test Date: Jun-2020  
Hardware Availability: Jul-2020  
Software Availability: Apr-2020  

**Platform Notes (Continued)**

From /proc/cpuinfo

```
model name : Intel(R) Xeon(R) Gold 6242R CPU @ 3.10GHz  
2 "physical id"s (chips)  
80 "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 : 20  
siblings : 40  
physical 0: cores 0 1 2 4 5 6 8 9 10 11 12 13 16 17 18 19 21 26 28 29  
physical 1: cores 0 1 3 5 6 8 10 12 13 16 17 18 19 20 21 25 26 27 28 29
```

From lscpu:

```
Architecture: x86_64  
CPU op-mode(s): 32-bit, 64-bit  
Byte Order: Little Endian  
CPU(s): 80  
On-line CPU(s) list: 0-79  
Thread(s) per core: 2  
Core(s) per socket: 20  
Socket(s): 2  
NUMA node(s): 4  
Vendor ID: GenuineIntel  
CPU family: 6  
Model: 85  
Model name: Intel(R) Xeon(R) Gold 6242R CPU @ 3.10GHz  
Stepping: 7  
CPU MHz: 3770.069  
CPU max MHz: 4100.0000  
CPU min MHz: 1200.0000  
BogoMIPS: 6200.00  
Virtualization: VT-x  
L1d cache: 32K  
L1i cache: 32K  
L2 cache: 1024K  
L3 cache: 36608K  
NUMA node0 CPU(s): 0,4,8,12,16,20,24,28,32,36,40,44,48,52,56,60,64,68,72,76  
NUMA node1 CPU(s): 1,5,9,13,17,21,25,29,33,37,41,45,49,53,57,61,65,69,73,77  
NUMA node2 CPU(s): 2,6,10,14,18,22,26,30,34,38,42,46,50,54,58,62,66,70,74,78  
NUMA node3 CPU(s): 3,7,11,15,19,23,27,31,35,39,43,47,51,55,59,63,67,71,75,79  
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 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_pinn ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi
```

(Continued on next page)
Dell Inc.

PowerEdge R740xd (Intel Xeon Gold 6242R, 3.10 GHz)

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**Software Availability:** Apr-2020

**Hardware Availability:** Jul-2020

---

**SPECrate®2017_fp_base = 263**

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---

**Platform Notes (Continued)**

```
flexpriority ept vpid fsqsbase 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 xsaves cqm_llc cqm_occup_llc cqm_mbm_total
cqm_mbm_local dtherm ida arat pln pts pku ospke avx512_vnni md_clear flush_l1d
arch_capabilities

/proc/cpuinfo cache data
cache size : 36608 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 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72 76
  node 0 size: 192072 MB
  node 0 free: 182888 MB
  node 1 cpus: 1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 65 69 73 77
  node 1 size: 193531 MB
  node 1 free: 192630 MB
  node 2 cpus: 2 6 10 14 18 22 26 30 34 38 42 46 50 54 58 62 66 70 74 78
  node 2 size: 193531 MB
  node 2 free: 193183 MB
  node 3 cpus: 3 7 11 15 19 23 27 31 35 39 43 47 51 55 59 63 67 71 75 79
  node 3 size: 193505 MB
  node 3 free: 193255 MB
node distances:
  node 0 1 2 3
  0: 10 21 11 21
  1: 21 10 21 11
  2: 11 21 10 21
  3: 21 11 21 10
```

From `/proc/meminfo`

```
MemTotal: 791185300 kB
HugePages_Total:   0
Hugepagesize: 2048 kB
```

From `/etc/*release*` `/etc/*version*`

```
os-release:
  NAME="Red Hat Enterprise Linux"
  VERSION="8.1 (Ootpa)"
  ID="rhel"
  ID_LIKE="fedora"
  VERSION_ID="8.1"
  PLATFORM_ID="platform:el8"
  PRETTY_NAME="Red Hat Enterprise Linux 8.1 (Ootpa)"
  ANSI_COLOR="0;31"
redhat-release: Red Hat Enterprise Linux release 8.1 (Ootpa)
```

(Continued on next page)
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</table>

**Platform Notes (Continued)**

- system-release: Red Hat Enterprise Linux release 8.1 (Ootpa)
- system-release-cpe: cpe:/o:redhat:enterprise_linux:8.1:ga

```
uname -a:
    Linux user-pc.spa.lab 4.18.0-147.el8.x86_64 #1 SMP Thu Sep 26 15:52:44 UTC 2019 x86_64
    x86_64 x86_64 GNU/Linux
```

**Kernel self-reported vulnerability status:**

- CVE-2018-3620 (L1 Terminal Fault): Not affected
- Microarchitectural Data Sampling: Not affected
- 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: usercopy/swapgs barriers and __user pointer sanitization
- CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling

```
run-level 3 Jun 6 05:42 last=5
```

**SPEC is set to:** /mnt/ramdisk/cpu2017-ic19.1u1

<table>
<thead>
<tr>
<th>Filesystem</th>
<th>Type</th>
<th>Size</th>
<th>Used</th>
<th>Avail</th>
<th>Use %</th>
<th>Mounted on</th>
</tr>
</thead>
<tbody>
<tr>
<td>tmpfs</td>
<td>tmpfs</td>
<td>225G</td>
<td>4.3G</td>
<td>221G</td>
<td>2%</td>
<td>/mnt/ramdisk</td>
</tr>
</tbody>
</table>

**From /sys/devices/virtual/dmi/id**

- BIOS: Dell Inc. 2.7.7 05/04/2020
- Vendor: Dell Inc.
- Product: PowerEdge R740xd
- Product Family: PowerEdge
- Serial: F5BMCS2

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:
  - 19x 00AD00B300AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933
  - 1x 00AD063200AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933
  - 4x 00AD069D00AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933

(End of data from sysinfo program)
Dell Inc.  
PowerEdge R740xd (Intel Xeon Gold 6242R, 3.10 GHz)  

SPECrater®2017_fp_base = 263  
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CPU2017 License: 55  
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Compiler Version Notes

```
C               | 519.lbm_r(base, peak) 538.imagick_r(base, peak)  
                | 544.nab_r(base, peak)  
------------------------------------------------------------------------------
Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1  
NextGen Build 20200304  
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.  
------------------------------------------------------------------------------

C++             | 508.namd_r(base, peak) 510.parest_r(base, peak)  
------------------------------------------------------------------------------
Intel(R) C++ Compiler for applications running on Intel(R) 64, Version 2021.1  
NextGen Build 20200304  
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.  
------------------------------------------------------------------------------

C++, C          | 511.povray_r(base) 526.blender_r(base, peak)  
------------------------------------------------------------------------------
Intel(R) C++ Compiler for applications running on Intel(R) 64, Version 2021.1  
NextGen Build 20200304  
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.  
Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1  
NextGen Build 20200304  
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.  
------------------------------------------------------------------------------

C++, C          | 511.povray_r(peak)  
------------------------------------------------------------------------------
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,  
Version 19.1.1.217 Build 20200306  
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.  
Intel(R) C Compiler for applications running on Intel(R) 64,  
Version 19.1.1.217 Build 20200306  
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.  
------------------------------------------------------------------------------

C++, C          | 511.povray_r(base) 526.blender_r(base, peak)  
------------------------------------------------------------------------------
Intel(R) C++ Compiler for applications running on Intel(R) 64, Version 2021.1  
NextGen Build 20200304  
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Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1  
NextGen Build 20200304  
```

(Continued on next page)
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Compiler Version Notes (Continued)

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C++, C          | 511.povray_r(peak)
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==============================================================================
C++, C, Fortran | 507.cactuBSSN_r(base, peak)
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NextGen Build 20200304
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Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.1.1.217 Build 20200306
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Fortran         | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak)
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Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.1.1.217 Build 20200306
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

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Fortran, C      | 521.wrf_r(base) 527.cam4_r(base, peak)
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Compiler Version Notes (Continued)

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Intel(R) C Compiler for applications running on Intel(R) 64,
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==============================================================================
Base Compiler Invocation

C benchmarks:
icc

C++ benchmarks:
icpc

Fortran benchmarks:
ifort

(Continued on next page)
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Base Compiler Invocation (Continued)

Benchmarks using both Fortran and C:
ifort icc
Benchmarks using both C and C++:
icpc icc
Benchmarks using Fortran, C, and C++:
icpc icc ifort

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:
-m64 -qnextgen -std=c11
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
-fuse-ld=gold -xCORE-AVX512 -Ofast -ffast-math -flto -mfpmath=sse
-funroll-loops -qopt-mem-layout-trans=4
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

C++ benchmarks:
-m64 -qnextgen -Wl,-plugin-opt=-x86-branches-within-32B-boundaries
-Wl,-z,muldefs -fuse-ld=gold -xCORE-AVX512 -Ofast -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Fortran benchmarks:
-m64 -Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs

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Software Availability: Apr-2020

Base Optimization Flags (Continued):

Fortran benchmarks (continued):
- fuse-ld=gold -xCORE-AVX512 -O3 -ipo -no-prec-div -qopt-prefetch
- ff finite-math-only -qopt-multiple-gather-scatter-by-shuffles
- qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte
- auto -mbranches-within-32B-boundaries
- L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Benchmarks using both Fortran and C:
- m64 -nqnextgen -std=c11
- Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
- fuse-ld=gold -xCORE-AVX512 -Ofast -ffast-math -flto -mfpmath=sse
- funroll-loops -qopt-mem-layout-trans=4 -O3 -ipo -no-prec-div
- qopt-prefetch -ffinite-math-only
- qopt-multiple-gather-scatter-by-shuffles -n ostandard-realloc-lhs
- align array32byte -auto -mbranches-within-32B-boundaries
- L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Benchmarks using both C and C++:
- m64 -nqnextgen -std=c11
- Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
- fuse-ld=gold -xCORE-AVX512 -Ofast -ffast-math -flto -mfpmath=sse
- funroll-loops -qopt-mem-layout-trans=4
- L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Benchmarks using Fortran, C, and C++:
- m64 -nqnextgen -std=c11
- Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
- fuse-ld=gold -xCORE-AVX512 -Ofast -ffast-math -flto -mfpmath=sse
- funroll-loops -qopt-mem-layout-trans=4 -O3 -ipo -no-prec-div
- qopt-prefetch -ffinite-math-only
- qopt-multiple-gather-scatter-by-shuffles -n ostandard-realloc-lhs
- align array32byte -auto -mbranches-within-32B-boundaries
- L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Peak Compiler Invocation

C benchmarks:
icc

C++ benchmarks:
icpc

Fortran benchmarks:
ifort

(Continued on next page)
Dell Inc.  
PowerEdge R740xd (Intel Xeon Gold 6242R, 3.10 GHz)  

<table>
<thead>
<tr>
<th>SPECrate®2017_fp_base = 263</th>
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**Peak Compiler Invocation (Continued)**

Benchmarks using both Fortran and C:
ifort icc

Benchmarks using both C and C++:
icpc icc

Benchmarks using Fortran, C, and C++:
icpc icc ifort

**Peak Portability Flags**

Same as Base Portability Flags

**Peak Optimization Flags**

C benchmarks:

519.lbm_r: basepeak = yes
538.imagick_r: basepeak = yes
544.nab_r: basepeak = yes

C++ benchmarks:

508.namd_r: basepeak = yes
510.parest_r: -m64 -qnextgen
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries
-Wl,-z,muldefs -fuse-ld=gold -xCORE-AVX512 -Ofast
-ffast-math -fto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -L/usr/local/jemalloc64-5.0.1/lib
-ljemalloc

Fortran benchmarks:

503.bwaves_r: -m64 -Wl,-plugin-opt=-x86-branches-within-32B-boundaries
-Wl,-z,muldefs -fuse-ld=gold -xCORE-AVX512 -O3 -ipo
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-multiple-gather-scatter-by-shuffles

(Continued on next page)
Dell Inc.

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### Peak Optimization Flags (Continued)

503.bwaves_r (continued):
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs
-align array32byte -auto -mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

549.fotonik3d_r: basepeak = yes

554.roms_r: Same as 503.bwaves_r

Benchmarks using both Fortran and C:

521.wrf_r: -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX512 -O3
-ipo -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-multiple-gather-scatter-by-shuffles
-qopt-mem-layout-trans=4 -mbranches-within-32B-boundaries
-nostandard-realloc-lhs -align array32byte -auto
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

527.cam4_r: basepeak = yes

Benchmarks using both C and C++:

511.povray_r: -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX512 -O3
-ipo -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-multiple-gather-scatter-by-shuffles
-qopt-mem-layout-trans=4 -mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

526.blender_r: basepeak = yes

Benchmarks using Fortran, C, and C++:

507.cactuBSSN_r: basepeak = yes

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/Intel-ic19.1u1-official-linux64_revA.xml
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For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

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