



# SPEC® CPU2017 Integer Speed Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

## Dell Inc.

PowerEdge FC640 (Intel Xeon Platinum 8170, 2.10 GHz)

SPECspeed2017\_int\_base = 9.05

SPECspeed2017\_int\_peak = 9.33

CPU2017 License: 55

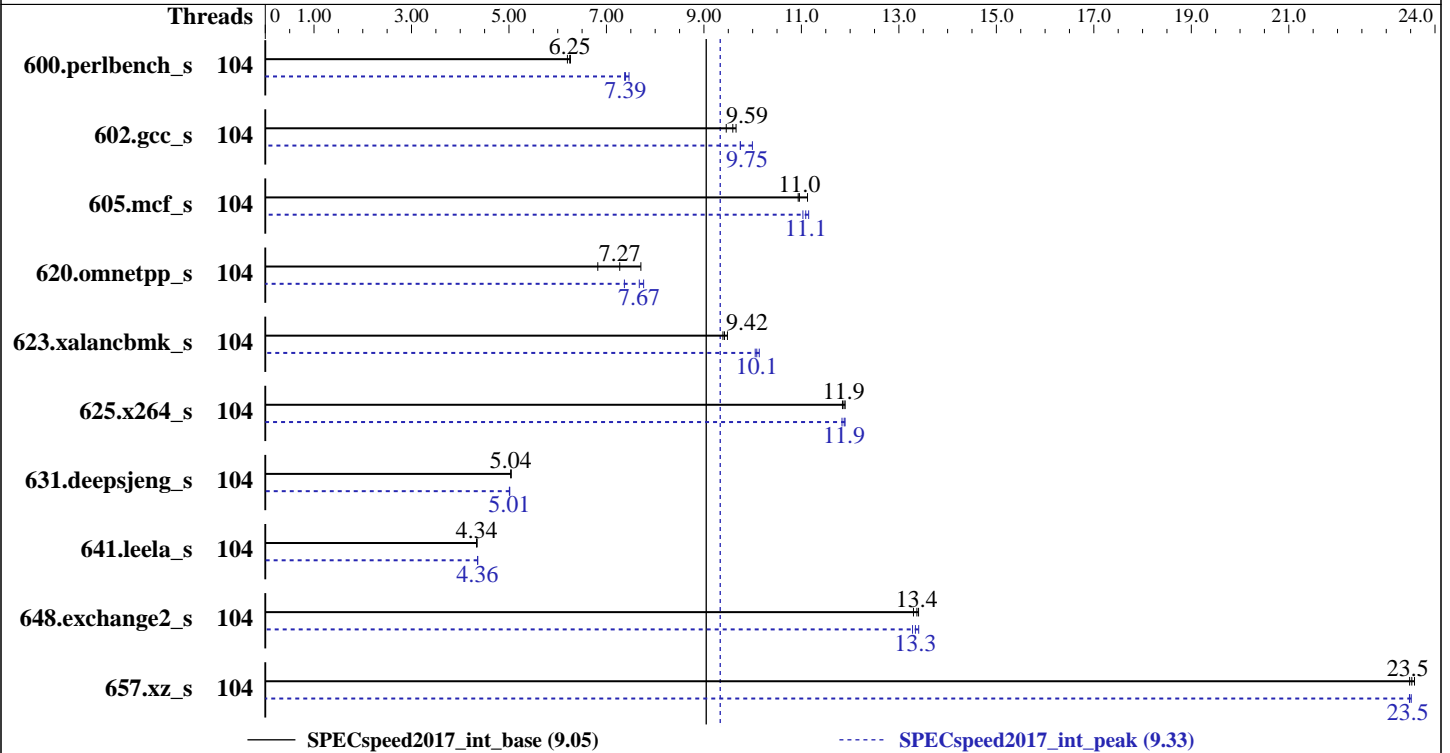
Test Sponsor: Dell Inc.

Tested by: Dell Inc.

Test Date: Feb-2018

Hardware Availability: Sep-2017

Software Availability: Sep-2017



### Hardware

CPU Name: Intel Xeon Platinum 8170  
 Max MHz.: 3700  
 Nominal: 2100  
 Enabled: 52 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: 35.75 MB I+D on chip per chip  
 Other: None  
 Memory: 192 GB (12 x 16 GB 2Rx8 PC4-2666V-R)  
 Storage: 1 TB SATA SSD  
 Other: None

### Software

OS: SUSE Linux Enterprise Server 12 SP3 (x86\_64) 4.4.114-94.11-default  
 Compiler: C/C++: Version 18.0.0.128 of Intel C/C++ Compiler for Linux;  
 Fortran: Version 18.0.0.128 of Intel Fortran Compiler for Linux  
 Parallel: Yes  
 Firmware: Version 1.3.7 released Feb-2018  
 File System: btrfs  
 System State: Run level 3 (multi-user)  
 Base Pointers: 64-bit  
 Peak Pointers: 32/64-bit  
 Other: jemalloc memory allocator library V5.0.1



# SPEC CPU2017 Integer Speed Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

## Dell Inc.

PowerEdge FC640 (Intel Xeon Platinum 8170, 2.10 GHz)

SPECspeed2017\_int\_base = 9.05

SPECspeed2017\_int\_peak = 9.33

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

Test Date: Feb-2018  
Hardware Availability: Sep-2017  
Software Availability: Sep-2017

## Results Table

Benchmark	Base						Peak							
	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
600.perlbench_s	104	283	6.26	<b>284</b>	<b>6.25</b>	286	6.20	104	<b>240</b>	<b>7.39</b>	241	7.37	238	7.46
602.gcc_s	104	421	9.46	<b>415</b>	<b>9.59</b>	412	9.66	104	398	9.99	<b>408</b>	<b>9.75</b>	409	9.75
605.mcf_s	104	424	11.1	<b>431</b>	<b>11.0</b>	432	10.9	104	423	11.1	<b>426</b>	<b>11.1</b>	428	11.0
620.omnetpp_s	104	239	6.82	212	7.71	<b>224</b>	<b>7.27</b>	104	210	7.76	221	7.37	<b>213</b>	<b>7.67</b>
623.xalancbmk_s	104	<b>150</b>	<b>9.42</b>	149	9.48	151	9.39	104	<b>141</b>	<b>10.1</b>	140	10.1	141	10.1
625.x264_s	104	149	11.8	<b>149</b>	<b>11.9</b>	148	11.9	104	148	11.9	<b>149</b>	<b>11.9</b>	149	11.8
631.deepsjeng_s	104	284	5.04	284	5.04	<b>284</b>	<b>5.04</b>	104	<b>286</b>	<b>5.01</b>	286	5.01	286	5.02
641.leela_s	104	393	4.34	<b>393</b>	<b>4.34</b>	393	4.34	104	<b>392</b>	<b>4.36</b>	392	4.36	392	4.36
648.exchange2_s	104	<b>220</b>	<b>13.4</b>	219	13.4	221	13.3	104	221	13.3	<b>220</b>	<b>13.3</b>	219	13.4
657.xz_s	104	<b>263</b>	<b>23.5</b>	262	23.6	263	23.5	104	263	23.5	<b>263</b>	<b>23.5</b>	263	23.5

SPECspeed2017\_int\_base = 9.05

SPECspeed2017\_int\_peak = 9.33

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"

## General Notes

Environment variables set by runcpu before the start of the run:

KMP\_AFFINITY = "granularity=fine,scatter"

LD\_LIBRARY\_PATH = "/root/cpu2017/lib/ia32:/root/cpu2017/lib/intel64:/root/cpu2017/je5.0.1-32:/root/cpu2017/je5.0.1-64"

OMP\_STACKSIZE = "192M"

Binaries compiled on a system with 1x Intel Core i7-4790 CPU + 32GB RAM memory using Redhat Enterprise Linux 7.4

Yes: 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.

jemalloc: configured and built at default for 32bit (i686) and 64bit (x86\_64) targets;

jemalloc: built with the RedHat Enterprise 7.4, and the system compiler gcc 4.8.5;

jemalloc: sources available via jemalloc.net

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
```



# SPEC CPU2017 Integer Speed Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

**Dell Inc.**

PowerEdge FC640 (Intel Xeon Platinum 8170, 2.10 GHz)

SPECspeed2017\_int\_base = 9.05

SPECspeed2017\_int\_peak = 9.33

CPU2017 License: 55

Test Sponsor: Dell Inc.

Tested by: Dell Inc.

Test Date: Feb-2018

Hardware Availability: Sep-2017

Software Availability: Sep-2017

## Platform Notes

BIOS settings:

Sub NUMA Cluster disabled  
 Virtualization Technology disabled  
 System Profile set to Custom  
 CPU Performance set to Maximum Performance  
 C States set to Autonomous  
 C1EE 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 /root/cpu2017/bin/sysinfo  
 Rev: r5797 of 2017-06-14 96c45e4568ad54c135fd618bcc091c0f  
 running on linux-4l3n Sat Feb 24 06:44:29 2018

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) Platinum 8170 CPU @ 2.10GHz
 2 "physical id"s (chips)
 104 "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 : 26
siblings : 52
physical 0: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 16 17 18 19 20 21 22 24 25 26 27 28
29
physical 1: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 16 17 18 19 20 21 22 24 25 26 27 28
29

```

From lscpu:

```

Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 104
On-line CPU(s) list: 0-103
Thread(s) per core: 2
Core(s) per socket: 26
Socket(s): 2
NUMA node(s): 2
Vendor ID: GenuineIntel
CPU family: 6
Model: 85

```

(Continued on next page)



# SPEC CPU2017 Integer Speed Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

## Dell Inc.

PowerEdge FC640 (Intel Xeon Platinum 8170, 2.10 GHz)

SPECspeed2017\_int\_base = 9.05

SPECspeed2017\_int\_peak = 9.33

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

**Test Date:** Feb-2018  
**Hardware Availability:** Sep-2017  
**Software Availability:** Sep-2017

### Platform Notes (Continued)

```

Model name: Intel(R) Xeon(R) Platinum 8170 CPU @ 2.10GHz
Stepping: 4
CPU MHz: 2100.098
BogoMIPS: 4200.19
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 36608K
NUMA node0 CPU(s):
0,2,4,6,8,10,12,14,16,18,20,22,24,26,28,30,32,34,36,38,40,42,44,46,48,50,52,54,56,58
,60,62,64,66,68,70,72,74,76,78,80,82,84,86,88,90,92,94,96,98,100,102
NUMA node1 CPU(s):
1,3,5,7,9,11,13,15,17,19,21,23,25,27,29,31,33,35,37,39,41,43,45,47,49,51,53,55,57,59
,61,63,65,67,69,71,73,75,77,79,81,83,85,87,89,91,93,95,97,99,101,103
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
aperfperf eagerfpu pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg
fma cx16 xtpr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes
xsave avx f16c rdrand lahf_lm abm 3dnowprefetch ida arat epb invpcid_single pln pts
dtherm intel_pt rsb_ctxsw spec_ctrl retpoline kaiser tpr_shadow vnmi flexpriority
ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm cqm mpx
avx512f avx512dq rdseed adx smap clflushopt clwb avx512cd avx512bw avx512vl xsaveopt
xsavec xgetbv1 cqm_llc cqm_occup_llc pku ospke

```

```
/proc/cpuinfo cache data
cache size : 36608 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 40 42 44 46 48 50
52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100 102
node 0 size: 95349 MB
node 0 free: 94794 MB
node 1 cpus: 1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51
53 55 57 59 61 63 65 67 69 71 73 75 77 79 81 83 85 87 89 91 93 95 97 99 101 103
node 1 size: 96744 MB
node 1 free: 96006 MB
node distances:
node 0 1
0: 10 21
1: 21 10

```

```
From /proc/meminfo
MemTotal: 196703712 kB
```

(Continued on next page)



# SPEC CPU2017 Integer Speed Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

**Dell Inc.**

PowerEdge FC640 (Intel Xeon Platinum 8170, 2.10 GHz)

SPECspeed2017\_int\_base = 9.05

SPECspeed2017\_int\_peak = 9.33

CPU2017 License: 55

Test Sponsor: Dell Inc.

Tested by: Dell Inc.

Test Date: Feb-2018

Hardware Availability: Sep-2017

Software Availability: Sep-2017

## Platform Notes (Continued)

HugePages\_Total: 0  
Hugepagesize: 2048 kB

From /etc/\*release\* /etc/\*version\*

SuSE-release:

SUSE Linux Enterprise Server 12 (x86\_64)

VERSION = 12

PATCHLEVEL = 3

# This file is deprecated and will be removed in a future service pack or release.

# Please check /etc/os-release for details about this release.

os-release:

NAME="SLES"

VERSION="12-SP3"

VERSION\_ID="12.3"

PRETTY\_NAME="SUSE Linux Enterprise Server 12 SP3"

ID="sles"

ANSI\_COLOR="0;32"

CPE\_NAME="cpe:/o:suse:sles:12:sp3"

uname -a:

Linux linux-413n 4.4.114-94.11-default #1 SMP Thu Feb 1 19:28:26 UTC 2018 (4309ff9)  
x86\_64 x86\_64 x86\_64 GNU/Linux

run-level 3 Feb 24 01:18

SPEC is set to: /root/cpu2017

Filesystem	Type	Size	Used	Avail	Use%	Mounted on
/dev/sda7	btrfs	855G	43G	812G	6%	/

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. 1.3.7 02/09/2018

Memory:

2x 002C00B3002C 18ASF2G72PDZ-2G6D1 16 GB 2 rank 2666

10x 00AD00B300AD HMA82GR7AFR8N-VK 16 GB 2 rank 2666

4x Not Specified Not Specified

(End of data from sysinfo program)

## Compiler Version Notes

=====  
CC 600.perlbench\_s(base) 602.gcc\_s(base) 605.mcf\_s(base) 625.x264\_s(base, peak) 657.xz\_s(base)

(Continued on next page)



# SPEC CPU2017 Integer Speed Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

**Dell Inc.**

PowerEdge FC640 (Intel Xeon Platinum 8170, 2.10 GHz)

SPECspeed2017\_int\_base = 9.05

SPECspeed2017\_int\_peak = 9.33

**CPU2017 License:** 55

**Test Sponsor:** Dell Inc.

**Tested by:** Dell Inc.

**Test Date:** Feb-2018

**Hardware Availability:** Sep-2017

**Software Availability:** Sep-2017

## Compiler Version Notes (Continued)

```
-----
icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
-----
```

```
=====
CC 600.perlbench_s(peak) 602.gcc_s(peak) 605.mcf_s(peak) 657.xz_s(peak)
-----
```

```
icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
-----
```

```
=====
CXXC 620.omnetpp_s(base) 623.xalancbmk_s(base) 631.deepsjeng_s(base)
641.leela_s(base)
-----
```

```
icpc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
-----
```

```
=====
CXXC 620.omnetpp_s(peak) 623.xalancbmk_s(peak) 631.deepsjeng_s(peak)
641.leela_s(peak)
-----
```

```
icpc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
-----
```

```
=====
FC 648.exchange2_s(base, peak)
-----
```

```
ifort (IFORT) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
-----
```

## Base Compiler Invocation

C benchmarks:

icc

C++ benchmarks:

icpc

Fortran benchmarks:

ifort



# SPEC CPU2017 Integer Speed Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

**Dell Inc.**

PowerEdge FC640 (Intel Xeon Platinum 8170,  
2.10 GHz)

SPECspeed2017\_int\_base = 9.05

SPECspeed2017\_int\_peak = 9.33

**CPU2017 License:** 55

**Test Sponsor:** Dell Inc.

**Tested by:** Dell Inc.

**Test Date:** Feb-2018

**Hardware Availability:** Sep-2017

**Software Availability:** Sep-2017

## Base Portability Flags

```
600.perlbench_s: -DSPEC_LP64 -DSPEC_LINUX_X64
602.gcc_s: -DSPEC_LP64
605.mcf_s: -DSPEC_LP64
620.omnetpp_s: -DSPEC_LP64
623.xalancbmk_s: -DSPEC_LP64 -DSPEC_LINUX
625.x264_s: -DSPEC_LP64
631.deepsjeng_s: -DSPEC_LP64
641.leela_s: -DSPEC_LP64
648.exchange2_s: -DSPEC_LP64
657.xz_s: -DSPEC_LP64
```

## Base Optimization Flags

C benchmarks:

```
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=3 -qopenmp -DSPEC_OPENMP
-L/usr/local/je5.0.1-64/lib -ljemalloc
```

C++ benchmarks:

```
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=3 -L/usr/local/je5.0.1-64/lib -ljemalloc
```

Fortran benchmarks:

```
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=3 -nostandard-realloc-lhs -align array32byte
-L/usr/local/je5.0.1-64/lib -ljemalloc
```

## Base Other Flags

C benchmarks:

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

C++ benchmarks:

```
-m64
```

Fortran benchmarks:

```
-m64
```



# SPEC CPU2017 Integer Speed Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

**Dell Inc.**

PowerEdge FC640 (Intel Xeon Platinum 8170,  
2.10 GHz)

SPECspeed2017\_int\_base = 9.05

SPECspeed2017\_int\_peak = 9.33

**CPU2017 License:** 55

**Test Sponsor:** Dell Inc.

**Tested by:** Dell Inc.

**Test Date:** Feb-2018

**Hardware Availability:** Sep-2017

**Software Availability:** Sep-2017

## Peak Compiler Invocation

C benchmarks:

icc

C++ benchmarks:

icpc

Fortran benchmarks:

ifort

## Peak Portability Flags

```
600.perlbench_s: -DSPEC_LP64 -DSPEC_LINUX_X64
602.gcc_s: -DSPEC_LP64
605.mcf_s: -DSPEC_LP64
620.omnetpp_s: -DSPEC_LP64
623.xalancbmk_s: -D_FILE_OFFSET_BITS=64 -DSPEC_LINUX
625.x264_s: -DSPEC_LP64
631.deepsjeng_s: -DSPEC_LP64
641.leela_s: -DSPEC_LP64
648.exchange2_s: -DSPEC_LP64
657.xz_s: -DSPEC_LP64
```

## Peak Optimization Flags

C benchmarks:

```
600.perlbench_s: -w1,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -O2
-xCORE-AVX512 -qopt-mem-layout-trans=3 -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: -w1,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -O2
-xCORE-AVX512 -qopt-mem-layout-trans=3 -ipo -O3
-no-prec-div -DSPEC_SUPPRESS_OPENMP -qopenmp
-DSPEC_OPENMP -L/usr/local/je5.0.1-64/lib -ljemalloc

605.mcf_s: -w1,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
-xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=3
-DSPEC_SUPPRESS_OPENMP -qopenmp -DSPEC_OPENMP
-L/usr/local/je5.0.1-64/lib -ljemalloc
```

(Continued on next page)





# SPEC CPU2017 Integer Speed Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

**Dell Inc.**

PowerEdge FC640 (Intel Xeon Platinum 8170,  
2.10 GHz)

SPECspeed2017\_int\_base = 9.05

SPECspeed2017\_int\_peak = 9.33

**CPU2017 License:** 55

**Test Sponsor:** Dell Inc.

**Tested by:** Dell Inc.

**Test Date:** Feb-2018

**Hardware Availability:** Sep-2017

**Software Availability:** Sep-2017

## Peak Optimization Flags (Continued)

625.x264\_s: -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div  
-qopt-mem-layout-trans=3 -qopenmp -DSPEC\_OPENMP  
-L/usr/local/je5.0.1-64/lib -ljemalloc

657.xz\_s: Same as 602.gcc\_s

C++ benchmarks:

620.omnetpp\_s: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo  
-xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=3  
-DSPEC\_SUPPRESS\_OPENMP -qopenmp -DSPEC\_OPENMP  
-L/usr/local/je5.0.1-64/lib -ljemalloc

623.xalancbmk\_s: -L/opt/intel/compilers\_and\_libraries\_2018/linux/lib/ia32  
-Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo  
-xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=3  
-DSPEC\_SUPPRESS\_OPENMP -qopenmp -DSPEC\_OPENMP  
-L/usr/local/je5.0.1-32/lib -ljemalloc

631.deepsjeng\_s: Same as 620.omnetpp\_s

641.leela\_s: Same as 620.omnetpp\_s

Fortran benchmarks:

-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div  
-qopt-mem-layout-trans=3 -nostandard-realloc-lhs -align array32byte  
-L/usr/local/je5.0.1-64/lib -ljemalloc

## Peak Other Flags

C benchmarks:

-m64 -std=c11

C++ benchmarks (except as noted below):

-m64

623.xalancbmk\_s: -m32

Fortran benchmarks:

-m64



# SPEC CPU2017 Integer Speed Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

**Dell Inc.**

PowerEdge FC640 (Intel Xeon Platinum 8170,  
2.10 GHz)

SPECspeed2017\_int\_base = 9.05

SPECspeed2017\_int\_peak = 9.33

**CPU2017 License:** 55

**Test Sponsor:** Dell Inc.

**Tested by:** Dell Inc.

**Test Date:** Feb-2018

**Hardware Availability:** Sep-2017

**Software Availability:** Sep-2017

The flags files that were used to format this result can be browsed at

<http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.2017-10-19.html>

<http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge14G-revC.html>

You can also download the XML flags sources by saving the following links:

<http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.2017-10-19.xml>

<http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge14G-revC.xml>

SPEC is a registered trademark of the Standard Performance Evaluation Corporation. All other brand and product names appearing in this result are trademarks or registered trademarks of their respective holders.

For questions about this result, please contact the tester. For other inquiries, please contact [info@spec.org](mailto:info@spec.org).

Tested with SPEC CPU2017 v1.0.2 on 2018-02-24 07:44:29-0500.

Report generated on 2018-10-31 17:08:22 by CPU2017 PDF formatter v6067.

Originally published on 2018-03-20.