## Dell Inc. PowerEdge R660 (Intel Xeon Gold 6430)

### SPECrate®2017_fp_base = 618
### SPECrate®2017_fp_peak = 647

<table>
<thead>
<tr>
<th>CPU2017 License: 6573</th>
<th>Test Date: Dec-2022</th>
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<tbody>
<tr>
<td>Test Sponsor: Dell Inc.</td>
<td>Hardware Availability: Feb-2023</td>
</tr>
<tr>
<td>Tested by: Dell Inc.</td>
<td>Software Availability: Jun-2022</td>
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**CPU2017 License: 6573**
- Test Date: Dec-2022
- Hardware Availability: Feb-2023
- Software Availability: Jun-2022
- **Test Sponsor:** Dell Inc.
- **Tested by:** Dell Inc.

### Software
- **OS:** SUSE Linux Enterprise Server 15 SP4 5.14.21-150400.22-default
- **Compiler:** C/C++: Version 2022.1 of Intel oneAPI DPC++/C++ Compiler for Linux;
  Fortran: Version 2022.1 of Intel Fortran Compiler for Linux;
- **Parallel:** No
- **Firmware:** Version 0.3.2 released Nov-2022
- **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 and OS set to prefer performance at the cost of additional power usage.

### Hardware
- **CPU Name:** Intel Xeon Gold 6430
- **Max MHz:** 3400
- **Nominal:** 2100
- **Enabled:** 64 cores, 2 chips, 2 threads/core
- **Orderable:** 1.2 chips
- **Cache L1:** 32 KB I + 48 KB D on chip per core
- **L2:** 2 MB I+D on chip per core
- **L3:** 60 MB I+D on chip per core
- **Other:** None
- **Memory:** 1 TB (16 x 64 GB 2Rx4 PC5-4800B-R, running at 4400)
- **Storage:** 125 GB on tmpfs
- **Other:** None

### SPECrate®2017_fp_base (618) - SPECrate®2017_fp_peak (647)

<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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<td>538.imagick_r</td>
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<td>963</td>
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<tr>
<td>549.fotonik3d_r</td>
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<td>554.roms_r</td>
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</tr>
</tbody>
</table>

**Copies** 647

**Test Sponsor:** Dell Inc.
**Hardware Availability:** Feb-2023
**Software Availability:** Jun-2022

---

**Notes:**
- The test was conducted on a Dell PowerEdge R660 with an Intel Xeon Gold 6430 processor.
- The SPECrate®2017_fp_base and SPECrate®2017_fp_peak results are shown for benchmark performance.
- The test was performed by Dell Inc. on December 2022.

---

**Additional Information:**
- The CPU has 64 cores, 2 chips, with 2 threads per core.
- Memory configuration includes 1 TB of RAM.
- The system state was set to run level 3 (multi-user) for the test.

---

**Contact:**
- Standard Performance Evaluation Corporation (info@spec.org)
- https://www.spec.org/
### Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
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<td>282</td>
<td>361</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"

### Environment Variables Notes

Environment variables set by runcpu before the start of the run:

LD_LIBRARY_PATH = 
"/mnt/ramdisk/cpu2017-1.1.8-ic2022.1/lib/intel64:/mnt/ramdisk/cpu2017-1.1.8-ic2022.1/je5.0.1-64"

MALLOCONF = "retain:true"

### General Notes

Binaries compiled on a system with 2x Intel Xeon Platinum 8280M CPU + 384GB RAM memory using Red Hat Enterprise Linux 8.4

Transparent Huge Pages enabled by default

(Continued on next page)
General Notes (Continued)

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>
jemalloc, a general purpose malloc implementation
built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5

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.

Benchmark run from a 125 GB ramdisk created with the cmd: "mount -t tmpfs -o size=125G tmpfs /mnt/ramdisk"

Platform Notes

BIOS settings:
  ADDDC Setting : Disabled
  DIMM Self Healing on
  Uncorrectable Memory Error : Disabled
  Virtualization Technology : Disabled
  Sub NUMA Cluster : 4-way Clustering
  DCU Streamer Prefetcher : Disabled
  LLC Prefetch : Disabled
  Dead Line LLC Alloc : Disabled
  Optimizer Mode : Enabled
  System Profile : Custom
  CPU Power Management : Maximum Performance
    C1E : Disabled
    C States : Autonomous
  Memory Patrol Scrub : Disabled
  Energy Efficiency Policy : Performance
  PCI ASPM L1 Link
  Power Management : Disabled

Sysinfo program /mnt/ramdisk/cpu2017-1.1.8-ic2022.1/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acaf64d
running on localhost Wed Dec 14 17:41:45 2022

SUT (System Under Test) info as seen by some common utilities.

(Continued on next page)
Dell Inc.
PowerEdge R660 (Intel Xeon Gold 6430)

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

Copyright 2017-2023 Standard Performance Evaluation Corporation

**SPECrate®2017_fp_base = 618**

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<table>
<thead>
<tr>
<th>CPU2017 License:</th>
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<td>Jun-2022</td>
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For more information on this section, see [https://www.spec.org/cpu2017/Docs/config.html#sysinfo](https://www.spec.org/cpu2017/Docs/config.html#sysinfo)

From /proc/cpuinfo

```plaintext
model name : Intel(R) Xeon(R) Gold 6430
2 "physical id"s (chips)
128 "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 : 32
siblings : 64
physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
```

From lscpu from util-linux 2.37.2:

```plaintext
Architecture:                    x86_64
CPU op-mode(s):                  32-bit, 64-bit
Address sizes:                   46 bits physical, 57 bits virtual
Byte Order:                      Little Endian
CPU(s):                          128
On-line CPU(s) list:             0-127
Vendor ID:                       GenuineIntel
Model name:                      Intel(R) Xeon(R) Gold 6430
CPU family:                      6
Model:                           143
Thread(s) per core:              2
Core(s) per socket:              32
Socket(s):                       2
Stepping:                        8
BogoMIPS:                        4200.00
```

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
pdevclnb rdtscp lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology
nonstop_tsc cpuid aperfmperf tsc_known_freq pni pclmulqdq dtes64 ds_cpl smx est tm2
ssse3 sdbg fma cx16 xtpr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt
```

Platform Notes (Continued)

(Continued on next page)
Dell Inc.

PowerEdge R660 (Intel Xeon Gold 6430)

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</tbody>
</table>

**Platform Notes (Continued)**

- **L1d cache:** 3 MiB (64 instances)
- **L1i cache:** 2 MiB (64 instances)
- **L2 cache:** 128 MiB (64 instances)
- **L3 cache:** 120 MiB (2 instances)

- **NUMA node(s):** 8
- **NUMA node0 CPU(s):** 0-7, 64-71
- **NUMA node1 CPU(s):** 8-15, 72-79
- **NUMA node2 CPU(s):** 16-23, 80-87
- **NUMA node3 CPU(s):** 24-31, 88-95
- **NUMA node4 CPU(s):** 32-39, 96-103
- **NUMA node5 CPU(s):** 40-47, 104-111
- **NUMA node6 CPU(s):** 48-55, 112-119
- **NUMA node7 CPU(s):** 56-63, 120-127

- **Vulnerability Itlb multihit:** Not affected
- **Vulnerability L1tf:** Not affected
- **Vulnerability Mds:** Not affected
- **Vulnerability Meltdown:** Not affected

- **Vulnerability Spec store bypass:** Mitigation; Speculative Store Bypass disabled via prctl and seccomp
- **Vulnerability Spectre v1:** Mitigation; usercopy/swapgs barriers and __user pointer sanitization
- **Vulnerability Spectre v2:** Mitigation; Enhanced IBRS, IBPB conditional, RSB filling
- **Vulnerability Srbd:** Not affected
- **Vulnerability Tsx async abort:** Not affected

From `lscpu --cache`:

<table>
<thead>
<tr>
<th>NAME</th>
<th>ONE-SIZE</th>
<th>ALL-SIZE</th>
<th>WAYS</th>
<th>TYPE</th>
<th>LEVEL</th>
<th>SETS</th>
<th>PHY-LINE</th>
<th>COHERENCY-SIZE</th>
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<td>12</td>
<td>Data</td>
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<td>1</td>
<td>64</td>
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<td>L1i</td>
<td>32K</td>
<td>2M</td>
<td>8</td>
<td>Instruction</td>
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<td>64</td>
</tr>
<tr>
<td>L2</td>
<td>2M</td>
<td>128M</td>
<td>16</td>
<td>Unified</td>
<td>2</td>
<td>2048</td>
<td>1</td>
<td>64</td>
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<tr>
<td>L3</td>
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<td>15</td>
<td>Unified</td>
<td>3</td>
<td>65536</td>
<td>1</td>
<td>64</td>
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</table>

/proc/cpuinfo cache data

```
cache size : 61440 KB
```

From `numactl --hardware`

```
WARNING: a numactl 'node' might or might not correspond to a physical chip.
available: 8 nodes (0-7)
node 0 cpus: 0 1 2 3 4 5 6 7 64 65 66 67 68 69 70 71
node 0 size: 128472 MB
node 0 free: 117078 MB
node 1 cpus: 8 9 10 11 12 13 14 15 72 73 74 75 76 77 78 79
node 1 size: 129019 MB
node 1 free: 122493 MB
node 2 cpus: 16 17 18 19 20 21 22 23 80 81 82 83 84 85 86 87
node 2 size: 129019 MB
```
SPEC CPU®2017 Floating Point Rate Result

Dell Inc.

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Platform Notes (Continued)

node 2 free: 121639 MB
node 3 cpus: 24 25 26 27 28 29 30 31 88 89 90 91 92 93 94 95
node 3 size: 128985 MB
node 3 free: 115046 MB
node 4 cpus: 32 33 34 35 36 37 38 39 96 97 98 99 100 101 102 103
node 4 size: 129019 MB
node 4 free: 122512 MB
node 5 cpus: 40 41 42 43 44 45 46 47 104 105 106 107 108 109 110 111
node 5 size: 129019 MB
node 5 free: 122509 MB
node 6 cpus: 48 49 50 51 52 53 54 55 112 113 114 115 116 117 118 119
node 6 size: 129019 MB
node 6 free: 122508 MB
node 7 cpus: 56 57 58 59 60 61 62 63 120 121 122 123 124 125 126 127
node 7 size: 128972 MB
node 7 free: 122457 MB
node distances:
node 0 1 2 3 4 5 6 7
0: 10 12 12 12 21 21 21 21
1: 12 10 12 12 21 21 21 21
2: 12 12 10 12 21 21 21 21
3: 12 12 12 10 21 21 21 21
4: 21 21 21 21 10 12 12 12
5: 21 21 21 21 12 10 12 12
6: 21 21 21 21 12 12 10 12
7: 21 21 21 21 12 12 12 10

From /proc/meminfo
MemTotal: 1056286520 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

From /etc/*release* /etc/*version*
oS-release:
NAME="SLES"
VERSION="15-SP4"
VERSION_ID="15.4"
PRETTY_NAME="SUSE Linux Enterprise Server 15 SP4"
ID="sles"
ID_LIKE="suse"
ANSI_COLOR="0;32"
CPE_NAME="cpe:/o:suse:sles:15:sp4"

uname -a:
Linux localhost 5.14.21-150400.22-default #1 SMP PREEMPT_DYNAMIC Wed May 11 06:57:18
UTC 2022 (49db222) x86_64 x86_64 x86_64 GNU/Linux

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

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---

**Platform Notes (Continued)**

**Kernel self-reported vulnerability status:**

- CVE-2018-12207 (iTLB Multihit): Not affected  
- 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 prct1 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  
- CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected  
- CVE-2019-11135 (TSX Asynchronous Abort): Not affected

**run-level 3 Dec 14 12:57**

**Filesystem** | **Type** | **Size** | **Used** | **Avail** | **Use%** | **Mounted on**
---|---|---|---|---|---|---
tmpfs | tmpfs | 125G | 54G | 72G | 44% | /mnt/ramdisk

**Additional information from dmidecode 3.2 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:** 8x 00CE00B300CE M321R8GA0BB0-CQKEG 64 GB 2 rank 4800, configured at 4400
- **BIOS:**  
  - BIOS Vendor: Dell Inc.  
  - BIOS Version: 0.3.2  
  - BIOS Date: 11/30/2022  
  - BIOS Revision: 0.3

(End of data from sysinfo program)
## Compiler Version Notes

<table>
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<tr>
<th></th>
<th>baselines</th>
<th>peak baselines</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C</strong></td>
<td>519.lbm_r(base, peak) 538.imagick_r(base, peak) 544.nab_r(base, peak)</td>
<td></td>
</tr>
<tr>
<td><strong>C++</strong></td>
<td>508.namd_r(base, peak) 510.parest_r(base, peak)</td>
<td></td>
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<tr>
<td><strong>C++, C</strong></td>
<td>511.povray_r(base, peak) 526.blender_r(base, peak)</td>
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<tr>
<td><strong>C++, C, Fortran</strong></td>
<td>507.cactuBSSN_r(base, peak)</td>
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<tr>
<td><strong>Fortran</strong></td>
<td>503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak) 554.roms_r(base, peak)</td>
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2022.1.0 Build 20220316
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Dell Inc.
PowerEdge R660 (Intel Xeon Gold 6430)

SPEC CPU®2017 Floating Point Rate Result
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SPECrates
SPEC CPU®2017_fp_base = 618
SPEC CPU®2017_fp_peak = 647

CPU2017 License: 6573
Test Sponsor: Dell Inc.
Tested by: Dell Inc.

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Compiler Version Notes (Continued)

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Fortran, C
| 521.wrf_r(base, peak) 527.cam4_r(base, peak)

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version
2022.1.0 Build 20220316
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
Version 2022.1.0 Build 20220316
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Base Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:
ifx

Benchmarks using both Fortran and C:
ifx icx

Benchmarks using both C and C++:
icpx icx

Benchmarks using Fortran, C, and C++:
icpx icx ifx

---

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

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

Dell Inc.

PowerEdge R660 (Intel Xeon Gold 6430)

Dell Inc.

Test Sponsor: Dell Inc.
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CPU2017 License: 6573
Test Date: Dec-2022
Hardware Availability: Feb-2023
Software Availability: Jun-2022

SPECRate®2017_fp_base = 618
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Base Portability Flags (Continued)

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:
-w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

C++ benchmarks:
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

Fortran benchmarks:
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte -auto -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

Benchmarks using both Fortran and C:
-w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte -auto -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

Benchmarks using both C and C++:
-w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

Benchmarks using Fortran, C, and C++:
-w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte -auto -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib
Dell Inc.  
PowerEdge R660 (Intel Xeon Gold 6430)  

SPECrate®2017_fp_base = 618  
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### Peak Compiler Invocation

- **C benchmarks:** `icx`
- **C++ benchmarks:** `icpx`
- **Fortran benchmarks:** `ifx`
- **Benchmarks using both Fortran and C:** `ifx icx`
- **Benchmarks using both C and C++:** `icpx icx`
- **Benchmarks using Fortran, C, and C++:** `icpx icx ifx`

### 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: -w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math -flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -qopt-zmm-usage=high -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib

- **C++ benchmarks:**
  
  508.namd_r: basepeak = yes
  
  510.parest_r: -w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math -flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -ljemalloc

(Continued on next page)
Peak Optimization Flags (Continued)

510.parest_r (continued):
-\texttt{-L/usr/local/jemalloc64-5.0.1/lib}

Fortran benchmarks:

503.bwaves_r: \texttt{basepeak = yes}
549.fotonik3d_r: \texttt{basepeak = yes}

554.roms_r: \texttt{-w -m64 -Wl,-z,muldefs \texttt{-xCORE-AVX512 -Ofast -ffast-math}}
\texttt{-flto -mfpmath=sse -funroll-loops}
\texttt{-qopt-mem-layout-trans=4 -nostandard-realloc-lhs}
\texttt{-align array32byte -auto -ljemalloc}
\texttt{-L/usr/local/jemalloc64-5.0.1/lib}

Benchmarks using both Fortran and C:

521.wrf_r: \texttt{basepeak = yes}
527.cam4_r: \texttt{basepeak = yes}

Benchmarks using both C and C++:

511.povray_r: \texttt{basepeak = yes}
526.blender_r: \texttt{basepeak = yes}

Benchmarks using Fortran, C, and C++:
\texttt{-w -m64 -std=\texttt{c11} -Wl,-z,muldefs \texttt{-xCORE-AVX512 -Ofast -ffast-math}}
\texttt{-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4}
\texttt{-nostandard-realloc-lhs -align array32byte -auto -ljemalloc}
\texttt{-L/usr/local/jemalloc64-5.0.1/lib}

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

http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-Intel-Xeon-v1.2.html

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

http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-Intel-Xeon-v1.2.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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