Dell Inc.

PowerEdge R650 (Intel Xeon Silver 4316, 2.30 GHz)

SPEC CPU®2017 Integer Speed Result
Copyright 2017-2021 Standard Performance Evaluation Corporation

SPECspeed®2017_int_base = 11.3
SPECspeed®2017_int_peak = 11.6

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

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SPECspeed®2017_int_base (11.3)
SPECspeed®2017_int_peak (11.6)

Software

OS: Red Hat Enterprise Linux 8.3 (Ootpa)
4.18.0-240.15.1.el8_3.x86_64
Compiler: C/C++: Version 2021.1 of Intel oneAPI DPC++/C++ Compiler Build 20201113 for Linux;
Fortran: Version 2021.1 of Intel Fortran Compiler Classic Build 20201112 for Linux;
C/C++: Version 2021.1 of Intel C/C++ Compiler Classic Build 20201112 for Linux
Parallel: Yes
Firmware: Version 1.2.1 released May-2021
File System: tmpfs
System State: Run level 5 (graphical multi-user)
Base Pointers: 64-bit
Peak Pointers: 64-bit
Other: jemalloc memory allocator V5.0.1
Power Management: BIOS and OS set to prefer performance at the cost of additional power usage.

Hardware

CPU Name: Intel Xeon Silver 4316
Max MHz: 3400
Nominal: 2300
Enabled: 40 cores, 2 chips
Orderable: 1.2 chips
Cache L1: 32 KB I + 48 KB D on chip per core
L2: 1.25 MB I+D on chip per core
L3: 30 MB I+D on chip per chip
Other: None
Memory: 512 GB (16 x 32 GB 2Rx8 PC4-3200AA-R, running at 2666)
Storage: 225 GB on tmpfs
Other: None

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<td>158</td>
<td>10.2</td>
<td>154</td>
<td>10.6</td>
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<td>161</td>
<td>10.2</td>
<td>154</td>
<td>10.6</td>
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<tr>
<td>625.x264_s</td>
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<td>107</td>
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<td>648.exchange2_s</td>
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Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

### 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,scatter"
LD_LIBRARY_PATH = "/mnt/ramdisk/cpu2017-1.1.5-ic2021.1/lib/intel64:/mnt/ramdisk/cpu2017-1.1.5-ic2021.1/je5.0.1-64"
MALLOCONF = "retain:true"
OMP_STACKSIZE = "192M"
```

### General Notes

Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM memory using Redhat Enterprise Linux 8.0

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
```

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

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

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CPU2017 License: 55  Test Date:  May-2021
Test Sponsor:  Dell Inc.  Hardware Availability:  May-2021
Tested by:  Dell Inc.  Software Availability:  Feb-2021

General Notes (Continued)
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.

Benchmark run from a 225 GB ramdisk created with the cmd: "mount -t tmpfs -o size=225G tmpfs /mnt/ramdisk"

Platform Notes

BIOS Settings:
  Logical Processor : Disabled
  Virtualization Technology : Disabled

  System Profile : Custom
  CPU Power Management : Maximum Performance
    C1E : Disabled
    C States : Autonomous
  Memory Patrol Scrub : Disabled
  Energy Efficiency Policy : Performance
  CPU Interconnect Bus Link
    Power Management : Disabled

Sysinfo program /mnt/ramdisk/cpu2017-1.1.5-ic2021.1/bin/sysinfo
Rev: r6538 of 2020-09-24 e8664e66d2d7080afeaa89d4b38e2f1c
running on localhost.localdomain Fri May 14 05:36:44 2021

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 4316 CPU @ 2.30GHz
    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
      siblings : 20
        physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
        physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

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

(Continued on next page)
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Test Date: May-2021
Hardware Availability: May-2021
Software Availability: Feb-2021

Platform Notes (Continued)

CPU(s): 40
On-line CPU(s) list: 0-39
Thread(s) per core: 1
Core(s) per socket: 20
Socket(s): 2
NUMA node(s): 2
Vendor ID: GenuineIntel
CPU family: 6
Model: 106
Model name: Intel(R) Xeon(R) Silver 4316 CPU @ 2.30GHz
Stepping: 6
CPU MHz: 3050.470
BogoMIPS: 4600.00
Virtualization: VT-x
L1d cache: 48K
L1i cache: 32K
L2 cache: 1280K
L3 cache: 30720K
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 mp rdtscp lm Constant_tsc arch_perfmon pbebs bts rep_good nopl xtopology nonstop_tsc cpuid aperfmperf pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16 xprid pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt pdatc_deadline_timer aes xsave avx f16c rdrand lahf_lm abal abtl am s3nowprefetch cpuid_fault epbt cat_l3 invpcid_single intel_pin ssbd mba ibrs ibp bts ibrs_enhanced fsbs_base tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid cqm rdt_a avx512f avx512dq rdseed adx smap avx512ifma clflushopt clwb intel_pt avx512cd sha ni avx512bw avx512vl xsaveopt xsave vgetbv1 xsaveas cqm llc cqm_occup llc cqm_mb_total cqm_mb_local split_lock_detect wbenoind dse tret idat arat plt vs avx512vbi umip pkp uspek avx512_vbm2 gfni vaes vpcmuloqeqd avx512_vnni avx512_bitalg tme avx512_vpopcntdq 1a57 rndid md_clear pconfig flush_lld arch_capabilities

/proc/cpuinfo cache data
cache size: 30720 KB

From numactl --hardware WARNING: a numactl 'node' might or might not correspond to a 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: 249238 MB
node 0 free: 241931 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: 249552 MB
node 1 free: 256279 MB
node distances:
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Software Availability: Feb-2021

Platform Notes (Continued)

node  0  1
   0:  10  20
   1:  20  10

From /proc/meminfo
MemTotal:       527813836 kB
HugePages_Total:       0
Hugepagesize:       2048 kB

/sbin/tuned-adm active
Current active profile: throughput-performance

From /etc/*release* /etc/*version*
  os-release:
    NAME="Red Hat Enterprise Linux"
    VERSION="8.3 (Ootpa)"
    ID="rhel"
    ID_LIKE="fedora"
    VERSION_ID="8.3"
    PLATFORM_ID="platform:el8"
    PRETTY_NAME="Red Hat Enterprise Linux 8.3 (Ootpa)"
    ANSI_COLOR="0;31"
  redhat-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
  system-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
  system-release-cpe: cpe:/o:redhat:enterprise_linux:8.3:ga

uname -a:
Linux localhost.localdomain 4.18.0-240.15.1.el8_3.x86_64 #1 SMP Wed Feb 3 03:12:15 EST 2021 x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:
CVE-2018-12207 (iTLB Multihit): Not affected
CVE-2018-3620 (L1 Terminal Fault): Not affected
Microarchitectural Data Sampling: Not affected
CVE-2017-5754 (Meltdown): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2018-3639 (Speculative Store Bypass): Mitigation: usercopy/swapsgs barriers and __user pointer sanitization
CVE-2017-5753 (Spectre variant 1): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling
CVE-2017-5715 (Spectre variant 2): Not affected
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort): Not affected

(Continued on next page)
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Hardware Availability: May-2021
Software Availability: Feb-2021

Platform Notes (Continued)

run-level 5 May 14 05:32
SPEC is set to: /mnt/ramdisk/cpu2017-1.1.5-ic2021.1
Filesystem Type Size Used Avail Use% Mounted on
tmpfs tmpfs 225G 6.9G 219G 4% /mnt/ramdisk

From /sys/devices/virtual/dmi/id
Vendor: Dell Inc.
Product: PowerEdge R650
Product Family: PowerEdge
Serial: 1234567

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:
7x 00AD00B300AD HMAA4GR7AJR8N-XN 32 GB 2 rank 3200, configured at 2666
9x 00AD063200AD HMAA4GR7AJR8N-XN 32 GB 2 rank 3200, configured at 2666
16x Not Specified Not Specified

BIOS:
BIOS Vendor: Dell Inc.
BIOS Version: 1.2.1
BIOS Date: 05/06/2021
BIOS Revision: 1.2

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
C       | 600.perlbench_s(peak)
==============================================================================
Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

==============================================================================
C       | 600.perlbench_s(base) 602.gcc_s(base, peak) 605.mcf_s(base, peak)
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2021.1 Build 20201113
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Base Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:	ifort

Compiler Version Notes (Continued)

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C       | 600.perlbench_s(peak)
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==============================================================================
C++     | 620.omnetpp_s(base, peak) 623.xalancbmk_s(base, peak)
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==============================================================================
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

==============================================================================
Fortran | 648.exchange2_s(base, peak)
==============================================================================
Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on Intel(R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

Test Date: May-2021
Hardware Availability: May-2021
Software Availability: Feb-2021
## SPEC CPU®2017 Integer Speed Result

### Dell Inc.

**PowerEdge R650 (Intel Xeon Silver 4316, 2.30 GHz)**

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<td>Dell Inc.</td>
<td>Hardware Availability:</td>
<td>May-2021</td>
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<td>Spec</td>
<td>Dell Inc.</td>
<td>Software Availability:</td>
<td>Feb-2021</td>
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</table>

### SPECspeed®2017_int_base = 11.3

### SPECspeed®2017_int_peak = 11.6

#### Base Portability Flags

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Flags</th>
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</thead>
<tbody>
<tr>
<td>600.perlbench_s</td>
<td><code>-DSPEC_LP64 -DSPEC_LINUX_X64</code></td>
</tr>
<tr>
<td>602.gcc_s</td>
<td><code>-DSPEC_LP64</code></td>
</tr>
<tr>
<td>605.mcf_s</td>
<td><code>-DSPEC_LP64</code></td>
</tr>
<tr>
<td>620.omnetpp_s</td>
<td><code>-DSPEC_LP64</code></td>
</tr>
<tr>
<td>623.xalancbmk_s</td>
<td><code>-DSPEC_LP64 -DSPEC_LINUX</code></td>
</tr>
<tr>
<td>625.x264_s</td>
<td><code>-DSPEC_LP64</code></td>
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<tr>
<td>631.deepsjeng_s</td>
<td><code>-DSPEC_LP64</code></td>
</tr>
<tr>
<td>641.leela_s</td>
<td><code>-DSPEC_LP64</code></td>
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<tr>
<td>648.exchange2_s</td>
<td><code>-DSPEC_LP64</code></td>
</tr>
<tr>
<td>657.xz_s</td>
<td><code>-DSPEC_LP64</code></td>
</tr>
</tbody>
</table>

#### Base Optimization Flags

**C benchmarks**:
- `-DSPEC_OPENMP -std=c11 -m64 -fiopenmp -Wl,-z,muldefs -xCORE-AVX512`  
- `-O3 -ffast-math -flto -mfpmath=sse -funroll-loops`  
- `-qopt-mem-layout-trans=4 -mbranches-within-32B-boundaries`  
- `-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc`  

**C++ benchmarks**:
- `-DSPEC_OPENMP -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ffast-math`  
- `-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4`  
- `-mbranches-within-32B-boundaries`  
- `-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin/`  
- `-lqkmalloc`  

**Fortran benchmarks**:
- `-m64 -xCORE-AVX512 -O3 -ipo -no-prec-div -qopt-mem-layout-trans=4`  
- `-nostandard-realloc-lhs -align array32byte -auto`  
- `-mbranches-within-32B-boundaries`  

#### Peak Compiler Invocation

**C benchmarks (except as noted below):**

- `icx`
- `600.perlbench_s: icc`

**C++ benchmarks**:

- `icpx`
Peak Compiler Invocation (Continued)

Fortran benchmarks:
ifort

Peak Portability Flags
Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

600.perlbench_s: -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
-mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

602.gcc_s: -m64 -std=c11 -Wl,-z,muldefs -fprofile-generate(pass 1)
-fprofile-use=default.profdata(pass 2) -xCORE-AVX512 -flto
-Ofast(pass 1) -O3 -ffast-math -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

605.mcf_s: basepeak = yes

625.x264_s: -DSPEC_OPENMP -fiopenmp -std=c11 -m64 -Wl,-z,muldefs
-xCORE-AVX512 -flto -O3 -ffast-math
-qopt-mem-layout-trans=4 -fno-alias
-mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

657.xz_s: basepeak = yes

C++ benchmarks:

620.omnetpp_s: basepeak = yes

623.xalancbmk_s: basepeak = yes

631.deepsjeng_s: basepeak = yes

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

**PowerEdge R650 (Intel Xeon Silver 4316, 2.30 GHz)**

<table>
<thead>
<tr>
<th>SPECspeed\textsuperscript{®}2017_int_peak</th>
<th>SPECspeed\textsuperscript{®}2017_int_base</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.6</td>
<td>11.3</td>
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**CPU2017 License:** 55  
**Test Sponsor:** Dell Inc.  
**Tested by:** Dell Inc.  
**Test Date:** May-2021  
**Hardware Availability:** May-2021  
**Software Availability:** Feb-2021

### Peak Optimization Flags (Continued)

641.leela\textunderscore s: \texttt{basepeak = yes}

Fortran benchmarks:

648.exchange2\textunderscore s: \texttt{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:


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