# SPEC CPU®2017 Floating Point Rate Result

## Dell Inc.

PowerEdge T640 (Intel Xeon Gold 6230R, 2.10 GHz)

- **CPU2017 License:** 55
- **Test Sponsor:** Dell Inc.
- **Tested by:** Dell Inc.
- **Test Date:** May-2020
- **Hardware Availability:** Feb-2020
- **Software Availability:** Apr-2020

### SPECrate®2017_fp_base = 244

### SPECrate®2017_fp_peak = 259

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<td>554.roms_r</td>
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### Hardware

- **CPU Name:** Intel Xeon Gold 6230R
- **Max MHz:** 4000
- **Nominal:** 2100
- **Enabled:** 52 cores, 2 chips, 2 threads/core
- **Orderable:** 1, 2 chips
- **Cache L1:** 32 KB I + 32 KB D on chip per core
- **Cache L2:** 1 MB I+D on chip per core
- **Cache L3:** 35.75 MB I+D on chip per chip
- **Other:** None
- **Memory:** 384 GB (20 x 16 GB 2Rx8 PC4-2933V-R; 4 x 16 GB 2Rx8 PC4-3200V-R, running at 2933)
- **Storage:** 1 x 1.92 TB SATA SSD
- **Other:** None

### Software

- **OS:** Red Hat Enterprise Linux 8.1
  - kernel 4.18.0-147.8.1.el8_1.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:** xfs
- **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.
Results Table

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<tr>
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</table>

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

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 = "/home/cpu2017/lib/intel64:/home/cpu2017/jec5.0.1-64"
MALLOC_CONF = "retain:true"
SPEC CPU®2017 Floating Point Rate Result

Dell Inc.

PowerEdge T640 (Intel Xeon Gold 6230R, 2.10 GHz)

SPECrate®2017_fp_base = 244
SPECrate®2017_fp_peak = 259

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

Test Date: May-2020
Hardware Availability: Feb-2020
Software Availability: Apr-2020

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)
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>
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
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 295195f888a3d7edbe1e6e46a485a0011
running on poweredge-sut-rhel8-1 Wed Jun 10 21:46:41 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)
SPEC CPU®2017 Floating Point Rate Result

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From /proc/cpuinfo

model name : Intel(R) Xeon(R) Gold 6230R CPU @ 2.10GHz
  2 "physical id"s (chips)
  104 "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 : 26
  siblings : 52
  physical 0: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 16 17 18 19 20 21 22 24 25 26 27 28 29
  physical 1: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 16 17 18 19 20 21 22 24 25 26 27 28 29
From lscpu:
Architecture:        x86_64
CPU op-mode(s):      32-bit, 64-bit
Byte Order:          Little Endian
CPU(s):              104
On-line CPU(s) list: 0-103
Thread(s) per core:  2
Core(s) per socket:  26
Socket(s):           2
NUMA node(s):        4
Vendor ID:           GenuineIntel
CPU family:          6
Model:               85
Model name:          Intel(R) Xeon(R) Gold 6230R CPU @ 2.10GHz
Stepping:            7
CPU MHz:             1594.478
CPU max MHz:         4000.0000
CPU min MHz:         1000.0000
BogoMIPS:            4200.00
Virtualization:      VT-x
L1d cache:           32K
L1i cache:           32K
L2 cache:            1024K
L3 cache:            36608K
NUMA node0 CPU(s):
  0,4,8,12,16,20,24,28,32,36,40,44,48,52,56,60,64,68,72,76,80,84,88,92,96,100
NUMA node1 CPU(s):
  1,5,9,13,17,21,25,29,33,37,41,45,49,53,57,61,65,69,73,77,81,85,89,93,97,101
NUMA node2 CPU(s):
  2,6,10,14,18,22,26,30,34,38,42,46,50,54,58,62,66,70,74,78,82,86,90,94,98,102
NUMA node3 CPU(s):
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 rdtsscp

(Continued on next page)
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SPECRate®2017_fp_base = 244

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

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 xtrp pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault cat_l3 cdp_l3 invpcid_single intel_puin ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi flexpriority ept vpid fbsqsb ncs_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm cmq mpx rt_a avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd avx512bw avx512vl xsaves xsaveopt xsavec xgetbv1 xsave vmm save vcpu_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 80 84 88 92 96
  node 0 size: 95304 MB
  node 0 free: 94459 MB
  node 1 cpus: 1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 65 69 73 77 81 85 89 93 97
  node 1 size: 96737 MB
  node 1 free: 96296 MB
  node 2 cpus: 2 6 10 14 18 22 26 30 34 38 42 46 50 54 58 62 66 70 74 78 82 86 90 94 98
  node 2 size: 96762 MB
  node 2 free: 95624 MB
  node 3 cpus: 3 7 11 15 19 23 27 31 35 39 43 47 51 55 59 63 67 71 75 79 83 87 91 95 99
  node 3 size: 96762 MB
  node 3 free: 96338 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: 394821164 kB
  HugePages_Total: 0
  Hugepagesize: 2048 kB

From /etc/*release* /etc/*version*
  os-release:

(Continued on next page)
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<table>
<thead>
<tr>
<th>Platform Notes (Continued)</th>
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<tbody>
<tr>
<td>NAME=&quot;Red Hat Enterprise Linux&quot;</td>
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<tr>
<td>VERSION=&quot;8.1 (Ootpa)&quot;</td>
</tr>
<tr>
<td>ID=&quot;rhel&quot;</td>
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<tr>
<td>ID_LIKE=&quot;fedora&quot;</td>
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<td>redhat-release: Red Hat Enterprise Linux release 8.1 (Ootpa)</td>
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<td>system-release: Red Hat Enterprise Linux release 8.1 (Ootpa)</td>
</tr>
<tr>
<td>system-release-cpe: cpe:/o:redhat:enterprise_linux:8.1:ga</td>
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uname -a:
Linux poweredge-sut-rhel8-1 4.18.0-147.8.1.el8_1.x86_64 #1 SMP Wed Feb 26 03:08:15 UTC 2020 x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

- itlb_multihit: Processor vulnerable
- CVE-2018-3620 (L1 Terminal Fault): Not affected
- Microarchitectural Data Sampling: Not affected
- CVE-2018-3639 (Microarchitectural Data Sampling): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
- CVE-2017-5753 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling
- CVE-2017-5715 (Spectre variant 1): Mitigation: Clear CPU buffers; SMT vulnerable
- ttx_async_abort:

run-level 3 Jun 10 15:24 last=5

SPEC is set to: /home/cpu2017

Filesystem Type Size Used Avail Use% Mounted on
/dev/mapper/rhel-home xfs 1.5T 20G 1.4T 2% /home

From /sys/devices/virtual/dmi/id
BIOS: Dell Inc. 2.7.7 05/05/2020
Vendor: Dell Inc.
Product: PowerEdge T640
Product Family: PowerEdge
Serial: 1234567

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.

(Continued on next page)
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Platform Notes (Continued)

Memory:
14x 002C069D002C 18ASF2G72PDZ-2G9E1 16 GB 2 rank 2933
2x 00AD00B300AD HMA82GR7CJR8N-WM 16 GB 2 rank 2933
4x 00AD00B300AD HMA82GR7CJR8N-XN 16 GB 2 rank 3200
4x 00AD069D00AD HMA82GR7CJR8N-WM 16 GB 2 rank 2933

(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 Compiler for applications running on Intel(R) 64, Version 2021.1
NextGen Build 20200304
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C++
| 508.namd_r(base, peak) 510.parest_r(base, peak)

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C++, C
| 511.povray_r(base) 526.blender_r(base, peak)

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(Continued on next page)
### Dell Inc.

**PowerEdge T640 (Intel Xeon Gold 6230R, 2.10 GHz)**

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### Compiler Version Notes (Continued)

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Compiler Version Notes (Continued)

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

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Fortran, C | 521.wrf_r(peak)

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Intel(R) C Compiler for applications running on Intel(R) 64, Version 19.1.1.217 Build 20200306
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Fortran, C | 521.wrf_r(base) 527.cam4_r(base, peak)

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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Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1 NextGen Build 20200304
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Fortran, C | 521.wrf_r(peak)

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Intel(R) C Compiler for applications running on Intel(R) 64, Version 19.1.1.217 Build 20200306
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## Dell Inc.

**PowerEdge T640 (Intel Xeon Gold 6230R, 2.10 GHz)**

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

<table>
<thead>
<tr>
<th>SPECrate®2017_fp_peak = 259</th>
<th>SPECrate®2017_fp_base = 244</th>
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<tbody>
<tr>
<td>Dell Inc.</td>
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<td>CPU2017 License: 55</td>
<td>Test Date: May-2020</td>
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<tr>
<td>Test Sponsor: Dell Inc.</td>
<td>Hardware Availability: Feb-2020</td>
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<td>Tested by: Dell Inc.</td>
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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

### Base Optimization Flags

- **C benchmarks:**
  - -m64
  - -mnextgen
  - -std=c11
  - -Wl,-plugin-opt=-x86-branches-within-32B-boundaries
  - -Wl,-z,muldefs
  - -fuse-ld=gold
  - -xCORE-AVX2
  - -Ofast
  - -ffast-math
  - -flto
  - -mfpmath=sse
  - -funroll-loops
  - -gopt-mem-layout-trans=4
  - -L/usr/local/jemalloc64-5.0.1/lib
  - -ljemalloc

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**Base Optimization Flags (Continued)**

C++ benchmarks:
- m64 -qnextgen -Wl,-plugin-opt=-x86-branches-within-32B-boundaries
- Wl,-z,muldefs -fuse-ld=gold -xCORE-AVX2 -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
- fuse-ld=gold -xCORE-AVX2 -O3 -ipo -no-prec-div -qopt-prefetch
- ffinite-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 -qnextgen -std=c11
- Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
- fuse-ld=gold -xCORE-AVX2 -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 -nostandard-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 -qnextgen -std=c11
- Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
- fuse-ld=gold -xCORE-AVX2 -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 -qnextgen -std=c11
- Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
- fuse-ld=gold -xCORE-AVX2 -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 -nostandard-realloc-lhs
- align array32byte -auto -mbranches-within-32B-boundaries
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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

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-AVX2 -Ofast
-ffast-math -flto
-mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -L/usr/local/jemalloc64-5.0.1/lib
-ljemalloc

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Peak Optimization Flags (Continued)

Fortran benchmarks:


549.fotonik3d_r: basepeak = yes

554.roms_r: Same as 503.bwaves_r

Benchmarks using both Fortran and C:


527.cam4_r: basepeak = yes

Benchmarks using both C and C++:

511.povray_r: -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX2 -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:
### SPEC CPU®2017 Floating Point Rate Result

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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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