## Dell Inc.

**PowerEdge R440 (Intel Xeon Gold 5218R, 2.10 GHz)**

| SPECspeed®2017_fp_base | 124 |
| SPECspeed®2017_fp_peak | 126 |

### Hardware

- **CPU Name:** Intel Xeon Gold 5218R  
  - Max MHz: 4000  
  - Nominal: 2100  
  - Enabled: 40 cores, 2 chips  
  - 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: 27.5 MB I+D on chip per core  
  - Other: None  
  - Memory: 384 GB (12 x 32 GB 2Rx4 PC4-3200AA-R, running at 2666)  
  - Storage: 1 x 1.92 TB SATA SSD  
  - Other: None

### Software

- **OS:** Red Hat Enterprise Linux 8.1  
  - kernel 4.18.0-147.el8.x86_64  
  - Parallel: Yes  
  - 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: None  
  - Power Management: jemalloc memory allocator V5.0.1  
  - BIOS set to prefer performance at the cost of additional power usage.

### Test Details

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

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<tr>
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<th>SPECspeed®2017_fp_peak</th>
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<td>146</td>
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<td>607.cactuBSSN_s</td>
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<td>619.lbm_s</td>
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<td>628.pop2_s</td>
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<td>644.nab_s</td>
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<td>649.fotonik3d_s</td>
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## Dell Inc.

PowerEdge R440 (Intel Xeon Gold 5218R, 2.10 GHz)

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<tr>
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<th>Threads</th>
<th>Base Threads</th>
<th>Base Seconds</th>
<th>Base Ratio</th>
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<td>57.3 91.3</td>
<td>60.8 86.2</td>
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<td>40</td>
<td>78.9 221</td>
<td>79.0 221</td>
<td><strong>78.9</strong> 221</td>
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<td>40</td>
<td>116 78.8</td>
<td>110 83.0</td>
<td><strong>114</strong> 80.2</td>
<td>40</td>
<td>110 82.7</td>
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<td>138 114</td>
<td>141 111</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

### Submit Notes

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 = "/home/cpu2017/lib/intel64:/home/cpu2017/je5.0.1-64"
- MALLOC_CONF = "retain:true"
- OMP_STACKSIZE = "192M"

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)
General Notes (Continued)

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 disabled
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 295195f888a3d7ed16e46a485a0011
running on localhost.localdomain Sun Jul 12 08:18:09 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

From /proc/cpuinfo
  model name : Intel(R) Xeon(R) Gold 5218R CPU @ 2.10GHz
  2 "physical id"s (chips)
  40 "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 : 20

(Continued on next page)
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**Test Sponsor:** Dell Inc.  
**Tested by:** Dell Inc.  
**Test Date:** May-2020  
**Hardware Availability:** Feb-2020  
**Software Availability:** Apr-2020

### Platform Notes (Continued)

```plaintext
siblings: 20
physical 0: cores 0 1 2 3 4 8 9 10 11 12 16 17 18 19 20 24 25 26 27 28
physical 1: cores 0 1 2 3 4 8 9 10 11 12 16 17 18 19 20 24 25 26 27 28

From lscpu:
- Architecture: x86_64
- CPU op-mode(s): 32-bit, 64-bit
- Byte Order: Little Endian
- CPU(s): 40
- On-line CPU(s) list: 0-39
- Core(s) per socket: 20
- Socket(s): 2
- NUMA node(s): 2
- Vendor ID: GenuineIntel
- CPU family: 6
- Model: 85
- Model name: Intel(R) Xeon(R) Gold 5218R CPU @ 2.10GHz
- Stepping: 7
- CPU MHz: 3655.347
- CPU max MHz: 4000.0000
- CPU min MHz: 800.0000
- BogoMIPS: 4200.00
- Virtualization: VT-x
- L1d cache: 32K
- L1i cache: 32K
- L2 cache: 1024K
- L3 cache: 28160K
- NUMA node0 CPU(s): 0,2,4,6,8,10,12,14,16,18,20,22,24,26,28,30,32,34,36,38
- NUMA nodel CPU(s): 1,3,5,7,9,11,13,15,17,19,21,23,25,27,29,31,33,35,37,39
- 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 aperfforf 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 pdpct tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb cat_l3 cdp_l3 invpcid_single intel_pmm ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnni fpxprecies ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 ibrx invpcid rdmsq mpx rdtd a avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd avx512bw avx512vl xsaves xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occuup_l1c cqm_mbb_total cqm_mbb_local dtherm ida at npl pts pku ospke avx512_vnni md_clear flush_lld arch_capabilities
```

From numactl --hardware WARNING: a numactl 'node' might or might not correspond to a

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

- 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 32 34 36 38
    - node 0 size: 192073 MB
    - node 0 free: 184363 MB
    - node 1 cpus: 1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39
    - node 1 size: 193505 MB
    - node 1 free: 192421 MB
    - node distances:
      - node 0: 10 21
      - node 1: 21 10

- From `/proc/meminfo`
  - MemTotal:  394833816 kB
  - HugePages_Total:  0
  - Hugepagesize:  2048 kB

- From `/etc/*release* /etc/*version*`
  - os-release:
    - NAME="Red Hat Enterprise Linux"
    - VERSION="8.1 (Ootpa)"
    - ID="rhel"
    - ID_LIKE="fedora"
    - VERSION_ID="8.1"
    - PLATFORM_ID="platform:el8"
    - PRETTY_NAME="Red Hat Enterprise Linux 8.1 (Ootpa)"
    - ANSI_COLOR="0;31"
  - redhat-release: Red Hat Enterprise Linux release 8.1 (Ootpa)
  - system-release: Red Hat Enterprise Linux release 8.1 (Ootpa)
  - system-release-cpe: cpe:/o:redhat:enterprise_linux:8.1:ga

- `uname -a`:
  - Linux localhost.localdomain 4.18.0-147.el8.x86_64 #1 SMP Thu Sep 26 15:52:44 UTC 2019
  - x86_64 x86_64 x86_64 GNU/Linux

- Kernel self-reported vulnerability status:
  - 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/swapgs barriers and __user pointer sanitization
  - CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling
Platform Notes (Continued)

run-level 3 Jul 12 03:54 last=5

SPEC is set to: /home/cpu2017

Filesystem Type Size Used Avail Use% Mounted on
/dev/mapper/rhel-home xfs 1.7T  29G  1.7T  2% /home

From /sys/devices/virtual/dmi/id
BIOS: Dell Inc. 2.7.7 05/06/2020
Vendor: Dell Inc.
Product: PowerEdge R440
Product Family: PowerEdge
Serial: F9TD613

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:
12x 002C069D002C 36ASF4G72PZ-3G2E2 32 GB 2 rank 3200
4x Not Specified Not Specified

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
C               | 619.lbm_s(base, peak) 638.imagick_s(base, peak)
| 644.nab_s(base, peak)
==============================================================================
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.1.1.217 Build 20200306
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
==============================================================================
C++, C, Fortran | 607.cactuBSSN_s(base, peak)
-----------------------------------------------------------------------------
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.1.1.217 Build 20200306
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.1.1.217 Build 20200306
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
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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### Dell Inc.

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<th>SPECspeed®2017_fp_base = 124</th>
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### Compiler Version Notes (Continued)

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

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<tr>
<th>Fortran</th>
<th>603.bwaves_s(base, peak) 649.fotonik3d_s(base, peak) 654.roms_s(base, peak)</th>
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### 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`

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

Dell Inc.

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Base Portability Flags (Continued)

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-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP
-mbranches-within-32B-boundaries

Fortran benchmarks:
-m64 -Wl,-z,muldefs -DSPEC_OPENMP -xCORE-AVX2 -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-AVX2 -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-AVX2 -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:
	icc

Fortran benchmarks:
	ifort

(Continued on next page)
Peak Compiler Invocation (Continued)

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

Peak Optimization Flags

C benchmarks:

619.lbm_s: basepeak = yes

638.imagick_s: basepeak = yes

644.nab_s: -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -gopenmp -DSPEC_OPENMP

-mbranches-within-32B-boundaries -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Fortran benchmarks:

603.bwaves_s: -m64 -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2)
-DSPEC_SUPPRESS_OPENMP -DSPEC_OPENMP -ipo -xCORE-AVX2 -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

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(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4

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Peak Optimization Flags (Continued)

621.wrf_s (continued):
-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.cactusBSSN_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-ic19.1u1-official-linux64_revA.xml

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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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