SPEC CPU®2017 Integer Rate Result
Copyright 2017-2019 Standard Performance Evaluation Corporation

Dell Inc.
PowerEdge R540 (Intel Xeon Gold 5220, 2.20 GHz)

SPECrerate®2017_int_base = 202
SPECrerate®2017_int_peak = 209

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

Test Date: Sep-2019
Hardware Availability: Apr-2019
Software Availability: May-2019

| Copies | 0 | 20 | 40 | 60 | 80 | 100 | 120 | 140 | 160 | 180 | 200 | 220 | 240 | 260 | 280 | 300 | 320 | 340 | 360 | 380 | 400 | 420 |
|--------|---|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|
| 500.perlbench_r | 72 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 72 |
| 502.gcc_r | 72 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 72 |
| 505.mcf_r | 72 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 72 |
| 520.omnetpp_r | 72 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 72 |
| 523.xalancbmk_r | 72 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 72 |
| 525.x264_r | 72 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 72 |
| 531.deepsjeng_r | 72 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 72 |
| 541.leela_r | 72 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 72 |
| 548.exchange2_r | 72 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 72 |
| 557.xz_r | 72 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 72 |

SPECrerate®2017_int_base (202) SPECrerate®2017_int_peak (209)

Hardware
CPU Name: Intel Xeon Gold 5220
Max MHz: 3900
Nominal: 2200
Enabled: 36 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: 24.75 MB I+D on chip per chip
Other: None
Memory: 384 GB (12 x 32 GB 2Rx4 PC4-2933P-R, running at 2666)
Storage: 480 GB SATA SSD
Other: None

Software
OS: Ubuntu 18.04.2 LTS
4.15.0-45-generic
Compiler: C/C++: Version 19.0.4.227 of Intel C/C++ Compiler Build 20190416 for Linux;
Fortran: Version 19.0.4.227 of Intel Fortran Compiler Build 20190416 for Linux
Parallel: No
Firmware: Version 2.2.11 released Jun-2019
File System: ext4
System State: Run level 5 (multi-user)
Base Pointers: 64-bit
Peak Pointers: 32/64-bit
Other: jemalloc memory allocator V5.0.1
Power Management: --
Dell Inc. | PowerEdge R540 (Intel Xeon Gold 5220, 2.20 GHz)

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

SPECrate®2017_int_base = 202
SPECrate®2017_int_peak = 209

Results Table

<table>
<thead>
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<td>72</td>
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</tr>
</tbody>
</table>

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

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"

General Notes
Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = "/home/cpu2017/lib/intel64:/home/cpu2017/lib/ia32:/home/cpu2017/je5.0.1-32"

Binaries compiled on a system with 1x Intel Core i9-799X CPU + 32GB RAM
memory using Redhat Enterprise Linux 7.5
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>
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. jemalloc, a general purpose malloc implementation built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5 sources available from jemalloc.net or https://github.com/jemalloc/jemalloc/releases

Platform Notes

BIOS settings:
ADDCC setting disabled
Sub NUMA Cluster disabled
Virtualization Technology disabled
DCU Streamer Prefetcher 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 enabled
CPU Interconnet Bus Link Power Management disabled
PCI ASPM L1 Link Power Management disabled
Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r5974 of 2018-05-19 9bcede8f2999c33d61f64985e45859ea9
running on intel-sut Thu Sep 19 16:42:10 2019

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 5220 CPU @ 2.20GHz
  2 "physical id"s (chips)
  72 "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 : 18
siblings : 36
physical 0: cores 0 1 2 3 4 8 9 10 11 16 17 18 19 20 24 25 26 27
physical 1: cores 0 1 2 3 4 8 9 10 11 16 17 18 19 20 24 25 26 27

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 72

(Continued on next page)
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SPECrates:
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Hardware Availability: Apr-2019
Software Availability: May-2019

Platform Notes (Continued)

On-line CPU(s) list: 0-71
Thread(s) per core: 2
Core(s) per socket: 18
Socket(s): 2
NUMA node(s): 4
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Gold 5220 CPU @ 2.20GHz
Stepping: 6
CPU MHz: 2784.327
BogoMIPS: 4400.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 25344K
NUMA node0 CPU(s): 0,4,8,12,16,20,24,28,32,36,40,44,48,52,56,60,64,68
NUMA node1 CPU(s): 1,5,9,13,17,21,25,29,33,37,41,45,49,53,57,61,65,69
NUMA node2 CPU(s): 2,6,10,14,18,22,26,30,34,38,42,46,50,54,58,62,66,70
NUMA node3 CPU(s): 3,7,11,15,19,23,27,31,35,39,43,47,51,55,59,63,67,71

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 pfni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16
xtpr pdcm pclid dca sse4_1 sse4_2 x2apic movbe popcnt aes xsave avx f16c rdrand
lahf_lm abm 3dnowprefetch cpuid_fault epb cat_l3 cdp_l3 invpcid_single intel_ppl
ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vmni flexpriority ept vpid
fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm cqm mpx rdt_a avx512f
avx512dq rdseed adx clflushopt clwb intel_pt avx512cd avx512bw avx512vl
xsaveopt xsaves xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbb_total cqm_mbb_local
dtherm ida arat pln pts pkus ospke avx512_vnni flush_l1d arch_capabilities

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
node 0 size: 95147 MB
node 0 free: 94878 MB
node 1 cpus: 1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 65 69
node 1 size: 96743 MB
node 1 free: 96474 MB
node 2 cpus: 2 6 10 14 18 22 26 30 34 38 42 46 50 54 58 62 66 70
node 2 size: 96764 MB

/proc/cpuinfo cache data
  cache size : 25344 KB

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

node 2 free: 96555 MB
node 3 cpus: 3 7 11 15 19 23 27 31 35 39 43 47 51 55 59 63 67 71
node 3 size: 96763 MB
node 3 free: 96507 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: 394668432 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

```
/usr/bin/lsb_release -d
Ubuntu 18.04.2 LTS
```

From /etc/*release* /etc/*version*
debian_version: buster/sid
os-release:
  NAME="Ubuntu"
  VERSION="18.04.2 LTS (Bionic Beaver)"
  ID=ubuntu
  ID_LIKE=debian
  PRETTY_NAME="Ubuntu 18.04.2 LTS"
  VERSION_ID="18.04"
  HOME_URL="https://www.ubuntu.com/"
  SUPPORT_URL="https://help.ubuntu.com/"

```
uname -a:
Linux intel-sut 4.15.0-45-generic #48-Ubuntu SMP Tue Jan 29 16:28:13 UTC 2019 x86_64
x86_64 x86_64 GNU/Linux
```

Kernel self-reported vulnerability status:
CVE-2017-5754 (Meltdown): Not affected
CVE-2017-5753 (Spectre variant 1): Mitigation: __user pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB

run-level 5 Sep 19 16:38

SPEC is set to: /home/cpu2017

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<th>Size</th>
<th>Used</th>
<th>Avail</th>
<th>Use%</th>
<th>Mounted on</th>
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<tr>
<td>/dev/sda2</td>
<td>Ext4</td>
<td>439G</td>
<td>21G</td>
<td>396G</td>
<td>5%</td>
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</tr>
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</table>

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Platform Notes (Continued)

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.

BIOS Dell Inc. 2.2.11 06/14/2019
Memory:
12x 00AD063200AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933, configured at 2666
4x Not Specified Not Specified

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
C       | 502.gcc_r(peak)
---
Intel(R) C Intel(R) 64 Compiler for applications running on IA-32, Version
19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.
---
------------------------------------------------------------------------------
C       | 500.perlbench_r(base, peak) 502.gcc_r(base) 505.mcf_r(base, peak)
| 525.x264_r(base, peak) 557.xz_r(base, peak)
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**Compiler Version Notes (Continued)**

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Base Compiler Invocation

C benchmarks:
icc -m64 -std=c11

C++ benchmarks:
icpc -m64

Fortran benchmarks:
ifort -m64

Base Portability Flags

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
525.x264_r: -DSPEC_LP64
531.deepsjeng_r: -DSPEC_LP64
541.leela_r: -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-W1,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
-lqkmalloc

C++ benchmarks:
-W1,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
-lqkmalloc

Fortran benchmarks:
-W1,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
-lqkmalloc
Dell Inc. PowerEdge R540 (Intel Xeon Gold 5220, 2.20 GHz)  

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**Peak Compiler Invocation**

C benchmarks (except as noted below):

```
icc -m64 -std=c11
```

$02.gcc_r:icc -m32 -std=c11 -L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/ia32_lin

C++ benchmarks (except as noted below):

```
icpc  -m64
```

$23.xalancbmk_r: icpc -m32 -L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/ia32_lin

Fortran benchmarks:

```
ifort  -m64
```

**Peak Portability Flags**

```
500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
502.gcc_r: -D_FILE_OFFSET_BITS=64
505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
523.xalancbmk_r: -D_FILE_OFFSET_BITS=64 -DSPEC_LINUX
525.x264_r: -DSPEC_LP64
531.deepsjeng_r: -DSPEC_LP64
541.leela_r: -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64
```

**Peak Optimization Flags**

```
C benchmarks:
```

```
500.perlbench_r: -Wl,-z,muldefs  -prof-gen(pass 1)  -prof-use(pass 2)  -ipo
-xCORE-AVX512  -O3  -no-prec-div  -qopt-mem-layout-trans=4
-fno-strict-overflow
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
-1qkmalloc
```

```
502.gcc_r: -Wl,-z,muldefs  -prof-gen(pass 1)  -prof-use(pass 2)  -ipo
-xCORE-AVX512  -O3  -no-prec-div  -qopt-mem-layout-trans=4
-L/usr/local/je5.0.1-32/lib  -ljemalloc
```

```
505.mcf_r: -Wl,-z,muldefs  -xCORE-AVX512  -ipo  -O3  -no-prec-div
-qopt-mem-layout-trans=4
```

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

**PowerEdge R540 (Intel Xeon Gold 5220, 2.20 GHz)**

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<tr>
<th>SPEC CPU®2017 Int. Rate Result</th>
<th>SPECrate®2017_int_base = 202</th>
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**CPU2017 License:** 55  
**Test Sponsor:** Dell Inc.  
**Tested by:** Dell Inc.  
**Test Date:** Sep-2019  
**Hardware Availability:** Apr-2019  
**Software Availability:** May-2019

#### Peak Optimization Flags (Continued)

505.mcf_r (continued):
- `-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64`
- `-lqkmalloc`


557.xz_r: Same as 505.mcf_r

C++ benchmarks:


523.xalancbmk_r: `-Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=4 -L/usr/local/je5.0.1-32/lib -ljemalloc`

531.deepsjeng_r: Same as 520.omnetpp_r

541.leela_r: Same as 520.omnetpp_r

Fortran benchmarks:


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:

### Dell Inc.

PowerEdge R540 (Intel Xeon Gold 5220, 2.20 GHz)

| SPECrate®2017_int_base | 202 |
| SPECrate®2017_int_peak | 209 |

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

Test Date: Sep-2019  
Hardware Availability: Apr-2019  
Software Availability: May-2019

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Tested with SPEC CPU®2017 v1.0.5 on 2019-09-19 12:42:10-0400.  