



SPEC CPU®2017 Floating Point Speed Result

Copyright 2017-2020 Standard Performance Evaluation Corporation

Dell Inc.

SPECspeed®2017_fp_base = 100

PowerEdge R7515 (AMD EPYC 7532, 2.40 GHz)

SPECspeed®2017_fp_peak = 101

CPU2017 License: 55

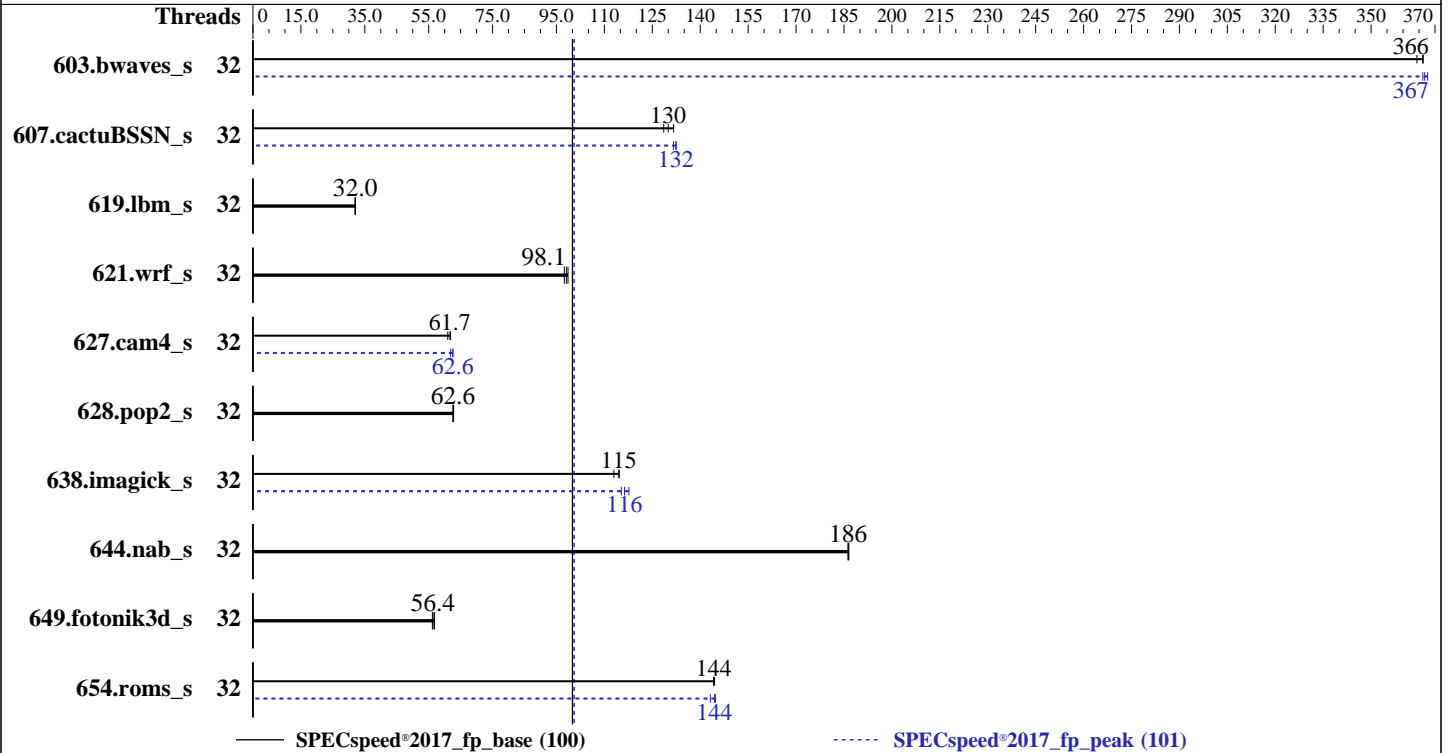
Test Date: Jan-2020

Test Sponsor: Dell Inc.

Hardware Availability: Apr-2020

Tested by: Dell Inc.

Software Availability: Aug-2019



Hardware

CPU Name: AMD EPYC 7532
 Max MHz: 3300
 Nominal: 2400
 Enabled: 32 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 / 2 cores
 Other: None
 Memory: 256 GB (8 x 32 GB 2Rx4 PC4-3200AA-R)
 Storage: 1 x 960 GB SATA 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: Yes
 Firmware: Version 1.3.0 released Jan-2020
 File System: xfs
 System State: Run level 3 (multi-user)
 Base Pointers: 64-bit
 Peak Pointers: 64-bit
 Other: jemalloc: jemalloc memory allocator library v5.1.0
 Power Management: BIOS set to prefer performance at the cost of additional power usage.



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Results Table

| Benchmark | Base | | | | | | | Peak | | | | | | |
|-----------------|---------|-------------|-------------|------------|-------------|------------|------------|---------|-------------|-------------|------------|-------------|------------|------------|
| | Threads | Seconds | Ratio | Seconds | Ratio | Seconds | Ratio | Threads | Seconds | Ratio | Seconds | Ratio | Seconds | Ratio |
| 603.bwaves_s | 32 | 161 | 366 | 162 | 364 | 161 | 366 | 32 | 160 | 368 | 161 | 366 | 161 | 367 |
| 607.cactuBSSN_s | 32 | 130 | 129 | 127 | 132 | 128 | 130 | 32 | 126 | 132 | 126 | 132 | 127 | 132 |
| 619.lbm_s | 32 | 164 | 32.0 | 164 | 32.0 | 163 | 32.1 | 32 | 164 | 32.0 | 164 | 32.0 | 163 | 32.1 |
| 621.wrf_s | 32 | 135 | 98.1 | 134 | 98.6 | 136 | 97.5 | 32 | 135 | 98.1 | 134 | 98.6 | 136 | 97.5 |
| 627.cam4_s | 32 | 144 | 61.7 | 145 | 61.0 | 143 | 61.8 | 32 | 143 | 61.9 | 142 | 62.6 | 142 | 62.6 |
| 628.pop2_s | 32 | 189 | 62.8 | 190 | 62.6 | 190 | 62.6 | 32 | 189 | 62.8 | 190 | 62.6 | 190 | 62.6 |
| 638.imagick_s | 32 | 128 | 113 | 126 | 115 | 126 | 115 | 32 | 124 | 116 | 123 | 118 | 125 | 115 |
| 644.nab_s | 32 | 93.8 | 186 | 93.8 | 186 | 93.7 | 187 | 32 | 93.8 | 186 | 93.8 | 186 | 93.7 | 187 |
| 649.fotonik3d_s | 32 | 162 | 56.4 | 162 | 56.2 | 160 | 56.8 | 32 | 162 | 56.4 | 162 | 56.2 | 160 | 56.8 |
| 654.roms_s | 32 | 109 | 144 | 109 | 144 | 109 | 144 | 32 | 109 | 145 | 109 | 144 | 110 | 143 |

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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 all set using privileged echo (e.g. echo 1 > /proc/sys/vm/swappiness).

Transparent huge pages set to 'always' for this run (OS default)



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Environment Variables Notes

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

GOMP_CPU_AFFINITY = "0-63"

LD_LIBRARY_PATH =

"/root/cpu2017-1.1.0/amd_speed_aocc200_rome_C_lib/64;/root/cpu2017-1.1.0/amd_speed_aocc200_rome_C_lib/32:"

MALLOC_CONF = "retain:true"

OMP_DYNAMIC = "false"

OMP_SCHEDULE = "static"

OMP_STACKSIZE = "128M"

OMP_THREAD_LIMIT = "64"

Environment variables set by runcpu during the 603.bwaves_s peak run:

GOMP_CPU_AFFINITY = "0-31"

Environment variables set by runcpu during the 607.cactuBSSN_s peak run:

GOMP_CPU_AFFINITY = "0-31"

Environment variables set by runcpu during the 627.cam4_s peak run:

GOMP_CPU_AFFINITY = "0-31"

Environment variables set by runcpu during the 638.imagick_s peak run:

GOMP_CPU_AFFINITY = "0-31"

Environment variables set by runcpu during the 654.roms_s peak run:

GOMP_CPU_AFFINITY = "0-31"

General Notes

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 5.1.0 is available here:

<https://github.com/jemalloc/jemalloc/releases/download/5.1.0/jemalloc-5.1.0.tar.bz2>



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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
 Memory Interleaving set to Disabled
 Memory Freq set to 3200
 Fan Speed = Maximum

Sysinfo program /root/cpu2017-1.1.0/bin/sysinfo
 Rev: r6365 of 2019-08-21 295195f888a3d7edble6e46a485a0011
 running on linux-g3ob Sat Jan 25 08:55:40 2020

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 7532 32-Core Processor
 1 "physical id"s (chips)
 64 "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 4 5 8 9 12 13 16 17 20 21 24 25 28 29 32 33 36 37 40 41 44 45
48 49 52 53 56 57 60 61
  
```

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): 64
On-line CPU(s) list: 0-63
Thread(s) per core: 2
Core(s) per socket: 32
Socket(s): 1
NUMA node(s): 16
  
```

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Platform Notes (Continued)

```

Vendor ID: AuthenticAMD
CPU family: 23
Model: 49
Model name: AMD EPYC 7532 32-Core Processor
Stepping: 0
CPU MHz: 2395.591
BogoMIPS: 4791.18
Virtualization: AMD-V
L1d cache: 32K
L1i cache: 32K
L2 cache: 512K
L3 cache: 16384K
NUMA node0 CPU(s): 0,1,32,33
NUMA node1 CPU(s): 2,3,34,35
NUMA node2 CPU(s): 4,5,36,37
NUMA node3 CPU(s): 6,7,38,39
NUMA node4 CPU(s): 8,9,40,41
NUMA node5 CPU(s): 10,11,42,43
NUMA node6 CPU(s): 12,13,44,45
NUMA node7 CPU(s): 14,15,46,47
NUMA node8 CPU(s): 16,17,48,49
NUMA node9 CPU(s): 18,19,50,51
NUMA node10 CPU(s): 20,21,52,53
NUMA node11 CPU(s): 22,23,54,55
NUMA node12 CPU(s): 24,25,56,57
NUMA node13 CPU(s): 26,27,58,59
NUMA node14 CPU(s): 28,29,60,61
NUMA node15 CPU(s): 30,31,62,63

```

```

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 x2apic 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)

```

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Platform Notes (Continued)

```

node 0 cpus: 0 1 32 33
node 0 size: 15548 MB
node 0 free: 15473 MB
node 1 cpus: 2 3 34 35
node 1 size: 16127 MB
node 1 free: 16067 MB
node 2 cpus: 4 5 36 37
node 2 size: 16127 MB
node 2 free: 16084 MB
node 3 cpus: 6 7 38 39
node 3 size: 16126 MB
node 3 free: 16080 MB
node 4 cpus: 8 9 40 41
node 4 size: 16127 MB
node 4 free: 16060 MB
node 5 cpus: 10 11 42 43
node 5 size: 16127 MB
node 5 free: 16084 MB
node 6 cpus: 12 13 44 45
node 6 size: 16127 MB
node 6 free: 16080 MB
node 7 cpus: 14 15 46 47
node 7 size: 16126 MB
node 7 free: 16078 MB
node 8 cpus: 16 17 48 49
node 8 size: 16127 MB
node 8 free: 15999 MB
node 9 cpus: 18 19 50 51
node 9 size: 16127 MB
node 9 free: 16098 MB
node 10 cpus: 20 21 52 53
node 10 size: 16127 MB
node 10 free: 16080 MB
node 11 cpus: 22 23 54 55
node 11 size: 16126 MB
node 11 free: 16062 MB
node 12 cpus: 24 25 56 57
node 12 size: 16097 MB
node 12 free: 16056 MB
node 13 cpus: 26 27 58 59
node 13 size: 16127 MB
node 13 free: 16089 MB
node 14 cpus: 28 29 60 61
node 14 size: 16127 MB
node 14 free: 16092 MB
node 15 cpus: 30 31 62 63
node 15 size: 16113 MB

```

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Platform Notes (Continued)

node 15 free: 16004 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 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 1: | 11 | 10 | 11 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 2: | 11 | 11 | 10 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 3: | 11 | 11 | 11 | 10 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 4: | 11 | 11 | 11 | 11 | 10 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 5: | 11 | 11 | 11 | 11 | 11 | 10 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 6: | 11 | 11 | 11 | 11 | 11 | 11 | 10 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 7: | 11 | 11 | 11 | 11 | 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 | 11 | 11 | 11 | 11 |
| 9: | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 11 | 10 | 11 | 11 | 11 | 11 | 11 | 11 |
| 10: | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 11 | 11 | 10 | 11 | 11 | 11 | 11 | 11 |
| 11: | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 11 | 11 | 11 | 10 | 11 | 11 | 11 | 11 |
| 12: | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 10 | 11 | 11 | 11 |
| 13: | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 11 | 10 | 11 | 11 |
| 14: | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 11 | 11 | 10 | 11 |
| 15: | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 10 |

From /proc/meminfo

```
MemTotal:      263586664 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-2018-3620 (L1 Terminal Fault):      Not affected
Microarchitectural Data Sampling:      Not affected
CVE-2017-5754 (Meltdown):              Not affected
CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled
via prctl and seccomp
```

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Platform Notes (Continued)

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 Nov 25 11:35 last=5

SPEC is set to: /root/cpu2017-1.1.0

| Filesystem | Type | Size | Used | Avail | Use% | Mounted on |
|------------|------|------|------|-------|------|------------|
| /dev/sda2 | xf | 440G | 36G | 404G | 9% | / |

From /sys/devices/virtual/dmi/id

BIOS: Dell Inc. 1.3.0 01/14/2020
 Vendor: Dell Inc.
 Product: PowerEdge R7515
 Product Family: PowerEdge
 Serial: 5MGPH13

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.

Memory:

8x 80AD80B380AD HMA84GR7CJR4N-XN 32 GB 2 rank 3200
 8x Not Specified Not Specified

(End of data from sysinfo program)

Compiler Version Notes

```
=====  

C | 619.lbm_s(base, peak) 638.imagick_s(base, peak)  

  | 644.nab_s(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++, C, Fortran | 607.cactuBSSN_s(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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Compiler Version Notes (Continued)

```

Target: x86_64-unknown-linux-gnu
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
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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          | 603.bwaves_s(base, peak) 649.fotonik3d_s(base, peak)
                  | 654.roms_s(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      | 621.wrf_s(base, peak) 627.cam4_s(base, peak)
                  | 628.pop2_s(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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```

Base Compiler Invocation

C benchmarks:
clang

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Base Compiler Invocation (Continued)

Fortran benchmarks:

flang

Benchmarks using both Fortran and C:

flang clang

Benchmarks using Fortran, C, and C++:

clang++ clang flang

Base Portability Flags

603.bwaves_s: -DSPEC_LP64
 607.cactuBSSN_s: -DSPEC_LP64
 619.lbm_s: -DSPEC_LP64
 621.wrf_s: -DSPEC_CASE_FLAG -Mbyteswapio -DSPEC_LP64
 627.cam4_s: -DSPEC_CASE_FLAG -DSPEC_LP64
 628.pop2_s: -DSPEC_CASE_FLAG -Mbyteswapio -DSPEC_LP64
 638.imagick_s: -DSPEC_LP64
 644.nab_s: -DSPEC_LP64
 649.fotonik3d_s: -DSPEC_LP64
 654.roms_s: -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 -DSPEC_OPENMP -fopenmp
 -fopenmp=libomp -lomp -lpthread -ldl -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

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PowerEdge R7515 (AMD EPYC 7532, 2.40 GHz)

SPECSpeed®2017_fp_peak = 101

CPU2017 License: 55

Test Sponsor: Dell Inc.

Tested by: Dell Inc.

Test Date: Jan-2020

Hardware Availability: Apr-2020

Software Availability: Aug-2019

Base Optimization Flags (Continued)

Fortran benchmarks (continued):

```
-funroll-loops -Mrecursive -mllvm -vector-library=LIBMVEC -z muldefs
-Kieee -fno-finite-math-only -DSPEC_OPENMP -fopenmp -fopenmp=libomp
-lomp -lpthread -ldl -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 -DSPEC_OPENMP -fopenmp -fopenmp=libomp
-lomp -lpthread -ldl -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
-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
-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lpthread -ldl -lmvec
-lamdlibm -ljemalloc -lflang
```

Base Other Flags

C benchmarks:

```
-Wno-return-type
```

Fortran benchmarks:

```
-Wno-return-type
```

Benchmarks using both Fortran and C:

```
-Wno-return-type
```

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Base Other Flags (Continued)

Benchmarks using Fortran, C, and C++:

-Wno-return-type

Peak Compiler Invocation

C benchmarks:

clang

Fortran benchmarks:

flang

Benchmarks using both Fortran and C:

flang clang

Benchmarks using Fortran, C, and C++:

clang++ clang flang

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

619.lbm_s: basepeak = yes

638.imagick_s: -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 -DSPEC_OPENMP -fopenmp

-lmvec -lamdlibm -fopenmp=libomp -lomp -lpthread -ldl

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Peak Optimization Flags (Continued)

638.imagick_s (continued):

-ljemalloc -lflang

644.nab_s: basepeak = yes

Fortran benchmarks:

603.bwaves_s: -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 -DSPEC_OPENMP -fopenmp

-fopenmp=libomp -lomp -lpthread -ldl -lmvec -lamdlibm

-ljemalloc -lflang

649.fotonik3d_s: basepeak = yes

654.roms_s: -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,-enable-X86-prefetching -O3 -march=znver2

-funroll-loops -Mrecursive -mllvm -vector-library=LIBMVEC

-Kieee -fno-finite-math-only -DSPEC_OPENMP -fopenmp

-fopenmp=libomp -lomp -lpthread -ldl -lmvec -lamdlibm

-ljemalloc -lflang

Benchmarks using both Fortran and C:

621.wrf_s: basepeak = yes

627.cam4_s: -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 -DSPEC_OPENMP

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Peak Optimization Flags (Continued)

627.cam4_s (continued):

```
-fopenmp -fopenmp=libomp -lomp -lpthread -ldl -lmvec
-lamdlibm -ljemalloc -lflang
```

628.pop2_s: basepeak = yes

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 -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
-O3 -funroll-loops -mrecursive -Kieee -fno-finite-math-only
-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lpthread -ldl -lmvec
-lamdlibm -ljemalloc -lflang
```

Peak Other Flags

C benchmarks:

```
-Wno-return-type
```

Fortran benchmarks:

```
-Wno-return-type
```

Benchmarks using both Fortran and C:

```
-Wno-return-type
```

Benchmarks using Fortran, C, and C++:

```
-Wno-return-type
```

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

<http://www.spec.org/cpu2017/flags/aocc200-flags-C3.html>

<http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-revE9.html>

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

<http://www.spec.org/cpu2017/flags/aocc200-flags-C3.xml>

<http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-revE9.xml>



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