# SPEC CPU®2017 Integer Rate Result

## Dell Inc.

**PowerEdge R540 (Intel Xeon Gold 5218R, 2.10 GHz)**

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

### Test Date: Jun-2020
### Hardware Availability: Feb-2020
### Software Availability: Apr-2020

### SPECrate®2017_int_base = 230
### SPECrate®2017_int_peak = 238

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### Hardware

- **CPU Name:** Intel Xeon Gold 5218R
- **Max MHz:** 4000
- **Nominal:** 2100
- **Enabled:** 40 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:** 27.5 MB I+D on chip per chip
- **Other:** None
- **Memory:** 384 GB (12 x 32 GB 2Rx4 PC4-2933V-R, running at 2666)
- **Storage:** 1 x 480 GB SATA SSD
- **Other:** None

### Software

- **OS:** Red Hat Enterprise Linux 8.2
  kernel 4.18.0-193.el8.x86_64
- **Compiler:** C/C++: Version 19.1.1.217 of Intel C/C++ Compiler for Linux;
  Fortran: Version 19.1.1.217 of Intel Fortran Compiler for Linux
- **Parallel:** No
- **Firmware:** Version 2.7.7 released May-2020
- **File System:** xfs
- **System State:** Run level 3 (multi-user)
- **Base Pointers:** 64-bit
- **Peak Pointers:** 32/64-bit
- **Other:** jemalloc memory allocator V5.0.1
- **Power Management:** BIOS set to prefer performance at the cost of additional power usage.
Dell Inc.

PowerEdge R540 (Intel Xeon Gold 5218R, 2.10 GHz)

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Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

Compiler Notes
The inconsistent Compiler version information under Compiler Version section is due to a discrepancy in Intel Compiler. The correct version of C/C++ compiler is: Version 19.1.1.217 Build 20200306 Compiler for Linux
The correct version of Fortran compiler is: Version 19.1.1.217 Build 20200306 Compiler for Linux

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"

Environment Variables Notes
Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = 
    "/home/cpu2017-ic19.1u1/lib/intel64:/home/cpu2017-ic19.1u1/lib/ia32:/home/cpu2017-ic19.1u1/je5.0.1-32"
MALLOCONF = "retain:true"
Dell Inc. PowerEdge R540 (Intel Xeon Gold 5218R, 2.10 GHz) SPECrate®2017_int_base = 230
SPECrate®2017_int_peak = 238

CPU2017 License: 55
Test Date: Jun-2020
Test Sponsor: Dell Inc.
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Software Availability: Apr-2020

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
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 set to standard
Logical Processor enabled
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-ic19.1u1/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7edbl1e6e46a435a0011
running on RHEL-8-2-SUT Thu Jun 18 16:14:37 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

(Continued on next page)
Platform Notes (Continued)

From /proc/cpuinfo
model name : Intel(R) Xeon(R) Gold 5218R CPU @ 2.10GHz
  2 "physical id"s (chips)
  80 "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
siblings : 40
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):              80
On-line CPU(s) list: 0-79
Thread(s) per core:  2
Core(s) per socket:  20
Socket(s):           2
NUMA node(s):        4
Vendor ID:           GenuineIntel
CPU family:          6
Model:               85
Model name:          Intel(R) Xeon(R) Gold 5218R CPU @ 2.10GHz
Stepping:            7
CPU MHz:             1942.111
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):   0,4,8,12,16,20,24,28,32,36,40,44,48,52,56,60,64,68,72,76
NUMA node1 CPU(s):   1,5,9,13,17,21,25,29,33,37,41,45,49,53,57,61,65,69,73,77
NUMA node2 CPU(s):   2,6,10,14,18,22,26,30,34,38,42,46,50,54,58,62,66,70,74,78
NUMA node3 CPU(s):   3,7,11,15,19,23,27,31,35,39,43,47,51,55,59,63,67,71,75,79
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
aperfmpref pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16
xtral pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave
avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb cat_l3 cdp_l3
invpcid_single intel_pinn ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi
flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm

(Continued on next page)
## Dell Inc.

### PowerEdge R540 (Intel Xeon Gold 5218R, 2.10 GHz)

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### Platform Notes (Continued)

```
cqm mpx rdt_a avx512f avx512dq rseed adx smap clflushopt clwb intel_pt avx512cd
avx512bw avx512vl xsaveopt xsaves cqm_llc cqm_occult_llc cqm_mbm_total

/proc/cpuinfo cache data
cache size : 28160 KB
```

From `numactl --hardware`  WARNING: a numactl 'node' might or might not correspond to a physical chip.

```
  available: 4 nodes (0-3)
  node 0 cpus: 0 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72 76
  node 0 size: 95277 MB
  node 0 free: 85736 MB
  node 1 cpus: 1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 65 69 73 77
  node 1 size: 96763 MB
  node 1 free: 96165 MB
  node 2 cpus: 2 6 10 14 18 22 26 30 34 38 42 46 50 54 58 62 66 70 74 78
  node 2 size: 96763 MB
  node 2 free: 96587 MB
  node 3 cpus: 3 7 11 15 19 23 27 31 35 39 43 47 51 55 59 63 67 71 75 79
  node 3 size: 96762 MB
  node 3 free: 96582 MB
  node distances:
  node 0 1 2 3
  0: 10 21 11 21
  1: 21 10 21 11
  2: 11 21 10 21
  3: 21 11 21 10
```

```
From /proc/meminfo
MemTotal: 394821456 kB
HugePages_Total: 0
Hugepagesize: 2048 kB
```

```
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)
```

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### Dell Inc.

PowerEdge R540 (Intel Xeon Gold 5218R, 2.10 GHz)

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CPU2017 License: 55  
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### Platform Notes (Continued)

```
uname -a:
    Linux RHEL-8-2-SUT 4.18.0-193.el8.x86_64 #1 SMP Fri Mar 27 14:35:58 UTC 2020 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

    itlb_multihit:                        KVM: Vulnerable
    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
    tsx_async_abort:                     Mitigation: Clear CPU buffers; SMT vulnerable

run-level 3 Jun 18 16:14 last=5

SPEC is set to: /home/cpu2017-ic19.1u1
    Filesystem            Type  Size  Used Avail Use% Mounted on
    /dev/mapper/rhel-home xfs   392G  7.0G  385G   2% /home

From /sys/devices/virtual/dmi/id
    BIOS:    Dell Inc. 2.7.7 05/06/2020
    Vendor:  Dell Inc.
    Product: PowerEdge R540
    Product Family: PowerEdge

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:
    1x 00AD00B300AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933
    6x 00AD063200AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933
    5x 00AD069D00AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933
    4x Not Specified Not Specified

(End of data from sysinfo program)
Dell Inc.  
PowerEdge R540 (Intel Xeon Gold 5218R, 2.10 GHz)  

SPECFISC®2017 Integer Rate Result  

Copyright 2017-2020 Standard Performance Evaluation Corporation

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PowerEdge R540 (Intel Xeon Gold 5218R, 2.10 GHz)  

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Compiler Version Notes

==============================================================================
C         | 502.gcc_r(peak) 
Intel(R) C Compiler for applications running on IA-32, Version 2021.1 NextGen Build 20200304  
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
==============================================================================

Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1 NextGen Build 20200304  
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

Intel(R) C 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 Compiler for applications running on IA-32, Version 2021.1 NextGen Build 20200304  
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Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

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C       | 502.gcc_r(peak)
-----------------------------
Intel(R) C Compiler for applications running on IA-32, Version 2021.1 NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

C       | 500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base, peak) 525.x264_r(base, peak) 557.xz_r(base)
-----------------------------
Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1 NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

C       | 500.perlbench_r(peak) 557.xz_r(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++     | 520.omnetpp_r(base, peak) 523.xalancbmk_r(base, peak) 531.deepsjeng_r(base, peak) 541.leela_r(base, peak)
-----------------------------
Intel(R) C++ Compiler for applications running on Intel(R) 64, Version 2021.1 NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

Fortran | 548.exchange2_r(base, peak)
-----------------------------
Intel(R) Fortran 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.
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## Base Compiler Invocation

C benchmarks:
- `icc`

C++ benchmarks:
- `icpc`

Fortran benchmarks:
- `ifort`

## Base Portability Flags

```text
500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
502.gcc_r: -DSPEC_LP64
505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
523.xalancbmk_r: -DSPEC_LP64 -DSPEC_LINUX
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541.leela_r: -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64
```

## Base Optimization Flags

**C benchmarks:**
- `-m64 -qnextgen -std=c11`
- `-Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs`
- `xCORE-AVX512 -O3 -ffast-math -flto -mfpmath=sse -funroll-loops`
- `-fuse-ld=gold -qopt-mem-layout-trans=4`
- `-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin`
- `-lqkmalloc`

**C++ benchmarks:**
- `-m64 -qnextgen -Wl,-plugin-opt=-x86-branches-within-32B-boundaries`
- `-Wl,-z,muldefs -xCORE-AVX512 -O3 -ffast-math -flto -mfpmath=sse`
- `-funroll-loops -fuse-ld=gold -qopt-mem-layout-trans=4`
- `-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin`
- `-lqkmalloc`

**Fortran benchmarks:**
- `-m64 -Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs`
- `xCORE-AVX512 -O3 -ipo -no-prec-div -qopt-mem-layout-trans=4`

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

Fortran benchmarks (continued):
- nostandard-realloc-lhs
- align array32byte
- m.branches-within-32B-boundaries
- L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
  - lqkmalloc

Peak Compiler Invocation

C benchmarks:
icc

C++ benchmarks:
icpc

Fortran benchmarks:
ifort

Peak Portability Flags

500.perlbench: -DSPEC_LP64 -DSPEC_LINUX_X64
502.gcc: -D_FILE_OFFSET_BITS=64
505.mcf: -DSPEC_LP64
520.omnetpp: -DSPEC_LP64
523.xalancbmk: -DSPEC_LP64 -DSPEC_LINUX
525.x264: -DSPEC_LP64
531.deepsjeng: -DSPEC_LP64
541.leela: -DSPEC_LP64
548.exchange2: -DSPEC_LP64
557.xz: -DSPEC_LP64

Peak Optimization Flags

C benchmarks:
500.perlbench: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2)
-xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4 -fno-strict-overflow
-m.branches-within-32B-boundaries
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
  - lqkmalloc

(Continued on next page)
SPEC CPU®2017 Integer Rate Result

Dell Inc.

PowerEdge R540 (Intel Xeon Gold 5218R, 2.10 GHz)

SPECrate®2017_int_base = 230
SPECrate®2017_int_peak = 238

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

Test Date: Jun-2020
Hardware Availability: Feb-2020
Software Availability: Apr-2020

Peak Optimization Flags (Continued)

502.gcc_r: -m32
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/ia32_lin
-std=gnu89
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries
-Wl,-z,muldefs -fprofile-generate(pass 1)
-fprofile-use=default.profdata(pass 2) -xCORE-AVX512 -flto
-O3 -ffast-math -qnextgen -fuse-ld=gold
-gopt-mem-layout-trans=4 -L/usr/local/jemalloc32-5.0.1/lib
-ljemalloc

505.mcf_r: basepeak = yes

525.x264_r: -m64 -qnextgen -std=c11
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries
-Wl,-z,muldefs -xCORE-AVX512 -flto -O3 -ffast-math
-fuse-ld=gold -gopt-mem-layout-trans=4 -fno-alias
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
-lqkmalloc

557.xz_r: -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-gopt-mem-layout-trans=4 -mbranches-within-32B-boundaries
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
-lqkmalloc

C++ benchmarks:

520.omnetpp_r: basepeak = yes

523.xalancbmk_r: basepeak = yes

531.deepsjeng_r: basepeak = yes

541.leela_r: basepeak = yes

Fortran benchmarks:

548.exchange2_r: basepeak = yes

The flags files that were used to format this result can be browsed at
## SPEC CPU®2017 Integer Rate Result

### Dell Inc.

**PowerEdge R540 (Intel Xeon Gold 5218R, 2.10 GHz)**

<table>
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<tr>
<th>SPECrate®2017_int_base</th>
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<tbody>
<tr>
<td>SPECrate®2017_int_peak</td>
<td>238</td>
</tr>
</tbody>
</table>

Dell Inc.

### CPU2017 License: 55

**Test Date:** Jun-2020  
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Test Sponsor: Dell Inc.  
Tested by: Dell Inc.

You can also download the XML flags sources by saving the following links:


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