



# SPEC CPU®2017 Floating Point Rate Result

Copyright 2017-2019 Standard Performance Evaluation Corporation

## Dell Inc.

### SPECrate®2017\_fp\_base = 251

### PowerEdge R7515 (AMD EPYC 7742, 2.25GHz)

### SPECrate®2017\_fp\_peak = 278

CPU2017 License: 55

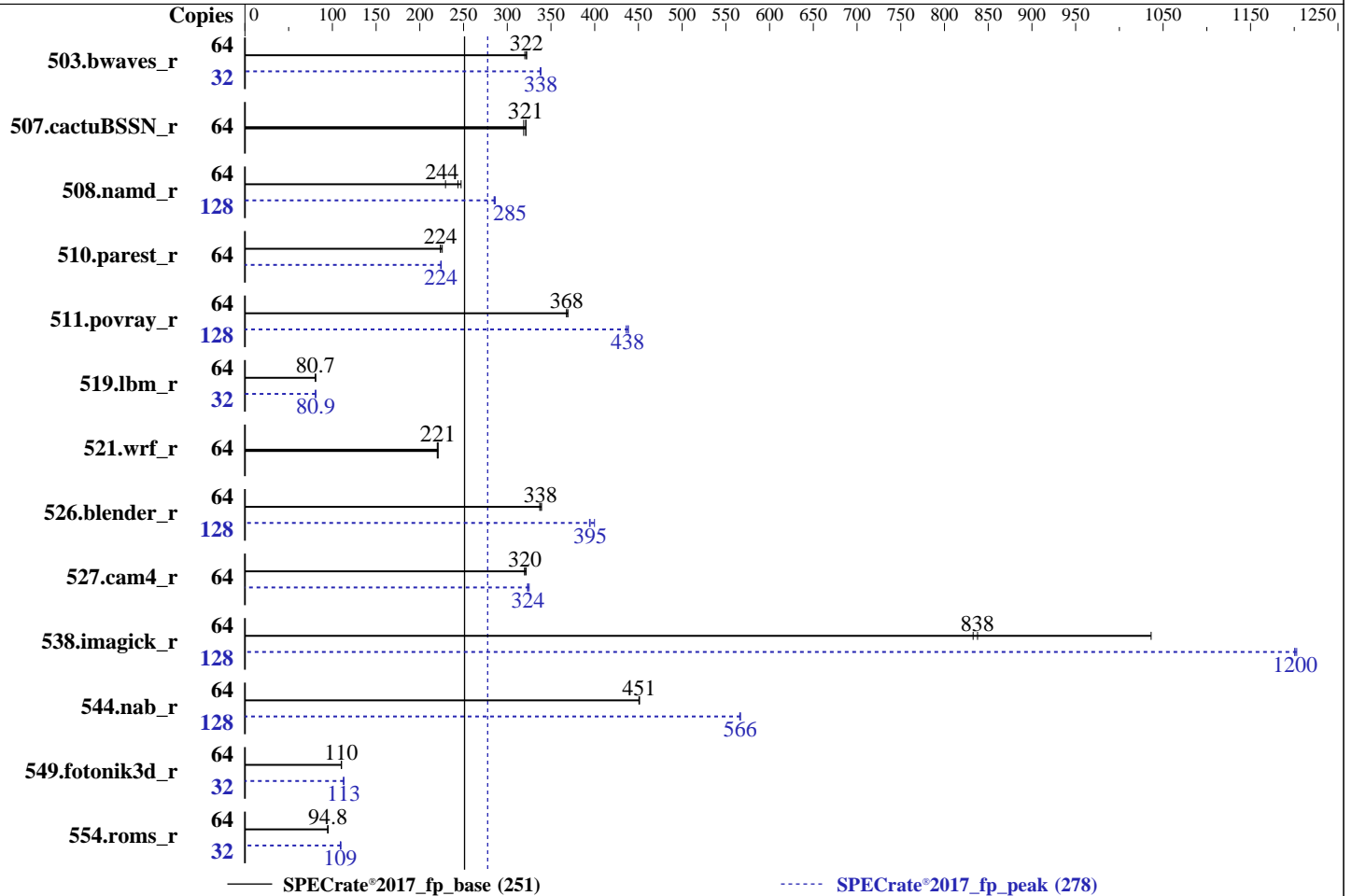
Test Date: Sep-2019

Test Sponsor: Dell Inc.

Hardware Availability: Sep-2019

Tested by: Dell Inc.

Software Availability: Aug-2019



### Hardware

CPU Name: AMD EPYC 7742  
 Max MHz: 3400  
 Nominal: 2250  
 Enabled: 64 cores, 1 chip, 2 threads/core  
 Orderable: 1 chip  
 Cache L1: 32 KB I + 32 KB D on chip per core  
 L2: 512 KB I+D on chip per core  
 L3: 256 MB I+D on chip per chip, 16 MB shared / 4 cores  
 Other: None  
 Memory: 256 GB (8 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 1.0.4 released Aug-2019  
 File System: xfs  
 System State: Run level 5 (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	64	2005	320	<b>1994</b>	<b>322</b>	1992	322	32	<b>949</b>	<b>338</b>	950	338	948	338
507.cactuBSSN_r	64	<b>252</b>	<b>321</b>	252	321	254	319	64	<b>252</b>	<b>321</b>	252	321	254	319
508.namd_r	64	<b>250</b>	<b>244</b>	265	229	246	247	128	427	285	<b>426</b>	<b>285</b>	425	286
510.parest_r	64	<b>748</b>	<b>224</b>	749	223	742	226	64	<b>747</b>	<b>224</b>	746	225	747	224
511.povray_r	64	406	368	<b>406</b>	<b>368</b>	405	369	128	<b>683</b>	<b>438</b>	682	439	686	436
519.lbm_r	64	837	80.6	<b>835</b>	<b>80.7</b>	835	80.8	32	418	80.7	417	80.9	<b>417</b>	<b>80.9</b>
521.wrf_r	64	649	221	652	220	<b>649</b>	<b>221</b>	64	649	221	652	220	<b>649</b>	<b>221</b>
526.blender_r	64	287	339	289	337	<b>288</b>	<b>338</b>	128	488	400	495	394	<b>494</b>	<b>395</b>
527.cam4_r	64	348	322	<b>350</b>	<b>320</b>	350	320	64	344	325	346	323	<b>346</b>	<b>324</b>
538.imagick_r	64	154	1040	191	833	<b>190</b>	<b>838</b>	128	265	1200	<b>265</b>	<b>1200</b>	265	1200
544.nab_r	64	239	451	239	451	<b>239</b>	<b>451</b>	128	380	567	<b>380</b>	<b>566</b>	381	566
549.fotonik3d_r	64	<b>2262</b>	<b>110</b>	2260	110	2262	110	32	<b>1105</b>	<b>113</b>	1106	113	1102	113
554.roms_r	64	<b>1072</b>	<b>94.8</b>	1073	94.8	1072	94.9	32	466	109	463	110	<b>466</b>	<b>109</b>

SPECrate®2017\_fp\_base = **251**

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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

dirty\_ratio, swappiness, zone\_reclaim\_mode and drop\_caches were

(Continued on next page)



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## Operating System Notes (Continued)

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:"  
MALLOCONF = "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 Wed Sep 4 21:07:09 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>

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## Platform Notes (Continued)

From /proc/cpuinfo

model name : AMD EPYC 7742 64-Core Processor

1 "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 : 64

siblings : 128

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 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52  
53 54 55 56 57 58 59 60 61 62 63

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: 64  
Socket(s): 1  
NUMA node(s): 16  
Vendor ID: AuthenticAMD  
CPU family: 23  
Model: 49  
Model name: AMD EPYC 7742 64-Core Processor  
Stepping: 0  
CPU MHz: 2245.880  
BogoMIPS: 4491.76  
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  
NUMA node8 CPU(s): 32-35,96-99  
NUMA node9 CPU(s): 36-39,100-103  
NUMA node10 CPU(s): 40-43,104-107

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## Platform Notes (Continued)

```

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 bmi1 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: 15691 MB
node 0 free: 15392 MB
node 1 cpus: 4 5 6 7 68 69 70 71
node 1 size: 16126 MB
node 1 free: 15215 MB
node 2 cpus: 8 9 10 11 72 73 74 75
node 2 size: 16126 MB
node 2 free: 15813 MB
node 3 cpus: 12 13 14 15 76 77 78 79
node 3 size: 16125 MB
node 3 free: 15843 MB
node 4 cpus: 16 17 18 19 80 81 82 83
node 4 size: 16126 MB
node 4 free: 15849 MB
node 5 cpus: 20 21 22 23 84 85 86 87
node 5 size: 16126 MB
node 5 free: 15921 MB
node 6 cpus: 24 25 26 27 88 89 90 91
node 6 size: 16126 MB
node 6 free: 15929 MB
node 7 cpus: 28 29 30 31 92 93 94 95
node 7 size: 16125 MB
node 7 free: 15917 MB

```

(Continued on next page)



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## Platform Notes (Continued)

```

node 8 cpus: 32 33 34 35 96 97 98 99
node 8 size: 16126 MB
node 8 free: 15796 MB
node 9 cpus: 36 37 38 39 100 101 102 103
node 9 size: 16096 MB
node 9 free: 15902 MB
node 10 cpus: 40 41 42 43 104 105 106 107
node 10 size: 16126 MB
node 10 free: 15891 MB
node 11 cpus: 44 45 46 47 108 109 110 111
node 11 size: 16125 MB
node 11 free: 15923 MB
node 12 cpus: 48 49 50 51 112 113 114 115
node 12 size: 16126 MB
node 12 free: 15824 MB
node 13 cpus: 52 53 54 55 116 117 118 119
node 13 size: 16126 MB
node 13 free: 15828 MB
node 14 cpus: 56 57 58 59 120 121 122 123
node 14 size: 16126 MB
node 14 free: 15930 MB
node 15 cpus: 60 61 62 63 124 125 126 127
node 15 size: 16111 MB
node 15 free: 15891 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 12 12 12 12 12 12 12 12 12 12 12 12
  1:  11 10 11 11 12 12 12 12 12 12 12 12 12 12 12 12
  2:  11 11 10 11 12 12 12 12 12 12 12 12 12 12 12 12
  3:  11 11 11 10 12 12 12 12 12 12 12 12 12 12 12 12
  4:  12 12 12 12 10 11 11 11 12 12 12 12 12 12 12 12
  5:  12 12 12 12 11 10 11 11 12 12 12 12 12 12 12 12
  6:  12 12 12 12 11 11 10 11 12 12 12 12 12 12 12 12
  7:  12 12 12 12 11 11 11 10 12 12 12 12 12 12 12 12
  8:  12 12 12 12 12 12 12 12 10 11 11 11 12 12 12 12
  9:  12 12 12 12 12 12 12 12 11 10 11 11 12 12 12 12
10:  12 12 12 12 12 12 12 12 11 11 10 11 12 12 12 12
11:  12 12 12 12 12 12 12 12 11 11 11 10 12 12 12 12
12:  12 12 12 12 12 12 12 12 12 12 12 12 10 11 11 11
13:  12 12 12 12 12 12 12 12 12 12 12 12 11 10 11 11
14:  12 12 12 12 12 12 12 12 12 12 12 12 11 11 10 11
15:  12 12 12 12 12 12 12 12 12 12 12 12 11 11 11 10

```

```

From /proc/meminfo
MemTotal:      263721456 kB
HugePages_Total:      0
Hugepagesize:    2048 kB

```

(Continued on next page)



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## Platform Notes (Continued)

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 5 Sep 4 18:53

SPEC is set to: /root/cpu2017-1.0.5

Filesystem	Type	Size	Used	Avail	Use%	Mounted on
/dev/sda2	xfs	440G	19G	422G	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. 1.0.4 08/26/2019

Memory:

5x 80AD80B380AD HMA84GR7CJR4N-XN 32 GB 2 rank 3200

1x 80AD863280AD HMA84GR7CJR4N-XN 32 GB 2 rank 3200

2x 80AD869D80AD HMA84GR7CJR4N-XN 32 GB 2 rank 3200

8x Not Specified Not Specified

(End of data from sysinfo program)

## Compiler Version Notes

C | 519.lbm\_r(base, peak) 538.imagick\_r(base, peak)

(Continued on next page)



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## Compiler Version Notes (Continued)

| 544.nab\_r(base, peak)

```
-----
AOCCLLVM.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)

```
-----
AOCCLLVM.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++, C | 511.povray\_r(base, peak) 526.blender\_r(base, peak)

```
-----
AOCCLLVM.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
AOCCLLVM.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++, C, Fortran | 507.cactuBSSN\_r(base, peak)

```
-----
AOCCLLVM.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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```
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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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
```

## Base Compiler Invocation

C benchmarks:  
clang

C++ benchmarks:  
clang++

Fortran benchmarks:  
flang

Benchmarks using both Fortran and C:  
flang clang

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## Base Compiler Invocation (Continued)

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
-fremap-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
-Wl,-mllvm -Wl,-suppress-fmas -O3 -ffast-math -march=znver2
```

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# SPEC CPU®2017 Floating Point Rate Result

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SPECrate®2017\_fp\_base = 251

PowerEdge R7515 (AMD EPYC 7742, 2.25GHz)

SPECrate®2017\_fp\_peak = 278

CPU2017 License: 55

Test Sponsor: Dell Inc.

Tested by: Dell Inc.

Test Date: Sep-2019

Hardware Availability: Sep-2019

Software Availability: Aug-2019

## Base Optimization Flags (Continued)

C++ benchmarks (continued):

```
-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
-fremap-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 -fremap-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 -fremap-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
```

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## Base Optimization Flags (Continued)

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

```
-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:

```
-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
```

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## Peak Optimization Flags (Continued)

C benchmarks (continued):

```
-mllvm -global-vectorize-slp -mllvm -inline-threshold=1000
-flv-function-specialization -lmvec -lamdlibm -ljemalloc -lflang
```

C++ benchmarks:

```
508.namd_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 -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
```

```
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
-Kieee -fno-finite-math-only -lmvec -lamdlibm -ljemalloc
-lflang
```

Benchmarks using both Fortran and C:

521.wrf\_r: basepeak = yes

```
527.cam4_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 -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 -Kieee -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
```

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## Peak Optimization Flags (Continued)

```
526.blender_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 -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
```

Benchmarks using Fortran, C, and C++:

```
507.cactuBSSN_r: basepeak = yes
```

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

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

<http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-revE5.html>

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

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

<http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-revE5.xml>

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