



# SPEC® CPU2017 Integer Rate Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

## Dell Inc.

SPECrate2017\_int\_base = 71.7

PowerEdge R6415 (AMD EPYC 7281, 2.10GHz)

SPECrate2017\_int\_peak = 77.0

CPU2017 License: 55

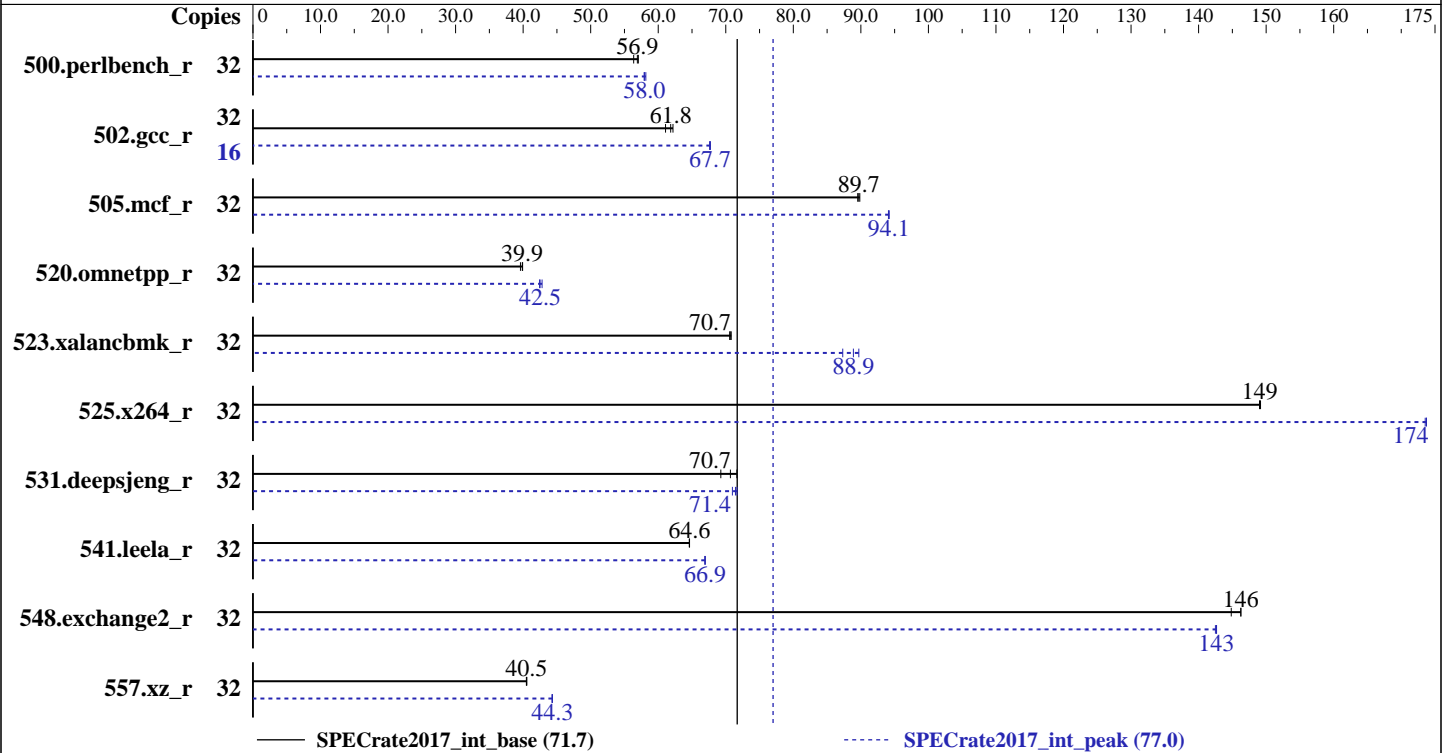
Test Date: Nov-2018

Test Sponsor: Dell Inc.

Hardware Availability: Dec-2018

Tested by: Dell Inc.

Software Availability: Jul-2018



### Hardware

CPU Name: AMD EPYC 7281  
 Max MHz.: 2700  
 Nominal: 2100  
 Enabled: 16 cores, 1 chip, 2 threads/core  
 Orderable: 1 chip  
 Cache L1: 64 KB I + 32 KB D on chip per core  
 L2: 512 KB I+D on chip per core  
 L3: 32 MB I+D on chip per chip, 4 MB shared / 2 cores  
 Other: None  
 Memory: 512 GB (8 x 64 GB 4DRx4 PC4-2667V-L)  
 Storage: 1 x 480 GB SATA SSD  
 Other: None

### Software

OS: SUSE Linux Enterprise Server 12 SP3  
 kernel 4.4.126-94.22-default  
 Compiler: C/C++: Version 1.0.0 of AOCC  
 Fortran: Version 4.8.2 of GCC  
 Parallel: No  
 Firmware: Version 1.6.7 released Oct-2018  
 File System: xfs  
 System State: Run level 3 (multi-user)  
 Base Pointers: 64-bit  
 Peak Pointers: 32/64-bit  
 Other: jemalloc: jemalloc memory allocator library  
 V4.5.0



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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	32	<b>895</b>	<b>56.9</b>	904	56.4	893	57.1	32	876	58.2	880	57.9	<b>879</b>	<b>58.0</b>
502.gcc_r	32	<b>733</b>	<b>61.8</b>	729	62.2	742	61.1	16	335	67.6	<b>335</b>	<b>67.7</b>	335	67.7
505.mcf_r	32	<b>577</b>	<b>89.7</b>	576	89.8	578	89.5	32	<b>549</b>	<b>94.1</b>	549	94.2	550	94.1
520.omnetpp_r	32	1052	39.9	<b>1053</b>	<b>39.9</b>	1060	39.6	32	989	42.4	<b>988</b>	<b>42.5</b>	981	42.8
523.xalancbmk_r	32	<b>478</b>	<b>70.7</b>	477	70.8	479	70.6	32	377	89.7	<b>380</b>	<b>88.9</b>	387	87.3
525.x264_r	32	376	149	376	149	<b>376</b>	<b>149</b>	32	<b>323</b>	<b>174</b>	323	174	323	174
531.deepsjeng_r	32	512	71.6	529	69.3	<b>519</b>	<b>70.7</b>	32	512	71.7	517	71.0	<b>513</b>	<b>71.4</b>
541.leela_r	32	<b>820</b>	<b>64.6</b>	820	64.6	820	64.6	32	<b>792</b>	<b>66.9</b>	792	66.9	791	67.0
548.exchange2_r	32	579	145	<b>573</b>	<b>146</b>	573	146	32	<b>588</b>	<b>143</b>	588	143	588	142
557.xz_r	32	<b>853</b>	<b>40.5</b>	854	40.5	852	40.5	32	780	44.3	<b>780</b>	<b>44.3</b>	781	44.3

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

## Compiler Notes

The AMD64 AOCC Compiler Suite is available at <http://developer.amd.com/amd-aocc/>

The AOCC Gold Linker plugin was installed and used for the link stage.

The AOCC Fortran Plugin version 1.0 was used to leverage AOCC optimizers with gfortran. It is available here: <http://developer.amd.com/amd-aocc/>

## Submit Notes

The config file option 'submit' was used.  
'numactl' was used to bind copies to the cores.  
See the configuration file for details.

## Operating System Notes

'ulimit -s unlimited' was used to set environment stack size  
'ulimit -l 2097152' was used to set environment locked pages in memory limit

runspec command invoked through numactl i.e.:  
numactl --interleave=all runspec <etc>

Set dirty\_ratio=8 to limit dirty cache to 8% of memory  
Set swappiness=1 to swap only if necessary  
Set zone\_reclaim\_mode=1 to free local node memory and avoid remote memory  
sync then drop\_caches=3 to reset caches before invoking runcpu

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## Operating System Notes (Continued)

dirty\_ratio, swappiness, zone\_reclaim\_mode and drop\_caches were all set using privileged echo (e.g. echo 1 > /proc/sys/vm/swappiness).

Transparent huge pages were enabled for this run (OS default)

## General Notes

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

```
LD_LIBRARY_PATH = "/home/cpu2017-1.0.5/amd1704-rate-libs-revD/64:/home/cpu2017-1.0.5/amd1704-rate-libs-revD/32:"
MALLOCCONF = "lg_chunk:26"
```

Binaries were compiled on a system with 2x AMD EPYC 7601 CPU + 512GB Memory using RHEL 7.4  
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.

jemalloc: configured and built with GCC v4.8.5 in RHEL v7.2 under default conditions.

jemalloc: sources available from jemalloc.net or <https://github.com/jemalloc/jemalloc/releases>

jemalloc uses environment variable MALLOCCONF with values narenas and lg\_chunk:

narenas: sets the maximum number of arenas to use for automatic multiplexing of threads and arenas.

lg\_chunk: set the virtual memory chunk size (log base 2). For example,

lg\_chunk:21 sets the default chunk size to 2^21 = 2MiB.

## Platform Notes

BIOS settings:

Memory Interleaving set to Channel Interleaving

Virtualization Technology disabled

System Profile set to Custom

CPU Power Management set to Maximum Performance

Memory Frequency set to Maximum Performance

Turbo Boost enabled

C States set to Autonomous

Memory Patrol Scrub disabled

Memory Refresh Rate set to 1x

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## Platform Notes (Continued)

PCI ASPM L1 Link Power Management disabled  
Determinism Slider set to Power Determinism  
Sysinfo program /home/cpu2017-1.0.5/bin/sysinfo  
Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9  
running on linux-j270 Mon Nov 19 09:27:19 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 : AMD EPYC 7281 16-Core Processor
 1 "physical id"s (chips)
 32 "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 8 9 12 13 16 17 20 21 24 25 28 29
```

From lscpu:

```
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 32
On-line CPU(s) list: 0-31
Thread(s) per core: 2
Core(s) per socket: 16
Socket(s): 1
NUMA node(s): 4
Vendor ID: AuthenticAMD
CPU family: 23
Model: 1
Model name: AMD EPYC 7281 16-Core Processor
Stepping: 2
CPU MHz: 2096.010
BogoMIPS: 4192.02
Virtualization: AMD-V
L1d cache: 32K
L1i cache: 64K
L2 cache: 512K
L3 cache: 4096K
NUMA node0 CPU(s): 0,4,8,12,16,20,24,28
NUMA node1 CPU(s): 1,5,9,13,17,21,25,29
NUMA node2 CPU(s): 2,6,10,14,18,22,26,30
NUMA node3 CPU(s): 3,7,11,15,19,23,27,31
Flags: fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
```

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## Platform Notes (Continued)

```

pat pse36 clflush mmx fxsr sse sse2 ht syscall nx mmxext fxsr_opt pdpe1gb rdtscp lm
constant_tsc rep_good nopl nonstop_tsc extd_apicid amd_dcm aperfmperf eagerfpu pni
pclmulqdq monitor ssse3 fma cx16 sse4_1 sse4_2 movbe popcnt aes xsave avx f16c
rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse 3dnowprefetch
osvw skinit wdt tce topoext perfctr_core perfctr_nb bpext perfctr_l2 mwaitx arat cpb
hw_pstate retpoline retpoline_amd npt lbrv svm_lock nrip_save tsc_scale vmcb_clean
flushbyasid decodeassists pausefilter pfthreshold vmmcall avic fsgsbase bmi1 avx2
smep bmi2 rdseed adx smap clflushopt sha_ni xsaveopt xsavec xgetbv1 clzero irperf
ibpb overflow_recov succor smca

```

```

/proc/cpuinfo cache data
cache size : 512 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
node 0 size: 128621 MB
node 0 free: 128476 MB
node 1 cpus: 1 5 9 13 17 21 25 29
node 1 size: 129018 MB
node 1 free: 128873 MB
node 2 cpus: 2 6 10 14 18 22 26 30
node 2 size: 129018 MB
node 2 free: 128869 MB
node 3 cpus: 3 7 11 15 19 23 27 31
node 3 size: 129017 MB
node 3 free: 128866 MB
node distances:
node  0  1  2  3
0:  10 16 16 16
1:  16 10 16 16
2:  16 16 10 16
3:  16 16 16 10

```

```

From /proc/meminfo
MemTotal:      528052476 kB
HugePages_Total:      0
Hugepagesize:    2048 kB

```

```

/usr/bin/lsb_release -d
SUSE Linux Enterprise Server 12 SP3

```

```

From /etc/*release* /etc/*version*
SuSE-release:
SUSE Linux Enterprise Server 12 (x86_64)
VERSION = 12

```

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## Platform Notes (Continued)

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-j270 4.4.126-94.22-default #1 SMP Wed Apr 11 07:45:03 UTC 2018 (9649989)  
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: Full AMD retpoline + IBPB

run-level 3 Nov 18 11:09

SPEC is set to: /home/cpu2017-1.0.5

Filesystem	Type	Size	Used	Avail	Use%	Mounted on
/dev/sda4	xfs	405G	16G	389G	4%	/home

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. 1.6.7 10/29/2018

Memory:

8x 80CE863280CE M386A8K40BM2-CTD 64 GB 4 rank 2666

8x Not Specified Not Specified

(End of data from sysinfo program)

## Compiler Version Notes

=====  
CC 502.gcc\_r(peak)  
-----

AOCC.LLVM.4.0.0.B35.2017\_04\_26 clang version 4.0.0 (CLANG:) (based on LLVM

AOCC.LLVM.4.0.0.B35.2017\_04\_26)

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## Compiler Version Notes (Continued)

Target: i386-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin

=====  
CXXC 523.xalancbmk\_r(peak)

-----  
AOCC.LLVM.4.0.0.B35.2017\_04\_26 clang version 4.0.0 (CLANG:) (based on LLVM  
AOCC.LLVM.4.0.0.B35.2017\_04\_26)  
Target: i386-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin

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

-----  
AOCC.LLVM.4.0.0.B35.2017\_04\_26 clang version 4.0.0 (CLANG:) (based on LLVM  
AOCC.LLVM.4.0.0.B35.2017\_04\_26)  
Target: x86\_64-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin

=====  
CXXC 520.omnetpp\_r(base, peak) 523.xalancbmk\_r(base) 531.deepsjeng\_r(base,  
peak) 541.leela\_r(base)

-----  
AOCC.LLVM.4.0.0.B35.2017\_04\_26 clang version 4.0.0 (CLANG:) (based on LLVM  
AOCC.LLVM.4.0.0.B35.2017\_04\_26)  
Target: x86\_64-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin

=====  
CC 500.perlbench\_r(peak) 525.x264\_r(peak)

-----  
AOCC.LLVM.4.0.0.B35.2017\_04\_26 clang version 4.0.0 (CLANG:) (based on LLVM  
AOCC.LLVM.4.0.0.B35.2017\_04\_26)  
Target: x86\_64-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin

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## Compiler Version Notes (Continued)

=====  
CXXC 541.leela\_r(peak)  
-----

AOCC.LLVM.4.0.0.B35.2017\_04\_26 clang version 4.0.0 (CLANG:) (based on LLVM  
AOCC.LLVM.4.0.0.B35.2017\_04\_26)  
Target: x86\_64-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin  
-----

=====  
FC 548.exchange2\_r(base, peak)  
-----

GNU Fortran (GCC) 4.8.2  
Copyright (C) 2013 Free Software Foundation, Inc.  
GNU Fortran comes with NO WARRANTY, to the extent permitted by law.  
You may redistribute copies of GNU Fortran  
under the terms of the GNU General Public License.  
For more information about these matters, see the file named COPYING  
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## Base Compiler Invocation

C benchmarks:

clang

C++ benchmarks:

clang++

Fortran benchmarks:

clang\_gfortran

## Base Portability Flags

500.perlbench\_r: -DSPEC\_LINUX\_X64 -DSPEC\_LP64  
502.gcc\_r: -DSPEC\_LP64  
505.mcf\_r: -DSPEC\_LP64  
520.omnetpp\_r: -DSPEC\_LP64  
523.xalancbmk\_r: -DSPEC\_LINUX -DSPEC\_LP64  
525.x264\_r: -DSPEC\_LP64  
531.deepsjeng\_r: -DSPEC\_LP64  
541.leela\_r: -DSPEC\_LP64  
548.exchange2\_r: -DSPEC\_LP64

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## Base Portability Flags (Continued)

557.xz\_r: -DSPEC\_LP64

## Base Optimization Flags

C benchmarks:

```
-flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Wl,-plugin-opt=-disable-vect-cmp
-O3 -ffast-math -march=znver1 -fstruct-layout=2
-mllvm -unroll-threshold=100 -fremap-arrays -mno-avx2
-mllvm -inline-threshold=1000 -mllvm -disable-vect-cmp -z muldefs
-ljemalloc
```

C++ benchmarks:

```
-flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Wl,-plugin-opt=-disable-vect-cmp
-O3 -march=znver1 -mllvm -unroll-threshold=100 -finline-aggressive
-fremap-arrays -mllvm -inline-threshold=1000 -mllvm -disable-vect-cmp
-z muldefs -ljemalloc
```

Fortran benchmarks:

```
-flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Wl,-plugin-opt=-disable-vect-cmp
-O3 -mavx -madx -funroll-loops -ffast-math -z muldefs -Ofast
-fdefault-integer-8 -fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option=-lsr-in-nested-loop
-fplugin-arg-dragonegg-llvm-option=-enable-iv-split
-fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-inline-threshold:1000
-fplugin-arg-dragonegg-llvm-option=-disable-vect-cmp -ljemalloc
-lgfortran -lamdlibm
```

## Peak Compiler Invocation

C benchmarks:

clang

C++ benchmarks:

clang++

Fortran benchmarks:

clang gfortran



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## Peak Portability Flags

```

500.perlbench_r: -DSPEC_LINUX_X64 -DSPEC_LP64
502.gcc_r: -D_FILE_OFFSET_BITS=64
505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
523.xalancbmk_r: -DSPEC_LINUX -D_FILE_OFFSET_BITS=64
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: -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop
-fprofile-instr-generate(pass 1)
-fprofile-instr-use(pass 2) -Ofast -march=znver1
-fstruct-layout=3 -mllvm -vectorize-memory-aggressively
-mno-avx2 -mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -ljemalloc

```

```

502.gcc_r: -m32 -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Ofast -march=znver1
-fstruct-layout=3 -mllvm -vectorize-memory-aggressively
-mno-avx2 -mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -fgnu89-inline -ljemalloc

```

```

505.mcf_r: -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Ofast -march=znver1
-fstruct-layout=3 -mllvm -vectorize-memory-aggressively
-mno-avx2 -mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -ljemalloc

```

525.x264\_r: Same as 500.perlbench\_r

557.xz\_r: Same as 505.mcf\_r

C++ benchmarks:

```

520.omnetpp_r: -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Ofast -march=znver1
-finline-aggressive -mllvm -unroll-threshold=100

```

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## Peak Optimization Flags (Continued)

520.omnetpp\_r (continued):

-fremap-arrays -mllvm -inline-threshold=1000 -ljemalloc

523.xalancbmk\_r: -m32 -flto -Wl,-plugin-opt=-merge-constant

-Wl,-plugin-opt=-lsr-in-nested-loop -Ofast -march=znver1

-finline-aggressive -mllvm -unroll-threshold=100

-fremap-arrays -mllvm -inline-threshold=1000 -ljemalloc

531.deepsjeng\_r: Same as 520.omnetpp\_r

541.leela\_r: -flto -Wl,-plugin-opt=-merge-constant

-Wl,-plugin-opt=-lsr-in-nested-loop

-fprofile-instr-generate(pass 1)

-fprofile-instr-use(pass 2) -Ofast -march=znver1

-mllvm -unroll-count=8 -mllvm -unroll-threshold=100

-ljemalloc

Fortran benchmarks:

-flto -Wl,-plugin-opt=-merge-constant

-Wl,-plugin-opt=-lsr-in-nested-loop -O3 -mavx2 -madx -funroll-loops

-ffast-math -Ofast -fdefault-integer-8 -fplugin=dragonegg.so

-fplugin-arg-dragonegg-llvm-option=-lsr-in-nested-loop

-fplugin-arg-dragonegg-llvm-option=-enable-iv-split

-fplugin-arg-dragonegg-llvm-option=-merge-constant

-fplugin-arg-dragonegg-llvm-option=-inline-threshold:1000

-fplugin-arg-dragonegg-llvm-option=-disable-vect-cmp -ljemalloc

-lgfortran -lamdlibm

## Peak Other Flags

C benchmarks:

502.gcc\_r: -L/root/work/lib/jemalloc/lib32

C++ benchmarks:

523.xalancbmk\_r: -L/root/work/lib/jemalloc/lib32

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

<http://www.spec.org/cpu2017/flags/aocc100-flags-revC-I.2018-11-13.html>

<http://www.spec.org/cpu2017/flags/gcc.2018-02-16.html>



# SPEC CPU2017 Integer Rate Result

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Dell Inc.

SPECrate2017\_int\_base = 71.7

PowerEdge R6415 (AMD EPYC 7281, 2.10GHz)

SPECrate2017\_int\_peak = 77.0

**CPU2017 License:** 55

**Test Sponsor:** Dell Inc.

**Tested by:** Dell Inc.

**Test Date:** Nov-2018

**Hardware Availability:** Dec-2018

**Software Availability:** Jul-2018

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

<http://www.spec.org/cpu2017/flags/aocc100-flags-revC-I.2018-11-13.xml>

<http://www.spec.org/cpu2017/flags/gcc.2018-02-16.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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