# SPEC CPU®2017 Floating Point Speed Result

Dell Inc.
PowerEdge C6520 (Intel Xeon Silver 4310T, 2.30 GHz)

<table>
<thead>
<tr>
<th>Test Date:</th>
<th>May-2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware Availability:</td>
<td>Apr-2021</td>
</tr>
<tr>
<td>Software Availability:</td>
<td>Dec-2020</td>
</tr>
</tbody>
</table>

| SPECspeed®2017_fp_base | 106 |
| SPECspeed®2017_fp_peak | 108 |

## Threads
- **Threads**
  - **603.bwaves_s**: 20
  - **607.cactuBSSN_s**: 20
  - **619.lbm_s**: 20
  - **621.wrf_s**: 20
  - **627.cam4_s**: 20
  - **628.pop2_s**: 20
  - **638.imagick_s**: 20
  - **644.nab_s**: 20
  - **649.fotonik3d_s**: 20
  - **654.roms_s**: 20

## Hardware
- **CPU Name**: Intel Xeon Silver 4310T
- **Max MHz**: 3400
- **Nominal**: 2300
- **Enabled**: 20 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**: 15 MB I+D on chip per chip
- **Other**: None
- **Memory**: 1 TB (16 x 64 GB 2Rx4 PC4-3200AA-R, running at 2666)
- **Storage**: 125 GB on tmpfs
- **Other**: None

## Software
- **OS**: Red Hat Enterprise Linux 8.2 (Ootpa) 4.18.0-193.el8.x86_64
- **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 1.1.3 released Apr-2021
- **File System**: tmpfs
- **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 and OS set to prefer performance at the cost of additional power usage.
Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Base Seconds</th>
<th>Base Ratio</th>
<th>Peak Seconds</th>
<th>Peak Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>603.bwaves_s</td>
<td>20</td>
<td>138</td>
<td>429</td>
<td>138</td>
<td>427</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>20</td>
<td><strong>133</strong></td>
<td>125</td>
<td>132</td>
<td>126</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>20</td>
<td>63.7</td>
<td><strong>82.3</strong></td>
<td>63.6</td>
<td>82.4</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>20</td>
<td><strong>127</strong></td>
<td>104</td>
<td>126</td>
<td>105</td>
</tr>
<tr>
<td>627.cam4_s</td>
<td>20</td>
<td>138</td>
<td>64.2</td>
<td>138</td>
<td>64.2</td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>20</td>
<td>168</td>
<td>70.8</td>
<td>168</td>
<td>70.5</td>
</tr>
<tr>
<td>638.imagick_s</td>
<td>20</td>
<td>200</td>
<td><strong>72.0</strong></td>
<td>200</td>
<td>72.2</td>
</tr>
<tr>
<td>641.nab_s</td>
<td>20</td>
<td>106</td>
<td><strong>97.4</strong></td>
<td>101</td>
<td>97.6</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/cpu2017-1.1.7-ic2021.1/lib/intel64:/mnt/ramdisk/cpu2017-1.1.7-ic2021.1/je5.0.1-64"
MALLOC_CONF = "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

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
General Notes (Continued)

Filesystem page cache synced and cleared with:
`sync; echo 3>/proc/sys/vm/drop_caches`


Benchmark run from a 125 GB ramdisk created with the cmd: "mount -t tmpfs -o size=125G 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/cpu2017-1.1.7-ic2021.1/bin/sysinfo
Rev: r6538 of 2020-09-24 e8664e66d2d7080afeaa89d4b38e2f1c running on localhost.localdomain Mon May 24 12:11:40 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 4310T CPU @ 2.30GHz
- 2 "physical id"s (chips)
- 20 "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 : 10
- siblings : 10
- physical 0: cores 0 1 2 3 4 5 6 7 8 9
- physical 1: cores 0 1 2 3 4 5 6 7 8 9

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

(Continued on next page)
Dell Inc.
PowerEdge C6520 (Intel Xeon Silver 4310T, 2.30 GHz)

SPECspeed\textsuperscript{\textregistered}2017\_fp\_base = 106
SPECspeed\textsuperscript{\textregistered}2017\_fp\_peak = 108

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

<table>
<thead>
<tr>
<th>Platform Notes (Continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byte Order:  Little Endian</td>
</tr>
<tr>
<td>CPU(s): 20</td>
</tr>
<tr>
<td>On-line CPU(s) list: 0-19</td>
</tr>
<tr>
<td>Thread(s) per core: 1</td>
</tr>
<tr>
<td>Core(s) per socket: 10</td>
</tr>
<tr>
<td>Socket(s): 2</td>
</tr>
<tr>
<td>NUMA node(s): 2</td>
</tr>
<tr>
<td>Vendor ID: GenuineIntel</td>
</tr>
<tr>
<td>CPU family: 6</td>
</tr>
<tr>
<td>Model: 106</td>
</tr>
<tr>
<td>Model name: Intel(R) Xeon(R) Silver 4310T CPU @ 2.30GHz</td>
</tr>
<tr>
<td>Stepping: 6</td>
</tr>
<tr>
<td>CPU MHz: 3170.092</td>
</tr>
<tr>
<td>BogoMIPS: 4600.00</td>
</tr>
<tr>
<td>Virtualization: VT-x</td>
</tr>
<tr>
<td>L1d cache: 48K</td>
</tr>
<tr>
<td>L1i cache: 32K</td>
</tr>
<tr>
<td>L2 cache: 1280K</td>
</tr>
<tr>
<td>L3 cache: 15360K</td>
</tr>
<tr>
<td>NUMA node0 CPU(s): 0-9</td>
</tr>
<tr>
<td>NUMA node1 CPU(s): 10-19</td>
</tr>
<tr>
<td>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 aperfmperf pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtrnr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault ebcat_13 invpcid_single ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm cqm rdt_a avx512f avx512dq rdseed adx smap avx512ifma clflushopt clwb intel_pt avx512cd sha ni avx512bw avx512vl xsaveopt xsaves cqm llc cqm_occup_llc cqm_mbm_total cqm_mbm_local wbinvd dtherm ida arat pln pts avx512vnni umip pku ospke avx512_vbmi2 gfi vaes vpclmulqdq avx512_vnni avx512_vbitalg tme avx512_vpopcntdq la57 rdpid md_clear pconfig flush_l1d arch_capabilities</td>
</tr>
<tr>
<td>/proc/cpuinfo cache data</td>
</tr>
<tr>
<td>cache size : 15360 KB</td>
</tr>
</tbody>
</table>

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 1 2 3 4 5 6 7 8 9
node 0 size: 515460 MB
node 0 free: 499809 MB
node 1 cpus: 10 11 12 13 14 15 16 17 18 19
node 1 size: 516090 MB
node 1 free: 515422 MB

(Continued on next page)
Dell Inc.
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SPECspeed\textsuperscript{®}2017\_fp\_peak = 108
SPECspeed\textsuperscript{®}2017\_fp\_base = 106

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

Test Date: May-2021
Hardware Availability: Apr-2021
Software Availability: Dec-2020

Platform Notes (Continued)

node distances:
node 0 1
 0: 10 20
 1: 20 10

From /proc/meminfo
MemTotal: 1056308084 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="8.2 (Ootpa)"
    ID="rhel"
    ID_LIKE="fedora"
    VERSION_ID="8.2"
    PLATFORM_ID="platform:el8"
    PRETTY_NAME="Red Hat Enterprise Linux 8.2 (Ootpa)"
    ANSI_COLOR="0;31"
  redhat-release: Red Hat Enterprise Linux release 8.2 (Ootpa)
  system-release: Red Hat Enterprise Linux release 8.2 (Ootpa)
  system-release-cpe: cpe:/o:redhat:enterprise_linux:8.2:ga

uname -a:
  Linux localhost.localdomain 4.18.0-193.el8.x86_64 #1 SMP Fri Mar 27 14:35:58 UTC 2020
  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):
No status reported

CVE-2019-11135 (TSX Asynchronous Abort):
Not affected

(Continued on next page)
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| SPECspeed\(^\circ\)2017\_fp\_base | 106 |
| SPECspeed\(^\circ\)2017\_fp\_peak | 108 |

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

**Platform Notes (Continued)**

run-level 3 May 24 09:14

SPEC is set to: /mnt/ramdisk/cpu2017-1.1.7-ic2021.1  
Filesystem Type Size Used Avail Use% Mounted on  
tmpfs tmpfs 125G 11G 115G 9% /mnt/ramdisk

From /sys/devices/virtual/dmi/id  
Vendor: Dell Inc.  
Product: PowerEdge C6520  
Product Family: PowerEdge  
Serial: SDPT078

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: 16x 00AD063200AD HMAA8GR7AjiR4N-XN 64 GB 2 rank 3200, configured at 2666

BIOS:  
BIOS Vendor: Dell Inc.  
BIOS Version: 1.1.3  
BIOS Date: 04/27/2021  
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)
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CPU2017 License: 55  
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<tr>
<th>C</th>
<th>644.nab_s(peak)</th>
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<tr>
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<tr>
<th>C++, C, Fortran</th>
<th>607.cactuBSSN_s(base, peak)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Intel(R) C++ Intel(R) 64 Compiler Classic for applications running on Intel(R) 64, Version 2021.1 Build 20201112_000000</td>
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<th>Fortran, C</th>
<th>603.bwaves_s(base, peak) 649.fotonik3d_s(base, peak) 654.roms_s(base, peak)</th>
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<tr>
<th>Fortran</th>
<th>621.wrf_s(base, peak) 627.cam4_s(base, peak) 628.pop2_s(base, peak)</th>
</tr>
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<tr>
<td></td>
<td>Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on Intel(R) 64, Version 2021.1 Build 20201112_000000</td>
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CPU2017 License: 55  
Test Sponsor: Dell Inc.  
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Compiler Version Notes (Continued)

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  
- 628.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)
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Base Optimization Flags (Continued)

Fortran benchmarks:
-m64 -Wl,-z,muldefs -DSPEC_OPENMP -xCORE-AVX512 -ipo -03
-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 -03 -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 -03 -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
<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>619.lbm_s</td>
<td>--m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math</td>
</tr>
<tr>
<td></td>
<td>-ffilto -mfpmath=sse -funroll-loops -fiopenmp</td>
</tr>
<tr>
<td></td>
<td>-DSPEC_OPENMP -qopt-mem-layout-trans=4</td>
</tr>
<tr>
<td></td>
<td>-fimf-accuracy-bits=14:sqrt</td>
</tr>
<tr>
<td></td>
<td>-mbranches-within-32B-boundaries</td>
</tr>
<tr>
<td></td>
<td>-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>-m64 -std=c11 -Wl,-z,muldefs -prof-gen(pass 1)</td>
</tr>
<tr>
<td></td>
<td>-ipo -xCORE-AVX512 -O3 -no-prec-div</td>
</tr>
<tr>
<td></td>
<td>-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4</td>
</tr>
<tr>
<td></td>
<td>-DSPEC_SUPPRESS_OPENMP -qopenmp -DSPEC_OPENMP</td>
</tr>
<tr>
<td></td>
<td>-mbranches-within-32B-boundaries</td>
</tr>
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<td></td>
<td>-nostandard-realloc-lhs</td>
</tr>
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<td></td>
<td>-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc</td>
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<tr>
<td>627.cam4_s</td>
<td>-m64 --std=c11 -Wl,-z,muldefs -prof-gen(pass 1)</td>
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<tr>
<td></td>
<td>-ipo -xCORE-AVX512 -O3 -no-prec-div</td>
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<td>-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4</td>
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<td>-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc</td>
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</tbody>
</table>

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
Dell Inc.
PowerEdge C6520 (Intel Xeon Silver 4310T, 2.30 GHz)

SPECspeed\textsuperscript{\textcopyright}2017\_fp\_base = 106
SPECspeed\textsuperscript{\textcopyright}2017\_fp\_peak = 108

| CPU\textsuperscript{\textcopyright}2017 License: | 55 |
| Test Sponsor: | Dell Inc. |
| Tested by: | Dell Inc. |
| Test Date: | May-2021 |
| Hardware Availability: | Apr-2021 |
| Software Availability: | Dec-2020 |

For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

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