## SPEC CPU®2017 Floating Point Speed Result

**Dell Inc.**

PowerEdge R650 (Intel Xeon Silver 4310, 2.10 GHz)

<table>
<thead>
<tr>
<th>SPECspeed®2017_fp_base</th>
<th>116</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECspeed®2017_fp_peak</td>
<td>119</td>
</tr>
</tbody>
</table>

### CPU2017 License:
55

### Test Sponsor:
Dell Inc.

### Tested by:
Dell Inc.

### Test Date:
May-2021

### Hardware Availability:
May-2021

### Software Availability:
Feb-2021

### Software

#### OS:
Red Hat Enterprise Linux 8.3 (Ootpa)

#### Compiler:
C/C++: Version 2021.1 of Intel oneAPI DPC++/C++ Compiler Build 20201113 for Linux;
Fortran: Version 2021.1 of Intel Fortran Compiler Classic Build 20201112 for Linux;
C/C++: Version 2021.1 of Intel C/C++ Compiler Classic Build 20201112 for Linux

#### Parallel:
Yes

#### File System:
tmpfs

#### System State:
Run level 5 (graphical 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

<table>
<thead>
<tr>
<th>Threads</th>
<th>SPECspeed®2017_fp_base (116)</th>
<th>SPECspeed®2017_fp_peak (119)</th>
</tr>
</thead>
<tbody>
<tr>
<td>603.bwaves_s</td>
<td>24</td>
<td>138</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>24</td>
<td>93.6</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>24</td>
<td>106</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>24</td>
<td>116</td>
</tr>
<tr>
<td>627.cam4_s</td>
<td>24</td>
<td>69.5</td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>24</td>
<td>68.7</td>
</tr>
<tr>
<td>638.imagick_s</td>
<td>24</td>
<td>80.2</td>
</tr>
<tr>
<td>644.nab_s</td>
<td>24</td>
<td>163</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>24</td>
<td>183</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>24</td>
<td>119</td>
</tr>
</tbody>
</table>

### CPU Name:
Intel Xeon Silver 4310

### Max MHz:
3300

### Nominal:
2100

### Enabled:
24 cores, 2 chips

### Orderable:
1.2 chips

### Cache L1:
32 KB I + 48 KB D on chip per core

### L2:
1.25 MB I+D on chip per core

### L3:
18 MB I+D on chip per chip

### Other:
None

### Memory:
512 GB (16 x 32 GB 2Rx8 PC4-3200AA-R, running at 2666)

### Storage:
225 GB on tmpfs

### Other:
None
## Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
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<th>Ratio</th>
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<th>Seconds</th>
<th>Ratio</th>
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<tbody>
<tr>
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<td>93.6</td>
<td>24</td>
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<td>113</td>
<td>117</td>
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<tr>
<td>627.cam4_s</td>
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<td>69.5</td>
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<td>99.5</td>
<td>91.6</td>
<td>99.2</td>
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<td>24</td>
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<td>91.3</td>
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<td>119</td>
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<td>119</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 = "/mnt/ramdisk/cpu2017-1.1.5-ic2021.1/lib/intel64:/mnt/ramdisk/cpu2017-1.1.5-ic2021.1/je5.0.1-64"
- `MALLOCONF = "retain:true"
- `OMP_STACKSIZE = "192M"

### General Notes

Binaries compiled on a system with 1x Intel Core i9–7980XE CPU + 64GB RAM
memory using Redhat Enterprise Linux 8.0
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
```
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.

(Continued on next page)
Dell Inc.

PowerEdge R650 (Intel Xeon Silver 4310, 2.10 GHz)

SPECspeed®2017_fp_base = 116
SPECspeed®2017_fp_peak = 119

General Notes (Continued)

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 225 GB ramdisk created with the cmd: "mount -t tmpfs -o size=225G tmpfs /mnt/ramdisk"

Platform Notes

BIOS Settings:
- Logical Processor : Disabled
- Virtualization Technology : Disabled
- System Profile : Custom
- CPU Power Management : Maximum Performance
- C1E : Disabled
- C States : Autonomous
- Memory Patrol Scrub : Disabled
- Energy Efficiency Policy : Performance
- CPU Interconnect Bus Link
  - Power Management : Disabled

Sysinfo program /mnt/ramdisk/cpu2017-1.1.5-ic2021.1/bin/sysinfo
Rev: r6538 of 2020-09-24 e8664e66d2d7080afeaa89d4b38e2f1c
running on localhost.localdomain Tue May 25 07:13:56 2021

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 4310 CPU @ 2.10GHz
- 2 "physical id"s (chips)
- 24 "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 : 12
- siblings : 12
- physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11
- physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11

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

(Continued on next page)
Dell Inc.

PowerEdge R650 (Intel Xeon Silver 4310, 2.10 GHz) 

**SPECspeed®2017_fp_base = 116**  
**SPECspeed®2017_fp_peak = 119**

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**CPU2017 License:** 55  
**Test Sponsor:** Dell Inc.  
**Hardware Availability:** May-2021

---

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

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**CPU(s):** 24  
**On-line CPU(s) list:** 0-23  
**Thread(s) per core:** 1  
**Core(s) per socket:** 12  
**Socket(s):** 2  
**NUMA node(s):** 2  
**Vendor ID:** GenuineIntel

---

**Model:** 106  
**Model name:** Intel(R) Xeon(R) Silver 4310 CPU @ 2.10GHz  
**Stepping:** 6  
**CPU MHz:** 1269.505  
**BogoMIPS:** 4200.00

---

**Virtualization:** VT-x  
**L1d cache:** 48K  
**L1i cache:** 32K  
**L2 cache:** 1280K  
**L3 cache:** 18432K

---

**NUMA node0 CPU(s):** 0,2,4,6,8,10,12,14,16,18,20,22  
**NUMA node1 CPU(s):** 1,3,5,7,9,11,13,15,17,19,21,23

---

**Flags:** fpu vme de pse ts cmov pd cmov 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 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 xtpr pdcm pcid dca sse4_1 lse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm ablm abm dca

---

```
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
   node 0 size: 252923 MB
   node 0 free: 239547 MB
   node 1 cpus: 1 3 5 7 9 11 13 15 17 19 21 23
   node 1 size: 253800 MB
   node 1 free: 252504 MB
   node distances:
```

---

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

```
node  0  1
  0:  10  20
  1:  20  10
```

From `/proc/meminfo`
```
MemTotal:       527817296 kB
HugePages_Total:       0
Hugepagesize:       2048 kB
```

/sbin/tuned-adm active
```
Current active profile: throughput-performance
```

From `/etc/*release* /etc/*version*`
```
os-release:
  NAME="Red Hat Enterprise Linux"
  VERSION="8.3 (Ootpa)"
  ID="rhel"
  ID_LIKE="fedora"
  VERSION_ID="8.3"
  PLATFORM_ID="platform:el8"
  PRETTY_NAME="Red Hat Enterprise Linux 8.3 (Ootpa)"
  ANSI_COLOR="0;31"
redhat-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
system-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
system-release-cpe: cpe:/o:redhat:enterprise_linux:8.3:ga
```

```
uname -a:
  Linux localhost.localdomain 4.18.0-240.15.1.el8_3.x86_64 #1 SMP Wed Feb 3 03:12:15 EST 2021 x86_64 x86_64 x86_64 GNU/Linux
```

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 prctl and seccomp
- **CVE-2017-5753 (Spectre variant 1):** Mitigation: usercopy/swaps 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
Dell Inc.

PowerEdge R650 (Intel Xeon Silver 4310, 2.10 GHz)

| SPECspeed®2017_fp_base = 116 |
| SPECspeed®2017_fp_peak = 119 |

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

Test Date: May-2021
Hardware Availability: May-2021
Software Availability: Feb-2021

Platform Notes (Continued)

run-level 5 May 25 02:51

SPEC is set to: /mnt/ramdisk/cpu2017-1.1.5-ic2021.1
Filesystem Type Size Used Avail Use% Mounted on
tmpfs tmpfs 225G 13G 213G 6% /mnt/ramdisk

From /sys/devices/virtual/dmi/id
Vendor: Dell Inc.
Product: PowerEdge R650
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.
Memory:
  7x 00AD00B300AD HMAA4GR7AJR8N-XN 32 GB 2 rank 3200, configured at 2666
  9x 00AD063200AD HMAA4GR7AJR8N-XN 32 GB 2 rank 3200, configured at 2666
  16x Not Specified Not Specified

BIOS:
  BIOS Vendor: Dell Inc.
  BIOS Version: 1.2.3
  BIOS Date: 05/21/2021
  BIOS Revision: 1.2

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
C | 619.lbm_s(base, peak) 638.imagick_s(base, peak)
   644.nab_s(base)
==============================================================================
Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R)
   64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
==============================================================================
C | 644.nab_s(peak)
==============================================================================
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
   Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

(Continued on next page)
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CPU2017 License: 55  
Test Sponsor:  Dell Inc.  
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Test Date:  May-2021  
Hardware Availability:  May-2021  
Software Availability:  Feb-2021  

---Compiler Version Notes (Continued)---

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**Intel(R) C Compiler Classic** for applications running on Intel(R)  
64, Version 2021.1 Build 20201112_000000  
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.

---

**Intel(R) oneAPI DPC++/C++ Compiler** for applications running on Intel(R) 64,  
Version 2021.1 Build 20201113  
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.

---

**Intel(R) C++ Compiler Classic** for applications running on  
Intel(R) 64, Version 2021.1 Build 20201112_000000  
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.

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**Intel(R) Fortran Compiler Classic** for applications running on  
Intel(R) 64, Version 2021.1 Build 20201112_000000  
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.

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**Intel(R) Fortran Fourier Transform Compiler** for applications running on  
Intel(R) 64, Version 2021.1 Build 20201112_000000  
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.

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**Intel(R) Fortran Compiler Classic** for applications running on  
Intel(R) 64, Version 2021.1 Build 20201112_000000  
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.

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Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.

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Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.

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Compiler Version Notes (Continued)

Intel (R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985–2020 Intel Corporation. All rights reserved.
Intel (R) C Intel (R) 64 Compiler Classic for applications running on Intel (R)
64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985–2020 Intel Corporation. All rights reserved.

Base Compiler Invocation

C benchmarks:
  icc

Fortran benchmarks:
  ifort

Benchmarks using both Fortran and C:
  ifort icc

Benchmarks using Fortran, C, and C++:
  icpc icc ifort

Base Portability Flags

603.bwaves_s: -DSPEC_LP64
607.cactuBSSN_s: -DSPEC_LP64
619.lbm_s: -DSPEC_LP64
621.wrf_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
627.cam4_s: -DSPEC_LP64 -DSPEC_CASE_FLAG
628.pop2_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
  -assume byterecl
638.imagick_s: -DSPEC_LP64
644.nab_s: -DSPEC_LP64
649.fotonik3d_s: -DSPEC_LP64
654.roms_s: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
  -m64 -std=c11 -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
  -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP
  -mbranches-within-32B-boundaries

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Base Optimization Flags (Continued)

Fortran benchmarks:
-m64 -Wl,-z,muldefs -DSPEC_OPENMP -xCORE-AVX512 -ipo -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -qopenmp -nostandard-realloc-lhs
-mbranches-within-32B-boundaries -L/usr/local/jemalloc64-5.0.1/lib
-ljemalloc

Benchmarks using both Fortran and C:
-m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp
-DSPEC_OPENMP -mbranches-within-32B-boundaries -nostandard-realloc-lhs
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Benchmarks using Fortran, C, and C++:
-m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp
-DSPEC_OPENMP -mbranches-within-32B-boundaries -nostandard-realloc-lhs
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Peak Compiler Invocation

C benchmarks (except as noted below):
icc

644.nab_s: icx

Fortran benchmarks:
ifort

Benchmarks using both Fortran and C:
ifort icc

Benchmarks using Fortran, C, and C++:
icpc icc ifort

Peak Portability Flags

Same as Base Portability Flags
Dell Inc.

PowerEdge R650 (Intel Xeon Silver 4310, 2.10 GHz)

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CPU2017 License: 55
Test Sponsor: Dell Inc.
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Software Availability: Feb-2021

Peak Optimization Flags

C benchmarks:

619.lbm_s: basepeak = yes
638.imagick_s: basepeak = yes
644.nab_s: -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-fito -mfpmath=sse -funroll-loops -fiopenmp
-DSPEC_OPENMP -qopt-mem-layout-trans=4
-fimf-accuracy-bits=14:sqrt
-mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Fortran benchmarks:

603.bwaves_s: basepeak = yes
649.fotonik3d_s: basepeak = yes
654.roms_s: basepeak = yes

Benchmarks using both Fortran and C:

621.wrf_s: -m64 -std=c11 -Wl,-z,muldefs -prof-gen(pass 1)
-prof-use(pass 2) -ipo -xCORE-AVX512 -03 -no-prec-div
-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4
-DSPEC_SUPPRESS_OPENMP -qopenmp -DSPEC_OPENMP
-mbranches-within-32B-boundaries -nostandard-realloc-lhs
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

627.cam4_s: basepeak = yes
628.pop2_s: basepeak = yes

Benchmarks using Fortran, C, and C++:

607.cactuBSSN_s: 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:
http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64_revA.xml
<table>
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<th>Dell Inc.</th>
<th>PowerEdge R650 (Intel Xeon Silver 4310, 2.10 GHz)</th>
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<tr>
<td>SPECspeed®2017_fp_base = 116</td>
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<td>Test Sponsor: Dell Inc.</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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