### Hardware

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU Name</td>
<td>Intel Xeon Gold 6230</td>
</tr>
<tr>
<td>Max MHz</td>
<td>3900</td>
</tr>
<tr>
<td>Nominal</td>
<td>2100</td>
</tr>
<tr>
<td>Enabled</td>
<td>40 cores, 2 chips</td>
</tr>
<tr>
<td>Orderable</td>
<td>1.2 chips</td>
</tr>
<tr>
<td>Cache L1</td>
<td>32 KB I + 32 KB D on chip per core</td>
</tr>
<tr>
<td>L2</td>
<td>1 MB I+D on chip per core</td>
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<tr>
<td>L3</td>
<td>27.5 MB I+D on chip per chip</td>
</tr>
<tr>
<td>Other</td>
<td>None</td>
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<tr>
<td>Memory</td>
<td>384 GB (12 x 32 GB 2Rx8 PC4-3200V-R, running at 2666)</td>
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<tr>
<td>Storage</td>
<td>1 x 960 GB SATA SSD</td>
</tr>
<tr>
<td>Other</td>
<td>None</td>
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### Software

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
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</thead>
<tbody>
<tr>
<td>OS</td>
<td>SUSE Linux Enterprise Server 15 SP1</td>
</tr>
<tr>
<td>kernel</td>
<td>4.12.14-195-default</td>
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<tr>
<td>Compiler</td>
<td>C/C++: Version 19.0.4.227 of Intel C/C++</td>
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<td>Compiler Build 20190416 for Linux:</td>
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<tr>
<td></td>
<td>Fortran: Version 19.0.4.227 of Intel Fortran</td>
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<td>Compiler Build 20190416 for Linux:</td>
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<tr>
<td>Parallel</td>
<td>Yes</td>
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<tr>
<td>Firmware</td>
<td>Version 2.4.8 released Nov-2019</td>
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<tr>
<td>File System</td>
<td>xfs</td>
</tr>
<tr>
<td>System State</td>
<td>Run level 3 (multi-user)</td>
</tr>
<tr>
<td>Base Pointers</td>
<td>64-bit</td>
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<tr>
<td>Peak Pointers</td>
<td>64-bit</td>
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<td>Other</td>
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<tr>
<td>Power Management</td>
<td>BIOS set to prefer performance at the cost of additional power usage</td>
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### Test Details

- **Test Date:** Mar-2020
- **CPU2017 License:** 55
- **Test Sponsor:** Dell Inc.
- **Tested by:** Dell Inc.
- **Hardware Availability:** Dec-2019
- **Software Availability:** Jun-2019
- **Software:**
  - OS: SUSE Linux Enterprise Server 15 SP1
  - 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: Yes
  - Firmware: Version 2.4.8 released Nov-2019
  - File System: xfs
  - System State: Run level 3 (multi-user)
  - Base Pointers: 64-bit
  - Peak Pointers: 64-bit
  - Other: None
  - Power Management: BIOS set to prefer performance at the cost of additional power usage
Dell Inc.

PowerEdge R440 (Intel Xeon Gold 6230, 2.10 GHz)

Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Threads</th>
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<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
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<tbody>
<tr>
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<td>40</td>
<td>127</td>
<td>464</td>
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<td>127</td>
<td>463</td>
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<td>126</td>
<td>469</td>
<td>125</td>
<td>472</td>
<td>128</td>
<td>462</td>
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<td>607.cactuBSSN_s</td>
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<td>120</td>
<td>139</td>
<td>122</td>
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<td>123</td>
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<td>649.fotonik3d_s</td>
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<td>128</td>
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<td>129</td>
<td>122</td>
<td>134</td>
<td>118</td>
<td>130</td>
<td>121</td>
</tr>
</tbody>
</table>

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

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:
- KMP_AFFINITY = "granularity=fine,compact"
- LD_LIBRARY_PATH = "/home/cpu2017/lib/intel64"
- OMP_STACKSIZE = "192M"

General Notes

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

Filesystem page cache synced and cleared with:
```
sync; echo 3>/proc/sys/vm/drop_caches
```
The SPEC CPU 2017 Floating Point Speed Result

**Dell Inc.**

**PowerEdge R440 (Intel Xeon Gold 6230, 2.10 GHz)**

**SPECspeed**

- SPECspeed**2017_fp_peak** = 124
- SPECspeed**2017_fp_base** = 124

**CPU2017 License:** 55
**Test Date:** Mar-2020
**Test Sponsor:** Dell Inc.
**Hardware Availability:** Dec-2019
**Tested by:** Dell Inc.
**Software Availability:** Jun-2019

**Platform Notes**

BIOS settings:
- Sub NUMA Cluster disabled
- Virtualization Technology disabled
- DCU Streamer Prefetcher 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
- Memory Patrol Scrub disabled
- Logical Processor disabled
- CPU Interconnect Bus Link Power Management enabled
- PCI ASPM L1 Link Power Management enabled

Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7edble6e46a485a0011
running on linux-g3ob Fri Mar 20 13:53:24 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

From /proc/cpuinfo
- model name : Intel(R) Xeon(R) Gold 6230 CPU @ 2.10GHz
  - 2 "physical id"s (chips)
  - 40 "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 : 20
  - 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
- Address sizes: 46 bits physical, 48 bits virtual
- CPU(s): 40
- On-line CPU(s) list: 0-39
- Thread(s) per core: 1
- Core(s) per socket: 20
- Socket(s): 2
- NUMA node(s): 2
- Vendor ID: GenuineIntel
- CPU family: 6

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

Dell Inc.

PowerEdge R440 (Intel Xeon Gold 6230, 2.10 GHz)

SPECspeed®2017_fp_base = 124
SPECspeed®2017_fp_peak = 124

CPU2017 License: 55
Test Sponsor: Dell Inc.
Test Date: Mar-2020
Tested by: Dell Inc.
Hardware Availability: Dec-2019
Software Availability: Jun-2019

Platform Notes (Continued)

Model: 85
Model name: Intel(R) Xeon(R) Gold 6230 CPU @ 2.10GHz
Stepping: 6
CPU MHz: 2100.000
CPU max MHz: 3900.0000
CPU min MHz: 800.0000
BogoMIPS: 4200.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 28160K
NUMA node0 CPU(s): 0,2,4,6,8,10,12,14,16,18,20,22,24,26,28,30,32,34,36,38
NUMA node1 CPU(s): 1,3,5,7,9,11,13,15,17,19,21,23,25,27,29,31,33,35,37,39
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 pdel1gb rdtscp lm constant_tsc art arch_perfmon pebs bts rep_good nop1 xtopology nonstop_tsc cpuid aperfmperf pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pclid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx fl64 fex8c rdrand lahf_lm abm 3nowprefetch cpuid_fault epb cat_l3 cdp_l3 invpcid_single intel_pinn ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 8rms invpcid rtm cmx mpdx rdt_a avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd avx512bw avx512vl xsaveopt xsavec xsavec xsavePrefetch cpuid_fault epb cat_l3 cdp_l3

From /proc/cpuinfo cache data
  cache size: 28160 KB

From numactl --hardware WARNING: a numactl 'node' might or might not correspond to a physical chip.
  available: 2 nodes (0-1)
  node 0 cpus: 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38
  node 0 size: 191914 MB
  node 0 free: 183840 MB
  node 1 cpus: 1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39
  node 1 size: 193501 MB
  node 1 free: 192284 MB
  node distances:
    node   0   1
    0: 10  21
    1: 21  10

From /proc/meminfo
  MemTotal: 394666088 KB
  HugePages_Total: 0

(Continued on next page)
Dell Inc.  
PowerEdge R440 (Intel Xeon Gold 6230, 2.10 GHz)  

<table>
<thead>
<tr>
<th>SPECspeed®2017_fp_base</th>
<th>124</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECspeed®2017_fp_peak</td>
<td>124</td>
</tr>
</tbody>
</table>

**SPEC CPU®2017 Floating Point Speed Result**

**CPU2017 License:** 55  
**Test Sponsor:** Dell Inc.  
**Test Date:** Mar-2020  
**Tested by:** Dell Inc.  
**Hardware Availability:** Dec-2019  
**Software Availability:** Jun-2019

**Platform Notes (Continued)**

<table>
<thead>
<tr>
<th>Hugepagesize:</th>
<th>2048 kB</th>
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</thead>
</table>

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

```bash
os-release:
  NAME="SLES"
  VERSION="15-SP1"
  VERSION_ID="15.1"
  PRETTY_NAME="SUSE Linux Enterprise Server 15 SP1"
  ID="sles"
  ID_LIKE="suse"
  ANSI_COLOR="0;32"
  CPE_NAME="cpe:/o:suse:sles:15:sp1"
```

```bash
uname -a:
  Linux linux-g3ob 4.12.14-195-default #1 SMP Tue May 7 10:55:11 UTC 2019 (8fba516)
  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: __user pointer sanitization
- **CVE-2017-5715 (Spectre variant 2):** Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling

run-level 3 Mar 20 05:03 last=5

**SPEC is set to:** /home/cpu2017

```bash
Filesystem Type Size Used Avail Use% Mounted on
/dev/sda2 xfs 440G 40G 401G 9% /
```

From /sys/devices/virtual/dmi/id

- **BIOS:** Dell Inc. 2.4.8 11/27/2019
- **Vendor:** Dell Inc.
- **Product:** PowerEdge R440
- **Product Family:** PowerEdge
- **Serial:** F9TD613

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:**

- 12x 002C069D002C 36ASF4G72PZ-3G2E2 32 GB 2 rank 3200

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

Dell Inc.

PowerEdge R440 (Intel Xeon Gold 6230, 2.10 GHz)

<table>
<thead>
<tr>
<th>SPECspeed®2017_fp_base</th>
<th>124</th>
</tr>
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<tbody>
<tr>
<td>SPECspeed®2017_fp_peak</td>
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**CPU2017 License:** 55

**Test Sponsor:** Dell Inc.

**Test Date:** Mar-2020

**Tested by:** Dell Inc.

**Hardware Availability:** Dec-2019

**Software Availability:** Jun-2019

**Platform Notes (Continued)**

4x Not Specified Not Specified

*(End of data from sysinfo program)*

**Compiler Version Notes**

<table>
<thead>
<tr>
<th>C</th>
<th>619.lbm_s(base, peak) 638.imagick_s(base, peak) 644.nab_s(base, peak)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel(R) C</td>
<td>Intel(R) 64 Compiler for applications running on Intel(R) 64,</td>
</tr>
<tr>
<td>Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.4.227 Build 20190416</td>
<td></td>
</tr>
<tr>
<td>Copyright (C) 1985-2019 Intel Corporation. All rights reserved.</td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>C++, C, Fortran</th>
<th>607.cactuBSSN_s(base, peak)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel(R) C++</td>
<td>Intel(R) 64 Compiler for applications running on Intel(R) 64,</td>
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<thead>
<tr>
<th>Fortran</th>
<th>603.bwaves_s(base, peak) 649.fotonik3d_s(base, peak) 654.roms_s(base, peak)</th>
</tr>
</thead>
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<tr>
<th>Fortran, C</th>
<th>621.wrf_s(base, peak) 627.cam4_s(base, peak) 628.pop2_s(base, peak)</th>
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Dell Inc. PowerEdge R440 (Intel Xeon Gold 6230, 2.10 GHz)  

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<tr>
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<tr>
<td>Test Sponsor: Dell Inc.</td>
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<tr>
<td>Tested by: Dell Inc.</td>
<td>Software Availability: Jun-2019</td>
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</tbody>
</table>

### Compiler Version Notes (Continued)

Version 19.0.4.227 Build 20190416  
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

---

### Base Compiler Invocation

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

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

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

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

### Base Portability Flags

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>bwaves_s</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>cactuBSSN_s</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>lbm_s</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>wrf_s</td>
<td>-DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian</td>
</tr>
<tr>
<td>cam4_s</td>
<td>-DSPEC_LP64 -DSPEC_CASE_FLAG</td>
</tr>
<tr>
<td>pop2_s</td>
<td>-DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian -assume byterecl</td>
</tr>
<tr>
<td>imagick_s</td>
<td>-DSPEC_LP64</td>
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<tr>
<td>nab_s</td>
<td>-DSPEC_LP64</td>
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<td>fotoni3d_s</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>roms_s</td>
<td>-DSPEC_LP64</td>
</tr>
</tbody>
</table>

### Base Optimization Flags

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

Fortran benchmarks:  
```sh  
-DSPEC_OPENMP -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp  
```
Dell Inc.

PowerEdge R440 (Intel Xeon Gold 6230, 2.10 GHz)

SPECspeed®2017_fp_base = 124
SPECspeed®2017_fp_peak = 124

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<th>CPU2017 License: 55</th>
<th>Test Date:</th>
<th>Mar-2020</th>
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<td>Hardware Availability: Dec-2019</td>
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<td>Tested by: Dell Inc.</td>
<td>Software Availability: Jun-2019</td>
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**Base Optimization Flags (Continued)**

Fortran benchmarks (continued):
- nostandard-realloc-lhs

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

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

**Peak Compiler Invocation**

C benchmarks:
icc -m64 -std=c11

Fortran benchmarks:
ifort -m64

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

Fortran benchmarks:

(Continued on next page)
Dell Inc.  

PowerEdge R440 (Intel Xeon Gold 6230, 2.10 GHz)  

SPECspeed®2017_fp_base = 124  
SPECspeed®2017_fp_peak = 124

Peak Optimization Flags ( Continued )

603.bwaves_s: -prof-gen(pass 1) -prof-use(pass 2) -DSPEC_SUPPRESS_OPENMP  
-DSPEC_OPENMP -o2 -xCORE-AVX512 -qopt-prefetch -ipo -O3  
-ffinite-math-only -no-prec-div -qopt-mem-layout-trans=4  
-qopenmp -nstandard-realloc-lhs

649.fotonik3d_s: Same as 603.bwaves_s

654.roms_s: -DSPEC_OPENMP -xCORE-AVX512 -ipo -O3 -no-prec-div  
-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4  
-qopenmp -nstandard-realloc-lhs

Benchmarks using both Fortran and C:

621.wrf_s: -prof-gen(pass 1) -prof-use(pass 2) -O2 -xCORE-AVX512  
-qopt-prefetch -ipo -O3 -ffinite-math-only -no-prec-div  
-qopt-mem-layout-trans=4 -DSPEC_SUPPRESS_OPENMP -qopenmp  
-DSPEC_OPENMP -nstandard-realloc-lhs

627.cam4_s: -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch  
-ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp  
-DSPEC_OPENMP -nstandard-realloc-lhs

628.pop2_s: Same as 621.wrf_s

Benchmarks using Fortran, C, and C++:

-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch  
-ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP  
-nstandard-realloc-lhs

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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