



SPEC CPU®2017 Floating Point Speed Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL365 Gen10 Plus v2

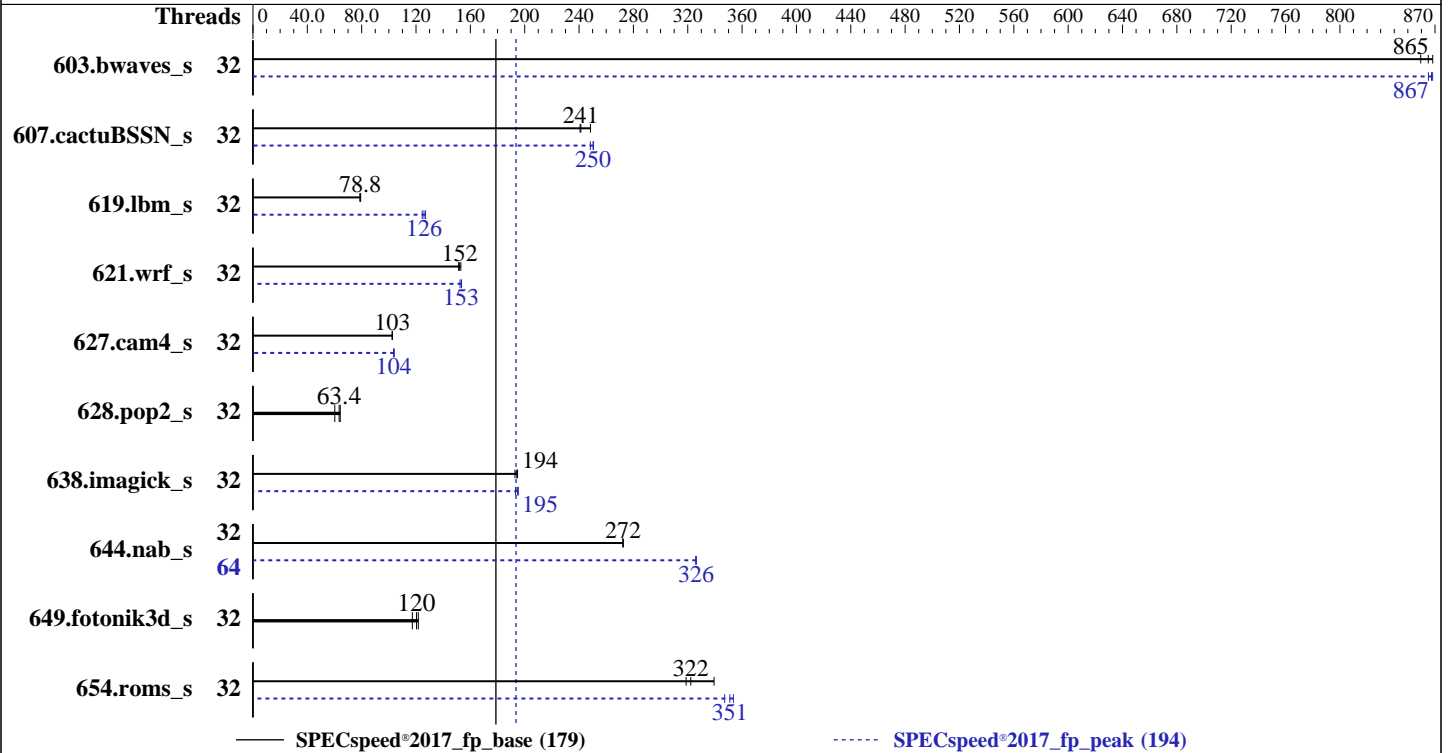
AMD EPYC 7373X

SPECspeed®2017_fp_base = 179

SPECspeed®2017_fp_peak = 194

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

Test Date: Apr-2022
Hardware Availability: Mar-2022
Software Availability: Jan-2022



Hardware

CPU Name: AMD EPYC 7373X
 Max MHz: 3800
 Nominal: 3050
 Enabled: 32 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: 768 MB I+D on chip per chip,
 96 MB shared / 2 cores
 Other: None
 Memory: 2 TB (16 x 128 GB 4Rx4 PC4-3200AA-L)
 Storage: 1 x 500 GB SAS SSD, RAID 0
 Other: None

Software

OS: Ubuntu 20.04.3 LTS (x86_64)
 Kernel 5.13.0-28-generic
 Compiler: C/C++/Fortran: Version 3.2.0 of AOCC
 Parallel: Yes
 Firmware: HPE BIOS Version A42 v2.56 02/10/2022 released Feb-2022
 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	32	67.9	868	<u>68.2</u>	<u>865</u>	68.6	859	32	67.9	868	68.2	865	<u>68.0</u>	<u>867</u>
607.cactuBSSN_s	32	<u>69.1</u>	<u>241</u>	69.2	241	67.1	248	32	<u>66.6</u>	<u>250</u>	66.5	251	67.1	248
619.lbm_s	32	<u>66.4</u>	<u>78.8</u>	66.1	79.3	66.5	78.8	32	42.0	125	<u>41.6</u>	<u>126</u>	41.2	127
621.wrf_s	32	87.4	151	<u>86.9</u>	<u>152</u>	86.4	153	32	86.2	154	<u>86.3</u>	<u>153</u>	86.8	152
627.cam4_s	32	86.5	102	<u>86.4</u>	<u>103</u>	86.4	103	32	85.3	104	<u>85.4</u>	<u>104</u>	85.7	103
628.pop2_s	32	<u>187</u>	<u>63.4</u>	185	64.3	197	60.2	32	<u>187</u>	<u>63.4</u>	185	64.3	197	60.2
638.imagick_s	32	<u>74.3</u>	<u>194</u>	74.1	195	74.8	193	32	74.6	193	73.9	195	<u>74.1</u>	<u>195</u>
644.nab_s	32	<u>64.1</u>	<u>272</u>	64.1	272	64.2	272	64	53.5	326	53.6	326	<u>53.6</u>	<u>326</u>
649.fotonik3d_s	32	77.7	117	<u>75.7</u>	<u>120</u>	74.9	122	32	77.7	117	<u>75.7</u>	<u>120</u>	74.9	122
654.roms_s	32	46.4	339	49.4	319	<u>48.9</u>	<u>322</u>	32	<u>44.9</u>	<u>351</u>	44.5	354	45.4	347

SPECspeed®2017_fp_base = **179**

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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 limit
'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>

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

To enable Transparent Hugepages (THP) for all allocations,

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Operating System Notes (Continued)

```
'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:
'echo madvise > /sys/kernel/mm/transparent_hugepage/enabled' run as root.
To disable THP for peak runs of 627.cam4_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 = "0-63"
```

```
LD_LIBRARY_PATH =
```

```
"/home/cpu2017_speed/amd_speed_aocc320_milanx_A_lib/lib;/home/cpu2017_sp
eed/amd_speed_aocc320_milanx_A_lib/lib32:"
```

```
LIBOMP_NUM_HIDDEN_HELPER_THREADS = "0"
```

```
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 619.lbm_s peak run:

```
GOMP_CPU_AFFINITY = "0-31"
```

Environment variables set by runcpu during the 621.wrf_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 644.nab_s peak run:

```
GOMP_CPU_AFFINITY = "0-63"
```

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

```
GOMP_CPU_AFFINITY = "0-31"
```



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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:

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

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

Sysinfo program /home/cpu2017_speed/bin/sysinfo

Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d

running on admin1-ProLiant-DL365-Gen10-Plus Mon Jan 10 14:00:05 2022

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 7373X 16-Core Processor

2 "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 : 16

siblings : 32

physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

From lscpu from util-linux 2.34:

(Continued on next page)



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Platform Notes (Continued)

```

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):                       64
On-line CPU(s) list:         0-63
Thread(s) per core:          2
Core(s) per socket:          16
Socket(s):                    2
NUMA node(s):                16
Vendor ID:                    AuthenticAMD
CPU family:                   25
Model:                        1
Model name:                   AMD EPYC 7373X 16-Core Processor
Stepping:                     2
CPU MHz:                      3044.409
BogoMIPS:                     6088.81
Virtualization:              AMD-V
L1d cache:                   1 MiB
L1i cache:                   1 MiB
L2 cache:                     16 MiB
L3 cache:                     1.5 GiB
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
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,

```

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Platform Notes (Continued)

IBRS_FW, STIBP always-on, RSB filling
 Vulnerability Srbds: Not affected
 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 bmi1 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 rdpru wbnoinvd amd_ppin arat
 npt lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists
 pausefilter pfthreshold v_vmsave_vmload vgif v_spec_ctrl umip pku ospke vaes
 vpclmulqdq rdpid overflow_recov succor smca

From lscpu --cache:

NAME	ONE-SIZE	ALL-SIZE	WAYS	TYPE	LEVEL
L1d	32K	1M	8	Data	1
L1i	32K	1M	8	Instruction	1
L2	512K	16M	8	Unified	2
L3	96M	1.5G	16	Unified	3

```
/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 32 33
node 0 size: 128711 MB
node 0 free: 128079 MB
node 1 cpus: 2 3 34 35
node 1 size: 129022 MB
node 1 free: 128937 MB
node 2 cpus: 4 5 36 37
node 2 size: 129022 MB
node 2 free: 128953 MB
node 3 cpus: 6 7 38 39
node 3 size: 129022 MB
node 3 free: 128945 MB
node 4 cpus: 8 9 40 41
node 4 size: 129022 MB
node 4 free: 128901 MB
node 5 cpus: 10 11 42 43
node 5 size: 129022 MB
```

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Platform Notes (Continued)

```

node 5 free: 128905 MB
node 6 cpus: 12 13 44 45
node 6 size: 129022 MB
node 6 free: 128822 MB
node 7 cpus: 14 15 46 47
node 7 size: 116876 MB
node 7 free: 116828 MB
node 8 cpus: 16 17 48 49
node 8 size: 129022 MB
node 8 free: 128879 MB
node 9 cpus: 18 19 50 51
node 9 size: 129022 MB
node 9 free: 128947 MB
node 10 cpus: 20 21 52 53
node 10 size: 129022 MB
node 10 free: 128953 MB
node 11 cpus: 22 23 54 55
node 11 size: 129022 MB
node 11 free: 128798 MB
node 12 cpus: 24 25 56 57
node 12 size: 129022 MB
node 12 free: 128916 MB
node 13 cpus: 26 27 58 59
node 13 size: 129022 MB
node 13 free: 128974 MB
node 14 cpus: 28 29 60 61
node 14 size: 129022 MB
node 14 free: 128935 MB
node 15 cpus: 30 31 62 63
node 15 size: 129015 MB
node 15 free: 128860 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	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

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Platform Notes (Continued)

```
14: 32 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 32 11 11 11 11 11 11 11 10
```

From /proc/meminfo

```
MemTotal: 2101144604 kB
HugePages_Total: 0
Hugepagesize: 2048 kB
```

/sbin/tuned-adm active

Current active profile: throughput-performance

/usr/bin/lsb_release -d

Ubuntu 20.04.3 LTS

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

```
debian_version: bullseye/sid
os-release:
  NAME="Ubuntu"
  VERSION="20.04.3 LTS (Focal Fossa)"
  ID=ubuntu
  ID_LIKE=debian
  PRETTY_NAME="Ubuntu 20.04.3 LTS"
  VERSION_ID="20.04"
  HOME_URL="https://www.ubuntu.com/"
  SUPPORT_URL="https://help.ubuntu.com/"
```

uname -a:

```
Linux admin1-ProLiant-DL365-Gen10-Plus 5.13.0-28-generic #31~20.04.1-Ubuntu SMP Wed
Jan 19 14:08:10 UTC 2022 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/swapgs
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
```

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Platform Notes (Continued)

run-level 5 Jan 10 10:27

SPEC is set to: /home/cpu2017_speed

Filesystem	Type	Size	Used	Avail	Use%	Mounted on
/dev/sda2	ext4	439G	46G	371G	12%	/

From /sys/devices/virtual/dmi/id

Vendor: HPE
Product: ProLiant DL365 Gen10 Plus
Product Family: ProLiant
Serial: CN70430NKR

Additional information from dmidecode 3.2 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:

9x Hynix HMABAGL7ABR4N-XN 128 GB 4 rank 3200
7x Samsung M386AAG40AM3-CWE 128 GB 4 rank 3200
16x UNKNOWN NOT AVAILABLE

BIOS:

BIOS Vendor: HPE
BIOS Version: A42
BIOS Date: 02/10/2022
BIOS Revision: 2.56
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 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on LLVM Mirror.Version.13.0.0)

Target: x86_64-unknown-linux-gnu

Thread model: posix

InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin

```

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

```

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Compiler Version Notes (Continued)

```

-----
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
-----

```

```

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

```

```

AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
-----

```

```

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

```

```

AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
  LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin
-----

```



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

Test Date: Apr-2022
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Software Availability: Jan-2022

Base 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

Base Portability Flags

603.bwaves_s: -DSPEC_LP64
607.cactuBSSN_s: -DSPEC_LP64
619.ibm_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 -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 -fopenmp -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=libomp -lomp -lamdlibm -ljemalloc -lflang

Fortran benchmarks:

-m64 -Wl,-mllvm -Wl,-enable-X86-prefetching
-Wl,-mllvm -Wl,-enable-licm-vrp -Wl,-mllvm -Wl,-region-vectorize

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Base Optimization Flags (Continued)

Fortran benchmarks (continued):

```
-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 -fopenmp -Mrecursive
-mllvm -fuse-tile-inner-loop -funroll-loops
-mllvm -extra-vectorizer-passes -mllvm -lsr-in-nested-loop
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -mllvm -enable-loopinterchange
-mllvm -compute-interchange-order -z muldefs -DSPEC_OPENMP
-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
```

Benchmarks using both Fortran and C:

```
-m64 -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 -fopenmp -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
-mllvm -enable-loopinterchange -mllvm -compute-interchange-order
-z muldefs -DSPEC_OPENMP -fopenmp=libomp -lomp -lamdlibm -ljemalloc
-lflang
```

Benchmarks using Fortran, C, and C++:

```
-m64 -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 -fopenmp -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 -mllvm -enable-loopinterchange
-mllvm -compute-interchange-order -z muldefs -DSPEC_OPENMP
```

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Base Optimization Flags (Continued)

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

`-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang`

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



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Peak Optimization Flags

C benchmarks:

```
619.lbm_s: -m64 -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 -fopenmp
-flto -fstruct-layout=5 -mllvm -unroll-threshold=50
-freemap-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=libomp -lomp -lamdlibm -ljemalloc -lflang
```

```
638.imagick_s: -m64 -Wl,-allow-multiple-definition
-Wl,-mllvm -Wl,-enable-licm-vrp
-Wl,-mllvm -Wl,-do-block-reorder=aggressive
-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 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math -fopenmp
-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 -do-block-reorder=aggressive -DSPEC_OPENMP
-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
```

644.nab_s: Same as 638.imagick_s

Fortran benchmarks:

```
603.bwaves_s: -m64 -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 -fopenmp
-Mrecursive -mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -mllvm -enable-licm-vrp
-DSPEC_OPENMP -fopenmp=libomp -lomp -lamdlibm -ljemalloc
-lflang
```

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Peak Optimization Flags (Continued)

649.fotonik3d_s: basepeak = yes

654.roms_s: Same as 603.bwaves_s

Benchmarks using both Fortran and C:

```
621.wrf_s: -m64 -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 -fopenmp
-flto -fstruct-layout=5 -mllvm -unroll-threshold=50
-freemap-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 -Hz,1,0x1 -Mrecursive
-mllvm -fuse-tile-inner-loop -funroll-loops
-mllvm -extra-vectorizer-passes -mllvm -lsr-in-nested-loop
-mllvm -enable-loopinterchange
-mllvm -compute-interchange-order -DSPEC_OPENMP
-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
```

627.cam4_s: Same as 621.wrf_s

628.pop2_s: basepeak = yes

Benchmarks using Fortran, C, and C++:

```
-m64 -Wl,-mllvm -Wl,-x86-use-vzeroupper=false
-Wl,-mllvm -Wl,-enable-licm-vrp
-Wl,-mllvm -Wl,-do-block-reorder=aggressive
-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 -fopenmp -flto -fstruct-layout=5
-mllvm -unroll-threshold=50 -freemap-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
-finline-aggressive -mllvm -unroll-threshold=100 -mllvm -reroll-loops
-mllvm -aggressive-loop-unswitch -Mrecursive
-mllvm -do-block-reorder=aggressive -DSPEC_OPENMP -fopenmp=libomp
-lomp -lamdlibm -ljemalloc -lflang
```



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Peak 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

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-revR.html>

<http://www.spec.org/cpu2017/flags/aocc320-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-revR.xml>

<http://www.spec.org/cpu2017/flags/aocc320-flags-A1.xml>

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