



SPEC® CPU2017 Integer Rate Result

Copyright 2017-2019 Standard Performance Evaluation Corporation

Dell Inc.

SPECrate2017_int_base = 82.2

PowerEdge R6415 (AMD EPYC 7281, 2.10GHz)

SPECrate2017_int_peak = 85.6

CPU2017 License: 55

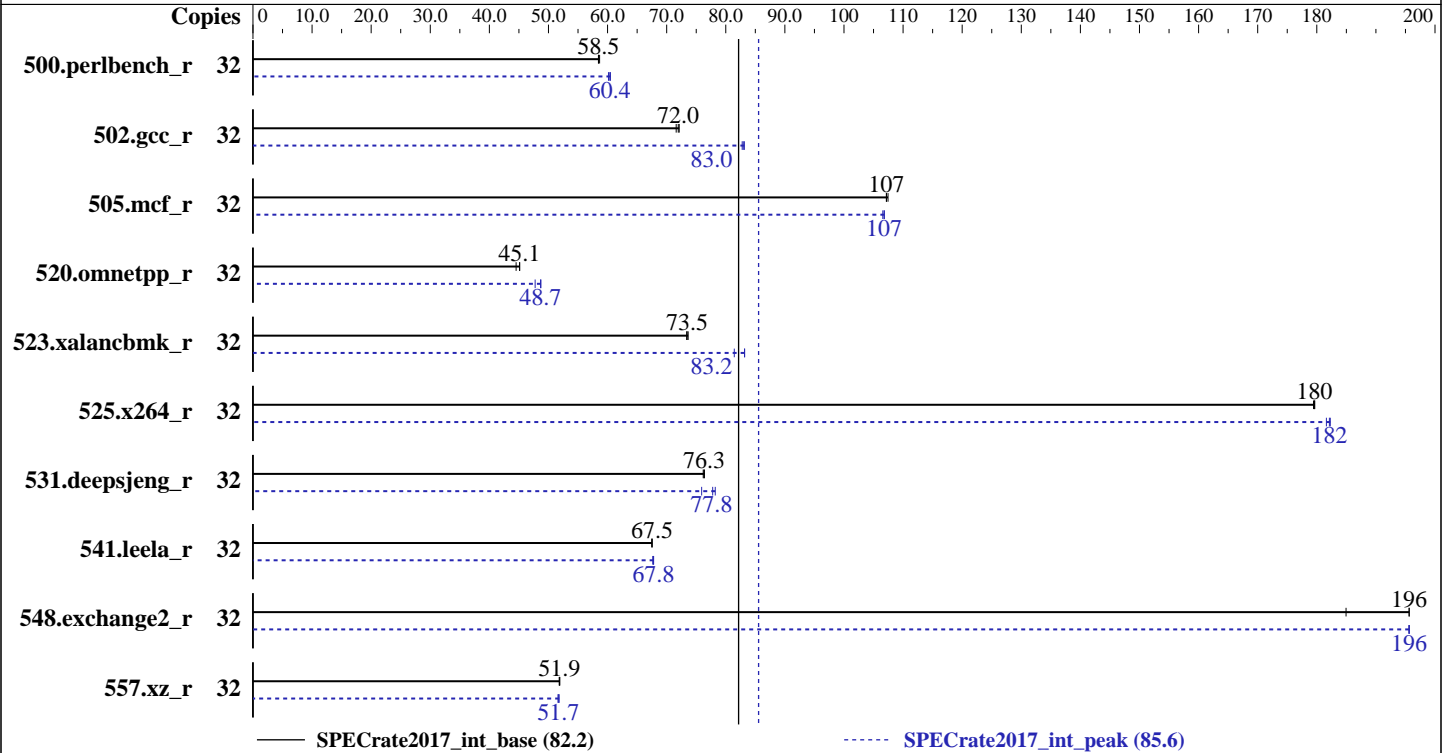
Test Date: Mar-2019

Test Sponsor: Dell Inc.

Hardware Availability: Apr-2019

Tested by: Dell Inc.

Software Availability: Feb-2019



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 4Rx4 PC4-2667V-L)
 Storage: 1 x 480 GB SATA SSD
 Other: None

Software

OS: Ubuntu 18.04.2 LTS
 kernel 4.15-45-generic
 Compiler: C/C++: Version 1.3.0 of AOCC
 Fortran: Version 4.8.2 of GCC
 Parallel: No
 Firmware: Version 1.8.4 Released Feb-2019
 File System: ext4
 System State: Run level 5 (multi-user)
 Base Pointers: 64-bit
 Peak Pointers: 32/64-bit
 Other: jemalloc: jemalloc memory allocator library
 V5.1.0;



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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	871	58.5	872	58.5	869	58.6	32	842	60.5	847	60.2	844	60.4
502.gcc_r	32	628	72.1	630	72.0	633	71.6	32	545	83.1	546	83.0	547	82.8
505.mcf_r	32	481	107	482	107	483	107	32	484	107	484	107	485	107
520.omnetpp_r	32	943	44.5	930	45.1	931	45.1	32	863	48.7	862	48.7	879	47.7
523.xalancbmk_r	32	459	73.6	460	73.4	460	73.5	32	415	81.4	406	83.2	406	83.2
525.x264_r	32	312	179	312	180	312	180	32	309	182	307	182	308	182
531.deepsjeng_r	32	480	76.4	481	76.2	480	76.3	32	483	75.9	469	78.2	471	77.8
541.leela_r	32	785	67.5	785	67.5	785	67.5	32	782	67.8	783	67.6	782	67.8
548.exchange2_r	32	429	196	429	196	453	185	32	429	196	429	196	429	196
557.xz_r	32	666	51.9	667	51.8	666	51.9	32	669	51.6	669	51.7	667	51.8

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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 1.3.0 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/amd1812na_rate_revA_lib/64;/home/cpu2017-1.0.5/amd1812na_rate_revA_lib/32:"

Binaries were compiled on a system with 2 x AMD EPYC 7601 CPU + 512GB Memory using RHEL 7.6

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:

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

PCI ASPM L1 Link Power Management disabled

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Platform Notes (Continued)

Determinism Slider set to Power Determinism
Sysinfo program /home/cpu2017-1.0.5/bin/sysinfo
Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9
running on bionic-beaver-sut Tue Mar 12 10:11:34 2019

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: 2619.478
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
pat pse36 clflush mmx fxsr sse sse2 ht syscall nx mmxext fxsr_opt pdpe1gb rdtscp lm
```

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Platform Notes (Continued)

```

constant_tsc rep_good nopl nonstop_tsc cpuid extd_apicid amd_dcm aperfmperf pni
pclmulqdq monitor ssse3 fma cx16 sse4_1 sse4_2 movbe popcnt aes xsave avx fl6c
rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse 3dnowprefetch
osvw skinit wdt tce topoext perfctr_core perfctr_nb bpext perfctr_llc mwaitx cpb
hw_pstate sme ssbd ibpb vmcall fsgsbase bmi1 avx2 smep bmi2 rdseed adx smap
clflushopt sha_ni xsaveopt xsavec xgetbv1 xsaves clzero irperf xsaveerptr arat npt
lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter
pfthreshold avic v_vmsave_vmload vgif 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: 128635 MB
node 0 free: 128434 MB
node 1 cpus: 1 5 9 13 17 21 25 29
node 1 size: 128996 MB
node 1 free: 128798 MB
node 2 cpus: 2 6 10 14 18 22 26 30
node 2 size: 129017 MB
node 2 free: 128829 MB
node 3 cpus: 3 7 11 15 19 23 27 31
node 3 size: 129016 MB
node 3 free: 128832 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:      528041808 kB
HugePages_Total:      0
Hugepagesize:    2048 kB

```

```

/usr/bin/lsb_release -d
Ubuntu 18.04.2 LTS

```

```

From /etc/*release* /etc/*version*
debian_version: buster/sid
os-release:
  NAME="Ubuntu"
  VERSION="18.04.2 LTS (Bionic Beaver)"

```

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Platform Notes (Continued)

```

ID=ubuntu
ID_LIKE=debian
PRETTY_NAME="Ubuntu 18.04.2 LTS"
VERSION_ID="18.04"
HOME_URL="https://www.ubuntu.com/"
SUPPORT_URL="https://help.ubuntu.com/"

```

uname -a:

```

Linux bionic-beaver-sut 4.15.0-45-generic #48-Ubuntu SMP Tue Jan 29 16:28:13 UTC 2019
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 5 Mar 12 10:09

SPEC is set to: /home/cpu2017-1.0.5

```

Filesystem      Type  Size  Used Avail Use% Mounted on
/dev/sda2       ext4  439G   25G  392G   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. 1.8.4 02/22/2019

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)
=====

```

```

AOCCLLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
AOCCL1_3_0_Release-Build#34) (based on LLVM AOCCLLVM.1.3.0.B34.2018_10_22)
Target: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aoccl1.3.0/AOCC-1.3.0-Compiler/bin
=====

```

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Compiler Version Notes (Continued)

=====
CXXC 523.xalancbmk_r(peak)

AOCC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
AOCC_1_3_0_Release-Build#34) (based on LLVM AOCC.LLVM.1.3.0.B34.2018_10_22)
Target: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aoccl.3.0/AOCC-1.3.0-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.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
AOCC_1_3_0_Release-Build#34) (based on LLVM AOCC.LLVM.1.3.0.B34.2018_10_22)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aoccl.3.0/AOCC-1.3.0-Compiler/bin

=====
CXXC 520.omnetpp_r(base, peak) 523.xalancbmk_r(base) 531.deepsjeng_r(base,
peak) 541.leela_r(base)

AOCC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
AOCC_1_3_0_Release-Build#34) (based on LLVM AOCC.LLVM.1.3.0.B34.2018_10_22)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aoccl.3.0/AOCC-1.3.0-Compiler/bin

=====
CC 500.perlbench_r(peak) 525.x264_r(peak)

AOCC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
AOCC_1_3_0_Release-Build#34) (based on LLVM AOCC.LLVM.1.3.0.B34.2018_10_22)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aoccl.3.0/AOCC-1.3.0-Compiler/bin

=====
CXXC 541.leela_r(peak)

AOCC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
AOCC_1_3_0_Release-Build#34) (based on LLVM AOCC.LLVM.1.3.0.B34.2018_10_22)

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Compiler Version Notes (Continued)

Target: x86_64-unknown-linux-gnu

Thread model: posix

InstalledDir: /root/work/compilers/aoccl.3.0/AOCC-1.3.0-Compiler/bin

FC 548.exchange2_r(base, peak)

GNU Fortran (GCC) 4.8.2

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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

557.xz_r: -DSPEC_LP64



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Base Optimization Flags

C benchmarks:

```
500.perlbench_r: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares -O3 -ffast-math
-march=znver1 -mno-avx2 -fstruct-layout=3
-mllvm -unroll-threshold=50 -fremap-arrays
-mllvm -inline-threshold=1000 -flv-function-specialization
-mllvm -enable-gvn-hoist -mllvm -function-specialize
-z muldefs -lamdlibm -lpthread -ldl -ljemalloc
```

502.gcc_r: Same as 500.perlbench_r

505.mcf_r: Same as 500.perlbench_r

525.x264_r: Same as 500.perlbench_r

```
557.xz_r: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares -O3 -ffast-math
-march=znver1 -mno-avx2 -fstruct-layout=3
-mllvm -unroll-threshold=50 -fremap-arrays
-mllvm -inline-threshold=1000 -flv-function-specialization
-mllvm -enable-gvn-hoist -mllvm -function-specialize
-z muldefs -lpthread -ldl -ljemalloc
```

C++ benchmarks:

```
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares -O3 -march=znver1
-mllvm -unroll-threshold=100 -finline-aggressive -fremap-arrays
-mllvm -inline-threshold=1000 -mllvm -enable-vectorize-compares=false
-z muldefs -lpthread -ldl -ljemalloc
```

Fortran benchmarks:

```
-Wl,-mllvm -Wl,-inline-recursion=4 -Wl,-mllvm -Wl,-lsr-in-nested-loop
-Wl,-mllvm -Wl,-enable-iv-split -Wl,-mllvm -Wl,-merge-constant
-Wl,-mllvm -Wl,-unroll-aggressive -Wl,-mllvm -Wl,-unroll-threshold=150
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares -O3(gfortran) -O3(clang)
-mavx -madx -funroll-loops -ffast-math -fpack-arrays -z muldefs
-fplugin=dragonegg.so -specs=integrated-as.specs
-fplugin-arg-dragonegg-llvm-option=-disable-indvar-simplify
-fplugin-arg-dragonegg-llvm-option=-unroll-aggressive
-fplugin-arg-dragonegg-llvm-option=-unroll-threshold:150 -lpthread -ldl
-ljemalloc -lgfortran -lamdlibm
```



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Peak Compiler Invocation

C benchmarks:

clang

C++ benchmarks:

clang++

Fortran benchmarks:

clang gfortran

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,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares
-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 -lpthread -ldl -ljemalloc

502.gcc_r: -m32 -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares -Ofast
-march=znver1 -fstruct-layout=3
-mllvm -vectorize-memory-aggressively -mno-avx2
-mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -fgnu89-inline -lpthread
-ldl -L/root/work/lib/jemalloc510/lib32 -ljemalloc
```

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Peak Optimization Flags (Continued)

```
505.mcf_r: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares -Ofast
-march=znver1 -fstruct-layout=3
-mllvm -vectorize-memory-aggressively -mno-avx2
-mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -lpthread -ldl -ljemalloc
```

```
525.x264_r: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares
-fprofile-instr-generate(pass 1)
-fprofile-instr-use(pass 2) -Ofast -march=znver1
-mno-avx2 -fstruct-layout=5
-mllvm -vectorize-memory-aggressively
-mllvm -unroll-threshold=50 -fremap-arrays
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-flv-function-specialization -lamdlibm -ljemalloc
-lpthread -ldl
```

557.xz_r: Same as 505.mcf_r

C++ benchmarks:

```
520.omnetpp_r: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares -Ofast
-march=znver1 -finline-aggressive
-mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -lpthread -ldl -ljemalloc
```

```
523.xalancbmk_r: -m32 -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares -Ofast
-march=znver1 -finline-aggressive
-mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -lpthread -ldl
-L/root/work/lib/jemalloc510/lib32 -ljemalloc
```

531.deepsjeng_r: Same as 520.omnetpp_r

```
541.leela_r: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares
-fprofile-instr-generate(pass 1)
-fprofile-instr-use(pass 2) -Ofast -march=znver1
-mllvm -unroll-count=8 -mllvm -unroll-threshold=100
-lpthread -ldl -ljemalloc
```

Fortran benchmarks:

```
-Wl,-mllvm -Wl,-inline-recursion=4 -Wl,-mllvm -Wl,-lsr-in-nested-loop
```

(Continued on next page)



SPEC CPU2017 Integer Rate Result

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Dell Inc.

SPECrate2017_int_base = 82.2

PowerEdge R6415 (AMD EPYC 7281, 2.10GHz)

SPECrate2017_int_peak = 85.6

CPU2017 License: 55

Test Sponsor: Dell Inc.

Tested by: Dell Inc.

Test Date: Mar-2019

Hardware Availability: Apr-2019

Software Availability: Feb-2019

Peak Optimization Flags (Continued)

Fortran benchmarks (continued):

```
-Wl,-mllvm -Wl,-enable-iv-split -Wl,-mllvm -Wl,-merge-constant
-Wl,-mllvm -Wl,-unroll-aggressive -Wl,-mllvm -Wl,-unroll-threshold=150
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares -O3(gfortran) -O3(clang)
-mavx -madox -funroll-loops -ffast-math -frepack-arrays
-fplugin=dragonegg.so -specs=integrated-as.specs
-fplugin-arg-dragonegg-llvm-option=-disable-indvar-simplify
-fplugin-arg-dragonegg-llvm-option=-unroll-aggressive
-fplugin-arg-dragonegg-llvm-option=-unroll-threshold:150 -lpthread -ldl
-ljemalloc -lgfortran -lamdlibm
```

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

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

<http://www.spec.org/cpu2017/flags/aocc130-flags-revA2.html>

<http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge14G-revE2.html>

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

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

<http://www.spec.org/cpu2017/flags/aocc130-flags-revA2.xml>

<http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge14G-revE2.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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