Dell Inc.

PowerEdge R440 (Intel Xeon Gold 5222, 3.80 GHz)

SPECrated® 2017 fp base = 75.8
SPECrated® 2017 fp peak = 77.2

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

Test Date: Apr-2020
Hardware Availability: Feb-2020
Software Availability: Nov-2019

Copies

| Benchmark | 0 | 15 | 30 | 45 | 60 | 75 | 90 | 105 | 120 | 135 | 150 | 165 | 180 | 195 | 210 | 225 | 240 | 255 | 270 | 285 | 305 |
|-----------|---|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|-----|
| 503.bwaves_r | 16 | 49.0 | | | | | | | | | | | | | | | | | | | |
| 507.cactuBSSN_r | 16 | 45.4 | | | | | | | | | | | | | | | | | | | |
| 508.namd_r | 16 | 45.7 | 70.9 | | | | | | | | | | | | | | | | | | | |
| 510.parest_r | 16 | 56.2 | | | | | | | | | | | | | | | | | | | |
| 511.povray_r | 16 | 74.8 | | | | | | | | | | | | | | | | | | | |
| 519.lbm_r | 16 | 45.0 | | | | | | | | | | | | | | | | | | | |
| 521.wrf_r | 8 | 89.5 | | | | | | | | | | | | | | | | | | | |
| 526.blender_r | 16 | 62.3 | | | | | | | | | | | | | | | | | | | |
| 527.cam4_r | 16 | 71.5 | | | | | | | | | | | | | | | | | | | |
| 538.imagick_r | 16 | 144 | | | | | | | | | | | | | | | | | | | |
| 544.nab_r | 16 | 100 | | | | | | | | | | | | | | | | | | | |
| 549.fotonik3d_r | 16 | 77.9 | | | | | | | | | | | | | | | | | | | |
| 554.roms_r | 8 | 51.5 | | | | | | | | | | | | | | | | | | | |

---

CPU Name: Intel Xeon Gold 5222
Max MHz: 3900
Nominal: 3800
Enabled: 8 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: 16.5 MB I+D on chip per chip
Other: None
Memory: 384 GB (12 x 16 GB 2Rx8 PC4-3200V-R, running at 2933)
Storage: 1.8 TB GB SATA SSD
Other: None

---

OS: Red Hat Enterprise Linux 8.1
Compiler: C/C++: Version 19.0.5.281 of Intel C/C++ Compiler for Linux;
Fortran: Version 19.0.5.281 of Intel Fortran Compiler for Linux
Parallel: No
Firmware: Version 2.6.3 released Jan-2020
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

---

Hardware
Software
Dell Inc.  
PowerEdge R440 (Intel Xeon Gold 5222, 3.80 GHz) 

**Results Table**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
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<td>264</td>
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<td>413</td>
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<td>526.blender_r</td>
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<td>62.3</td>
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<td>544.nab_r</td>
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<td>554.roms_r</td>
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<td>51.5</td>
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<td>51.6</td>
<td>8</td>
<td>229</td>
<td>55.4</td>
<td>230</td>
</tr>
</tbody>
</table>

**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"
MALLOC_CONF = "retain:true"

**General Notes**

Binaries compiled on a system with 1x Intel Core i9-9900K 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)
### SPEC CPU®2017 Floating Point Rate Result

**Dell Inc.**

**PowerEdge R440 (Intel Xeon Gold 5222, 3.80 GHz)**

<table>
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</tbody>
</table>

**SPECrate®2017_fp_base = 75.8**

**SPECrate®2017_fp_peak = 77.2**

---

### General Notes (Continued)

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.:

drop_caches --interleave=all runcpu <etc>

---

### Platform Notes

BIOS settings:
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
Memory Patrol Scrub disabled
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 /home/cpu2017/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7edble6e46a485a0011
running on localhost.localdomain Sat May 16 10:09:28 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 5222 CPU @ 3.80GHz
2 "physical id"s (chips)
16 "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 : 4
siblings : 8
physical 0: cores 5 8 9 13
SPEC CPU®2017 Floating Point Rate Result

Dell Inc.  

PowerEdge R440 (Intel Xeon Gold 5222, 3.80 GHz)

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CPU2017 License: 55  
Test Sponsor: Dell Inc.  
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Test Date: Apr-2020  
Hardware Availability: Feb-2020  
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Platform Notes (Continued)

physical 1: cores 2 5 8 13

From lscpu:

Architecture: x86_64  
CPU op-mode(s): 32-bit, 64-bit  
Byte Order: Little Endian  
CPU(s): 16  
On-line CPU(s) list: 0-15  
Thread(s) per core: 2  
Core(s) per socket: 4  
Socket(s): 2  
NUMA node(s): 4  
Vendor ID: GenuineIntel  
CPU family: 6  
Model: 85  
Model name: Intel(R) Xeon(R) Gold 5222 CPU @ 3.80GHz  
Stepping: 6  
CPU MHz: 3272.418  
CPU max MHz: 3900.0000  
CPU min MHz: 1200.0000  
BogoMIPS: 7600.00  
Virtualization: VT-x  
L1d cache: 32K  
L1i cache: 32K  
L2 cache: 1024K  
L3 cache: 16896K  
NUMA node0 CPU(s): 0,6,8,14  
NUMA node1 CPU(s): 1,5,9,13  
NUMA node2 CPU(s): 2,4,10,12  
NUMA node3 CPU(s): 3,7,11,15  
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 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_pni ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm cqm mxp rdt_a avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd avx512bw avx512vl xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbb_total cqm_mbb_local dtherm ida arat pfn pts pku ospke avx512_vnni md_clear flush_lld arch_capabilities

/proc/cpuinfo cache data  

cache size: 16896 KB

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

(Continued on next page)
### Platform Notes (Continued)

- **physical chip.**
  - available: 4 nodes (0-3)
  - node 0 cpus: 0 6 8 14
  - node 0 size: 95308 MB
  - node 0 free: 94676 MB
  - node 1 cpus: 1 5 9 13
  - node 1 size: 96766 MB
  - node 1 free: 96045 MB
  - node 2 cpus: 2 4 10 12
  - node 2 size: 96741 MB
  - node 2 free: 96147 MB
  - node 3 cpus: 3 7 11 15
  - node 3 size: 96766 MB
  - node 3 free: 96172 MB
  - **node distances:**
    - node 0: 10 21 11 21
    - node 1: 21 10 21 11
    - node 2: 11 21 10 21
    - node 3: 21 11 21 10

From /proc/meminfo
- MemTotal: 394837668 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)
- system-release: Red Hat Enterprise Linux release 8.1 (Ootpa)
- system-release-cpe: cpe:/o:redhat:enterprise_linux:8.1:ga

uname -a:
- Linux localhost.localdomain 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**
Dell Inc. PowerEdge R440 (Intel Xeon Gold 5222, 3.80 GHz)

SPECratenoturned

SPEC CPU®2017 Floating Point Rate Result

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PowerEdge R440 (Intel Xeon Gold 5222, 3.80 GHz)

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Dell Inc.
Compiler Version Notes (Continued)

Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.5.281 Build 20190815
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 19.0.5.281 Build 20190815
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

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

Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.5.281 Build 20190815
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

C++, C, Fortran | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak)

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.5.281 Build 20190815
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,
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(Continued on next page)
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Compiler Version Notes (Continued)

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Base Compiler Invocation

C benchmarks:
icc

C++ benchmarks:
icpc

Fortran benchmarks:
ifort

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
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</table>

### Base Optimization Flags

**C benchmarks:**
```bash
-std=c11 -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4
```

**C++ benchmarks:**
```bash
-m64 -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4
```

**Fortran benchmarks:**
```bash
-m64 -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -auto
-nostandard-realloc-lhs
```

**Benchmarks using both Fortran and C:**
```bash
-m64 -std=c11 -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -auto
-nostandard-realloc-lhs
```

**Benchmarks using both C and C++:**
```bash
-m64 -std=c11 -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4
```

**Benchmarks using Fortran, C, and C++:**
```bash
-m64 -std=c11 -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -auto
-nostandard-realloc-lhs
```

### Peak Compiler Invocation

**C benchmarks:**
icc

**C++ benchmarks:**
icpc

**Fortran benchmarks:**
ifort

**Benchmarks using both Fortran and C:**
ifort icc

**Benchmarks using both C and C++:**
icpc icc

(Continued on next page)
### Peak Compiler Invocation (Continued)

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: -m64  -std=c11  -prof-gen(pass 1)  -prof-use(pass 2)  -ipo  
  -xCORE-AVX2  -03  -no-prec-div  -qopt-prefetch  
  -ffinite-math-only  -qopt-mem-layout-trans=4

- 538.imagick_r: basepeak = yes

- 544.nab_r: basepeak = yes

**C++ benchmarks:**

- 508.namd_r: -m64  -ipo  
  -xCORE-AVX2  -03  -no-prec-div  -qopt-prefetch  
  -ffinite-math-only  -qopt-mem-layout-trans=4

- 510.parest_r: -m64  
  -ipo  -03  -no-prec-div  -qopt-prefetch  
  -ffinite-math-only  -qopt-mem-layout-trans=4

**Fortran benchmarks:**

- 503.bwaves_r: -m64  -xCORE-AVX2  -ipo  -03  
  -no-prec-div  -qopt-prefetch  
  -ffinite-math-only  -qopt-mem-layout-trans=4  -auto  
  -nostandard-realloc-lhs

- 549.fotonik3d_r: basepeak = yes

- 554.roms_r: -m64  -ipo  
  -xCORE-AVX2  -03  -no-prec-div  -qopt-prefetch  
  -ffinite-math-only  -qopt-mem-layout-trans=4  -auto  
  -nostandard-realloc-lhs

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

Benchmarks using both Fortran and C:
-m64 -std=c11 -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

Benchmarks using both C and C++:

511.povray_r: -m64 -std=c11 -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

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:

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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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