



SPEC CPU®2017 Floating Point Speed Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

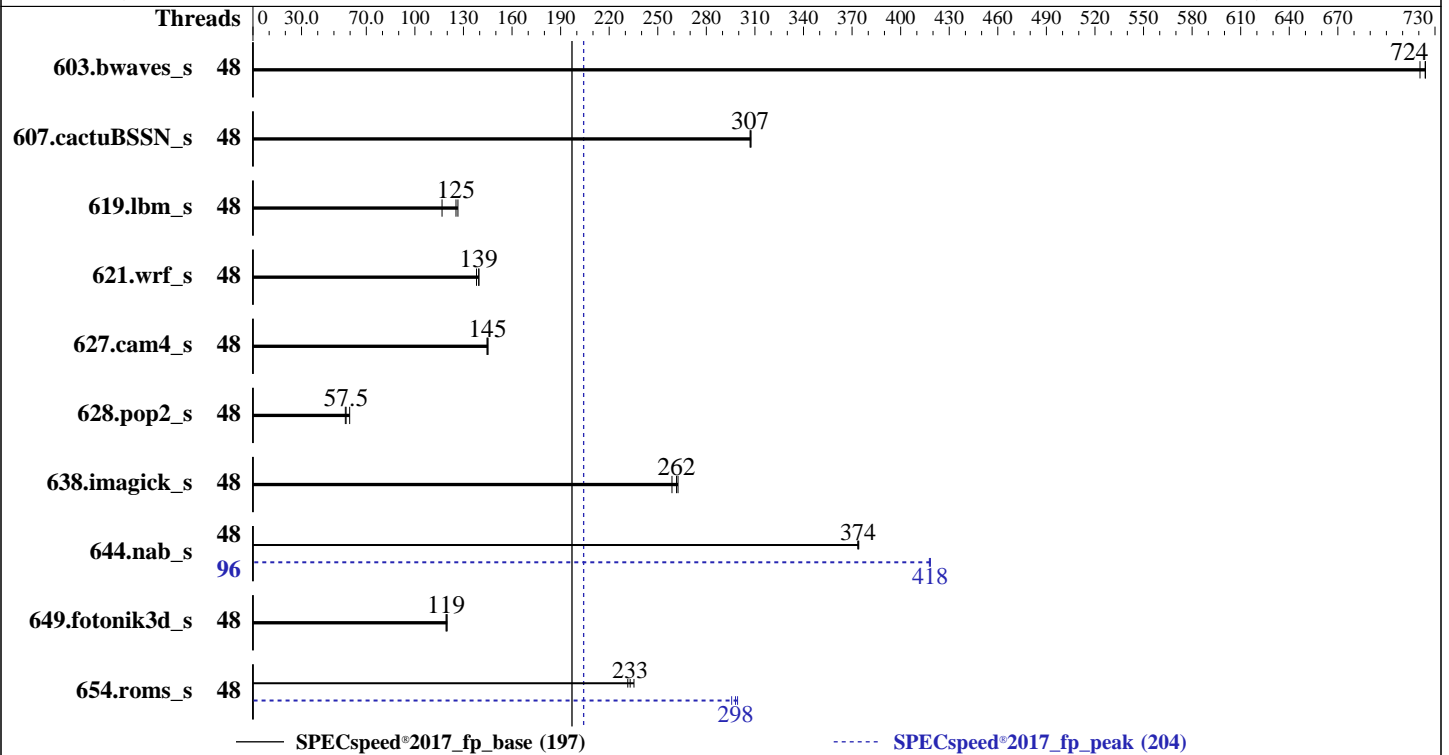
ProLiant DL365 Gen10 Plus
(3.20 GHz, AMD EPYC 74F3)

SPECspeed®2017_fp_base = 197

SPECspeed®2017_fp_peak = 204

CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Test Date: Jun-2021
Hardware Availability: Jun-2021
Software Availability: Mar-2021



Hardware

CPU Name: AMD EPYC 74F3
 Max MHz: 4000
 Nominal: 3200
 Enabled: 48 cores, 2 chips, 2 threads/core
 Orderable: 1,2 chip(s)
 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, 32 MB shared / 3 cores
 Other: None
 Memory: 2 TB (16 x 128 GB 4Rx4 PC4-3200AA-L)
 Storage: 1 x 196 GB SATA SSD, RAID 0
 Other: None

Software

OS: Ubuntu 20.04.1 LTS (x86_64)
 Kernel 5.4.0-56-generic
 Compiler: C/C++/Fortran: Version 3.0.0 of AOCC
 Parallel: Yes
 Firmware: HPE BIOS Version A42 v2.42 04/29/2021 released Apr-2021
 File System: ext4
 System State: Run level 5 (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 | 48 | 81.5 | 724 | 81.5 | 724 | 81.9 | 721 | 48 | 81.5 | 724 | 81.5 | 724 | 81.9 | 721 |
| 607.cactuBSSN_s | 48 | 54.3 | 307 | 54.2 | 308 | 54.3 | 307 | 48 | 54.3 | 307 | 54.2 | 308 | 54.3 | 307 |
| 619.lbm_s | 48 | 44.9 | 117 | 41.4 | 127 | 41.8 | 125 | 48 | 44.9 | 117 | 41.4 | 127 | 41.8 | 125 |
| 621.wrf_s | 48 | 94.9 | 139 | 95.8 | 138 | 94.8 | 140 | 48 | 94.9 | 139 | 95.8 | 138 | 94.8 | 140 |
| 627.cam4_s | 48 | 61.2 | 145 | 61.1 | 145 | 61.3 | 145 | 48 | 61.2 | 145 | 61.1 | 145 | 61.3 | 145 |
| 628.pop2_s | 48 | 199 | 59.7 | 208 | 57.0 | 206 | 57.5 | 48 | 199 | 59.7 | 208 | 57.0 | 206 | 57.5 |
| 638.imagick_s | 48 | 55.0 | 263 | 55.7 | 259 | 55.1 | 262 | 48 | 55.0 | 263 | 55.7 | 259 | 55.1 | 262 |
| 644.nab_s | 48 | 46.7 | 374 | 46.8 | 374 | 46.7 | 374 | 96 | 41.8 | 418 | 41.8 | 418 | 41.8 | 418 |
| 649.fotonik3d_s | 48 | 76.0 | 120 | 76.4 | 119 | 76.4 | 119 | 48 | 76.0 | 120 | 76.4 | 119 | 76.4 | 119 |
| 654.roms_s | 48 | 66.9 | 235 | 67.6 | 233 | 68.0 | 231 | 48 | 52.8 | 298 | 53.3 | 296 | 52.6 | 299 |

SPECspeed®2017_fp_base = **197**

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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>
'echo 8 > /proc/sys/vm/dirty_ratio' run as root to limit dirty cache to 8% of memory.
'echo 1 > /proc/sys/vm/swappiness' run as root to limit swap usage to minimum necessary.
'echo 1 > /proc/sys/vm/zone_reclaim_mode' run as root to free node-local memory and avoid remote memory usage.
'sync; echo 3 > /proc/sys/vm/drop_caches' run as root to reset filesystem caches.
'sysctl -w kernel.randomize_va_space=0' run as root to disable address space layout randomization (ASLR) to reduce run-to-run variability.

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Operating System Notes (Continued)

To enable Transparent Hugepages (THP) for all allocations,
'echo always > /sys/kernel/mm/transparent_hugepage/enabled' and
'echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root.
To enable THP only on request for peak runs of 628.pop2_s, and 638.imagick_s,
'echo madvise > /sys/kernel/mm/transparent_hugepage/enabled' run as root.
To disable THP for peak runs of 627.cam4_s, 644.nab_s, 649.fotonik3d_s, and 654.roms_s,
'echo never > /sys/kernel/mm/transparent_hugepage/enabled' run as root.

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
GOMP_CPU_AFFINITY = "0-95"
LD_LIBRARY_PATH =
"/home/SPEC_CPU2017/amd_speed_aocc300_milan_B_lib/64;/home/SPEC_CPU2017/
amd_speed_aocc300_milan_B_lib/32:"
MALLOC_CONF = "retain:true"
OMP_DYNAMIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "96"

Environment variables set by runcpu during the 644.nab_s peak run:
GOMP_CPU_AFFINITY = "0 48 1 49 2 50 3 51 4 52 5 53 6 54 7 55 8 56 9 57 10 58
11 59 12 60 13 61 14 62 15 63 16 64 17 65 18 66 19 67 20 68 21 69 22 70
23 71 24 72 25 73 26 74 27 75 28 76 29 77 30 78 31 79 32 80 33 81 34 82
35 83 36 84 37 85 38 86 39 87 40 88 41 89 42 90 43 91 44 92 45 93 46 94
47 95"

Environment variables set by runcpu during the 654.roms_s peak run:
GOMP_CPU_AFFINITY = "0-47"

General Notes

Binaries were compiled on a system with 2x AMD EPYC 7742 CPU + 1TiB Memory using openSUSE 15.2

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 v4.8.2 in RHEL 7.4 (No options specified)
jemalloc 5.1.0 is available here:

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General Notes (Continued)

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

Submitted_by: "Bhatnagar, Prateek" <prateek.bhatnagar@hpe.com>
Submitted: Mon Jun 21 10:16:41 EDT 2021
Submission: cpu2017-20210621-27518.sub

Platform Notes

BIOS Configuration
Workload Profile set to General Peak Frequency Compute
Determinism Control set to Manual
Performance Determinism set to Power Deterministic
Last-Level Cache (LLC) as NUMA Node set to Enabled
NUMA memory domains per socket set to One memory domain per socket
Thermal Configuration set to Maximum Cooling
Infinity Fabric Power Management set to Disabled
Infinity Fabric Performance State set to P0
Workload Profile set to Custom
Power Regulator set to OS Control Mode

Sysinfo program /home/SPEC_CPU2017/bin/sysinfo
Rev: r6538 of 2020-09-24 e8664e66d2d7080afeaa89d4b38e2f1c
running on admin Wed Apr 1 17:37:31 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 74F3 24-Core Processor
2 "physical id"s (chips)
96 "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 : 24
siblings : 48
physical 0: cores 0 1 2 4 5 6 8 9 10 12 13 14 16 17 18 20 21 22 24 25 26 28 29 30
physical 1: cores 0 1 2 4 5 6 8 9 10 12 13 14 16 17 18 20 21 22 24 25 26 28 29 30

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
Address sizes: 48 bits physical, 48 bits virtual
CPU(s): 96

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Platform Notes (Continued)

```

On-line CPU(s) list:          0-95
Thread(s) per core:          2
Core(s) per socket:          24
Socket(s):                    2
NUMA node(s):                16
Vendor ID:                    AuthenticAMD
CPU family:                   25
Model:                        1
Model name:                   AMD EPYC 74F3 24-Core Processor
Stepping:                     1
Frequency boost:              enabled
CPU MHz:                      2648.729
CPU max MHz:                  3200.0000
CPU min MHz:                  1500.0000
BogoMIPS:                     6387.69
Virtualization:               AMD-V
L1d cache:                    1.5 MiB
L1i cache:                    1.5 MiB
L2 cache:                     24 MiB
L3 cache:                     512 MiB
NUMA node0 CPU(s):            0-2,48-50
NUMA node1 CPU(s):            3-5,51-53
NUMA node2 CPU(s):            6-8,54-56
NUMA node3 CPU(s):            9-11,57-59
NUMA node4 CPU(s):            12-14,60-62
NUMA node5 CPU(s):            15-17,63-65
NUMA node6 CPU(s):            18-20,66-68
NUMA node7 CPU(s):            21-23,69-71
NUMA node8 CPU(s):            24-26,72-74
NUMA node9 CPU(s):            27-29,75-77
NUMA node10 CPU(s):           30-32,78-80
NUMA node11 CPU(s):           33-35,81-83
NUMA node12 CPU(s):           36-38,84-86
NUMA node13 CPU(s):           39-41,87-89
NUMA node14 CPU(s):           42-44,90-92
NUMA node15 CPU(s):           45-47,93-95
Vulnerability Itlb multihit:  Not affected
Vulnerability L1tf:           Not affected
Vulnerability Mds:            Not affected
Vulnerability Meltdown:       Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
Vulnerability Spectre v1:      Mitigation; usercopy/swapgs barriers and __user pointer sanitization
Vulnerability Spectre v2:      Mitigation; Full AMD retpoline, IBPB conditional, IBRS_FW, STIBP always-on, RSB filling
Vulnerability Srbds:           Not affected

```

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Platform Notes (Continued)

Vulnerability Tsx async abort: Not affected
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 cpuid extd_apicid aperfmperf pni pclmulqdq monitor ssse3 fma cx16 pcid 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_llc mwaitx cpb cat_l3 cdp_l3 invpcid_single hw_pstate ssbd mba ibrs ibpb stibp vmmcall fsgsbase bml avx2 smep bmi2 invpcid 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 wbnoinvd arat npt lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter pfthreshold v_vmsave_vmload vgif umip pku ospke vaes vpclmulqdq 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 48 49 50
node 0 size: 128775 MB
node 0 free: 128573 MB
node 1 cpus: 3 4 5 51 52 53
node 1 size: 129022 MB
node 1 free: 128795 MB
node 2 cpus: 6 7 8 54 55 56
node 2 size: 129022 MB
node 2 free: 128883 MB
node 3 cpus: 9 10 11 57 58 59
node 3 size: 128998 MB
node 3 free: 128760 MB
node 4 cpus: 12 13 14 60 61 62
node 4 size: 129022 MB
node 4 free: 128902 MB
node 5 cpus: 15 16 17 63 64 65
node 5 size: 129022 MB
node 5 free: 128902 MB
node 6 cpus: 18 19 20 66 67 68
node 6 size: 129022 MB
node 6 free: 128895 MB
node 7 cpus: 21 22 23 69 70 71
node 7 size: 116909 MB
node 7 free: 116763 MB
node 8 cpus: 24 25 26 72 73 74
node 8 size: 129022 MB
node 8 free: 128932 MB
```

(Continued on next page)



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Platform Notes (Continued)

```

node 9 cpus: 27 28 29 75 76 77
node 9 size: 129022 MB
node 9 free: 128946 MB
node 10 cpus: 30 31 32 78 79 80
node 10 size: 129022 MB
node 10 free: 128935 MB
node 11 cpus: 33 34 35 81 82 83
node 11 size: 129022 MB
node 11 free: 128945 MB
node 12 cpus: 36 37 38 84 85 86
node 12 size: 129022 MB
node 12 free: 128937 MB
node 13 cpus: 39 40 41 87 88 89
node 13 size: 129022 MB
node 13 free: 128946 MB
node 14 cpus: 42 43 44 90 91 92
node 14 size: 129022 MB
node 14 free: 128937 MB
node 15 cpus: 45 46 47 93 94 95
node 15 size: 129017 MB
node 15 free: 128940 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 11 32 32 32 32 32 32 32
 2:  11 11 10 11 11 11 11 11 11 32 32 32 32 32 32 32
 3:  11 11 11 10 11 11 11 11 11 32 32 32 32 32 32 32
 4:  11 11 11 11 10 11 11 11 11 32 32 32 32 32 32 32
 5:  11 11 11 11 11 10 11 11 11 32 32 32 32 32 32 32
 6:  11 11 11 11 11 11 10 11 11 32 32 32 32 32 32 32
 7:  11 11 11 11 11 11 11 10 11 32 32 32 32 32 32 32
 8:  32 32 32 32 32 32 32 32 10 11 11 11 11 11 11 11
 9:  32 32 32 32 32 32 32 32 11 10 11 11 11 11 11 11
10:  32 32 32 32 32 32 32 32 11 11 10 11 11 11 11 11
11:  32 32 32 32 32 32 32 32 11 11 11 10 11 11 11 11
12:  32 32 32 32 32 32 32 32 11 11 11 11 10 11 11 11
13:  32 32 32 32 32 32 32 32 11 11 11 11 11 10 11 11
14:  32 32 32 32 32 32 32 32 11 11 11 11 11 11 10 11
15:  32 32 32 32 32 32 32 32 11 11 11 11 11 11 11 10

```

```

From /proc/meminfo
MemTotal:      2101218068 kB
HugePages_Total:      0
Hugepagesize:    2048 kB

/sbin/tuned-adm active
Current active profile: balanced

```

(Continued on next page)



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Platform Notes (Continued)

```
/sys/devices/system/cpu/cpu*/cpufreq/scaling_governor has
performance
```

```
/usr/bin/lsb_release -d
Ubuntu 20.04.1 LTS
```

```
From /etc/*release* /etc/*version*
debian_version: bullseye/sid
os-release:
  NAME="Ubuntu"
  VERSION="20.04.1 LTS (Focal Fossa)"
  ID=ubuntu
  ID_LIKE=debian
  PRETTY_NAME="Ubuntu 20.04.1 LTS"
  VERSION_ID="20.04"
  HOME_URL="https://www.ubuntu.com/"
  SUPPORT_URL="https://help.ubuntu.com/"
```

```
uname -a:
Linux admin 5.4.0-56-generic #62-Ubuntu SMP Mon Nov 23 19:20:19 UTC 2020 x86_64 x86_64
x86_64 GNU/Linux
```

Kernel self-reported vulnerability status:

| | |
|--|---|
| CVE-2018-12207 (iTLB Multihit): | Not affected |
| 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 |
| CVE-2017-5753 (Spectre variant 1): | Mitigation: usercopy/swaps barriers and __user pointer sanitization |
| CVE-2017-5715 (Spectre variant 2): | Mitigation: Full AMD retpoline, IBPB: conditional, IBRS_FW, STIBP: always-on, RSB filling |
| CVE-2020-0543 (Special Register Buffer Data Sampling): | Not affected |
| CVE-2019-11135 (TSX Asynchronous Abort): | Not affected |

```
run-level 5 Apr 1 17:24
```

```
SPEC is set to: /home/SPEC_CPU2017
Filesystem      Type  Size  Used Avail Use% Mounted on
/dev/mapper/ubuntu--vg-ubuntu--lv ext4  196G  42G  145G  23% /
```

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Platform Notes (Continued)

```
From /sys/devices/virtual/dmi/id
Vendor:          HPE
Product:         ProLiant DL365 Gen10 Plus
Product Family: ProLiant
Serial:          CN70430NKR
```

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:
 16x Samsung M386AAG40AM3-CWE 128 GB 4 rank 3200
 16x UNKNOWN NOT AVAILABLE
```

```
BIOS:
 BIOS Vendor:      HPE
 BIOS Version:     A42
 BIOS Date:        04/29/2021
 BIOS Revision:    2.42
 Firmware Revision: 2.50
```

(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)
=====
```

```
AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on
LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin
=====
```

```
=====
C++, C, Fortran | 607.cactuBSSN_s(base, peak)
=====
```

```
AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on
LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin
AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on
LLVM Mirror.Version.12.0.0)
```

(Continued on next page)



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Target: x86_64-unknown-linux-gnu
Thread model: posix
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AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin

=====
Fortran | 603.bwaves_s(base, peak) 649.fotonik3d_s(base, peak)
| 654.roms_s(base, peak)

AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin

=====
Fortran, C | 621.wrf_s(base, peak) 627.cam4_s(base, peak)
| 628.pop2_s(base, peak)

AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin
AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin

Base Compiler Invocation

C benchmarks:
clang

Fortran benchmarks:
flang

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(Test Sponsor: HPE)

ProLiant DL365 Gen10 Plus
(3.20 GHz, AMD EPYC 74F3)

SPECspeed®2017_fp_base = 197

SPECspeed®2017_fp_peak = 204

CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Test Date: Jun-2021
Hardware Availability: Jun-2021
Software Availability: Mar-2021

Base Compiler Invocation (Continued)

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:

-m64 -mno-adx -mno-sse4a -Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver3
-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5
-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000
-fremap-arrays -mllvm -function-specialize -flv-function-specialization
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3 -z muldefs
-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc
-lflang -lflangrti

Fortran benchmarks:

-m64 -mno-adx -mno-sse4a -Wl,-mllvm -Wl,-enable-X86-prefetching
-Wl,-mllvm -Wl,-enable-licm-vrp -Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Hz,1,0x1 -O3
-march=znver3 -fveclib=AMDLIBM -ffast-math -Mrecursive
-mllvm -fuse-tile-inner-loop -funroll-loops

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Base Optimization Flags (Continued)

Fortran benchmarks (continued):

```
-mllvm -extra-vectorizer-passes -mllvm -lsr-in-nested-loop
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -z muldefs -DSPEC_OPENMP -fopenmp
-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang -lflangrti
```

Benchmarks using both Fortran and C:

```
-m64 -mno-adx -mno-sse4a -Wl,-mllvm -Wl,-enable-X86-prefetching
-Wl,-mllvm -Wl,-enable-licm-vrp -Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver3
-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5
-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000
-freemap-arrays -mllvm -function-specialize -flv-function-specialization
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3 -Hz,1,0x1
-Mrecursive -mllvm -fuse-tile-inner-loop -funroll-loops
-mllvm -extra-vectorizer-passes -mllvm -lsr-in-nested-loop -z muldefs
-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc
-lflang -lflangrti
```

Benchmarks using Fortran, C, and C++:

```
-m64 -mno-adx -mno-sse4a -std=c++98
-Wl,-mllvm -Wl,-x86-use-vzeroupper=false
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver3
-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5
-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000
-freemap-arrays -mllvm -function-specialize -flv-function-specialization
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3
-mllvm -enable-partial-unswitch -mllvm -unroll-threshold=100
-finline-aggressive -mllvm -loop-unswitch-threshold=200000
-mllvm -reroll-loops -mllvm -aggressive-loop-unswitch
-mllvm -extra-vectorizer-passes -mllvm -convert-pow-exp-to-int=false
-Hz,1,0x1 -Mrecursive -mllvm -fuse-tile-inner-loop -funroll-loops
-mllvm -lsr-in-nested-loop -z muldefs -DSPEC_OPENMP -fopenmp
-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang -lflangrti
```



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Base Other Flags

C benchmarks:

-Wno-unused-command-line-argument -Wno-return-type

Fortran benchmarks:

-Wno-unused-command-line-argument -Wno-return-type

Benchmarks using both Fortran and C:

-Wno-unused-command-line-argument -Wno-return-type

Benchmarks using Fortran, C, and C++:

-Wno-unused-command-line-argument -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: basepeak = yes

644.nab_s: -m64 -mno-adx -mno-sse4a -Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-function-specialize -Ofast -march=znver3

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Peak Optimization Flags (Continued)

644.nab_s (continued):

```
-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5
-mllvm -unroll-threshold=50 -fremap-arrays
-flv-function-specialization -mllvm -inline-threshold=1000
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true
-mllvm -function-specialize -mllvm -enable-licm-vrp
-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -fopenmp
-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
```

Fortran benchmarks:

603.bwaves_s: basepeak = yes

649.fotonik3d_s: basepeak = yes

```
654.roms_s: -m64 -mno-adx -mno-sse4a
-Wl,-mllvm -Wl,-enable-X86-prefetching
-Wl,-mllvm -Wl,-enable-licm-vrp
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math -Mrecursive
-mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -mllvm -enable-licm-vrp
-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lamdlibm
-ljemalloc -lflang
```

Benchmarks using both Fortran and C:

621.wrf_s: basepeak = yes

627.cam4_s: basepeak = yes

628.pop2_s: basepeak = yes

Benchmarks using Fortran, C, and C++:

607.cactuBSSN_s: basepeak = yes

Peak Other Flags

C benchmarks:

```
-Wno-unused-command-line-argument -Wno-return-type
```

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Peak Other Flags (Continued)

Fortran benchmarks:

-Wno-unused-command-line-argument -Wno-return-type

Benchmarks using both Fortran and C:

-Wno-unused-command-line-argument -Wno-return-type

Benchmarks using Fortran, C, and C++:

-Wno-unused-command-line-argument -Wno-return-type

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

<http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-V1.2-EPYC-revP.html>

<http://www.spec.org/cpu2017/flags/aocc300-flags-A1.html>

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

<http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-V1.2-EPYC-revP.xml>

<http://www.spec.org/cpu2017/flags/aocc300-flags-A1.xml>

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