Dell Inc.

PowerEdge FC640 (Intel Xeon Silver 4210, 2.20GHz)

SPEC® CPU2017 Integer Rate Result

Dell Inc.

Test Sponsor: Dell Inc.
Tested by: Dell Inc.

Hardware

CPU Name: Intel Xeon Silver 4210
Max MHz.: 3200
Nominal: 2200
Enabled: 20 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: 13.75 MB I+D on chip per core
Other: None
Memory: 384 GB (12 x 32 GB 2Rx8 PC4-2933Y-R, running at 2400)
Storage: 1 x 480 GB SATA SSD
Other: None

Software

OS: Ubuntu 18.04.2 LTS
Compiler: C/C++: Version 19.0.1.144 of Intel C/C++
Firmware: Update 2.2.2 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

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### Dell Inc.

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**CPU2017 License:** 55  
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**Results Table**

```
<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Base</th>
<th></th>
<th>Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Copies</td>
<td>Seconds</td>
<td>Ratio</td>
</tr>
<tr>
<td>500.perlbench_r</td>
<td>40</td>
<td>747</td>
<td>85.3</td>
</tr>
<tr>
<td>502.gcc_r</td>
<td>40</td>
<td>612</td>
<td>92.5</td>
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<td>152</td>
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<td>40</td>
<td>696</td>
<td>75.4</td>
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<td>209</td>
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<td>500</td>
<td>91.6</td>
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<td>40</td>
<td>798</td>
<td>83.0</td>
</tr>
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<td>40</td>
<td>543</td>
<td>193</td>
</tr>
<tr>
<td>557.xz_r</td>
<td>40</td>
<td>588</td>
<td>73.4</td>
</tr>
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</table>
```

**SPECrate2017_int_base = 111**  
**SPECrate2017_int_peak = 114**

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/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
runcpu command invoked through numactl i.e.:
numactl --interleave=all runcpu <etc>
```

(Continued on next page)
**SPEC CPU2017 Integer Rate Result**

**Dell Inc.**  
PowerEdge FC640 (Intel Xeon Silver 4210, 2.20GHz)

**SPECrate2017_int_base = 111**  
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<td>Software Availability:</td>
<td>Feb-2019</td>
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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 9bcde8f2999c33d61f64985e45859ea9  
running on intel-sut Wed May 29 19:42:33 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) Silver 4210 CPU @ 2.20GHz
        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 : 10
siblings : 20
        physical 0: cores 0 1 2 3 4 8 9 10 11 12
        physical 1: cores 0 1 2 3 4 8 9 10 11 12
```

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
```
Dell Inc.  
PowerEdge FC640 (Intel Xeon Silver 4210, 2.20GHz)  

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Platform Notes (Continued)

Thread(s) per core: 2  
Core(s) per socket: 10  
Socket(s): 2  
NUMA node(s): 2  
Vendor ID: GenuineIntel  
CPU family: 6  
Model: 85  
Model name: Intel(R) Xeon(R) Silver 4210 CPU @ 2.20GHz  
Stepping: 6  
CPU MHz: 2443.519  
BogoMIPS: 4400.00  
Virtualization: VT-x  
L1d cache: 32K  
L1i cache: 32K  
L2 cache: 1024K  
L3 cache: 14080K  
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 node1 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 pdelgb rdtscp lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpluid aperfmpref pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtrpr pdcm pcid 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 ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vmmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erts invpcid rtm cqm mpx rdt_a avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd avx512bw avx512vl xsaves cqm_1llc cqm_occup_llc cqm_mbm_total cqm_mbm_local dtmperf ida arat pln pts pku ospke avx512_vnni flush_lld arch_capabilities

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

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: 191911 MB
node 0 free: 191240 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: 193531 MB
node 1 free: 193155 MB
node distances:
node   0   1
0:  10  21
1:  21  10

(Continued on next page)
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Test Sponsor: Dell Inc.  
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**Platform Notes (Continued)**

```
From /proc/meminfo  
   MemTotal:       394693608 kB  
   HugePages_Total:       0  
   Hugepagesize:       2048 kB

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

From `/etc/*release*`  
```
debian_version: buster/sid
```

```
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 May 29 19:32

```
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 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. 2.2.2 03/05/2019
Memory:
```
   3x 00AD00B300AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933, configured at 2400
   9x 00AD063200AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933, configured at 2400
   4x Not Specified Not Specified
```

(End of data from sysinfo program)
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CPU2017 License: 55
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Test Date: Mar-2019
Hardware Availability: Apr-2019
Tested by: Dell Inc.
Software Availability: Feb-2019

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.
==============================================================================
CXXC 520.omnetpp_r(base, peak) 523.xalancbmk_r(base)
531.deepsjeng_r(base, peak) 541.leela_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.
==============================================================================
FC  548.exchange2_r(base, peak)
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.0.1.144 Build 20181018
(Continued on next page)
Compiled on Mar-2019
Published on Feb-2019

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Compiler Version Notes (Continued)
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Base Compiler Invocation

C benchmarks:
icc -m64 -std=c11

C++ benchmarks:
icpcc -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.leea_r: -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-Wl,-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
-1qkmalloc

C++ benchmarks:
-Wl,-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
-1qkmalloc

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### Base Optimization Flags (Continued)

For Fortran benchmarks:
- `-Wl,-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`
- `502.gcc_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`
- `523.xalancbmk_r icpc -m32 -L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/ia32_lin`

For 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`

(Continued on next page)
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#### Peak Optimization Flags (Continued)

500.perlbench_r (continued):
- `-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 -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`
- `-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/intel64`
- `-lqkmalloc`

525.x264_r: `-Wl,-z,muldefs,-xcORE-AVX512 -ipo -O3 -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 -O3 -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 -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:

- `-Wl,-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

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### Hardware Availability
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### Software Availability
Feb-2019

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.

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