SPEC CPU®2017 Floating Point Speed Result

Copyright 2017-2021 Standard Performance Evaluation Corporation

Cisco Systems

Cisco UCS C225 M6 (AMD EPYC 7443 24-Core)

$SPECspeed®2017\_fp\_base = 203$

$SPECspeed®2017\_fp\_peak = 208$

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

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

Threads

Benchmark	Threads	base	peak
603.bwaves_s	48	644	
607.cactuBSSN_s	48	318	319
619.lbm_s	48	125	
621.wrf_s	48	176	
627.cam4_s	48	153	
628.pop2_s	48	74.2	
638.imagick_s	48	256	
644.nab_s	48	366	
649.fotonik3d_s	48	115	
654.roms_s	48	219	278

SPECspeed®2017_fp_base (203)   SPECspeed®2017_fp_peak (208)

Hardware

CPU Name: AMD EPYC 7443
 Max MHz: 4000
 Nominal: 2850
Enabled: 48 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: 128 MB I+D on chip per chip,
  32 MB shared / 6 cores
 Other: None
Memory: 2 TB (16 x 128 GB 4Rx4 PC4-3200AA-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 3.0.0 of AOCC
Parallel: Yes
Firmware: Version 4.2.1c released Aug-2021
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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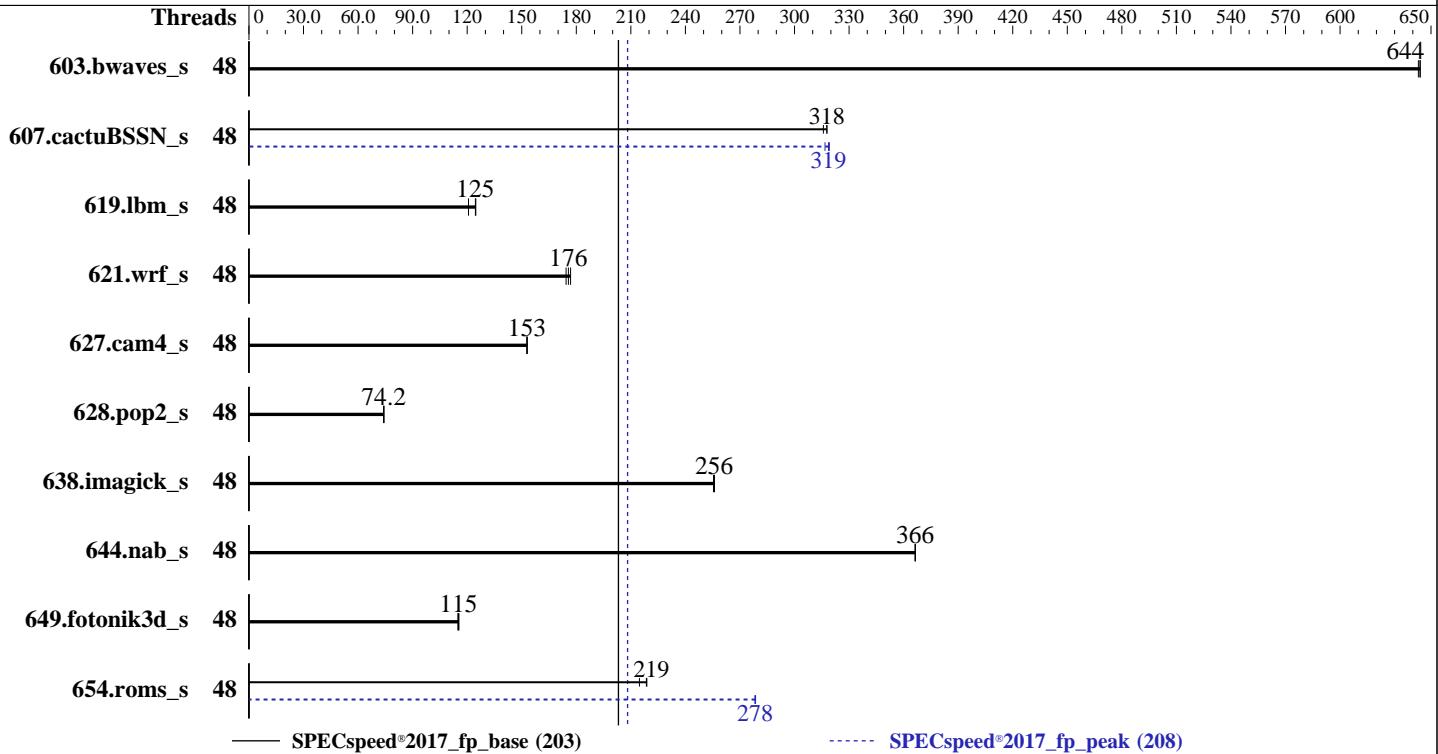
SPECspeed®2017_fp_peak = 208

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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	**91.6**	**644**	91.6	644	91.7	643	48	**91.6**	**644**	91.6	644	91.7	643
607.cactuBSSN_s	48	**52.5**	**318**	52.4	318	52.8	316	48	52.6	317	**52.3**	**319**	52.2	319
619.lbm_s	48	42.0	125	43.4	121	**42.1**	**125**	48	42.0	125	43.4	121	**42.1**	**125**
621.wrf_s	48	74.8	177	75.8	174	**75.3**	**176**	48	74.8	177	75.8	174	**75.3**	**176**
627.cam4_s	48	57.9	153	**58.0**	**153**	58.0	153	48	57.9	153	**58.0**	**153**	58.0	153
628.pop2_s	48	**160**	**74.2**	160	74.2	160	74.0	48	**160**	**74.2**	160	74.2	160	74.0
638.imagick_s	48	**56.4**	**256**	56.4	256	56.5	255	48	**56.4**	**256**	56.4	256	56.5	255
644.nab_s	48	47.7	366	**47.7**	**366**	47.7	366	48	47.7	366	**47.7**	**366**	47.7	366
649.fotonik3d_s	48	79.4	115	79.0	115	**79.1**	**115**	48	79.4	115	79.0	115	**79.1**	**115**
654.roms_s	48	73.3	215	72.0	219	**72.0**	**219**	48	**56.6**	**278**	56.6	278	56.5	279
SPECspeed®2017_fp_base =	**203**													
SPECspeed®2017_fp_peak =	**208**													

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>
'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.
'echo always > /sys/kernel/mm/transparent_hugepage/enabled' and
'echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root for peak
```

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Cisco Systems

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Operating System Notes (Continued)

```
integer runs and all FP runs to enable Transparent Hugepages (THP).
'cpupower frequency-set -g performance' run as root to set the scaling governor to
performance.
```

Environment Variables Notes

```
Environment variables set by runcpu before the start of the run:
GOMP_CPU_AFFINITY = "0-47"
LD_LIBRARY_PATH =
     "/home/cpu2017/amd_speed_aocc300_milan_B_lib/lib;/home/cpu2017/amd_speed
     _aocc300_milan_B_lib/lib32:"
MALLOC_CONF = "retain:true"
OMP_DYNAMIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "592M"
OMP_THREAD_LIMIT = "48"

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

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

Platform Notes

```
BIOS Configuration
 SMT Mode set to Disabled
 NUMA nodes per socket set to NPS1
 ACPI SRAT L3 Cache As NUMA Domain set to Enabled
```

(Continued on next page)

Cisco Systems

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Platform Notes (Continued)

```
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 Thu Oct 21 17:10:59 2021

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 7443 24-Core Processor
      2  "physical id"s (chips)
      48 "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  : 24
      physical 0: cores 0 1 2 3 4 5 8 9 10 11 12 13 16 17 18 19 20 21 24 25 26 27 28 29
      physical 1: cores 0 1 2 3 4 5 8 9 10 11 12 13 16 17 18 19 20 21 24 25 26 27 28 29

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):                   48
   On-line CPU(s) list:      0-47
   Thread(s) per core:       1
   Core(s) per socket:       24
   Socket(s):                2
   NUMA node(s):             8
   Vendor ID:                AuthenticAMD
   CPU family:               25
   Model:                    1
   Model name:               AMD EPYC 7443 24-Core Processor
   Stepping:                 1
   Frequency boost:          enabled
   CPU MHz:                  1544.483
   CPU max MHz:              2850.0000
   CPU min MHz:              1500.0000
   BogoMIPS:                 5688.98
   Virtualization:           AMD-V
```

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Cisco Systems

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Platform Notes (Continued)

```
    L1d cache:                     1.5 MiB
    L1i cache:                     1.5 MiB
    L2 cache:                      24 MiB
    L3 cache:                      256 MiB
    NUMA node0 CPU(s):             0-5
    NUMA node1 CPU(s):             6-11
    NUMA node2 CPU(s):             12-17
    NUMA node3 CPU(s):             18-23
    NUMA node4 CPU(s):             24-29
    NUMA node5 CPU(s):             30-35
    NUMA node6 CPU(s):             36-41
    NUMA node7 CPU(s):             42-47
    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
    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      1.5M    8 Data           1     64       1              64
      L1i      32K      1.5M    8 Instruction    1     64       1              64
      L2      512K       24M    8 Unified        2   1024       1              64
      L3       32M      256M   16 Unified        3  32768       1              64

  /proc/cpuinfo cache data
      cache size : 512 KB
```

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CPU2017 License:	9019	**Test Date:**	Oct-2021
Test Sponsor:	Cisco Systems	**Hardware Availability:**	Jun-2021
Tested by:	Cisco Systems	**Software Availability:**	Jun-2021

Platform Notes (Continued)

```
From numactl --hardware
WARNING: a numactl 'node' might or might not correspond to a physical chip.
  available: 8 nodes (0-7)
  node 0 cpus: 0 1 2 3 4 5
  node 0 size: 257860 MB
  node 0 free: 257632 MB
  node 1 cpus: 6 7 8 9 10 11
  node 1 size: 258046 MB
  node 1 free: 257880 MB
  node 2 cpus: 12 13 14 15 16 17
  node 2 size: 258046 MB
  node 2 free: 257867 MB
  node 3 cpus: 18 19 20 21 22 23
  node 3 size: 245935 MB
  node 3 free: 245801 MB
  node 4 cpus: 24 25 26 27 28 29
  node 4 size: 258046 MB
  node 4 free: 257916 MB
  node 5 cpus: 30 31 32 33 34 35
  node 5 size: 258012 MB
  node 5 free: 257878 MB
  node 6 cpus: 36 37 38 39 40 41
  node 6 size: 258046 MB
  node 6 free: 257724 MB
  node 7 cpus: 42 43 44 45 46 47
  node 7 size: 258043 MB
  node 7 free: 257860 MB
  node distances:
  node   0   1   2   3   4   5   6   7
    0:  10  11  11  11  32  32  32  32
    1:  11  10  11  11  32  32  32  32
    2:  11  11  10  11  32  32  32  32
    3:  11  11  11  10  32  32  32  32
    4:  32  32  32  32  10  11  11  11
    5:  32  32  32  32  11  10  11  11
    6:  32  32  32  32  11  11  10  11
    7:  32  32  32  32  11  11  11  10

From /proc/meminfo
  MemTotal:       2101283864 kB
  HugePages_Total:        0
  Hugepagesize:        2048 kB

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

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Platform Notes (Continued)

```
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 Oct 21 13:33

SPEC is set to: /home/cpu2017
   Filesystem      Type  Size  Used Avail Use% Mounted on
   /dev/sda3       xfs   557G   11G  546G   2% /

From /sys/devices/virtual/dmi/id
    Vendor:         Cisco Systems Inc
    Product:        UCSC-C225-M6S
    Serial:         WZP252309U3

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
```

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Platform Notes (Continued)

```
 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:       C225M6.4.2.1c.0.0806211349
     BIOS Date:          08/06/2021
     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 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)
Target: x86_64-unknown-linux-gnu
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Target: x86_64-unknown-linux-gnu
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InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin
------------------------------------------------------------------------------


==============================================================================
```

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Compiler Version Notes (Continued)

```
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
```

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`

(Continued on next page)

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Base Portability Flags (Continued)

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
-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
```

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Cisco UCS C225 M6 (AMD EPYC 7443 24-Core)

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Tested by: Cisco Systems

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

Base Optimization Flags (Continued)

Benchmarks using both Fortran and C (continued):
```
-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 -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
-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 -z muldefs -DSPEC_OPENMP -fopenmp
-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang -lflangrti
```

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
```

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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: `basepeak = yes`

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
```

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Peak Optimization Flags (Continued)

654.roms_s (continued):
```
-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 -mno-adx -mno-sse4a -std=c++98
-Wl,-mllvm -Wl,-x86-use-vzeroupper=false -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 -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 -DSPEC_OPENMP -fopenmp
-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/aocc300-flags-B2.html
http://www.spec.org/cpu2017/flags/Cisco-Platform-Settings-AMD-v2-revD.html

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You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/aocc300-flags-B2.xml
http://www.spec.org/cpu2017/flags/Cisco-Platform-Settings-AMD-v2-revD.xml

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