



# SPEC® CPU2017 Integer Rate Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

## Dell Inc.

SPECrate2017\_int\_base = 43.0

PowerEdge R7415 (AMD EPYC 7251, 2.10GHz)

SPECrate2017\_int\_peak = 45.5

CPU2017 License: 55

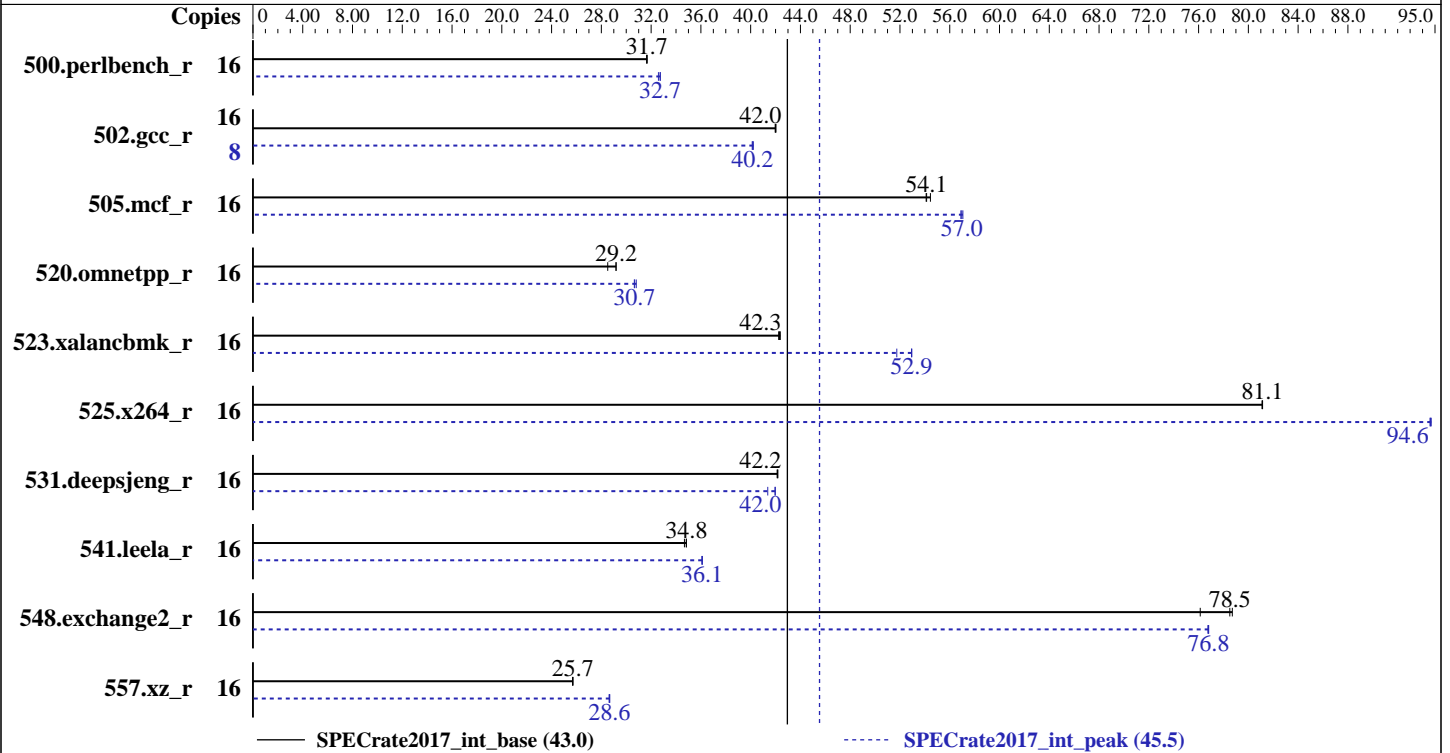
Test Date: Nov-2018

Test Sponsor: Dell Inc.

Hardware Availability: Dec-2018

Tested by: Dell Inc.

Software Availability: Apr-2018



### Hardware

CPU Name: AMD EPYC 7251  
 Max MHz.: 2900  
 Nominal: 2100  
 Enabled: 8 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  
 Other: None  
 Memory: 512 GB (8 x 64 GB 4DRx4 PC4-2667V-L, running at 2400)  
 Storage: 1 x 1.92 TB 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 1.6.4 released Oct-2018  
 File System: xfs  
 System State: Run level 3 (multi-user)  
 Base Pointers: 64-bit  
 Peak Pointers: 32/64-bit  
 Other: 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	16	804	31.7	805	31.6	<b>805</b>	<b>31.7</b>	16	<b>778</b>	<b>32.7</b>	782	32.6	778	32.7
502.gcc_r	16	540	42.0	539	42.0	<b>540</b>	<b>42.0</b>	8	282	40.1	282	40.2	<b>282</b>	<b>40.2</b>
505.mcf_r	16	478	54.1	475	54.4	<b>478</b>	<b>54.1</b>	16	454	56.9	<b>454</b>	<b>57.0</b>	453	57.1
520.omnetpp_r	16	719	29.2	<b>719</b>	<b>29.2</b>	736	28.5	16	681	30.8	685	30.7	<b>684</b>	<b>30.7</b>
523.xalancbmk_r	16	400	42.2	<b>399</b>	<b>42.3</b>	399	42.4	16	319	53.0	327	51.7	<b>319</b>	<b>52.9</b>
525.x264_r	16	<b>345</b>	<b>81.1</b>	345	81.1	345	81.1	16	<b>296</b>	<b>94.6</b>	296	94.6	296	94.7
531.deepsjeng_r	16	435	42.1	<b>435</b>	<b>42.2</b>	435	42.2	16	443	41.4	<b>437</b>	<b>42.0</b>	437	42.0
541.leela_r	16	761	34.8	764	34.7	<b>761</b>	<b>34.8</b>	16	734	36.1	<b>734</b>	<b>36.1</b>	734	36.1
548.exchange2_r	16	<b>534</b>	<b>78.5</b>	533	78.7	551	76.1	16	<b>546</b>	<b>76.8</b>	546	76.7	546	76.8
557.xz_r	16	672	25.7	673	25.7	<b>672</b>	<b>25.7</b>	16	603	28.7	604	28.6	<b>603</b>	<b>28.6</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 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

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## Operating System Notes (Continued)

sync then drop\_caches=3 to reset caches before invoking runcpu

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:"  
MALLOC\_CONF = "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 MALLOC\_CONF 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

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## Platform Notes (Continued)

Memory Refresh Rate set to 1x  
 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-fl85 Mon Nov 19 10:46:41 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 7251 8-Core Processor  
     1 "physical id"s (chips)  
     16 "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 : 8  
     siblings : 16  
     physical 0: cores 0 8 12 16 20 24 28

From lscpu:  
 Architecture:          x86\_64  
 CPU op-mode(s):       32-bit, 64-bit  
 Byte Order:            Little Endian  
 CPU(s):                16  
 On-line CPU(s) list:   0-15  
 Thread(s) per core:    2  
 Core(s) per socket:    8  
 Socket(s):             1  
 NUMA node(s):          4  
 Vendor ID:             AuthenticAMD  
 CPU family:            23  
 Model:                  1  
 Model name:            AMD EPYC 7251 8-Core Processor  
 Stepping:              2  
 CPU MHz:               2096.009  
 BogoMIPS:              4192.01  
 Virtualization:        AMD-V  
 L1d cache:             32K  
 L1i cache:             64K  
 L2 cache:              512K  
 L3 cache:              4096K  
 NUMA node0 CPU(s):    0,4,8,12  
 NUMA node1 CPU(s):    1,5,9,13  
 NUMA node2 CPU(s):    2,6,10,14  
 NUMA node3 CPU(s):    3,7,11,15

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## Platform Notes (Continued)

Flags: fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov 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
node 0 size: 128621 MB
node 0 free: 128475 MB
node 1 cpus: 1 5 9 13
node 1 size: 129018 MB
node 1 free: 128875 MB
node 2 cpus: 2 6 10 14
node 2 size: 129018 MB
node 2 free: 128867 MB
node 3 cpus: 3 7 11 15
node 3 size: 129017 MB
node 3 free: 128879 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: 528052376 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)
```

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## Platform Notes (Continued)

```

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-fl85 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 19 10:45 last=5

```

SPEC is set to: /home/cpu2017-1.0.5
Filesystem      Type  Size  Used Avail Use% Mounted on
/dev/sda4        xfs   1.8T   9.5G  1.8T   1% /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. 1.6.4 10/04/2018

Memory:

```

8x 80CE863280CE M386A8K40BM2-CTD 64 GB 4 rank 2666, configured at 2400
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

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## Compiler Version Notes (Continued)

```
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
```

```
=====  
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)
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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  
=====

## 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

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## Base Portability Flags (Continued)

548.exchange2\_r: -DSPEC\_LP64

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 -madox -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 = 43.0

PowerEdge R7415 (AMD EPYC 7251, 2.10GHz)

SPECrate2017\_int\_peak = 45.5

**CPU2017 License:** 55

**Test Sponsor:** Dell Inc.

**Tested by:** Dell Inc.

**Test Date:** Nov-2018

**Hardware Availability:** Dec-2018

**Software Availability:** Apr-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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