



SPEC CPU®2017 Floating Point Rate Result

Copyright 2017-2019 Standard Performance Evaluation Corporation

Dell Inc.

SPECrate®2017_fp_base = 354

PowerEdge R6525 (AMD EPYC 7542, 2.90 GHz)

SPECrate®2017_fp_peak = 391

CPU2017 License: 55

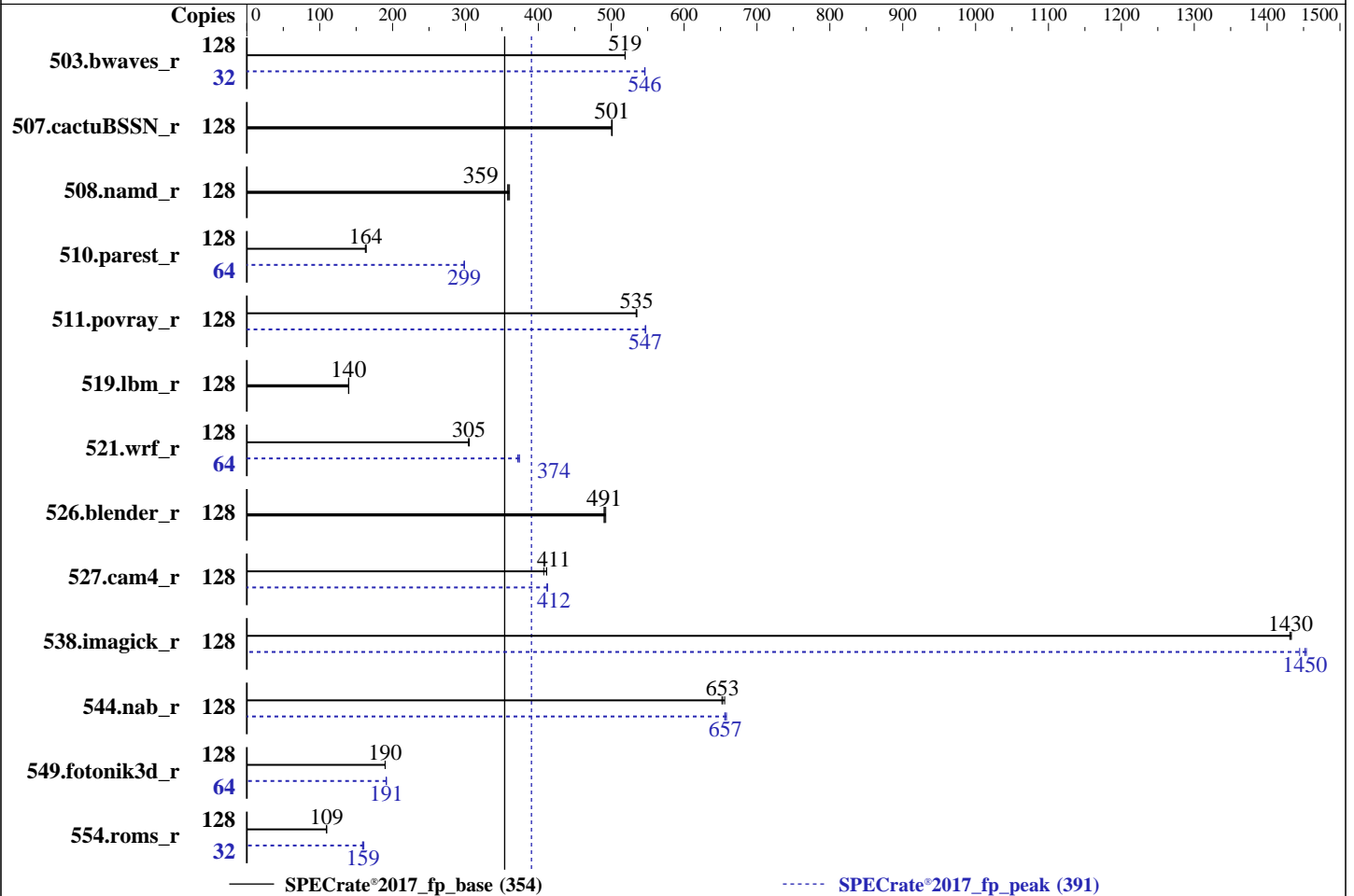
Test Sponsor: Dell Inc.

Tested by: Dell Inc.

Test Date: Sep-2019

Hardware Availability: Oct-2019

Software Availability: Aug-2019



Hardware

CPU Name: AMD EPYC 7542
 Max MHz: 3400
 Nominal: 2900
 Enabled: 64 cores, 2 chips, 2 threads/core
 Orderable: 1,2 chips
 Cache L1: 32 KB I + 32 KB D on chip per core
 L2: 512 KB I+D on chip per core
 L3: 128 MB I+D on chip per chip, 16 MB shared / 4 cores
 Other: None
 Memory: 512 GB (16 x 32 GB 2Rx4 PC4-3200AA-R, running at 3200)
 Storage: 1 x 960 GB SAS SSD
 Other: None

Software

OS: SUSE Linux Enterprise Server 15 SP1 kernel 4.12.14-195-default
 Compiler: C/C++/Fortran: Version 2.0.0 of AOCC
 Parallel: No
 Firmware: Version 0.4.11 released Sep-2019
 File System: xfs
 System State: Run level 3 (multi-user)
 Base Pointers: 64-bit
 Peak Pointers: 64-bit
 Other: jemalloc: jemalloc memory allocator library v5.2.0
 Power Management: --



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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	128	2474	519	2472	519	<u>2472</u>	<u>519</u>	32	587	546	588	546	<u>588</u>	<u>546</u>
507.cactuBSSN_r	128	323	501	<u>323</u>	<u>501</u>	324	500	128	323	501	<u>323</u>	<u>501</u>	324	500
508.namd_r	128	337	360	340	358	<u>339</u>	<u>359</u>	128	337	360	340	358	<u>339</u>	<u>359</u>
510.parest_r	128	2046	164	2059	163	<u>2048</u>	<u>164</u>	64	<u>561</u>	<u>299</u>	562	298	561	299
511.povray_r	128	559	535	<u>559</u>	<u>535</u>	559	534	128	547	547	<u>546</u>	<u>547</u>	546	547
519.lbm_r	128	964	140	<u>966</u>	<u>140</u>	966	140	128	964	140	<u>966</u>	<u>140</u>	966	140
521.wrf_r	128	943	304	<u>941</u>	<u>305</u>	939	305	64	386	372	<u>384</u>	<u>374</u>	383	374
526.blender_r	128	398	490	<u>397</u>	<u>491</u>	396	493	128	398	490	<u>397</u>	<u>491</u>	396	493
527.cam4_r	128	544	411	549	407	<u>544</u>	<u>411</u>	128	543	412	543	412	<u>543</u>	<u>412</u>
538.imagick_r	128	222	1430	<u>222</u>	<u>1430</u>	222	1430	128	<u>219</u>	<u>1450</u>	219	1450	220	1440
544.nab_r	128	329	656	330	652	<u>330</u>	<u>653</u>	128	<u>328</u>	<u>657</u>	327	658	328	656
549.fotonik3d_r	128	<u>2628</u>	<u>190</u>	2629	190	2626	190	64	1303	191	1304	191	<u>1303</u>	<u>191</u>
554.roms_r	128	1862	109	<u>1860</u>	<u>109</u>	1856	110	32	317	161	320	159	<u>319</u>	<u>159</u>

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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/>

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

runcpu command invoked through numactl i.e.:
numactl --interleave=all runcpu <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 set to 'always' for this run (OS default)

General Notes

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

LD_LIBRARY_PATH = "/root/cpu2017-1.0.5/amd_rate_aocc200_rome_B_lib/64;

/root/cpu2017-1.0.5/amd_rate_aocc200_rome_B_lib/32:"

MALLOC_CONF = "retain:true"

Binaries were compiled on a system with 2x AMD EPYC 7601 CPU + 512GB Memory using Fedora 26

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 v9.1.0 in Ubuntu 19.04 with -O3 -znver2 -flto jemalloc 5.2.0 is available here:

<https://github.com/jemalloc/jemalloc/releases/download/5.2.0/jemalloc-5.2.0.tar.bz2>

Platform Notes

BIOS settings:

NUMA Nodes Per Socket set to 4

CCX as NUMA Domain set to Enabled

System Profile set to Custom

CPU Power Management set to Maximum Performance

Memory Frequency set to Maximum Performance

Turbo Boost Enabled

Cstates set to Enabled

Memory Patrol Scrub Disabled

Memory Refresh Rate set to 1x

PCI ASPM L1 Link Power Management Disabled

Determinism Slider set to Power Determinism

Efficiency Optimized Mode Disabled

Sysinfo program /root/cpu2017-1.0.5/bin/sysinfo

Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9

running on linux-g3ob Tue Sep 10 17:56:50 2019

SUT (System Under Test) info as seen by some common utilities.

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Platform Notes (Continued)

For more information on this section, see
<https://www.spec.org/cpu2017/Docs/config.html#sysinfo>

From /proc/cpuinfo

model name : AMD EPYC 7542 32-Core Processor

2 "physical id"s (chips)

128 "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 : 32

siblings : 64

physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
25 26 27 28 29 30 31

physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
25 26 27 28 29 30 31

From lscpu:

Architecture: x86_64

CPU op-mode(s): 32-bit, 64-bit

Byte Order: Little Endian

Address sizes: 43 bits physical, 48 bits virtual

CPU(s): 128

On-line CPU(s) list: 0-127

Thread(s) per core: 2

Core(s) per socket: 32

Socket(s): 2

NUMA node(s): 16

Vendor ID: AuthenticAMD

CPU family: 23

Model: 49

Model name: AMD EPYC 7542 32-Core Processor

Stepping: 0

CPU MHz: 2894.608

BogoMIPS: 5789.21

Virtualization: AMD-V

L1d cache: 32K

L1i cache: 32K

L2 cache: 512K

L3 cache: 16384K

NUMA node0 CPU(s): 0-3,64-67

NUMA node1 CPU(s): 4-7,68-71

NUMA node2 CPU(s): 8-11,72-75

NUMA node3 CPU(s): 12-15,76-79

NUMA node4 CPU(s): 16-19,80-83

NUMA node5 CPU(s): 20-23,84-87

NUMA node6 CPU(s): 24-27,88-91

NUMA node7 CPU(s): 28-31,92-95

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Platform Notes (Continued)

NUMA node8 CPU(s): 32-35,96-99
 NUMA node9 CPU(s): 36-39,100-103
 NUMA node10 CPU(s): 40-43,104-107
 NUMA node11 CPU(s): 44-47,108-111
 NUMA node12 CPU(s): 48-51,112-115
 NUMA node13 CPU(s): 52-55,116-119
 NUMA node14 CPU(s): 56-59,120-123
 NUMA node15 CPU(s): 60-63,124-127

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 xtopology nonstop_tsc cpuid extd_apicid aperfmperf 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 ibs skinit wdt tce topoext perfctr_core perfctr_nb bpext perfctr_l2 mwaitx cpb
 cat_l3 cdp_l3 hw_pstate sme ssbd sev ibrs ibpb stibp vmmcall fsgsbase bml avx2 smep
 bmi2 cqm rdt_a rdseed adx smap clflushopt clwb sha_ni xsaveopt xsavec xgetbv1 xsaves
 cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local clzero irperf xsaveerptr arat npt
 lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter
 pfthreshold avic v_vmsave_vmload vgif umip rdpid 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: 16 nodes (0-15)
node 0 cpus: 0 1 2 3 64 65 66 67
node 0 size: 31676 MB
node 0 free: 31461 MB
node 1 cpus: 4 5 6 7 68 69 70 71
node 1 size: 32254 MB
node 1 free: 32052 MB
node 2 cpus: 8 9 10 11 72 73 74 75
node 2 size: 32254 MB
node 2 free: 32049 MB
node 3 cpus: 12 13 14 15 76 77 78 79
node 3 size: 32254 MB
node 3 free: 32039 MB
node 4 cpus: 16 17 18 19 80 81 82 83
node 4 size: 32254 MB
node 4 free: 32040 MB
node 5 cpus: 20 21 22 23 84 85 86 87
node 5 size: 32254 MB
node 5 free: 32048 MB
node 6 cpus: 24 25 26 27 88 89 90 91
node 6 size: 32254 MB
node 6 free: 32040 MB
  
```

(Continued on next page)



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Platform Notes (Continued)

```

node 7 cpus: 28 29 30 31 92 93 94 95
node 7 size: 32240 MB
node 7 free: 32039 MB
node 8 cpus: 32 33 34 35 96 97 98 99
node 8 size: 32224 MB
node 8 free: 32019 MB
node 9 cpus: 36 37 38 39 100 101 102 103
node 9 size: 32254 MB
node 9 free: 32059 MB
node 10 cpus: 40 41 42 43 104 105 106 107
node 10 size: 32254 MB
node 10 free: 32057 MB
node 11 cpus: 44 45 46 47 108 109 110 111
node 11 size: 32254 MB
node 11 free: 32057 MB
node 12 cpus: 48 49 50 51 112 113 114 115
node 12 size: 32254 MB
node 12 free: 32058 MB
node 13 cpus: 52 53 54 55 116 117 118 119
node 13 size: 32254 MB
node 13 free: 32021 MB
node 14 cpus: 56 57 58 59 120 121 122 123
node 14 size: 32254 MB
node 14 free: 32058 MB
node 15 cpus: 60 61 62 63 124 125 126 127
node 15 size: 32250 MB
node 15 free: 32031 MB
node distances:
node  0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
  0: 10 11 11 11 11 11 11 11 32 32 32 32 32 32 32 32
  1: 11 10 11 11 11 11 11 11 32 32 32 32 32 32 32 32
  2: 11 11 10 11 11 11 11 11 32 32 32 32 32 32 32 32
  3: 11 11 11 10 11 11 11 11 32 32 32 32 32 32 32 32
  4: 11 11 11 11 10 11 11 11 32 32 32 32 32 32 32 32
  5: 11 11 11 11 11 10 11 11 32 32 32 32 32 32 32 32
  6: 11 11 11 11 11 11 10 11 32 32 32 32 32 32 32 32
  7: 11 11 11 11 11 11 11 10 32 32 32 32 32 32 32 32
  8: 32 32 32 32 32 32 32 32 32 10 11 11 11 11 11 11
  9: 32 32 32 32 32 32 32 32 32 11 10 11 11 11 11 11
 10: 32 32 32 32 32 32 32 32 32 11 11 10 11 11 11 11
 11: 32 32 32 32 32 32 32 32 32 11 11 11 10 11 11 11
 12: 32 32 32 32 32 32 32 32 32 11 11 11 11 10 11 11
 13: 32 32 32 32 32 32 32 32 32 11 11 11 11 11 10 11
 14: 32 32 32 32 32 32 32 32 32 11 11 11 11 11 11 10
 15: 32 32 32 32 32 32 32 32 32 11 11 11 11 11 11 10

```

From /proc/meminfo

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Platform Notes (Continued)

MemTotal: 527815124 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

From /etc/*release* /etc/*version*

```
os-release:
NAME="SLES"
VERSION="15-SP1"
VERSION_ID="15.1"
PRETTY_NAME="SUSE Linux Enterprise Server 15 SP1"
ID="sles"
ID_LIKE="suse"
ANSI_COLOR="0;32"
CPE_NAME="cpe:/o:suse:sles:15:sp1"
```

uname -a:

```
Linux linux-g3ob 4.12.14-195-default #1 SMP Tue May 7 10:55:11 UTC 2019 (8fba516)
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: conditional,
IBRS_FW, STIBP: conditional, RSB filling
```

run-level 3 Sep 10 09:51

SPEC is set to: /root/cpu2017-1.0.5

Filesystem	Type	Size	Used	Avail	Use%	Mounted on
/dev/sda2	xfs	440G	20G	421G	5%	/

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. 0.4.11 09/05/2019

Memory:

16x 802C80B3802C 36ASF4G72PZ-3G2E2 32 GB 2 rank 3200
16x Not Specified Not Specified

(End of data from sysinfo program)



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Compiler Version Notes

```
=====
C | 519.lbm_r(base, peak) 538.imagick_r(base, peak)
  | 544.nab_r(base, peak)
=====
```

```
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
=====
```

```
=====
C++ | 508.namd_r(base, peak) 510.parest_r(base, peak)
=====
```

```
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
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Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
=====
```

```
=====
C++, C | 511.povray_r(base, peak) 526.blender_r(base, peak)
=====
```

```
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
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InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
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AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
=====
```

```
=====
C++, C, Fortran | 507.cactuBSSN_r(base, peak)
=====
```

```
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
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AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
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Compiler Version Notes (Continued)

```
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
```

```
=====
Fortran          | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak)
                  | 554.roms_r(base, peak)
```

```
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
```

```
=====
Fortran, C       | 521.wrf_r(base, peak) 527.cam4_r(base, peak)
```

```
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
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Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
```

Base Compiler Invocation

C benchmarks:
clang

C++ benchmarks:
clang++

Fortran benchmarks:
flang

(Continued on next page)



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Base Compiler Invocation (Continued)

Benchmarks using both Fortran and C:

flang clang

Benchmarks using both C and C++:

clang++ clang

Benchmarks using Fortran, C, and C++:

clang++ clang flang

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 -Mbyteswapio -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,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -ffast-math
-march=znver2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-freemap-arrays -mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp
-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000
-flv-function-specialization -z muldefs -lmvec -lamdlibm -ljemalloc
-lflang
```

C++ benchmarks:

```
-std=c++98 -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3
```

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CPU2017 License: 55

Test Sponsor: Dell Inc.

Tested by: Dell Inc.

Test Date: Sep-2019

Hardware Availability: Oct-2019

Software Availability: Aug-2019

Base Optimization Flags (Continued)

C++ benchmarks (continued):

```
-Wl,-mllvm -Wl,-suppress-fmas -O3 -ffast-math -march=znver2
-mllvm -loop-unswitch-threshold=200000 -mllvm -vector-library=LIBMVEC
-mllvm -unroll-threshold=100 -flv-function-specialization
-mllvm -enable-partial-unswitch -z muldefs -lmvec -lamdlibm
-ljemalloc -lflang
```

Fortran benchmarks:

```
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver2
-funroll-loops -Mrecursive -mllvm -vector-library=LIBMVEC -z muldefs
-Kieee -fno-finite-math-only -lmvec -lamdlibm -ljemalloc -lflang
```

Benchmarks using both Fortran and C:

```
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -ffast-math
-march=znver2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-freemap-arrays -mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp
-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000
-flv-function-specialization -funroll-loops -Mrecursive -z muldefs
-Kieee -fno-finite-math-only -lmvec -lamdlibm -ljemalloc -lflang
```

Benchmarks using both C and C++:

```
-std=c++98 -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-suppress-fmas -O3 -ffast-math -march=znver2
-fstruct-layout=3 -mllvm -unroll-threshold=50 -freemap-arrays
-mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp
-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000
-flv-function-specialization -mllvm -loop-unswitch-threshold=200000
-mllvm -unroll-threshold=100 -mllvm -enable-partial-unswitch -z muldefs
-lmvec -lamdlibm -ljemalloc -lflang
```

Benchmarks using Fortran, C, and C++:

```
-std=c++98 -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-suppress-fmas -O3 -ffast-math -march=znver2
-fstruct-layout=3 -mllvm -unroll-threshold=50 -freemap-arrays
-mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp
```

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Base Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++ (continued):

```
-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000
-flv-function-specialization -mllvm -loop-unswitch-threshold=200000
-mllvm -unroll-threshold=100 -mllvm -enable-partial-unswitch
-funroll-loops -Mrecursive -z muldefs -Kieee -fno-finite-math-only
-lmvec -lamdlibm -ljemalloc -lflang
```

Peak Compiler Invocation

C benchmarks:

clang

C++ benchmarks:

clang++

Fortran benchmarks:

flang

Benchmarks using both Fortran and C:

flang clang

Benchmarks using both C and C++:

clang++ clang

Benchmarks using Fortran, C, and C++:

clang++ clang flang

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

519.lbm_r: basepeak = yes

```
538.imagick_r: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-vector-library=LIBMVEC
```

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Peak Optimization Flags (Continued)

538.imagick_r (continued):

```
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver2 -mno-sse4a -fstruct-layout=5
-mllvm -vectorize-memory-aggressively
-mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -unroll-threshold=50 -fremap-arrays
-mllvm -vector-library=LIBMVEC
-mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp -mllvm -inline-threshold=1000
-flv-function-specialization -lmvec -lamdlibm -ljemalloc
-lflang
```

544.nab_r: Same as 538.imagick_r

C++ benchmarks:

508.namd_r: basepeak = yes

```
510.parest_r: -std=c++98 -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-suppress-fmas -Ofast -march=znver2
-flv-function-specialization -mllvm -unroll-threshold=100
-mllvm -enable-partial-unswitch
-mllvm -loop-unswitch-threshold=200000
-mllvm -vector-library=LIBMVEC
-mllvm -inline-threshold=1000 -lmvec -lamdlibm -ljemalloc
-lflang
```

Fortran benchmarks:

```
503.bwaves_r: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3
-march=znver2 -funroll-loops -Mrecursive
-mllvm -vector-library=LIBMVEC -Kieee
-fno-finite-math-only -lmvec -lamdlibm -ljemalloc
-lflang
```

549.fotonik3d_r: Same as 503.bwaves_r

```
554.roms_r: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-vector-library=LIBMVEC
```

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Peak Optimization Flags (Continued)

554.roms_r (continued):

```
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -O3 -march=znver2
-funroll-loops -Mrecursive -mllvm -vector-library=LIBMVEC
-Kieeee -fno-finite-math-only -lmvec -lamdlibm -ljemalloc
-lflang
```

Benchmarks using both Fortran and C:

```
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast -march=znver2
-mno-sse4a -fstruct-layout=5 -mllvm -vectorize-memory-aggressively
-mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -unroll-threshold=50 -fremap-arrays
-mllvm -vector-library=LIBMVEC -mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp -mllvm -inline-threshold=1000
-flv-function-specialization -O3 -funroll-loops -Mrecursive -Kieeee
-fno-finite-math-only -lmvec -lamdlibm -ljemalloc -lflang
```

Benchmarks using both C and C++:

```
511.povray_r: -std=c++98 -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-x86-use-vzeroupper=false -Ofast
-march=znver2 -mno-sse4a -fstruct-layout=5
-mllvm -vectorize-memory-aggressively
-mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -unroll-threshold=50 -fremap-arrays
-mllvm -vector-library=LIBMVEC
-mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp -mllvm -inline-threshold=1000
-flv-function-specialization -mllvm -unroll-threshold=100
-mllvm -enable-partial-unswitch
-mllvm -loop-unswitch-threshold=200000 -lmvec -lamdlibm
-ljemalloc -lflang
```

526.blender_r: basepeak = yes

Benchmarks using Fortran, C, and C++:

507.cactuBSSN_r: basepeak = yes



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

<http://www.spec.org/cpu2017/flags/aocc200-flags-B1-rate-Dell.html>

<http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-revE4.2019-10-15.html>

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

<http://www.spec.org/cpu2017/flags/aocc200-flags-B1-rate-Dell.xml>

<http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-revE4.2019-10-15.xml>

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