Dell Inc. PowerEdge FC640 (Intel Xeon Gold 6222V, 1.80GHz)

SPECrates:
- SPECrate\textsuperscript{\textregistered}2017\textsubscript{fp}_base = 182
- SPECrate\textsuperscript{\textregistered}2017\textsubscript{fp}_peak = 186

Hardware:
- CPU Name: Intel Xeon Gold 6222V
- Max MHz: 3600
- Nominal: 1800
- Enabled: 40 cores, 2 chips, 2 threads/core
- Orderable: 2 chips
- Cache L1: 32 KB I + 32 KB D on chip per core
- L2: 1 MB I+D on chip per core
- L3: 27.5 MB I+D on chip per chip
- Other: None
- Memory: 384 GB (12 x 32 GB 2Rx4 PC4-2933Y-R, running at 2400)
- Storage: 1 x 480 GB SATA SSD
- Other: None

Software:
- OS: Ubuntu 18.04.2 LTS
- Compiler: C/C++: Version 19.0.4.227 of Intel C/C++ Compiler Build 20190416 for Linux;
- Fortran: Version 19.0.4.227 of Intel Fortran Compiler Build 20190416 for Linux
- Parallel: No
- Firmware: Version 2.2.11 released Jun-2019
- File System: ext4
- System State: Run level 5 (multi-user)
- Base Pointers: 64-bit
- Peak Pointers: 64-bit
- Other: None
- Power Management: --

### Detailed Results

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>503.bwaves_r</td>
<td>80</td>
</tr>
<tr>
<td>507.caCTuBSSN_r</td>
<td>80</td>
</tr>
<tr>
<td>508.namd_r</td>
<td>80</td>
</tr>
<tr>
<td>510.parest_r</td>
<td>80</td>
</tr>
<tr>
<td>511.povray_r</td>
<td>80</td>
</tr>
<tr>
<td>519.lbM_r</td>
<td>80</td>
</tr>
<tr>
<td>521.wrf_r</td>
<td>80</td>
</tr>
<tr>
<td>526.blender_r</td>
<td>80</td>
</tr>
<tr>
<td>527.cam4_r</td>
<td>80</td>
</tr>
<tr>
<td>538.imagick_r</td>
<td>80</td>
</tr>
<tr>
<td>544.nab_r</td>
<td>80</td>
</tr>
<tr>
<td>549.fotonik3d_r</td>
<td>80</td>
</tr>
<tr>
<td>554.roms_r</td>
<td>80</td>
</tr>
</tbody>
</table>

The values are as follows:

- 503.bwaves_r = 155
- 507.caCTuBSSN_r = 134
- 508.namd_r = 137
- 510.parest_r = 102
- 511.povray_r = 211
- 519.lbM_r = 101
- 521.wrf_r = 193
- 526.blender_r = 197
- 527.cam4_r = 212
- 538.imagick_r = 443
- 544.nab_r = 313
- 549.fotonik3d_r = 139
- 554.roms_r = 80.6

The SPECrate\textsuperscript{\textregistered}2017\textsubscript{fp}_base is 182, and the SPECrate\textsuperscript{\textregistered}2017\textsubscript{fp}_peak is 186.
SPEC CPU®2017 Floating Point Rate Result

Dell Inc.

PowerEdge FC640 (Intel Xeon Gold 6222V, 1.80GHz)

SPECrate®2017_fp_base = 182

SPECrate®2017_fp_peak = 186

Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
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<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>503.bwaves_r</td>
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<td>1864</td>
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<td>1865</td>
<td>430</td>
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</tr>
<tr>
<td>507.cactuBSSN_r</td>
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<td></td>
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</tr>
<tr>
<td>508.namd_r</td>
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<td>549</td>
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<td>552</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>510.parest_r</td>
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<td>2068</td>
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<td>519.lbm_r</td>
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<td></td>
</tr>
<tr>
<td>521.wrf_r</td>
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<tr>
<td>526.blender_r</td>
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<tr>
<td>527.cam4_r</td>
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<tr>
<td>544.nab_r</td>
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<tr>
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<td>83.5</td>
<td>1522</td>
<td>83.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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"

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/je5.0.1-32:/home/cpu2017/je5.0.1-64"

Binaries compiled on a system with 1x Intel Core i9-7900X CPU + 32GB RAM
memory using Redhat Enterprise Linux 7.5
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
**SPEC CPU®2017 Floating Point Rate Result**

**Dell Inc.**

PowerEdge FC640 (Intel Xeon Gold 6222V, 1.80GHz)

| SPECrate®2017_fp_base = 182 |
| SPECrate®2017_fp_peak = 186 |

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

**General Notes (Continued)**

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>
```

**Platform Notes**

BIOS settings:
- ADDDC setting disabled
- Sub NUMA Cluster enabled
- Virtualization Technology disabled
- DCU Streamer Prefetcher enabled
- 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
- Memory Patrol Scrub disabled
- Logical Processor enabled
- CPU Interconect Bus Link Power Management disabled
- PCI ASPM L1 Link Power Management disabled
- Sysinfo program /home/cpu2017/bin/sysinfo
- Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9
- running on intel-sut Tue Sep 24 10:17:31 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 6222V CPU @ 1.80GHz
- 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 3 4 8 9 10 11 12 16 17 18 19 20 24 25 26 27 28
  - physical 1: cores 0 1 2 3 4 8 9 10 11 12 16 17 18 19 20 24 25 26 27 28

From lscpu:
- Architecture: x86_64
- CPU op-mode(s): 32-bit, 64-bit
- Byte Order: Little Endian
- CPU(s): 80

(Continued on next page)
SPEC CPU®2017 Floating Point Rate Result

Dell Inc.

PowerEdge FC640 (Intel Xeon Gold 6222V, 1.80GHz)

SPECrate®2017_fp_base = 182

SPECrate®2017_fp_peak = 186

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

**Test Date:** Sep-2019
**Hardware Availability:** Apr-2019
**Software Availability:** Sep-2019

**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 6222V CPU @ 1.80GHz
**Stepping:** 7
**CPU MHZ:** 3132.947
**BogoMIPS:** 3600.00

**Virtualization:** VT-x
**L1d cache:** 32K
**L1i cache:** 32K
**L2 cache:** 1024K
**L3 cache:** 28160K

**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 perf_counter aperff perfctr pkct 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_patin ssbd mba ibrs ibpb ibrs_enhanced tpr_shadow vmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm cqm mpx rdtds msnr cqm_srt a_x2apic rdseed adx smap cflushtopt clwb intel_pt avx512fd avx512bw avx512vi xsaves 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

From numactl --hardware WARNING: a numactl 'node' might or might not correspond to a physical chip.

<table>
<thead>
<tr>
<th>Available</th>
<th>Nodes</th>
<th>CPUs</th>
</tr>
</thead>
<tbody>
<tr>
<td>node 0</td>
<td>4</td>
<td>0-3</td>
</tr>
<tr>
<td>node 1</td>
<td>2</td>
<td>1-5</td>
</tr>
<tr>
<td>node 2</td>
<td>2</td>
<td>6-10</td>
</tr>
</tbody>
</table>

/cache data

**cache size:** 28160 KB

(Continued on next page)
Platform Notes (Continued)

    node 2 size: 96743 MB
    node 2 free: 96232 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: 96762 MB
    node 3 free: 96112 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:       394665044 kB
    HugePages_Total:       0
    Hugepagesize:       2048 kB

/usr/bin/lsb_release -d
    Ubuntu 18.04.2 LTS

From /etc/*release* /etc/*version*
    debian_version: buster/sid
    os-release:
        NAME="Ubuntu"
        VERSION="18.04.2 LTS (Bionic Beaver)"
        ID=ubuntu
        ID_LIKE=debian
        PRETTY_NAME="Ubuntu 18.04.2 LTS"
        VERSION_ID="18.04"
        HOME_URL="https://www.ubuntu.com/"
        SUPPORT_URL="https://help.ubuntu.com/"

    uname -a:
        Linux intel-sut 4.15.0-64-generic #73-Ubuntu SMP Thu Sep 12 13:16:13 UTC 2019 x86_64
        x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2017-5754 (Meltdown): Not affected
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 5 Sep 23 23:52

SPEC is set to: /home/cpu2017

(Continued on next page)
SPEC CPU®2017 Floating Point Rate Result

Dell Inc.

PowerEdge FC640 (Intel Xeon Gold 6222V, 1.80GHz)

Copyright 2017-2019 Standard Performance Evaluation Corporation

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

SPECrate®2017_fp_base = 182
SPECrate®2017_fp_peak = 186

Test Date: Sep-2019
Hardware Availability: Apr-2019
Software Availability: Sep-2019

Platform Notes (Continued)

Filesystem  Type  Size  Used  Avail  Use%  Mounted on
/dev/sda2  ext4  439G  35G  382G  9%  /

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.

BIOS Dell Inc. 2.2.11 06/14/2019
Memory:
3x 00AD00B300AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933, configured at 2400
6x 00AD063200AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933, configured at 2400
3x 00AD069D00AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933, configured at 2400
4x Not Specified Not Specified

(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,
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(Continued on next page)
Dell Inc.

PowerEdge FC640 (Intel Xeon Gold 6222V, 1.80GHz)

SPECrater®2017_fp_base = 182
SPECrater®2017_fp_peak = 186

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

Test Date: Sep-2019
Hardware Availability: Apr-2019
Software Availability: Sep-2019

Compiler Version Notes (Continued)

C++, C, Fortran | 507.cactuBSSN_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.

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

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

Benchmarks using both Fortran and C:

```bash
ifort -m64 icc -m64 -std=c11
```

Benchmarks using both C and C++:

```bash
icpc -m64 icc -m64 -std=c11
```

Benchmarks using Fortran, C, and C++:

```bash
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:**

```bash
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4
```

**C++ benchmarks:**

```bash
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4
```

**Fortran benchmarks:**

```bash
-xCORE-AVX2 -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:**

```bash
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
```

(Continued on next page)
Dell Inc. PowerEdge FC640 (Intel Xeon Gold 6222V, 1.80GHz)

SPECrate®2017_fp_base = 182
SPECrate®2017_fp_peak = 186

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

Base Optimization Flags (Continued)

Benchmarks using both Fortran and C (continued):
-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
-align array32byte

Benchmarks using both C and C++:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4

Benchmarks using Fortran, C, and C++:
-xCORE-AVX2 -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.ibm_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4

538.imagick_r: -xCORE-AVX2 -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-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4

510.parest_r: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4

Fortran benchmarks:

503.bwaves_r: -xCORE-AVX2 -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-AVX2 -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-AVX2 -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-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4
Dell Inc.
PowerEdge FC640 (Intel Xeon Gold 6222V, 1.80GHz)

SPECrate®2017_fp_base = 182
SPECrate®2017_fp_peak = 186

CPU2017 License: 55
Test Sponsor: Dell Inc.
Test Date: Sep-2019
Tested by: Dell Inc.
Hardware Availability: Apr-2019
Software Availability: Sep-2019

Peak Optimization Flags (Continued)

526.blender_r: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4

Benchmarks using Fortran, C, and C++:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -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

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

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