## SPEC® CPU2017 Integer Rate Result

### Dell Inc.

**PowerEdge C6420 (Intel Xeon Gold 5222, 3.80GHz)**

<table>
<thead>
<tr>
<th>SPECrate2017_int_base</th>
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<tbody>
<tr>
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<td>66.4</td>
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</tbody>
</table>

#### Hardware

- **CPU Name:** Intel Xeon Gold 5222  
  - Max MHz: 3900  
  - Nominal: 3800  
  - Enabled: 8 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: 16.5 MB I+D on chip per chip  
  - Other: None  
  - Memory: 384 GB (12 x 32 GB 2Rx4 PC4-2933Y-R, running at 2666)  
  - Storage: 1 x 480 GB SATA SSD  
  - Other: None

#### Software

- **OS:** Ubuntu 18.04.2 LTS  
  - kernel 4.15.0-45-generic  
- **Compiler:**  
  - C/C++: Version 19.0.1.144 of Intel C/C++ Compiler Build 20181018 for Linux;  
  - Fortran: Version 19.0.1.144 of Intel Fortran Compiler Build 20181018 for Linux
- **Parallel:** No
- **Firmware:** Version 2.1.6 released Mar-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

#### Test Information

- **CPU2017 License:** 55
- **Test Sponsor:** Dell Inc.
- **Tested by:** Dell Inc.
- **Test Date:** Mar-2019
- **Hardware Availability:** Apr-2019
- **Software Availability:** Feb-2019

### Graph

The graph shows the SPECrate2017_INT results for various benchmarks run on the Dell Inc. PowerEdge C6420. Each benchmark is represented by a line that indicates its performance at different workloads. The x-axis represents the workload range, and the y-axis shows the performance score. The data points highlighted with asterisks represent the SPECrate2017_int_base, while the solid line represents the SPECrate2017_int_peak.
### Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
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</tr>
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<tbody>
<tr>
<td>500.perlbench_r</td>
<td>16</td>
<td>522</td>
<td>48.8</td>
<td>525</td>
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<td>528</td>
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<td>16</td>
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<td>55.7</td>
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</tr>
<tr>
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<td>516</td>
<td>40.7</td>
<td>514</td>
<td>40.9</td>
<td>515</td>
<td>40.8</td>
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<tr>
<td>523.xalancbmk_r</td>
<td>16</td>
<td>202</td>
<td>83.5</td>
<td>200</td>
<td>84.3</td>
<td>200</td>
<td>84.4</td>
</tr>
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<td>16</td>
<td>208</td>
<td>135</td>
<td>209</td>
<td>134</td>
<td>212</td>
<td>132</td>
</tr>
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<td>52.1</td>
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<td>16</td>
<td>559</td>
<td>47.4</td>
<td>543</td>
<td>48.8</td>
<td>542</td>
<td>48.8</td>
</tr>
<tr>
<td>548.exchange2_r</td>
<td>16</td>
<td>378</td>
<td>111</td>
<td>377</td>
<td>111</td>
<td>377</td>
<td>111</td>
</tr>
<tr>
<td>557.xz_r</td>
<td>16</td>
<td>420</td>
<td>41.1</td>
<td>421</td>
<td>41.1</td>
<td>421</td>
<td>41.0</td>
</tr>
</tbody>
</table>

**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/ia32:/home/cpu2017/lib/intel64:/home/cpu2017/je5.0.1-32:/home/cpu2017/je5.0.1-64"
```

Binaries compiled on a system with 1x Intel Core i9-7900X CPU + 32GB RAM memory using Redhat Enterprise Linux 7.5

NA: The test sponsor attests, as of date of publication, that CVE-2017-5754 (Meltdown) is mitigated in the system as tested and documented.

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
```

`numactl` command invoked through `numactl` i.e.:

```
numactl --interleave=all runcpu <etc>
```

(Continued on next page)
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**General Notes (Continued)**

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:
- ADDDC setting disabled
- Sub NUMA Cluster enabled
- Virtualization Technology disabled
- DCU Streamer Prefetcher enabled
- 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 Interconnect 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 Tue Apr 23 19:26:43 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 5222 CPU @ 3.80GHz
  - physical id"s (chips)
  - 16 "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 : 4
  - siblings : 8
  - physical 0: cores 5 8 9 13
  - physical 1: cores 2 5 8 13

From lscpu:

- Architecture: x86_64
- CPU op-mode(s): 32-bit, 64-bit
- Byte Order: Little Endian
- CPU(s): 16
- On-line CPU(s) list: 0-15

(Continued on next page)
Dell Inc.

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**Platform Notes (Continued)**

Thread(s) per core: 2
Core(s) per socket: 4
Socket(s): 2
NUMA node(s): 4
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Gold 5222 CPU @ 3.80GHz
Stepping: 6
CPU MHz: 3198.579
BogoMIPS: 7600.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 16896K
NUMA node0 CPU(s): 0,6,8,14
NUMA node1 CPU(s): 1,5,9,13
NUMA node2 CPU(s): 2,4,10,12
NUMA node3 CPU(s): 3,7,11,15
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 xtpr pdcm dca sse4_1 sse4_2 x2apic movbe popcnt aes f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb cat_l3 cdp_l3 invpcid_single ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vmvi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 ertz invpcid rtm cqm mxp rdt_a avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd avx512bw avx512vl xsaveopt xsaves xsavec xgetbv1 xsavec cqm_llc cqm_occup_llc cqm_msb_total cqm_msb_local dtherm ida arat pln pts pku 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 cpu(s): 0 6 8 14
node 0 size: 95169 MB
node 0 free: 94969 MB
node 1 cpu(s): 1 5 9 13
node 1 size: 96767 MB
node 1 free: 96565 MB
node 2 cpu(s): 2 4 10 12
node 2 size: 96767 MB
node 2 free: 96613 MB

(Continued on next page)
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Platform Notes (Continued)

node 3 cpus: 3 7 11 15  
node 3 size: 96745 MB  
node 3 free: 96550 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: 394700100 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 Apr 23 19:23

SPEC is set to: /home/cpu2017  
Filesystem Type Size Used Avail Use% Mounted on  
/dev/sda2 ext4 439G 19G 398G 5% /

Additional information from dmidecode follows. WARNING: Use caution when you interpret

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

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. 2.1.6 03/04/2019
Memory:
11x 00AD00B300AD HMA84GR7CR4N-WM 32 GB 2 rank 2933
1x 00AD063200AD HMA84GR7CR4N-WM 32 GB 2 rank 2933
4x Not Specified Not Specified

(End of data from sysinfo program)

**Compiler Version Notes**

```
CC   502.gcc_r(peak)
Intel(R) C Intel(R) 64 Compiler for applications running on IA-32, Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

CC  500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base, peak)
525.x264_r(base, peak) 557.xz_r(base, peak)
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

CC   500.perlbench_r(peak)
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

CXXC 523.xalancbmk_r(peak)
Intel(R) C++ Intel(R) 64 Compiler for applications running on IA-32, Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
```

(Continued on next page)
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### Compiler Version Notes (Continued)

Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,  
Version 19.0.1.144 Build 20181018  
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

---

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64,  
Version 19.0.1.144 Build 20181018  
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

---

### 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`
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Dell Inc.

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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_2019.1.144/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_2019.1.144/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_2019.1.144/linux/compiler/lib/intel64
-lqkmalloc

Peak Compiler Invocation

C benchmarks (except as noted below):
icc -m64 -std=c11

502gcc_r:icc -m32 -std=c11 -L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/ia32_lin

C++ benchmarks (except as noted below):
icpc -m64

523xalancbmk_r:icpc -m32 -L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/ia32_lin

Fortran benchmarks:
ifort -m64

Peak Portability Flags

500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
502gcc_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

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Peak Portability Flags (Continued)

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 -03 -no-prec-div -qopt-mem-layout-trans=4
-fno-strict-overflow
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/intel64
-lqkmalloc

502.gcc_r: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
-xCORE-AVX512 -03 -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 -03 -no-prec-div
-qopt-mem-layout-trans=4
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/intel64
-lqkmalloc

525.x264_r: -Wl,-z,muldefs -xCORE-AVX512 -ipo -03 -no-prec-div
-qopt-mem-layout-trans=4 -fno-alias
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/intel64
-lqkmalloc

557.xz_r: Same as 505.mcf_r

C++ benchmarks:

520.omnetpp_r: -Wl,-z,muldefs -xCORE-AVX512 -ipo -03 -no-prec-div
-qopt-mem-layout-trans=4
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/intel64
-lqkmalloc

523.xalancbmk_r: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
-xCORE-AVX512 -03 -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

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Peak Optimization Flags (Continued)

541.leela_r: Same as 520.omnetpp_r

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_2019.1.144/linux/compiler/lib/intel64
-lqkmalloc

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

Tested with SPEC CPU2017 v1.0.5 on 2019-04-23 15:26:43-0400.
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