Dell Inc.

PowerEdge R650 (Intel Xeon Gold 6346, 3.10 GHz)

SPECspeed®2017_fp_base = 173
SPECspeed®2017_fp_peak = 177

CPU2017 License: 55
Test Sponsor: Dell Inc.
Test Date: Apr-2021
Hardware Availability: May-2021
Tested by: Dell Inc.
Software Availability: Feb-2021

<table>
<thead>
<tr>
<th>Thread</th>
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<th>SPECspeed®2017_fp_peak (177)</th>
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<tr>
<td>603.bwaves_s</td>
<td>32 threads</td>
<td>207</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>32 threads</td>
<td>131</td>
</tr>
<tr>
<td>619.ibm_s</td>
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<tr>
<td>621.wrf_s</td>
<td>32 threads</td>
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<td>627.cam4_s</td>
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<tr>
<td>628.pop2_s</td>
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<tr>
<td>638.imagick_s</td>
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</tr>
<tr>
<td>644.nab_s</td>
<td>32 threads</td>
<td>278</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>32 threads</td>
<td>109</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>32 threads</td>
<td>219</td>
</tr>
</tbody>
</table>

Hardware

CPU Name: Intel Xeon Gold 6346
Max MHz: 3600
Nominal: 3100
Enabled: 32 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: 36 MB I+D on chip per chip
Other: None
Memory: 512 GB (16 x 32 GB 2Rx8 PC4-3200AA-R)
Storage: 225 GB on tmpfs
Other: None

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
Firmware: Version 1.1.2 released Apr-2021
File System: tmpfs
System State: Run level 5 (graphical multi-user)
Base Pointers: 64-bit
Peak Pointers: 64-bit
Other: None
Power Management: BIOS and OS set to prefer performance at the cost of additional power usage.
Dell Inc.  
PowerEdge R650 (Intel Xeon Gold 6346, 3.10 GHz)  

SPEC CPU®2017 Floating Point Speed Result

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SPECspeed®2017_fp_base = 173

SPECspeed®2017_fp_peak = 177

Results Table

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<th>Benchmark</th>
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<th>Ratio</th>
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<tr>
<td>644.nab_s</td>
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<td>219</td>
<td>71.8</td>
<td>219</td>
<td>72.5</td>
<td>217</td>
<td></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 Gold 6346, 3.10 GHz)

**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 Apr 27 08:24:27 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) Gold 6346 CPU @ 3.10GHz
- 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 : 16
  - siblings : 16
  - physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
  - physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

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

(Continued on next page)
SPEC CPU®2017 Floating Point Speed Result
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Dell Inc.

PowerEdge R650 (Intel Xeon Gold 6346, 3.10 GHz)

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

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

CPU(s): 32
On-line CPU(s) list: 0-31
Thread(s) per core: 1
Core(s) per socket: 16
Socket(s): 2
NUMA node(s): 2
Vendor ID: GenuineIntel
CPU family: 6
Model: 106
Model name: Intel(R) Xeon(R) Gold 6346 CPU @ 3.10GHz
Stepping: 6
CPU MHz: 3416.782
BogoMIPS: 6200.00
Virtualization: VT-x
L1d cache: 48K
L1i cache: 32K
L2 cache: 1280K
L3 cache: 36864K
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 pdpe1gb rdtscp
lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid
aperfmprf 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 ablp lal_m abm fmlbf cplmp pfense cpuid pbmt cat13
invpcid_single intel_psep ssbd mba ibrs ibpb stibp ibrs_enhanced fsbgbase tsc_adjust bmi1 hle avx2
smep bmi2 erms invpccid cm qm rdt_a avx512f avx512dq rdseed adx smap avx512ifma
clfushopt clwb intel_pt avx512cd sha ni avx512bw avx512vl xsaveopt xsaves xgetbv1
xsaves cmq_occuq llc cmq_mbm_total cmq_mbm_local split_lock detect wbinvd
md yde ida arat pln pts avx512vbmni umip pku ospke avx512_vbmi2 gfni vaes vpclmulqdq
avx512_vnni avx512_bitalg tme avx512_vpopcntdq la57 rdpid md_clear pconfig flush_l1d
arch_capabilities

/platform/cpuinfo cache data
  cache size : 36864 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: 250185 MB
  node 0 free: 236434 MB
  node 1 cpus: 1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
  node 1 size: 251043 MB
  node 1 free: 255471 MB
  node distances:

(Continued on next page)
Dell Inc.

PowerEdge R650 (Intel Xeon Gold 6346, 3.10 GHz)

SPECspeed®2017_fp_base = 173
SPECspeed®2017_fp_peak = 177

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<th>Test Date: Apr-2021</th>
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<td>Hardware Availability: May-2021</td>
</tr>
<tr>
<td>Tested by: Dell Inc.</td>
<td>Software Availability: Feb-2021</td>
</tr>
</tbody>
</table>

**Platform Notes (Continued)**

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

From /proc/meminfo
MemTotal:       527815564 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): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2018-3639 (Speculative Store Bypass): Mitigation: usercopy/swapsgs barriers and __user pointer sanitization
CVE-2017-5753 (Spectre variant 1): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling
CVE-2017-5715 (Spectre variant 2): Not affected
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort): Not affected

(Continued on next page)
Paper:

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

**Dell Inc.**

**PowerEdge R650 (Intel Xeon Gold 6346, 3.10 GHz)**

- **SPECspeed®2017_fp_base** = 173
- **SPECspeed®2017_fp_peak** = 177

---

**Platform Notes (Continued)**

- **run-level 5** Apr 27 04:34
- **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
  - 9x 00AD063200AD HMAA4GR7AJR8N-XN 32 GB 2 rank 3200
  - 16x Not Specified Not Specified

**BIOS:**
- **BIOS Vendor:** Dell Inc.
- **BIOS Version:** 1.1.2
- **BIOS Date:** 04/09/2021
- **BIOS Revision:** 1.1

(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)```

---
Dell Inc.

PowerEdge R650 (Intel Xeon Gold 6346, 3.10 GHz)

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Tested by: Dell Inc.

Test Date: Apr-2021
Hardware Availability: May-2021
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Compiler Version Notes (Continued)

==============================================================================
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.
==============================================================================
C++, C, Fortran | 607.cactuBSSN_s(base, peak)
==============================================================================
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.
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.
Intel(R) Fortran 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.
==============================================================================
Fortran         | 603.bwaves_s(base, peak) 649.fotonik3d_s(base, peak)
               | 654.roms_s(base, peak)
==============================================================================
Intel(R) Fortran 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.
==============================================================================
Fortran, C     | 621.wrf_s(base, peak) 627.cam4_s(base, peak)
               | 628.pop2_s(base, peak)
==============================================================================
Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on

(Continued on next page)
Dell Inc.
PowerEdge R650 (Intel Xeon Gold 6346, 3.10 GHz)

**SPECspeed**
- **SPECspeed®2017_fp_base = 173**
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**CPU2017 License:** 55
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**Hardware Availability:** May-2021
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**Software Availability:** Feb-2021

---

### 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

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

**PowerEdge R650 (Intel Xeon Gold 6346, 3.10 GHz)**

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**Software Availability:** Feb-2021

---

### 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`  
- `-gopenmp`  
- `-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`  
- `-no-prec-div`  
- `-qopt-prefetch`  
- `-ffinite-math-only`  
- `-qopt-mem-layout-trans=4`  
- `-gopenmp`  
- `-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`  
- `-no-prec-div`  
- `-qopt-prefetch`  
- `-ffinite-math-only`  
- `-qopt-mem-layout-trans=4`  
- `-gopenmp`  
- `-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 Gold 6346, 3.10 GHz)**

<table>
<thead>
<tr>
<th>SPECspeed®2017_fp_base = 173</th>
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<tr>
<td>SPECspeed®2017_fp_peak = 177</td>
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**CPU2017 License:** 55  
**Test Sponsor:** Dell Inc.  
**Tested by:** Dell Inc.

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

---

#### Peak Optimization Flags

**C benchmarks:**

- 619.lbm_s: basepeak = yes
- 638.imagick_s: basepeak = yes

**Fortran benchmarks:**

- 603.bwaves_s: -m64 -Wl,-z,muldefs -prof-gen(pass1) -prof-use(pass2) -DSPEC_SUPPRESS_OPENMP -DSPEC_OPENMP -ipo -xCORE-AVX512 -O3 -no-prec-div -ffinite-math-only -qopt-mem-layout-trans=4 -gopenmp -nostandard-realloc-lhs -mbranches-within-32B-boundaries -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc
- 649.fotonik3d_s: Same as 603.bwaves_s
- 654.roms_s: basepeak = yes

**Benchmarks using both Fortran and C:**

- 621.wrf_s: -m64 -std=c11 -Wl,-z,muldefs -prof-gen(pass1) -prof-use(pass2) -ipo -xCORE-AVX512 -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -gopenmp -DSPEC_SUPPRESS_OPENMP -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
## SPEC CPU®2017 Floating Point Speed Result

### Dell Inc.

**PowerEdge R650 (Intel Xeon Gold 6346, 3.10 GHz)**

<table>
<thead>
<tr>
<th>SPECspeed®2017_fp_base</th>
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<tbody>
<tr>
<td>SPECspeed®2017_fp_peak</td>
<td>177</td>
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</tbody>
</table>

| CPU2017 License: | 55 |
| Test Sponsor:   | Dell Inc. |
| Tested by:      | Dell Inc. |
| Test Date:      | Apr-2021 |
| Hardware Availability: | May-2021 |
| Software Availability: | Feb-2021 |

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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