



# SPEC CPU®2017 Integer Rate Result

Copyright 2017-2020 Standard Performance Evaluation Corporation

## Dell Inc.

SPECrate®2017\_int\_base = 226

PowerEdge R740xd (Intel Xeon Gold 6226R, 2.90 GHz)

SPECrate®2017\_int\_peak = 235

CPU2017 License: 55

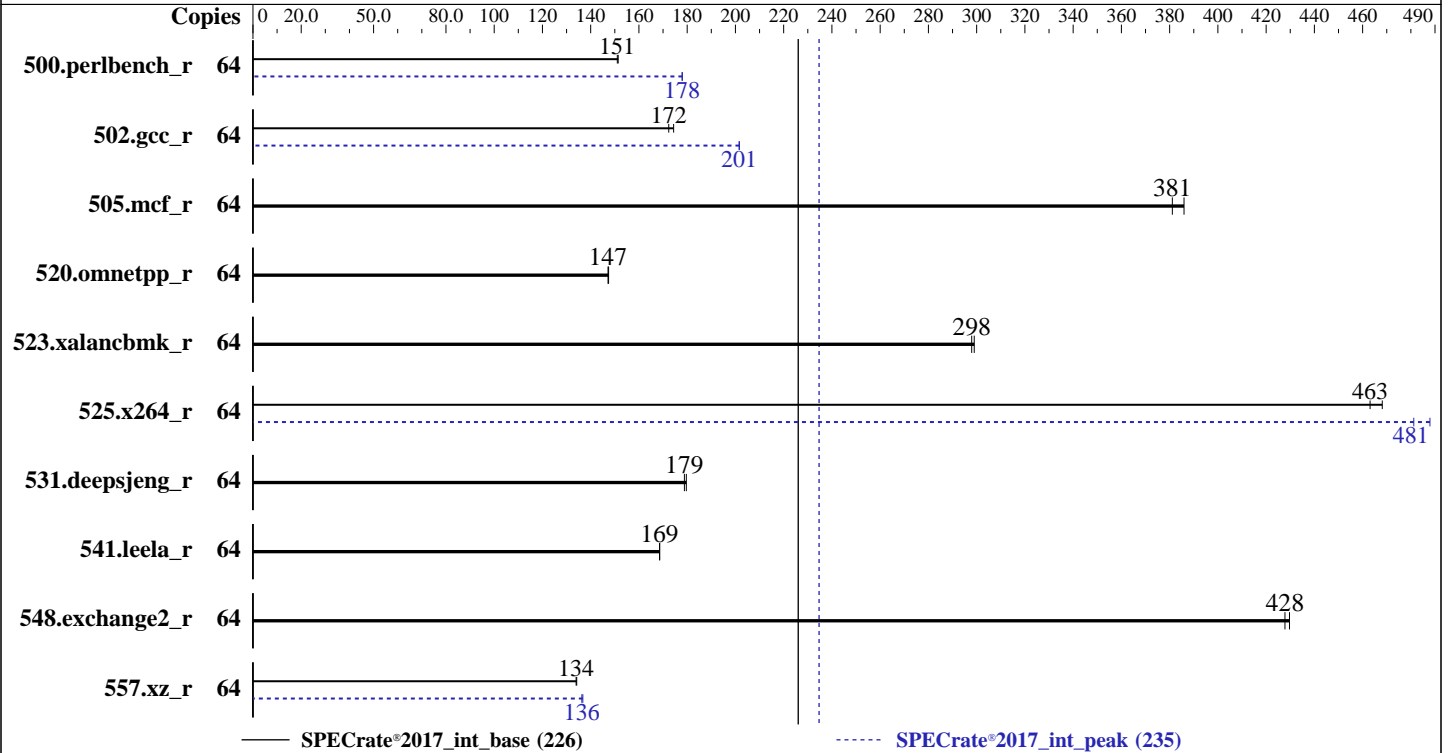
Test Date: Jun-2020

Test Sponsor: Dell Inc.

Hardware Availability: Jul-2020

Tested by: Dell Inc.

Software Availability: Apr-2020



### Hardware

CPU Name: Intel Xeon Gold 6226R  
 Max MHz: 3900  
 Nominal: 2900  
 Enabled: 32 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: 22 MB I+D on chip per chip  
 Other: None  
 Memory: 768 GB (24 x 32 GB 2Rx4 PC4-2933V-R, running at 2933)  
 Storage: 1 x 1.92 TB SATA SSD  
 Other: None

### Software

OS: Red Hat Enterprise Linux 8.1  
 kernel 4.18.0-147.el8.x86\_64  
 Compiler: C/C++: Version 19.1.1.217 of Intel C/C++ Compiler for Linux;  
 Fortran: Version 19.1.1.217 of Intel Fortran Compiler for Linux  
 Parallel: No  
 Firmware: Version 2.7.7 released May-2020  
 File System: tmpfs  
 System State: Run level 3 (multi-user)  
 Base Pointers: 64-bit  
 Peak Pointers: 32/64-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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## Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
500.perlbench_r	64	<b>675</b>	<b>151</b>	673	151			64	572	178	<b>573</b>	<b>178</b>		
502.gcc_r	64	520	174	<b>526</b>	<b>172</b>			64	<b>450</b>	<b>201</b>	449	202		
505.mcf_r	64	268	386	<b>271</b>	<b>381</b>			64	268	386	<b>271</b>	<b>381</b>		
520.omnetpp_r	64	<b>570</b>	<b>147</b>	570	147			64	<b>570</b>	<b>147</b>	570	147		
523.xalancbmk_r	64	<b>227</b>	<b>298</b>	226	299			64	<b>227</b>	<b>298</b>	226	299		
525.x264_r	64	<b>242</b>	<b>463</b>	239	468			64	230	488	<b>233</b>	<b>481</b>		
531.deepsjeng_r	64	<b>410</b>	<b>179</b>	408	180			64	<b>410</b>	<b>179</b>	408	180		
541.leela_r	64	<b>629</b>	<b>169</b>	629	169			64	<b>629</b>	<b>169</b>	629	169		
548.exchange2_r	64	<b>392</b>	<b>428</b>	390	430			64	<b>392</b>	<b>428</b>	390	430		
557.xz_r	64	<b>516</b>	<b>134</b>	515	134			64	505	137	<b>507</b>	<b>136</b>		

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Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

## Compiler Notes

The inconsistent Compiler version information under Compiler Version section is due to a discrepancy in Intel Compiler. The correct version of C/C++ compiler is: Version 19.1.1.217 Build 20200306 Compiler for Linux  
The correct version of Fortran compiler is: Version 19.1.1.217 Build 20200306 Compiler for Linux

## 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:  
LD\_LIBRARY\_PATH =  
"/mnt/ramdisk/cpu2017-ic19.lul/lib/intel64:/mnt/ramdisk/cpu2017-ic19.lul/lib/ia32:/mnt/ramdisk/cpu2017-ic19.lul/je5.0.1-32"  
MALLOCONF = "retain:true"



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## General Notes

Binaries compiled on a system with 1x Intel Core i9-7980XE 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.

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>
```

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

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>

## Platform Notes

BIOS settings:

- Sub NUMA Cluster enabled
- 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 enabled
- 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 /mnt/ramdisk/cpu2017-ic19.1u1/bin/sysinfo  
 Rev: r6365 of 2019-08-21 295195f888a3d7edble6e46a485a0011  
 running on user-pc.spa.lab Mon Jun 29 10:53:00 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>

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## Platform Notes (Continued)

From /proc/cpuinfo

```

model name : Intel(R) Xeon(R) Gold 6226R CPU @ 2.90GHz
 2 "physical id"s (chips)
 64 "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 : 16
siblings  : 32
physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

```

From lscpu:

```

Architecture:          x86_64
CPU op-mode(s):        32-bit, 64-bit
Byte Order:             Little Endian
CPU(s):                 64
On-line CPU(s) list:   0-63
Thread(s) per core:    2
Core(s) per socket:    16
Socket(s):              2
NUMA node(s):          4
Vendor ID:              GenuineIntel
CPU family:             6
Model:                  85
Model name:             Intel(R) Xeon(R) Gold 6226R CPU @ 2.90GHz
Stepping:               7
CPU MHz:                1896.738
CPU max MHz:           3900.0000
CPU min MHz:           1200.0000
BogoMIPS:               5800.00
Virtualization:        VT-x
L1d cache:              32K
L1i cache:              32K
L2 cache:               1024K
L3 cache:               22528K
NUMA node0 CPU(s):     0,4,8,12,16,20,24,28,32,36,40,44,48,52,56,60
NUMA node1 CPU(s):     1,5,9,13,17,21,25,29,33,37,41,45,49,53,57,61
NUMA node2 CPU(s):     2,6,10,14,18,22,26,30,34,38,42,46,50,54,58,62
NUMA node3 CPU(s):     3,7,11,15,19,23,27,31,35,39,43,47,51,55,59,63
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 pdpelt rdtscp
lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid
aperfperf pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16
xtpr pdc m pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave
avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb cat_l3 cdp_l3
invpcid_single intel_ppin ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi

```

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## Platform Notes (Continued)

flexpriority ept vpid fsgsbase tsc\_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm  
cqm mpx rdt\_a avx512f avx512dq rdseed adx smap clflushopt clwb intel\_pt avx512cd  
avx512bw avx512vl xsaveopt xsavec xgetbv1 xsaves cqm\_llc cqm\_occup\_llc cqm\_mbm\_total  
cqm\_mbm\_local dtherm ida arat pln pts pku ospke avx512\_vnni md\_clear flush\_lld  
arch\_capabilities

```
/proc/cpuinfo cache data
cache size : 22528 KB
```

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

```
available: 4 nodes (0-3)
node 0 cpus: 0 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60
node 0 size: 192074 MB
node 0 free: 191451 MB
node 1 cpus: 1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61
node 1 size: 193507 MB
node 1 free: 192765 MB
node 2 cpus: 2 6 10 14 18 22 26 30 34 38 42 46 50 54 58 62
node 2 size: 193532 MB
node 2 free: 193151 MB
node 3 cpus: 3 7 11 15 19 23 27 31 35 39 43 47 51 55 59 63
node 3 size: 193532 MB
node 3 free: 184327 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:      791189588 kB
HugePages_Total:      0
Hugepagesize:    2048 kB
```

```
From /etc/*release* /etc/*version*
os-release:
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)
```

(Continued on next page)



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## Platform Notes (Continued)

```
system-release: Red Hat Enterprise Linux release 8.1 (Ootpa)
system-release-cpe: cpe:/o:redhat:enterprise_linux:8.1:ga
```

uname -a:

```
Linux user-pc.spa.lab 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/swaps barriers and __user
pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB: conditional,
RSB filling
```

run-level 3 Jun 29 10:50 last=5

SPEC is set to: /mnt/ramdisk/cpu2017-ic19.lul

```
Filesystem Type Size Used Avail Use% Mounted on
tmpfs tmpfs 225G 4.3G 221G 2% /mnt/ramdisk
```

From /sys/devices/virtual/dmi/id

```
BIOS: Dell Inc. 2.7.7 05/04/2020
Vendor: Dell Inc.
Product: PowerEdge R740xd
Product Family: PowerEdge
Serial: F5BMCS2
```

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:

```
19x 00AD00B300AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933
1x 00AD063200AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933
4x 00AD069D00AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933
```

(End of data from sysinfo program)



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## Compiler Version Notes

=====  
C | 502.gcc\_r(peak)  
-----

Intel(R) C Compiler for applications running on IA-32, Version 2021.1 NextGen  
Build 20200304  
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.  
-----

=====  
C | 500.perlbench\_r(base) 502.gcc\_r(base) 505.mcf\_r(base, peak)  
525.x264\_r(base, peak) 557.xz\_r(base)

Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1  
NextGen Build 20200304  
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.  
-----

=====  
C | 500.perlbench\_r(peak) 557.xz\_r(peak)  
-----

Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,  
Version 19.1.1.217 Build 20200306  
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.  
-----

=====  
C | 502.gcc\_r(peak)  
-----

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-----

=====  
C | 500.perlbench\_r(base) 502.gcc\_r(base) 505.mcf\_r(base, peak)  
525.x264\_r(base, peak) 557.xz\_r(base)

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NextGen Build 20200304  
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.  
-----

=====  
C | 500.perlbench\_r(peak) 557.xz\_r(peak)  
-----

Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,  
Version 19.1.1.217 Build 20200306

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## Compiler Version Notes (Continued)

Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

C | 502.gcc\_r(peak)

Intel(R) C Compiler for applications running on IA-32, Version 2021.1 NextGen Build 20200304

Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

C | 500.perlbench\_r(base) 502.gcc\_r(base) 505.mcf\_r(base, peak) 525.x264\_r(base, peak) 557.xz\_r(base)

Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1 NextGen Build 20200304

Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

C | 500.perlbench\_r(peak) 557.xz\_r(peak)

Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.1.1.217 Build 20200306

Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

C++ | 520.omnetpp\_r(base, peak) 523.xalancbmk\_r(base, peak) 531.deepsjeng\_r(base, peak) 541.leela\_r(base, peak)

Intel(R) C++ Compiler for applications running on Intel(R) 64, Version 2021.1 NextGen Build 20200304

Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

Fortran | 548.exchange2\_r(base, peak)

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.1.1.217 Build 20200306

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## Base Compiler Invocation

C benchmarks:

icc

C++ benchmarks:

icpc

Fortran benchmarks:

ifort

## 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
```

## Base Optimization Flags

C benchmarks:

```
-m64 -qnextgen -std=c11
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
-xCORE-AVX512 -O3 -ffast-math -flto -mfpmath=sse -funroll-loops
-fuse-ld=gold -qopt-mem-layout-trans=4
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
-lqkmalloc
```

C++ benchmarks:

```
-m64 -qnextgen -Wl,-plugin-opt=-x86-branches-within-32B-boundaries
-Wl,-z,muldefs -xCORE-AVX512 -O3 -ffast-math -flto -mfpmath=sse
-funroll-loops -fuse-ld=gold -qopt-mem-layout-trans=4
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
-lqkmalloc
```

Fortran benchmarks:

```
-m64 -Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
-xCORE-AVX512 -O3 -ipo -no-prec-div -qopt-mem-layout-trans=4
```

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## Base Optimization Flags (Continued)

Fortran benchmarks (continued):

```
-nostandard-realloc-lhs -align array32byte -auto
-mbranches-within-32B-boundaries
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
-lqkmalloc
```

## Peak Compiler Invocation

C benchmarks:

icc

C++ benchmarks:

icpc

Fortran benchmarks:

ifort

## 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: -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
```

## Peak Optimization Flags

C benchmarks:

```
500.perlbench_r: -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/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
-lqkmalloc
```

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## Peak Optimization Flags (Continued)

502.gcc\_r: -m32

```
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/ia32_lin
-std=gnu89
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries
-Wl,-z,muldefs -fprofile-generate(pass 1)
-fprofile-use=default.profddata(pass 2) -xCORE-AVX512 -flto
-Ofast(pass 1) -O3 -ffast-math -qnextgen -fuse-ld=gold
-qopt-mem-layout-trans=4 -L/usr/local/jemalloc32-5.0.1/lib
-ljemalloc
```

505.mcf\_r: basepeak = yes

525.x264\_r: -m64 -qnextgen -std=c11

```
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries
-Wl,-z,muldefs -xCORE-AVX512 -flto -O3 -ffast-math
-fuse-ld=gold -qopt-mem-layout-trans=4 -fno-alias
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
-lqkmalloc
```

557.xz\_r: -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div

```
-qopt-mem-layout-trans=4 -mbranches-within-32B-boundaries
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
-lqkmalloc
```

C++ benchmarks:

520.omnetpp\_r: basepeak = yes

523.xalancbmk\_r: basepeak = yes

531.deepsjeng\_r: basepeak = yes

541.leela\_r: basepeak = yes

Fortran benchmarks:

548.exchange2\_r: basepeak = yes

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

[http://www.spec.org/cpu2017/flags/Intel-ic19.1u1-official-linux64\\_revA.html](http://www.spec.org/cpu2017/flags/Intel-ic19.1u1-official-linux64_revA.html)

<http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-revE11.html>



# SPEC CPU®2017 Integer Rate Result

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Dell Inc.

SPECrate®2017\_int\_base = 226

PowerEdge R740xd (Intel Xeon Gold 6226R, 2.90 GHz)

SPECrate®2017\_int\_peak = 235

**CPU2017 License:** 55

**Test Sponsor:** Dell Inc.

**Tested by:** Dell Inc.

**Test Date:** Jun-2020

**Hardware Availability:** Jul-2020

**Software Availability:** Apr-2020

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

[http://www.spec.org/cpu2017/flags/Intel-ic19.lul1-official-linux64\\_revA.xml](http://www.spec.org/cpu2017/flags/Intel-ic19.lul1-official-linux64_revA.xml)

<http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-revE11.xml>

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

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