## SPEC® CPU2017 Floating Point Rate Result

**Dell Inc.**

PowerEdge M640 (Intel Xeon Silver 4208, 2.10GHz)

<table>
<thead>
<tr>
<th>SPECrate2017_fp_peak</th>
<th>SPECrate2017_fp_base</th>
</tr>
</thead>
<tbody>
<tr>
<td>82.0</td>
<td>80.2</td>
</tr>
</tbody>
</table>

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

### Hardware

- **CPU Name:** Intel Xeon Silver 4208  
- **Max MHz.:** 3200  
- **Nominal:** 2100  
- **Enabled:** 16 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:** 11 MB I+D on chip per chip  
- **Other:** None  
- **Memory:** 384 GB (12 x 32 GB 2Rx8 PC4-2933Y-R, running at 2400)  
- **Storage:** 1 x 480 GB SATA SSD  
- **Other:** None

### Software

- **OS:** Ubuntu 18.04.2 LTS  
  - kernel 4.15.0-45-generic  
- **Compiler:** C/C++: Version 19.0.1.144 of Intel C/C++  
  - Compiler Build 20181018 for Linux; Fortran: Version 19.0.1.144 of Intel Fortran  
  - Compiler Build 20181018 for Linux  
- **Parallel:** No  
- **Firmware:** Version 2.2.2 released Mar-2019  
- **File System:** ext4  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 64-bit  
- **Other:** None
Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
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<th>Seconds</th>
<th>Ratio</th>
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<tbody>
<tr>
<td>503.bwaves_r</td>
<td>32</td>
<td>1511</td>
<td>212</td>
<td>1510</td>
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<tr>
<td>507.cactuBSSN_r</td>
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<td>66.8</td>
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<td>66.9</td>
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<td>66.8</td>
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<tr>
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<td>58.5</td>
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<td>58.7</td>
<td>520</td>
<td>58.4</td>
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<td>66.8</td>
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<td>554.roms_r</td>
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<td>38.4</td>
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<td>38.3</td>
<td>1296</td>
<td>39.2</td>
<td>1284</td>
<td>39.6</td>
</tr>
</tbody>
</table>

SPECrate2017_fp_base = 80.2
SPECrate2017_fp_peak = 82.0

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"

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

(Continued on next page)
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**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 Interconnect 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 Sat Mar 30 08:15:45 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) Silver 4208 CPU @ 2.10GHz
  2 "physical id"s (chips)
  32 "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 : 8
siblings : 16
  physical 0: cores 0 1 2 3 4 5 6 7
  physical 1: cores 0 1 2 3 4 5 6 7
```

From lscpu:

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

(Continued on next page)
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Platform Notes (Continued)

On-line CPU(s) list: 0–31
Thread(s) per core: 2
Core(s) per socket: 8
Socket(s): 2
NUMA node(s): 2
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Silver 4208 CPU @ 2.10GHz
Stepping: 6
CPU MHz: 2502.394
BogoMIPS: 4200.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 11264K
NUMA node0 CPU(s): 0,2,4,6,8,10,12,14,16,18,20,22,24,26,28,30
NUMA node1 CPU(s): 1,3,5,7,9,11,13,15,17,19,21,23,25,27,29,31
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 pdcpe lgdt
lm constant_tsc arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid
aerpmpref perf pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16
xptr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt aes xsave avx f16c rdrand
lahf_lm abm 3dnowprefetch cpuid_fault epb cat_1 cd8_13 invpcid_single ssbd mba ibrs
ibpb stibp ibrs_enhanced tpr_shadow vmmex flexpriority ept vpid fsgsbase tsc_adjust
bmi1 hle avx2 smep bmi2 erms invpcid rtm cqm mpx rdt_a avx512f avx512dq rdseed adx
smap clflushopt clwb intel_pt avx512cd avx512bw avx512vl xsaveopt xsavec xgetbv1
xsaveav cqm_llc cqm_occap_llc cqm_mbm_total cqm_mbm_local dtherm ida arat pln pts pku
ospke avx512_vnni flush_lld arch_capabilities

/pro/cpulinfo cache data
  cache size : 11264 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
  node 0 size: 192856 MB
  node 0 free: 191893 MB
  node 1 cpus: 1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
  node 1 size: 193532 MB
  node 1 free: 192541 MB
  node distances:
    node 0 1
    0: 10 21
    1: 21 10

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

From /proc/meminfo

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MemTotal:</td>
<td>395662248 kB</td>
</tr>
<tr>
<td>HugePages_Total:</td>
<td>0</td>
</tr>
<tr>
<td>Hugepagesize:</td>
<td>2048 kB</td>
</tr>
</tbody>
</table>

`/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 4.15.0-45-generic #48-Ubuntu SMP Tue Jan 29 16:28:13 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: __user pointer sanitization
- CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB

`run-level 3` Mar 29 22:03

SPEC is set to: /home/cpu2017

<table>
<thead>
<tr>
<th>Filesystem</th>
<th>Type</th>
<th>Size</th>
<th>Used</th>
<th>Avail</th>
<th>Use%</th>
<th>Mounted on</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/sda2</td>
<td>ext4</td>
<td>439G</td>
<td>19G</td>
<td>398G</td>
<td>5%</td>
<td>/</td>
</tr>
</tbody>
</table>

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. 2.2.2 03/05/2019**
- **Memory:**
  - 6x 00AD0DB0300AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933, configured at 2400
  - 6x 00AD0DB0300AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933, configured at 2400
  - 4x Not Specified Not Specified

(Continued on next page)
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**Compiler Version Notes**

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CC  519.lbm_r(base)  538.imagick_r(base, peak)  544.nab_r(base, peak)

Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
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Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

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CXXC  508.namd_r(base)  510.parest_r(base, peak)

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CC  511.povray_r(base)  526.blender_r(base, peak)

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---

**Base Compiler Invocation**

**C benchmarks:**

```shell
icc -m64 -std=c11
```

**C++ benchmarks:**

```shell
icpc -m64
```

**Fortran benchmarks:**

```shell
ifort -m64
```

**Benchmarks using both Fortran and C:**

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

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

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

**Benchmarks using Fortran, C, and C++:**

```shell
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

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**Base Portability Flags (Continued)**  
511.povray_r: -DSPEC_LP64  
519.libm_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:  
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4  

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

Fortran benchmarks:  
-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:  
-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 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
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<th>Test Sponsor:</th>
<th>Hardware Availability</th>
<th>Tested by:</th>
<th>Software Availability</th>
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**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.lbm_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`

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

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:

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 -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

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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<th>SPEC CPU2017 Floating Point Rate Result</th>
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<td>SPECrate2017_fp_base = 80.2</td>
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<tr>
<td>SPECrate2017_fp_peak = 82.0</td>
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<td>PowerEdge M640 (Intel Xeon Silver 4208, 2.10GHz)</td>
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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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