



SPEC® CPU2017 Floating Point Rate Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

Dell Inc.

SPECrate2017_fp_base = 86.0

PowerEdge R6415 (AMD EPYC 7281, 2.10GHz)

SPECrate2017_fp_peak = 87.5

CPU2017 License: 55

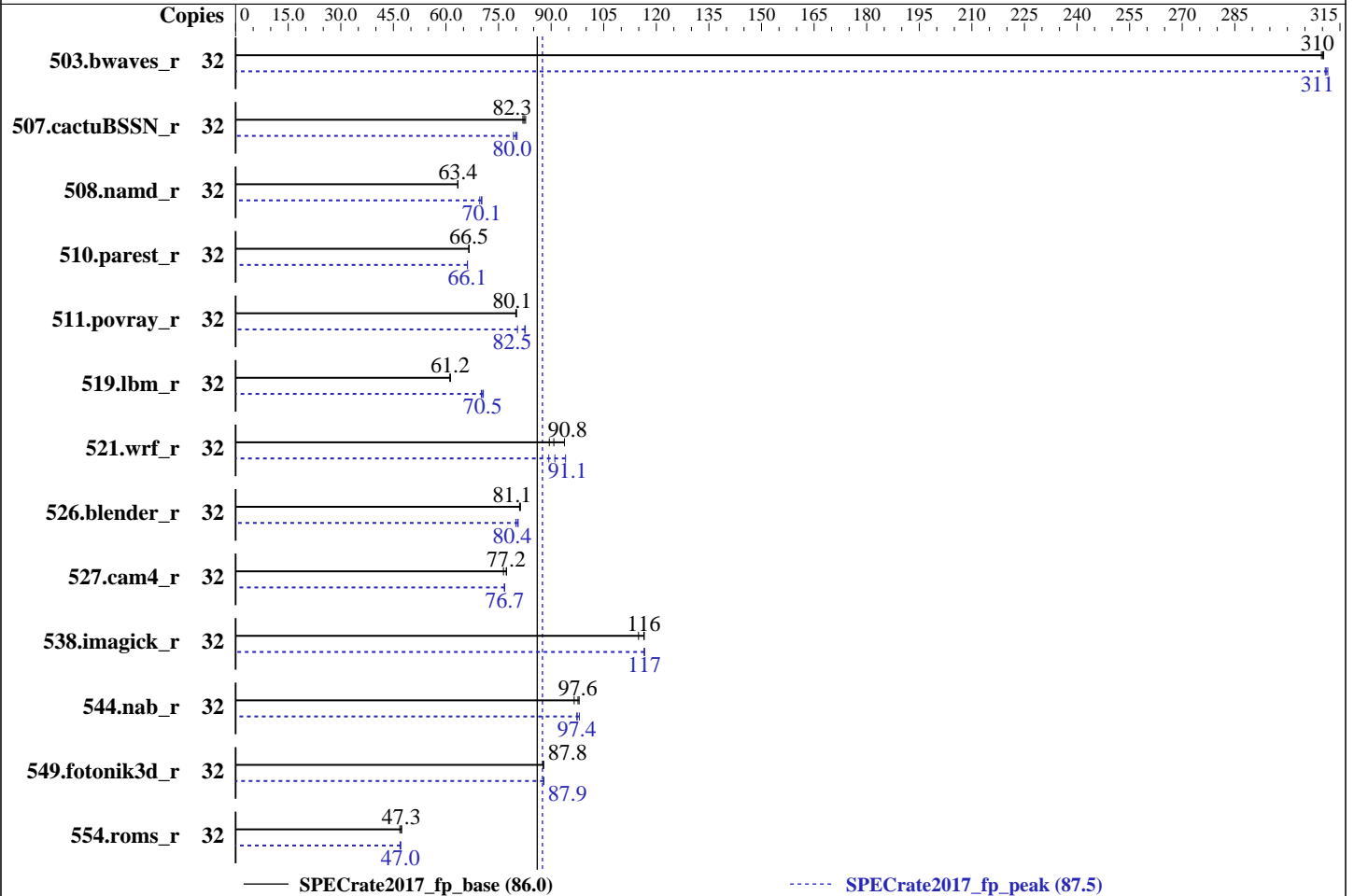
Test Date: Nov-2018

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: 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
503.bwaves_r	32	1036	310	1034	310	1035	310	32	1030	312	1032	311	1032	311
507.cactuBSSN_r	32	494	81.9	492	82.3	490	82.7	32	507	80.0	505	80.3	511	79.3
508.namd_r	32	479	63.4	480	63.3	479	63.4	32	433	70.1	433	70.2	436	69.6
510.parest_r	32	1256	66.6	1258	66.5	1259	66.5	32	1266	66.1	1266	66.1	1266	66.1
511.povray_r	32	935	79.9	933	80.1	933	80.1	32	904	82.6	929	80.4	906	82.5
519.lbm_r	32	552	61.1	550	61.3	551	61.2	32	479	70.5	481	70.1	477	70.7
521.wrf_r	32	790	90.8	801	89.5	764	93.8	32	762	94.1	802	89.3	787	91.1
526.blender_r	32	600	81.2	601	81.1	602	81.0	32	605	80.6	606	80.4	610	79.9
527.cam4_r	32	733	76.4	725	77.2	725	77.2	32	730	76.6	729	76.8	729	76.7
538.imagick_r	32	683	116	683	117	693	115	32	683	117	682	117	683	117
544.nab_r	32	558	96.6	550	98.0	552	97.6	32	553	97.4	553	97.4	549	98.0
549.fotonik3d_r	32	1420	87.8	1422	87.7	1420	87.8	32	1420	87.8	1419	87.9	1419	87.9
554.roms_r	32	1086	46.8	1075	47.3	1075	47.3	32	1081	47.1	1081	47.0	1084	46.9

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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>

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Operating System Notes (Continued)

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`

`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:"  
MALLOCONF = "lg_chunk:28"
```

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 `MALLOCONF` 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 $2^{21} = 2\text{MiB}$.

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

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Platform Notes (Continued)

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
 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 20:29:25 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

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Platform Notes (Continued)

```

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
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: 128464 MB
node 1 cpus: 1 5 9 13 17 21 25 29
node 1 size: 129018 MB
node 1 free: 128868 MB
node 2 cpus: 2 6 10 14 18 22 26 30
node 2 size: 129018 MB
node 2 free: 128862 MB
node 3 cpus: 3 7 11 15 19 23 27 31
node 3 size: 129017 MB
node 3 free: 128861 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

```

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Platform Notes (Continued)

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-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)



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Compiler Version Notes

=====
CC 519.lbm_r(base, peak) 538.imagick_r(base, peak) 544.nab_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 508.namd_r(base, peak) 510.parest_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
=====

=====
CC 511.povray_r(base, peak) 526.blender_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
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 507.cactuBSSN_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
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
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Compiler Version Notes (Continued)

InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin

GNU Fortran (GCC) 4.8.2

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=====
FC 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak) 554.roms_r(base, peak)

GNU Fortran (GCC) 4.8.2

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=====
CC 521.wrf_r(base, peak) 527.cam4_r(base, peak)

GNU Fortran (GCC) 4.8.2

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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

Base Compiler Invocation

C benchmarks:

clang

C++ benchmarks:

clang++

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Base Compiler Invocation (Continued)

Fortran benchmarks:

clang gfortran

Benchmarks using both Fortran and C:

clang gfortran

Benchmarks using both C and C++:

clang++ clang

Benchmarks using Fortran, C, and C++:

clang++ clang gfortran

Base Portability Flags

503.bwaves_r: -DSPEC_LP64

507.cactuBSSN_r: -DSPEC_LP64

508.namd_r: -DSPEC_LP64

510.parest_r: -DSPEC_LP64

511.povray_r: -DSPEC_LP64

519.lbm_r: -DSPEC_LP64

521.wrf_r: -DSPEC_CASE_FLAG -fconvert=big-endian -DSPEC_LP64

526.blender_r: -funsigned-char -D__BOOL_DEFINED -DSPEC_LP64

527.cam4_r: -DSPEC_CASE_FLAG -DSPEC_LP64

538.imagick_r: -DSPEC_LP64

544.nab_r: -DSPEC_LP64

549.fotonik3d_r: -DSPEC_LP64

554.roms_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

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Base Optimization Flags (Continued)

C++ benchmarks (continued):

```
-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
-fplugin=dragonegg.so -fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-disable-vect-cmp -ljemalloc
-lgfortran -lamdlibm
```

Benchmarks using both Fortran and C:

```
-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 -mavx -madox
-funroll-loops -z muldefs -fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-disable-vect-cmp -ljemalloc
-lgfortran -lamdlibm
```

Benchmarks using both C and C++:

```
-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
-finline-aggressive -z muldefs -ljemalloc
```

Benchmarks using Fortran, C, and C++:

```
-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
-finline-aggressive -mavx -madox -funroll-loops -z muldefs
-fplugin=dragonegg.so -fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-disable-vect-cmp -ljemalloc
```



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Peak Compiler Invocation

C benchmarks:

clang

C++ benchmarks:

clang++

Fortran benchmarks:

clang gfortran

Benchmarks using both Fortran and C:

clang gfortran

Benchmarks using both C and C++:

clang++ clang

Benchmarks using Fortran, C, and C++:

clang++ clang gfortran

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

-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

C++ benchmarks:

-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

Fortran benchmarks:

-flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -O3 -mavx2 -madox -funroll-loops
-ffast-math -fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option=-merge-constant

(Continued on next page)



SPEC CPU2017 Floating Point Rate Result

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Dell Inc.

SPECrate2017_fp_base = 86.0

PowerEdge R6415 (AMD EPYC 7281, 2.10GHz)

SPECrate2017_fp_peak = 87.5

CPU2017 License: 55

Test Sponsor: Dell Inc.

Tested by: Dell Inc.

Test Date: Nov-2018

Hardware Availability: Dec-2018

Software Availability: Jul-2018

Peak Optimization Flags (Continued)

Fortran benchmarks (continued):

```
-fplugin-arg-dragonegg-llvm-option=-inline-threshold:1000 -ljemalloc
-lgfortran -lamdlibm
```

Benchmarks using both Fortran and C:

```
521.wrf_r: -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -O3 -mavx -ffast-math
-funroll-loops -fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-inline-threshold:1000
-ljemalloc -lgfortran -lamdlibm
```

```
527.cam4_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 -O3 -mavx2 -madox
-funroll-loops -ffast-math -fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-inline-threshold:1000
-ljemalloc -lgfortran -lamdlibm
```

Benchmarks using both C and C++:

```
-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 -finline-aggressive -ljemalloc
```

Benchmarks using Fortran, C, and C++:

```
-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 -finline-aggressive -O3 -mavx2 -madox
-funroll-loops -ffast-math -fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-inline-threshold:1000 -ljemalloc
```

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

<http://www.spec.org/cpu2017/flags/aoccl100-flags-revC-I.2018-11-13.html>

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



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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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