SPEC CPU®2017 Floating Point Speed Result

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Supermicro
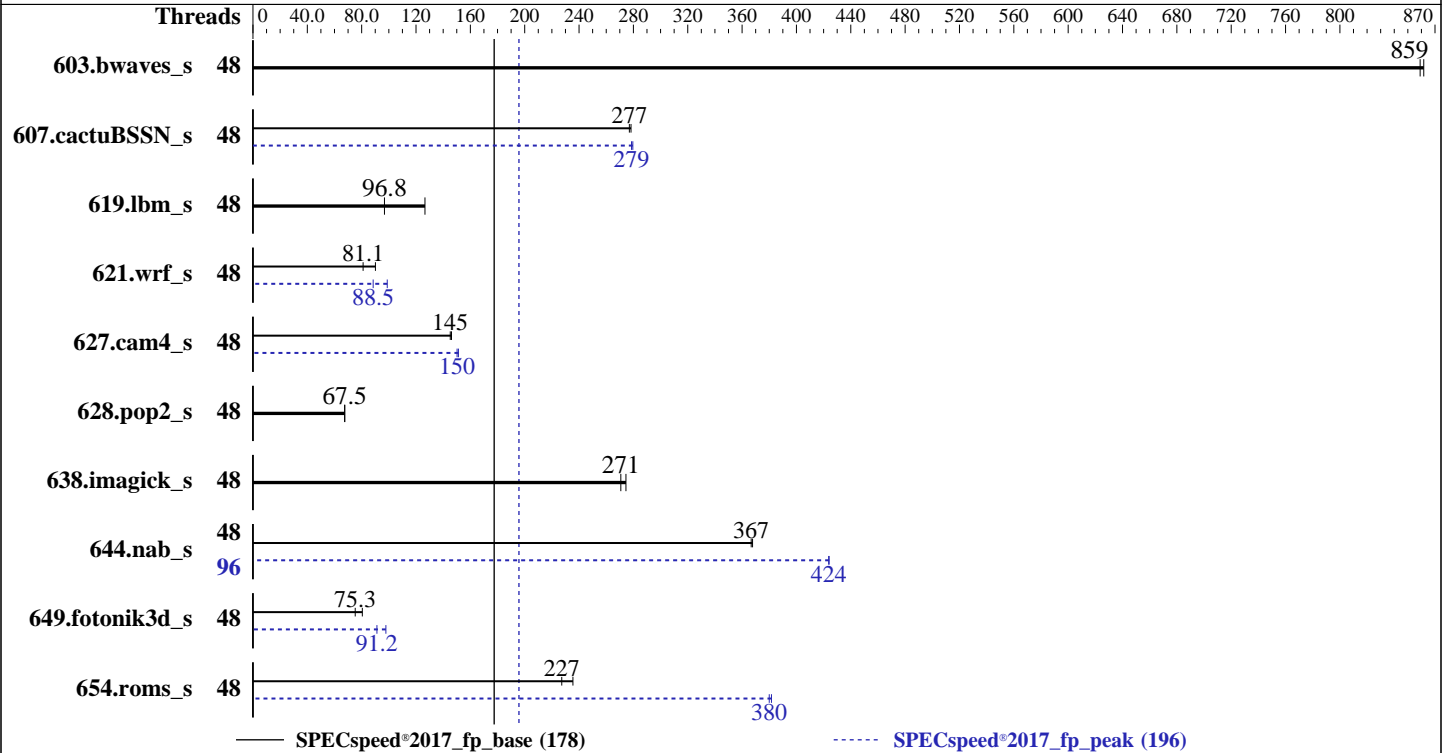
A+ Server 2024US-TRT
(H12DSU-iN , AMD EPYC 7473X)

$SPECspeed^{®}2017\_fp\_base = 178$

$SPECspeed^{®}2017\_fp\_peak = 196$

CPU2017 License: 001176
Test Sponsor: Supermicro
Tested by: Supermicro

Test Date: Feb-2022
Hardware Availability: Mar-2022
Software Availability: Feb-2022

Threads

Benchmark	Threads	base	peak
603.bwaves_s	48	859	
607.cactuBSSN_s	48	277	279
619.lbm_s	48	96.8	
621.wrf_s	48	81.1	88.5
627.cam4_s	48	145	150
628.pop2_s	48	67.5	
638.imagick_s	48	271	
644.nab_s	48 / 96	367	424
649.fotonik3d_s	48	75.3	91.2
654.roms_s	48	227	380

SPECspeed®2017_fp_base (178)   SPECspeed®2017_fp_peak (196)

Hardware

CPU Name: AMD EPYC 7473X
 Max MHz: 3700
 Nominal: 2800
Enabled: 48 cores, 2 chips, 2 threads/core
Orderable: 1,2 chips
Cache L1: 32 KB I + 32 KB D on chip per core
 L2: 512 KB I+D on chip per core
 L3: 768 MB I+D on chip per chip, 96 MB shared / 3 cores
 Other: None
Memory: 1 TB (16 x 64 GB 2Rx4 PC4-3200AA-R)
Storage: 1 x 200 GB SATA III SSD
Other: None

Software

OS: Ubuntu 20.04.3 LTS
 Kernel 5.4.0-99-generic
Compiler: C/C++/Fortran: Version 3.2.0 of AOCC
Parallel: Yes
Firmware: Version 2.3a released Jan-2022
File System: ext4
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 and OS 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	**68.7**	**859**	68.5	862			48	**68.7**	**859**	68.5	862		
607.cactuBSSN_s	48	**60.2**	**277**	59.9	278			48	**59.8**	**279**	59.6	280		
619.lbm_s	48	**54.1**	**96.8**	41.4	127			48	**54.1**	**96.8**	41.4	127		
621.wrf_s	48	**163**	**81.1**	147	90.1			48	**149**	**88.5**	134	98.8		
627.cam4_s	48	**61.0**	**145**	60.7	146			48	58.6	151	**59.0**	**150**		
628.pop2_s	48	**176**	**67.5**	176	67.6			48	**176**	**67.5**	176	67.6		
638.imagick_s	48	52.5	275	**53.3**	**271**			48	52.5	275	**53.3**	**271**		
644.nab_s	48	47.5	368	**47.6**	**367**			96	41.2	424	**41.2**	**424**		
649.fotonik3d_s	48	113	80.5	**121**	**75.3**			48	**99.9**	**91.2**	93.2	97.8		
654.roms_s	48	**69.3**	**227**	66.9	236			48	**41.4**	**380**	41.3	382		
SPECspeed®2017_fp_base =	**178**													
SPECspeed®2017_fp_peak =	**196**													

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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Standard Performance Evaluation Corporation (info@spec.org) https://www.spec.org/

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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 = "0-95"
LD_LIBRARY_PATH =
     "/home/cpu2017/amd_speed_aocc320_milanx_A_lib/lib;/home/cpu2017/amd_spee
     d_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 = "96"

Environment variables set by runcpu during the 607.cactuBSSN_s peak run:
GOMP_CPU_AFFINITY = "0-47"

Environment variables set by runcpu during the 621.wrf_s peak run:
GOMP_CPU_AFFINITY = "0-47"

Environment variables set by runcpu during the 627.cam4_s peak run:
GOMP_CPU_AFFINITY = "0-47"

Environment variables set by runcpu during the 644.nab_s peak run:
GOMP_CPU_AFFINITY = "0-95"

Environment variables set by runcpu during the 649.fotonik3d_s peak run:
GOMP_CPU_AFFINITY = "0-47"
PGHPF_ZMEM = "yes"

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
```

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Tested by:　　　　Supermicro　　　　　　　　　　　　　　**Software Availability:**　Feb-2022

General Notes (Continued)

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 Settings:
Determinism Control = Manual
Determinism Slider = Power
cTDP Control = Manual
cTDP = 280
Package Power Limit Control = Manual
Package Power Limit = 280
APBDIS = 1
NUMA Nodes Per Socket = NPS4

 Sysinfo program /home/cpu2017/bin/sysinfo
 Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
 running on h12dsu-7473x Sat Feb 19 00:31:30 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 7473X 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 from util-linux 2.34:
    Architecture:                 x86_64
    CPU op-mode(s):               32-bit, 64-bit
```

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Platform Notes (Continued)

```
Byte Order:                     Little Endian
Address sizes:                  48 bits physical, 48 bits virtual
CPU(s):                         96
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 7473X 24-Core Processor
Stepping:                       2
Frequency boost:                enabled
CPU MHz:                        1799.595
CPU max MHz:                    2800.0000
CPU min MHz:                    1500.0000
BogoMIPS:                       5600.16
Virtualization:                 AMD-V
L1d cache:                      1.5 MiB
L1i cache:                      1.5 MiB
L2 cache:                       24 MiB
L3 cache:                       1.5 GiB
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
```

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Platform Notes (Continued)

```
     Vulnerability Spectre v2:        Mitigation; Full AMD retpoline, IBPB conditional,
     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 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


  From lscpu --cache:
     NAME ONE-SIZE ALL-SIZE WAYS TYPE          LEVEL
     L1d       32K     1.5M   8 Data              1
     L1i       32K     1.5M   8 Instruction       1
     L2       512K      24M   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 2 48 49 50
   node 0 size: 64381 MB
   node 0 free: 64173 MB
   node 1 cpus: 3 4 5 51 52 53
   node 1 size: 64479 MB
   node 1 free: 64306 MB
   node 2 cpus: 6 7 8 54 55 56
   node 2 size: 64510 MB
   node 2 free: 64203 MB
   node 3 cpus: 9 10 11 57 58 59
   node 3 size: 64509 MB
   node 3 free: 64282 MB
   node 4 cpus: 12 13 14 60 61 62
   node 4 size: 64510 MB
   node 4 free: 64358 MB
   node 5 cpus: 15 16 17 63 64 65
   node 5 size: 64509 MB
```

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Platform Notes (Continued)

```
    node 5 free: 64364 MB
    node 6 cpus: 18 19 20 66 67 68
    node 6 size: 64510 MB
    node 6 free: 64051 MB
    node 7 cpus: 21 22 23 69 70 71
    node 7 size: 64497 MB
    node 7 free: 64296 MB
    node 8 cpus: 24 25 26 72 73 74
    node 8 size: 64510 MB
    node 8 free: 64365 MB
    node 9 cpus: 27 28 29 75 76 77
    node 9 size: 64509 MB
    node 9 free: 64356 MB
    node 10 cpus: 30 31 32 78 79 80
    node 10 size: 64510 MB
    node 10 free: 64374 MB
    node 11 cpus: 33 34 35 81 82 83
    node 11 size: 64509 MB
    node 11 free: 64370 MB
    node 12 cpus: 36 37 38 84 85 86
    node 12 size: 64510 MB
    node 12 free: 64375 MB
    node 13 cpus: 39 40 41 87 88 89
    node 13 size: 64509 MB
    node 13 free: 64372 MB
    node 14 cpus: 42 43 44 90 91 92
    node 14 size: 64510 MB
    node 14 free: 64369 MB
    node 15 cpus: 45 46 47 93 94 95
    node 15 size: 64508 MB
    node 15 free: 64369 MB
    node distances:
    node   0    1    2    3    4    5    6    7    8    9   10   11   12   13   14   15
      0:  10   11   12   12   12   12   12   12   32   32   32   32   32   32   32   32
      1:  11   10   12   12   12   12   12   12   32   32   32   32   32   32   32   32
      2:  12   12   10   11   12   12   12   12   32   32   32   32   32   32   32   32
      3:  12   12   11   10   12   12   12   12   32   32   32   32   32   32   32   32
      4:  12   12   12   12   10   11   12   12   32   32   32   32   32   32   32   32
      5:  12   12   12   12   11   10   12   12   32   32   32   32   32   32   32   32
      6:  12   12   12   12   12   12   10   11   32   32   32   32   32   32   32   32
      7:  12   12   12   12   12   12   11   10   32   32   32   32   32   32   32   32
      8:  32   32   32   32   32   32   32   32   10   11   12   12   12   12   12   12
      9:  32   32   32   32   32   32   32   32   11   10   12   12   12   12   12   12
     10:  32   32   32   32   32   32   32   32   12   12   10   11   12   12   12   12
     11:  32   32   32   32   32   32   32   32   12   12   11   10   12   12   12   12
     12:  32   32   32   32   32   32   32   32   12   12   12   12   10   11   12   12
     13:  32   32   32   32   32   32   32   32   12   12   12   12   11   10   12   12
```

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Platform Notes (Continued)

```
    14:  32  32  32  32  32  32  32  32  12  12  12  12  12  12  10  11
    15:  32  32  32  32  32  32  32  32  12  12  12  12  12  12  11  10

 From /proc/meminfo
    MemTotal:       1056754120 kB
    HugePages_Total:        0
    Hugepagesize:        2048 kB

 /sbin/tuned-adm active
     Current active profile: throughput-performance

 /sys/devices/system/cpu/cpu*/cpufreq/scaling_governor has
    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 h12dsu-7473x 5.4.0-99-generic #112-Ubuntu SMP Thu Feb 3 13:50:55 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:
```

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Platform Notes (Continued)

```
                                              always-on, RSB filling
 CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
 CVE-2019-11135 (TSX Asynchronous Abort):              Not affected

 run-level 3 Feb 18 11:37

 SPEC is set to: /home/cpu2017
    Filesystem     Type  Size  Used Avail Use% Mounted on
    /dev/sda3      ext4  178G   23G  147G  14% /

 From /sys/devices/virtual/dmi/id
    Vendor:        Supermicro
    Product:       AS-2024US-TRT
    Serial:        0123456789


 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:
     16x NO DIMM Unknown
     16x Samsung M393A8G40AB2-CWE 64 GB 2 rank 3200

 BIOS:
    BIOS Vendor:       American Megatrends Inc.
    BIOS Version:      2.3a
    BIOS Date:         01/25/2022
    BIOS Revision:     5.22

 (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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Supermicro
A+ Server 2024US-TRT
(H12DSU-iN , AMD EPYC 7473X)

SPECspeed®2017_fp_base = 178

SPECspeed®2017_fp_peak = 196

CPU2017 License: 001176
Test Sponsor: Supermicro
Tested by: Supermicro

Test Date: Feb-2022
Hardware Availability: Mar-2022
Software Availability: Feb-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.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 -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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Tested by:	Supermicro	**Software Availability:**	Feb-2022

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
-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 -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
-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
-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: basepeak = yes

638.imagick_s: basepeak = yes

644.nab_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 -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`
`-mllvm -do-block-reorder=aggressive -DSPEC_OPENMP`
`-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang`

Fortran benchmarks:

603.bwaves_s: basepeak = yes

649.fotonik3d_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 -Mrecursive -mllvm -reduce-array-computations=3`
`-mllvm -global-vectorize-slp=true -mllvm -enable-licm-vrp`
`-DSPEC_OPENMP -fopenmp=libomp -lomp -lamdlibm -ljemalloc`
`-lflang`

654.roms_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`

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Tested by:	Supermicro	**Software Availability:**	Feb-2022

Peak Optimization Flags (Continued)

654.roms_s (continued):

```
-lflang
```

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
-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 -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 -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
-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/aocc320-flags-A1.html
http://www.spec.org/cpu2017/flags/Supermicro-Platform-Settings-V1.2-Milan-revD.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/aocc320-flags-A1.xml
http://www.spec.org/cpu2017/flags/Supermicro-Platform-Settings-V1.2-Milan-revD.xml

For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

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