SPEC CPU®2017 Floating Point Speed Result

Cisco Systems

Cisco UCS C245 M6 (AMD EPYC 7773X 64-Core)

$SPECspeed®2017\_fp\_base = 288$

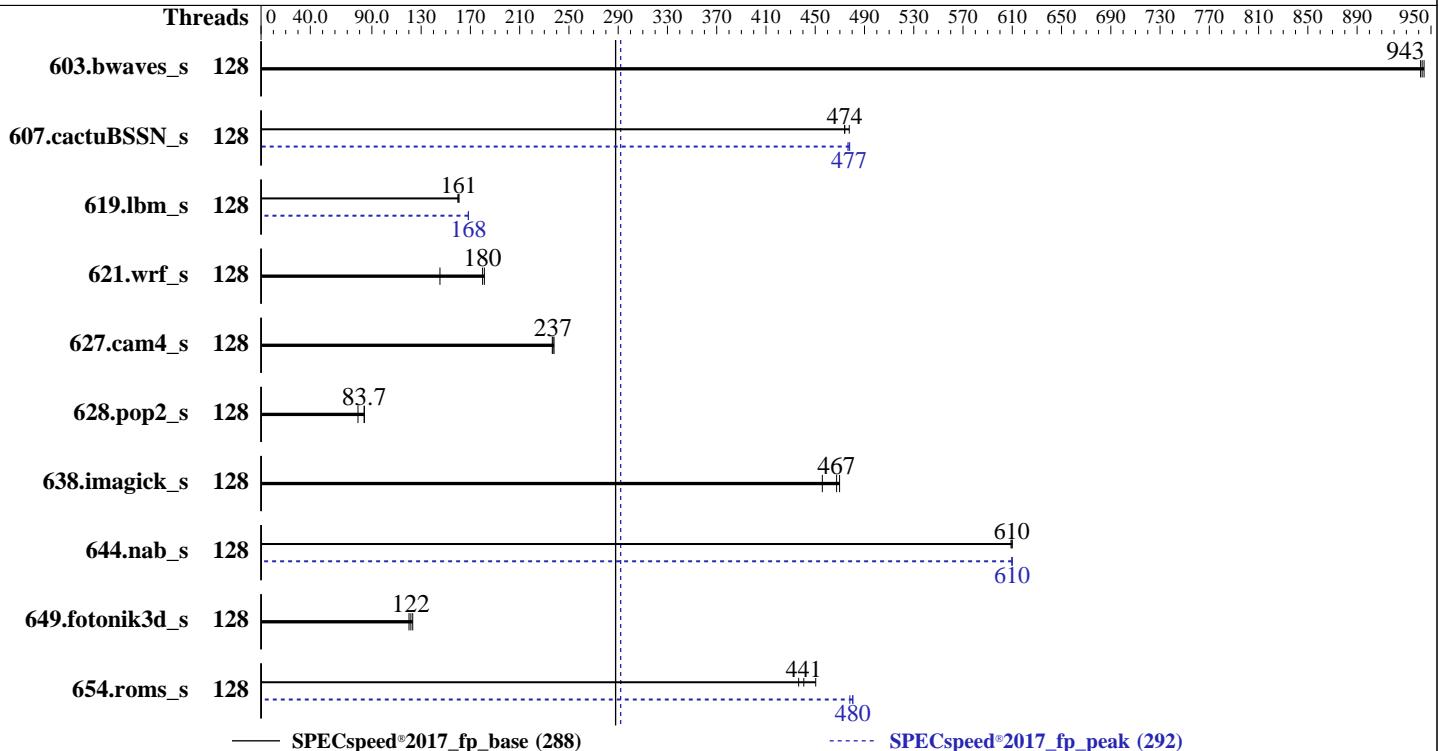$SPECspeed®2017\_fp\_peak = 292$

CPU2017 License: 9019
Test Sponsor: Cisco Systems
Tested by: Cisco Systems

Test Date: Feb-2022
Hardware Availability: Mar-2022
Software Availability: Dec-2021

Threads

Benchmark	Threads	base	peak
603.bwaves_s	128	943	
607.cactuBSSN_s	128	474	477
619.lbm_s	128	161	168
621.wrf_s	128	180	
627.cam4_s	128	237	
628.pop2_s	128	83.7	
638.imagick_s	128	467	
644.nab_s	128	610	610
649.fotonik3d_s	128	122	
654.roms_s	128	441	480

—— SPECspeed®2017_fp_base (288)   ----- SPECspeed®2017_fp_peak (292)

Hardware

CPU Name: AMD EPYC 7773X
 Max MHz: 3500
 Nominal: 2200
Enabled: 128 cores, 2 chips
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 / 8 cores
 Other: None
Memory: 2 TB (16 x 128 GB 4Rx4 PC4-3200V-L)
Storage: 1 x 960 GB M.2 SSD SATA
Other: None

Software

OS: SUSE Linux Enterprise Server 15 SP3 (x86_64)
 kernel version
 5.3.18-57-default
Compiler: C/C++/Fortran: Version 3.2.0 of AOCC
Parallel: Yes
Firmware: Version 4.2.1.30 released Feb-2022
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 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	128	62.7	942	**62.6**	**943**	62.5	944	128	62.7	942	**62.6**	**943**	62.5	944
607.cactuBSSN_s	128	34.9	478	**35.2**	**474**	35.2	474	128	34.9	478	35.0	477	**34.9**	**477**
619.lbm_s	128	32.6	161	32.8	160	**32.6**	**161**	128	31.1	168	31.1	168	**31.1**	**168**
621.wrf_s	128	**73.5**	**180**	72.9	181	91.0	145	128	**73.5**	**180**	72.9	181	91.0	145
627.cam4_s	128	37.3	238	37.5	236	**37.4**	**237**	128	37.3	238	37.5	236	**37.4**	**237**
628.pop2_s	128	**142**	**83.7**	151	78.7	141	83.9	128	**142**	**83.7**	151	78.7	141	83.9
638.imagick_s	128	**30.9**	**467**	30.7	470	31.7	456	128	**30.9**	**467**	30.7	470	31.7	456
644.nab_s	128	**28.7**	**610**	28.7	609	28.6	610	128	28.7	610	**28.6**	**610**	28.6	610
649.fotonik3d_s	128	74.0	123	**74.9**	**122**	75.9	120	128	74.0	123	**74.9**	**122**	75.9	120
654.roms_s	128	35.0	450	36.1	437	**35.7**	**441**	128	32.9	478	**32.8**	**480**	32.8	480
SPECspeed®2017_fp_base =		**288**												
SPECspeed®2017_fp_peak =		**292**												

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,
```

(Continued on next page)

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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 = "0-127"
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 = "32G"
OMP_THREAD_LIMIT = "128"

Environment variables set by runcpu during the 607.cactuBSSN_s peak run:
GOMP_CPU_AFFINITY = "0-127"

Environment variables set by runcpu during the 619.lbm_s peak run:
GOMP_CPU_AFFINITY = "0-127"

Environment variables set by runcpu during the 644.nab_s peak run:
GOMP_CPU_AFFINITY = "0-127"

Environment variables set by runcpu during the 654.roms_s peak run:
GOMP_CPU_AFFINITY = "0-127"
```

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.
```

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General Notes (Continued)

```
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
 SMT Mode set to Disabled
 NUMA nodes per socket set to NPS1
 ACPI SRAT L3 Cache As NUMA Domain set to Enabled
 DRAM Scrub Time set to Disabled
 Determinism Slider set to Power
 L1 Stream HW Prefetcher set to Enabled
 APBDIS set to 1

 Sysinfo program /home/cpu2017/bin/sysinfo
 Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
 running on localhost Sun Feb 27 00:26:34 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 7773X 64-Core Processor
       2  "physical id"s (chips)
       128 "processors"
    cores, siblings (Caution: counting these is hw and system dependent. The following
    excerpts from /proc/cpuinfo might not be reliable.  Use with caution.)
       cpu cores : 64
       siblings  : 64
       physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
       25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
       53 54 55 56 57 58 59 60 61 62 63
       physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
       25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
       53 54 55 56 57 58 59 60 61 62 63

 From lscpu from util-linux 2.36.2:
       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):                    128
       On-line CPU(s) list:       0-127
       Thread(s) per core:        1
```

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Platform Notes (Continued)

```
       Core(s) per socket:            64
       Socket(s):                     2
       NUMA node(s):                  16
       Vendor ID:                     AuthenticAMD
       CPU family:                    25
       Model:                         1
       Model name:                    AMD EPYC 7773X 64-Core Processor
       Stepping:                      2
       Frequency boost:               enabled
       CPU MHz:                       1795.797
       CPU max MHz:                   2200.0000
       CPU min MHz:                   1500.0000
       BogoMIPS:                      4392.06
       Virtualization:                AMD-V
       L1d cache:                     4 MiB
       L1i cache:                     4 MiB
       L2 cache:                      64 MiB
       L3 cache:                      1.5 GiB
       NUMA node0 CPU(s):             0-7
       NUMA node1 CPU(s):             8-15
       NUMA node2 CPU(s):             16-23
       NUMA node3 CPU(s):             24-31
       NUMA node4 CPU(s):             32-39
       NUMA node5 CPU(s):             40-47
       NUMA node6 CPU(s):             48-55
       NUMA node7 CPU(s):             56-63
       NUMA node8 CPU(s):             64-71
       NUMA node9 CPU(s):             72-79
       NUMA node10 CPU(s):            80-87
       NUMA node11 CPU(s):            88-95
       NUMA node12 CPU(s):            96-103
       NUMA node13 CPU(s):            104-111
       NUMA node14 CPU(s):            112-119
       NUMA node15 CPU(s):            120-127
       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 disabled, 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
```

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Platform Notes (Continued)

```
    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 erms 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 amd_ppin 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 fsrm

  From lscpu --cache:
    NAME ONE-SIZE ALL-SIZE WAYS TYPE         LEVEL   SETS PHY-LINE COHERENCY-SIZE
    L1d       32K       4M    8 Data             1     64        1             64
    L1i       32K       4M    8 Instruction      1     64        1             64
    L2       512K      64M    8 Unified          2   1024        1             64
    L3        96M     1.5G   16 Unified          3  98304        1             64

  /proc/cpuinfo cache data
    cache size : 512 KB

  From numactl --hardware
  WARNING: a numactl 'node' might or might not correspond to a physical chip.
    available: 16 nodes (0-15)
    node 0 cpus: 0 1 2 3 4 5 6 7
    node 0 size: 128834 MB
    node 0 free: 128087 MB
    node 1 cpus: 8 9 10 11 12 13 14 15
    node 1 size: 129021 MB
    node 1 free: 128851 MB
    node 2 cpus: 16 17 18 19 20 21 22 23
    node 2 size: 129021 MB
    node 2 free: 128859 MB
    node 3 cpus: 24 25 26 27 28 29 30 31
    node 3 size: 129021 MB
    node 3 free: 128912 MB
    node 4 cpus: 32 33 34 35 36 37 38 39
    node 4 size: 129021 MB
    node 4 free: 128866 MB
    node 5 cpus: 40 41 42 43 44 45 46 47
    node 5 size: 129021 MB
    node 5 free: 128905 MB
    node 6 cpus: 48 49 50 51 52 53 54 55
    node 6 size: 129021 MB
    node 6 free: 128889 MB
```

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Platform Notes (Continued)

```
    node 7 cpus: 56 57 58 59 60 61 62 63
    node 7 size: 116909 MB
    node 7 free: 116513 MB
    node 8 cpus: 64 65 66 67 68 69 70 71
    node 8 size: 128987 MB
    node 8 free: 121881 MB
    node 9 cpus: 72 73 74 75 76 77 78 79
    node 9 size: 129021 MB
    node 9 free: 128089 MB
    node 10 cpus: 80 81 82 83 84 85 86 87
    node 10 size: 129021 MB
    node 10 free: 128861 MB
    node 11 cpus: 88 89 90 91 92 93 94 95
    node 11 size: 129021 MB
    node 11 free: 128851 MB
    node 12 cpus: 96 97 98 99 100 101 102 103
    node 12 size: 129021 MB
    node 12 free: 128785 MB
    node 13 cpus: 104 105 106 107 108 109 110 111
    node 13 size: 129021 MB
    node 13 free: 128919 MB
    node 14 cpus: 112 113 114 115 116 117 118 119
    node 14 size: 129021 MB
    node 14 free: 128923 MB
    node 15 cpus: 120 121 122 123 124 125 126 127
    node 15 size: 129016 MB
    node 15 free: 128877 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
     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
```

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Platform Notes (Continued)

```
     MemTotal:        2101257052 kB
     HugePages_Total:          0
     Hugepagesize:          2048 kB


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

 From /etc/*release* /etc/*version*
    os-release:
       NAME="SLES"
       VERSION="15-SP3"
       VERSION_ID="15.3"
       PRETTY_NAME="SUSE Linux Enterprise Server 15 SP3"
       ID="sles"
       ID_LIKE="suse"
       ANSI_COLOR="0;32"
       CPE_NAME="cpe:/o:suse:sles:15:sp3"


 uname -a:
    Linux localhost 5.3.18-57-default #1 SMP Wed Apr 28 10:54:41 UTC 2021 (ba3c2e9) 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:
                                                   disabled, RSB filling
 CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
 CVE-2019-11135 (TSX Asynchronous Abort):               Not affected


 run-level 3 Feb 26 23:21


 SPEC is set to: /home/cpu2017
    Filesystem      Type  Size  Used Avail Use% Mounted on
    /dev/sdb4       xfs   144G   14G  130G  10% /home


 From /sys/devices/virtual/dmi/id
```

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Platform Notes (Continued)

```
        Vendor:         Cisco Systems Inc
        Product:        UCSC-C245-M6SX
        Serial:         WZP25130VQ2

 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 0xCE00 M386AAG40AM3-CWE 128 GB 4 rank 3200

 BIOS:
    BIOS Vendor:        Cisco Systems, Inc.
    BIOS Version:       C245M6.4.2.1.30.0221222139
    BIOS Date:          02/21/2022
    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)
--------------------------------------------------------------------------------
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
```

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Compiler Version Notes (Continued)

```
  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
------------------------------------------------------------------------
```

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`

SPEC CPU®2017 Floating Point Speed Result

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Cisco Systems

Cisco UCS C245 M6 (AMD EPYC 7773X 64-Core)

SPECspeed®2017_fp_base = 288

SPECspeed®2017_fp_peak = 292

CPU2017 License: 9019
Test Sponsor: Cisco Systems
Tested by: Cisco Systems

Test Date: Feb-2022
Hardware Availability: Mar-2022
Software Availability: Dec-2021

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
-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
```

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

Cisco Systems

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CPU2017 License: 9019		**Test Date:**	Feb-2022
Test Sponsor:	Cisco Systems	**Hardware Availability:**	Mar-2022
Tested by:	Cisco Systems	**Software Availability:**	Dec-2021

Base Optimization Flags (Continued)

Benchmarks using both Fortran and C (continued):
```
-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
-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
```

Cisco Systems

Cisco UCS C245 M6 (AMD EPYC 7773X 64-Core)

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Base Other Flags (Continued)

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

```
638.imagick_s: basepeak = yes
```

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Cisco Systems

Cisco UCS C245 M6 (AMD EPYC 7773X 64-Core)

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Hardware Availability: Mar-2022
Software Availability: Dec-2021

Peak Optimization Flags (Continued)

```
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: basepeak = yes
```

```
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
-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++:
```
-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
```

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Peak Optimization Flags (Continued)

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

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/Cisco-Platform-Settings-AMD-v2-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/Cisco-Platform-Settings-AMD-v2-revD.xml

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

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