## SPEC CPU®2017 Integer Speed Result

**Dell Inc.**

PowerEdge R440 (Intel Xeon Gold 6226, 2.70 GHz)

<table>
<thead>
<tr>
<th>SPECspeed®2017_int_base</th>
<th>8.98</th>
</tr>
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<tbody>
<tr>
<td>SPECspeed®2017_int_peak</td>
<td>9.10</td>
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**CPU2017 License:** 55  
**Test Sponsor:** Dell Inc.  
**Tested by:** Dell Inc.

<table>
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<tr>
<th>Threads</th>
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<tr>
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<td>6.08</td>
<td>6.88</td>
</tr>
<tr>
<td>602.gcc_s 24</td>
<td>8.60</td>
<td>8.69</td>
</tr>
<tr>
<td>605.mcf_s 24</td>
<td>11.4</td>
<td>11.5</td>
</tr>
<tr>
<td>620.omnetpp_s 24</td>
<td>6.58</td>
<td>6.48</td>
</tr>
<tr>
<td>623.xalancbmk_s 24</td>
<td>9.91</td>
<td>9.91</td>
</tr>
<tr>
<td>625.x264_s 24</td>
<td>5.14</td>
<td>5.14</td>
</tr>
<tr>
<td>631.deepsjeng_s 24</td>
<td>4.34</td>
<td>4.34</td>
</tr>
<tr>
<td>641.leela_s 24</td>
<td>14.5</td>
<td>14.5</td>
</tr>
<tr>
<td>648.exchange2_s 24</td>
<td>20.2</td>
<td>20.4</td>
</tr>
<tr>
<td>657.xz_s 24</td>
<td>20.4</td>
<td>20.4</td>
</tr>
</tbody>
</table>

### Hardware

- **CPU Name:** Intel Xeon Gold 6226  
- **Max MHz:** 3700  
- **Nominal:** 2700  
- **Enabled:** 24 cores, 2 chips  
- **Orderable:** 1.2 chips  
- **Cache L1:** 32 KB I + 32 KB D on chip per core  
- **Cache L2:** 1 MB I+D on chip per core  
- **Cache L3:** 19.25 MB I+D on chip per chip  
- **Memory:** 384 GB (12 x 16 GB 2Rx8 PC4-3200V-R, running at 2400)  
- **Storage:** 1.8 TB GB SATA SSD  
- **Other:** None

### Software

- **OS:** Red Hat Enterprise Linux 8.1  
- **Kernel:** 4.18.0-147.el8.x86_64  
- **Compiler:** C/C++: Version 19.0.5.281 of Intel C/C++ Compiler for Linux; Fortran: Version 19.0.5.281 of Intel Fortran Compiler for Linux  
- **Parallel:** Yes  
- **Firmware:** Version 2.6.3 released Jan-2020  
- **File System:** xfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 64-bit  
- **Other:** jemalloc memory allocator V5.0.1  
- **Power Management:** BIOS set to prefer performance at the cost of additional power usage.
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Dell Inc.

PowerEdge R440 (Intel Xeon Gold 6226, 2.70 GHz)  SPECspeed®2017_int_base = 8.98

SPECspeed®2017_int_peak = 9.10

Results Table

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<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
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<tr>
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<td>24</td>
<td>294</td>
<td>6.03</td>
<td>291</td>
<td>6.10</td>
<td>292</td>
<td>6.08</td>
<td>24</td>
<td>258</td>
<td>6.88</td>
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<td>8.58</td>
<td>463</td>
<td>8.60</td>
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<td>8.60</td>
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<td>459</td>
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<td>132</td>
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<td>5.14</td>
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<td>392</td>
<td>4.35</td>
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<td>393</td>
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<td>204</td>
<td>14.4</td>
<td>203</td>
<td>14.5</td>
<td>203</td>
<td>14.5</td>
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<td>204</td>
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<td>203</td>
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<td>24</td>
<td>308</td>
<td>20.1</td>
<td>306</td>
<td>20.2</td>
<td>307</td>
<td>20.2</td>
<td>24</td>
<td>303</td>
<td>20.4</td>
<td>305</td>
</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"

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
KMP_AFFINITY = "granularity=fine,scatter"
LD_LIBRARY_PATH = "/home/cpu2017/lib/intel64:/home/cpu2017/je5.0.1-64"
OMP_STACKSIZE = "192M"

General Notes

Binaries compiled on a system with 1x Intel Core i9-9900K 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.
General Notes (Continued)

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:
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 disabled
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/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7edble6e46a485a0011
running on localhost.localdomain Thu May 14 08:03:16 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

From /proc/cpuinfo
model name : Intel(R) Xeon(R) Gold 6226 CPU @ 2.70GHz
  2 "physical id"s (chips)
  24 "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 : 12
siblings : 12
physical 0: cores 0 2 3 5 6 8 9 10 11 12 13 14

(Continued on next page)
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CPU2017 License: 55
Test Sponsor: Dell Inc.
Test Date: Apr-2020
Tested by: Dell Inc.

Hardware Availability: Feb-2020
Software Availability: Nov-2019

Platform Notes (Continued)

physical 1: cores 0 2 3 4 5 6 8 9 10 11 12 13

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 24
On-line CPU(s) list: 0-23
Thread(s) per core: 1
Core(s) per socket: 12
Socket(s): 2
NUMA node(s): 2
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Gold 6226 CPU @ 2.70GHz
Stepping: 7
CPU MHz: 3209.852
CPU max MHz: 3700.0000
CPU min MHz: 1200.0000
BogoMIPS: 5400.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 19712K
NUMA node0 CPU(s): 0,2,4,6,8,10,12,14,16,18,20,22
NUMA node1 CPU(s): 1,3,5,7,9,11,13,15,17,19,21,23
Flags:

From numactl --hardware WARNING: a numactl 'node' might or might not correspond to a physical chip.
available: 2 nodes (0-1)

(Continued on next page)
### Dell Inc. PowerEdge R440 (Intel Xeon Gold 6226, 2.70 GHz)

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**SPEC CPU®2017 Integer Speed Result**

**SPECspeed®2017_int_base = 8.98**

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**Platform Notes (Continued)**

```
node 0 cpus: 0 2 4 6 8 10 12 14 16 18 20 22
node 0 size: 192075 MB
node 0 free: 191494 MB
node 1 cpus: 1 3 5 7 9 11 13 15 17 19 21 23
node 1 size: 193507 MB
node 1 free: 192337 MB
node distances:
  node 0 1
  0: 10 21
  1: 21 10
```

From `/proc/meminfo`

```
MemTotal:       394836832 kB
HugePages_Total:       0
Hugepagesize:       2048 kB
```

From `/etc/*release* /etc/*version*`

```
NAME="Red Hat Enterprise Linux"
VERSION="8.1 (Ootpa)"
ID="rhel"
ID_LIKE="fedora"
VERSION_ID="8.1"
PLATFORM_ID="platform:el8"
PRETTY_NAME="Red Hat Enterprise Linux 8.1 (Ootpa)"
ANSI_COLOR="0;31"
redhat-release: Red Hat Enterprise Linux release 8.1 (Ootpa)
system-release: Red Hat Enterprise Linux release 8.1 (Ootpa)
system-release-cpe: cpe:/o:redhat:enterprise_linux:8.1:ga
```

```
uname -a:
Linux localhost.localdomain 4.18.0-147.el8.x86_64 #1 SMP Thu Sep 26 15:52:44 UTC 2019
x86_64 x86_64 x86_64 GNU/Linux
```

Kernel self-reported vulnerability status:

**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

```
run-level 3 May 14 07:58 last=5
```

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### Platform Notes (Continued)

SPEC is set to: /home/cpu2017

```bash
Filesystem Type Size Used Avail Use% Mounted on
/dev/mapper/rhel-home xfs  1.7T  20G  1.7T  2% /home
```

From /sys/devices/virtual/dmi/id

- **BIOS:** Dell Inc. 2.6.3 01/18/2020
- **Vendor:** Dell Inc.
- **Product:** PowerEdge R440
- **Product Family:** PowerEdge
- **Serial:** F9TD613

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:**

- 12x 002C069D002C 36ASF4G72PZ-3G2E2 32 GB 2 rank 3200
- 4x Not Specified Not Specified

(End of data from sysinfo program)

---

### Compiler Version Notes

```
-----------------------------------------
C     | 600.perlbench_s (base, peak) 602.gcc_s (base, peak) 605.mcf_s (base, peak) 625.x264_s (base, peak) 657.xz_s (base, peak)
-----------------------------------------
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.5.281 Build 20190815
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.
-----------------------------------------

C++   | 620.omnetpp_s (base, peak) 623.xalancbmk_s (base, peak) 631.deepsjeng_s (base, peak) 641.leela_s (base, peak)
-----------------------------------------
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.5.281 Build 20190815
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.
-----------------------------------------

Fortran | 648.exchange2_s (base, peak)
-----------------------------------------
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
```

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### Compiler Version Notes (Continued)

64, Version 19.0.5.281 Build 20190815
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

### Base Compiler Invocation

- **C benchmarks:**
  - icc

- **C++ benchmarks:**
  - icpc

- **Fortran benchmarks:**
  - ifort

### Base Portability Flags

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Flags</th>
</tr>
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<tbody>
<tr>
<td>perlbench_s</td>
<td>-DSPEC_L64 -DSPEC_LINUX_X64</td>
</tr>
<tr>
<td>gcc_s</td>
<td>-DSPEC_L64</td>
</tr>
<tr>
<td>mcf_s</td>
<td>-DSPEC_L64</td>
</tr>
<tr>
<td>omnetpp_s</td>
<td>-DSPEC_L64</td>
</tr>
<tr>
<td>xalancbmk_s</td>
<td>-DSPEC_L64 -DSPEC_LINUX</td>
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<td>exchange2_s</td>
<td>-DSPEC_L64</td>
</tr>
<tr>
<td>xz_s</td>
<td>-DSPEC_L64</td>
</tr>
</tbody>
</table>

### Base Optimization Flags

- **C benchmarks:**
  - -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
  - -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP
  - -L/usr/local/je5.0.1-64/lib -ljemalloc

- **C++ benchmarks:**
  - -m64 -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
  - -qopt-mem-layout-trans=4
  - -L/usr/local/IntelCompiler19/compilers_and_libraries_2019.5.281/linux/compiler/lib/intel64_lin
  - -lqkmalloc

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### Base Optimization Flags (Continued)

Fortran benchmarks:
- `-m64 -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-mem-layout-trans=4 -nostandard-realloc-lhs`

### Peak Compiler Invocation

C benchmarks:
- `icc`

C++ benchmarks:
- `icpc`

Fortran benchmarks:
- `ifort`

### Peak Portability Flags

Same as Base Portability Flags

### Peak Optimization Flags

C benchmarks:

600.perlbench_s: `-m64 -std=c11 -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -O2 -xCORE-AVX512 -qopt-mem-layout-trans=4 -ipo -O3 -no-prec-div -DSPEC_SUPPRESS_OPENMP -qopenmp -DSPEC_OPENMP -fno-strict-overflow -L/usr/local/je5.0.1-64/lib -ljemalloc`

602.gcc_s: `-m64 -std=c11 -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -O2 -xCORE-AVX512 -qopt-mem-layout-trans=4 -ipo -O3 -no-prec-div -DSPEC_SUPPRESS_OPENMP -L/usr/local/je5.0.1-64/lib -ljemalloc`

605.mcf_s: `-m64 -std=c11 -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX512 -O3 -no-prec-div -DSPEC_SUPPRESS_OPENMP -qopenmp -DSPEC_OPENMP -L/usr/local/je5.0.1-64/lib -ljemalloc`

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**SPECspeed®2017_int_base = 8.98**

**SPECspeed®2017_int_peak = 9.10**

**Peak Optimization Flags (Continued)**

625.x264_s: basepeak = yes

657.xz_s: -m64 -std=c11 -W1,-z,muldefs -prof-gen(pass 1)
-prof-use(pass 2) -O2 -xCORE-AVX512
-qopt-mem-layout-trans=4 -ipo -O3 -no-prec-div
-DSPEC_SUPPRESS_OPENMP -qopenmp -DSPEC_OPENMP
-L/usr/local/je5.0.1-64/lib -ljemalloc

C++ benchmarks:

620.omnetpp_s: -m64 -W1,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2)
-ipo -xCORE-AVX512 -O3 -no-prec-div
-qopt-mem-layout-trans=4 -DSPEC_SUPPRESS_OPENMP
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.5.281/linux/compiler/lib/intel64_lin
-lqkmalloc

623.xalancbmk_s: basepeak = yes

631.deepsjeng_s: basepeak = yes

641.leela_s: basepeak = yes

Fortran benchmarks:

648.exchange2_s: 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:
http://www.spec.org/cpu2017/flags/Intel-ic19.0u5-official-linux64_rev0.xml

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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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