



SPEC CPU®2017 Floating Point Speed Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

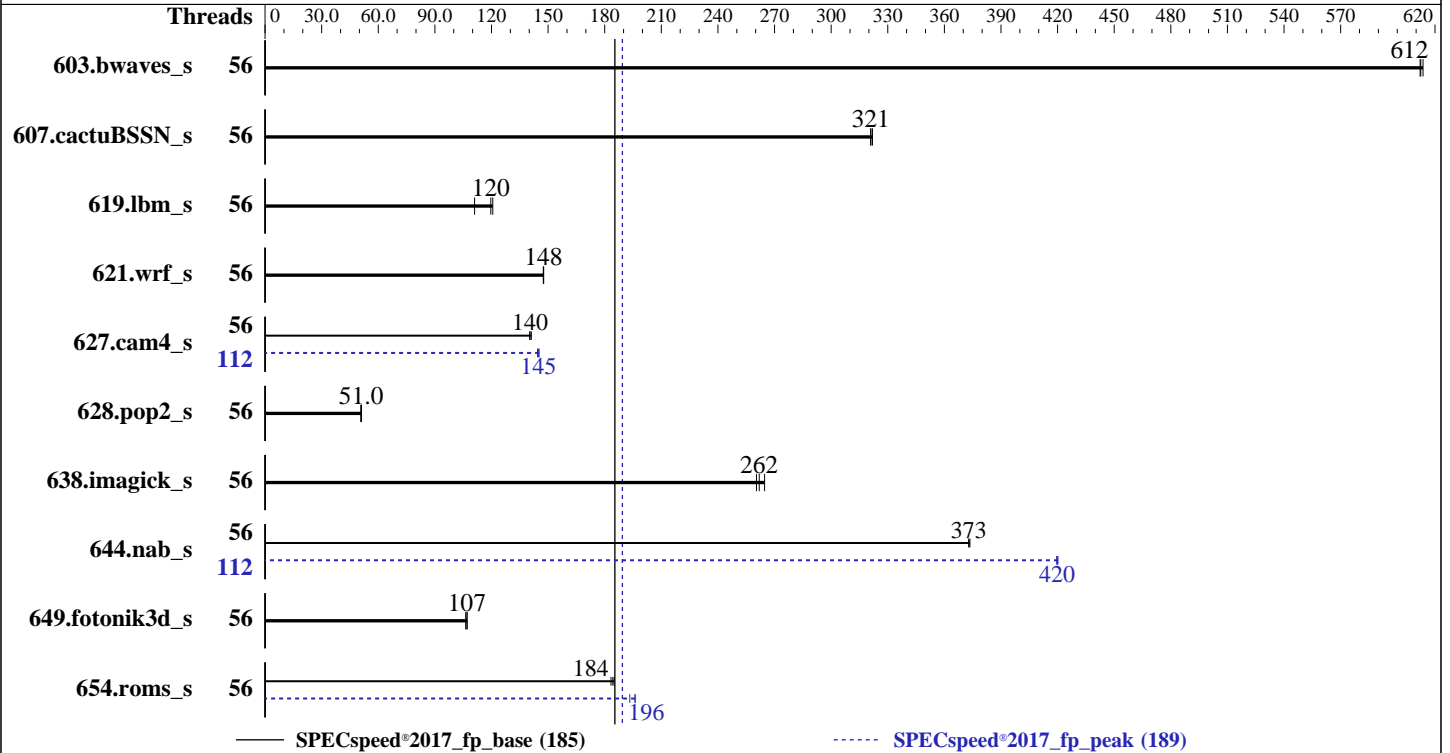
ProLiant DL385 Gen10 Plus v2
(2.75 GHz, AMD EPYC 7453)

SPECspeed®2017_fp_base = 185

SPECspeed®2017_fp_peak = 189

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

Test Date: May-2021
Hardware Availability: Apr-2021
Software Availability: Mar-2021



Hardware

CPU Name: AMD EPYC 7453
 Max MHz: 3450
 Nominal: 2750
 Enabled: 56 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: 64 MB I+D on chip per chip, 16 MB shared / 7 cores
 Other: None
 Memory: 2 TB (16 x 128 GB 4Rx4 PC4-3200AA-L)
 Storage: 1 x 182 GB SATA SSD, RAID 0
 Other: None

Software

OS: Ubuntu 20.04.1 LTS (x86_64)
 Kernel 5.4.0-42-generic
 Compiler: C/C++/Fortran: Version 3.0.0 of AOCC
 Parallel: Yes
 Firmware: HPE BIOS Version A42 v2.42 04/29/2021 released Apr-2021
 File System: ext4
 System State: Run level 5 (multi-user)
 Base Pointers: 64-bit
 Peak Pointers: 64-bit
 Other: jemalloc: jemalloc memory allocator library v5.1.0
 Power Management: BIOS set to prefer performance at the cost of additional power usage



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Results Table

Benchmark	Base							Peak						
	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
603.bwaves_s	56	96.3	612	96.4	612	96.1	614	56	96.3	612	96.4	612	96.1	614
607.cactuBSSN_s	56	51.9	321	51.8	322	51.9	321	56	51.9	321	51.8	322	51.9	321
619.lbm_s	56	43.4	121	47.2	111	43.8	120	56	43.4	121	47.2	111	43.8	120
621.wrf_s	56	89.6	148	89.6	148	89.7	147	56	89.6	148	89.6	148	89.7	147
627.cam4_s	56	62.8	141	63.2	140	63.1	140	112	61.4	144	61.0	145	61.1	145
628.pop2_s	56	232	51.1	233	51.0	234	50.7	56	232	51.1	233	51.0	234	50.7
638.imagick_s	56	55.4	260	55.1	262	54.5	265	56	55.4	260	55.1	262	54.5	265
644.nab_s	56	46.8	373	46.8	373	46.8	374	112	41.6	420	41.6	420	41.6	420
649.fotonik3d_s	56	85.2	107	85.2	107	85.7	106	56	85.2	107	85.2	107	85.7	106
654.roms_s	56	85.9	183	85.4	184	85.1	185	56	81.5	193	80.3	196	80.3	196

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Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

Compiler Notes

The AMD64 AOCC Compiler Suite is available at
<http://developer.amd.com/amd-aocc/>

Submit Notes

The config file option 'submit' was used.
'numactl' was used to bind copies to the cores.
See the configuration file for details.

Operating System Notes

'ulimit -s unlimited' was used to set environment stack size
'ulimit -l 2097152' was used to set environment locked pages in memory limit
runcpu command invoked through numactl i.e.:
numactl --interleave=all runcpu <etc>
'echo 8 > /proc/sys/vm/dirty_ratio' run as root to limit dirty cache to 8% of memory.
'echo 1 > /proc/sys/vm/swappiness' run as root to limit swap usage to minimum necessary.
'echo 1 > /proc/sys/vm/zone_reclaim_mode' run as root to free node-local memory and avoid remote memory usage.
'sync; echo 3 > /proc/sys/vm/drop_caches' run as root to reset filesystem caches.
'sysctl -w kernel.randomize_va_space=0' run as root to disable address space layout randomization (ASLR) to reduce run-to-run variability.

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Operating System Notes (Continued)

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

Environment Variables Notes

Environment variables set by runcpu before the start of the run:

```
GOMP_CPU_AFFINITY = "0-111"
LD_LIBRARY_PATH =
    "/home/cpu2017_B1/amd_speed_aocc300_milan_B_lib/64;/home/cpu2017_B1/amd_
    speed_aocc300_milan_B_lib/32:"
MALLOC_CONF = "retain:true"
OMP_DYNAMIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "112"
```

Environment variables set by runcpu during the 627.cam4_s peak run:

```
GOMP_CPU_AFFINITY = "0 56 1 57 2 58 3 59 4 60 5 61 6 62 7 63 8 64 9 65 10 66
    11 67 12 68 13 69 14 70 15 71 16 72 17 73 18 74 19 75 20 76 21 77 22 78
    23 79 24 80 25 81 26 82 27 83 28 84 29 85 30 86 31 87 32 88 33 89 34 90
    35 91 36 92 37 93 38 94 39 95 40 96 41 97 42 98 43 99 44 100 45 101 46
    102 47 103 48 104 49 105 50 106 51 107 52 108 53 109 54 110 55 111"
```

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

```
GOMP_CPU_AFFINITY = "0 56 1 57 2 58 3 59 4 60 5 61 6 62 7 63 8 64 9 65 10 66
    11 67 12 68 13 69 14 70 15 71 16 72 17 73 18 74 19 75 20 76 21 77 22 78
    23 79 24 80 25 81 26 82 27 83 28 84 29 85 30 86 31 87 32 88 33 89 34 90
    35 91 36 92 37 93 38 94 39 95 40 96 41 97 42 98 43 99 44 100 45 101 46
    102 47 103 48 104 49 105 50 106 51 107 52 108 53 109 54 110 55 111"
```

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

```
GOMP_CPU_AFFINITY = "0-55"
```

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)

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General Notes (Continued)

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
jemalloc 5.1.0 is available here:

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

Submitted_by: "Bhatnagar, Prateek" <prateek.bhatnagar@hpe.com>

Submitted: Mon Jun 7 11:54:36 EDT 2021

Submission: cpu2017-20210607-26891.sub

Platform Notes

BIOS Configuration

Workload Profile set to General Peak Frequency Compute

Determinism Control set to Manual

Performance Determinism set to Power Deterministic

Last-Level Cache (LLC) as NUMA Node set to Enabled

NUMA memory domains per socket set to One memory domain per socket

Thermal Configuration set to Maximum Cooling

Workload Profile set to Custom

Infinity Fabric Power Management set to Disabled

Infinity Fabric Performance State set to P0

Power Regulator set to OS Control Mode

Sysinfo program /home/cpu2017_B1/bin/sysinfo

Rev: r6538 of 2020-09-24 e8664e66d2d7080afeaa89d4b38e2f1c

running on dl385g10v2 Wed Apr 1 12:27:13 2020

SUT (System Under Test) info as seen by some common utilities.

For more information on this section, see

<https://www.spec.org/cpu2017/Docs/config.html#sysinfo>

From /proc/cpuinfo

model name : AMD EPYC 7453 28-Core Processor

2 "physical id"s (chips)

112 "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 : 28

siblings : 56

physical 0: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 14 16 17 18 19 20 21 22 24 25 26 27
28 29 30

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Platform Notes (Continued)

physical 1: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 14 16 17 18 19 20 21 22 24 25 26 27
28 29 30

From lscpu:

```

Architecture:          x86_64
CPU op-mode(s):        32-bit, 64-bit
Byte Order:             Little Endian
Address sizes:          48 bits physical, 48 bits virtual
CPU(s):                 112
On-line CPU(s) list:   0-111
Thread(s) per core:    2
Core(s) per socket:    28
Socket(s):              2
NUMA node(s):          8
Vendor ID:              AuthenticAMD
CPU family:             25
Model:                  1
Model name:             AMD EPYC 7453 28-Core Processor
Stepping:               1
Frequency boost:        enabled
CPU MHz:                1796.455
CPU max MHz:            2750.0000
CPU min MHz:            1500.0000
BogoMIPS:               5489.59
Virtualization:         AMD-V
L1d cache:              1.8 MiB
L1i cache:              1.8 MiB
L2 cache:               28 MiB
L3 cache:               128 MiB
NUMA node0 CPU(s):     0-6,56-62
NUMA node1 CPU(s):     7-13,63-69
NUMA node2 CPU(s):     14-20,70-76
NUMA node3 CPU(s):     21-27,77-83
NUMA node4 CPU(s):     28-34,84-90
NUMA node5 CPU(s):     35-41,91-97
NUMA node6 CPU(s):     42-48,98-104
NUMA node7 CPU(s):     49-55,105-111
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf:     Not affected
Vulnerability Mds:      Not affected
Vulnerability Meltdown: Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
Vulnerability Spectre v1: Mitigation; usercopy/swapgs barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Full AMD retpoline, IBPB conditional, IBRS_FW, STIBP always-on, RSB filling

```

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Platform Notes (Continued)

```

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
aperfmpperf pni pclmulqdq monitor ssse3 fma cx16 pcid sse4_1 sse4_2 movbe popcnt aes
xsave avx fl6c 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

```

```

/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: 8 nodes (0-7)
node 0 cpus: 0 1 2 3 4 5 6 56 57 58 59 60 61 62
node 0 size: 257798 MB
node 0 free: 257433 MB
node 1 cpus: 7 8 9 10 11 12 13 63 64 65 66 67 68 69
node 1 size: 258044 MB
node 1 free: 257700 MB
node 2 cpus: 14 15 16 17 18 19 20 70 71 72 73 74 75 76
node 2 size: 258020 MB
node 2 free: 257697 MB
node 3 cpus: 21 22 23 24 25 26 27 77 78 79 80 81 82 83
node 3 size: 245933 MB
node 3 free: 245702 MB
node 4 cpus: 28 29 30 31 32 33 34 84 85 86 87 88 89 90
node 4 size: 258044 MB
node 4 free: 257856 MB
node 5 cpus: 35 36 37 38 39 40 41 91 92 93 94 95 96 97
node 5 size: 258044 MB
node 5 free: 257837 MB
node 6 cpus: 42 43 44 45 46 47 48 98 99 100 101 102 103 104
node 6 size: 258044 MB
node 6 free: 257844 MB
node 7 cpus: 49 50 51 52 53 54 55 105 106 107 108 109 110 111
node 7 size: 258041 MB
node 7 free: 257830 MB
node distances:
node  0  1  2  3  4  5  6  7

```

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Platform Notes (Continued)

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: 2101220680 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 20.04.1 LTS

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

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

uname -a:

Linux dl385g10v2 5.4.0-42-generic #46-Ubuntu SMP Fri Jul 10 00:24:02 UTC 2020 x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2018-12207 (iTLB Multihit):	Not affected
CVE-2018-3620 (L1 Terminal Fault):	Not affected
Microarchitectural Data Sampling:	Not affected
CVE-2017-5754 (Meltdown):	Not affected
CVE-2018-3639 (Speculative Store Bypass):	Mitigation: Speculative Store Bypass disabled via prctl and

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Platform Notes (Continued)

```

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

```

run-level 5 Apr 1 12:23

SPEC is set to: /home/cpu2017_B1

```

Filesystem              Type  Size  Used Avail Use% Mounted on
/dev/mapper/ubuntu--vg-ubuntu--lv ext4  182G   65G  108G  38% /

```

From /sys/devices/virtual/dmi/id

```

Vendor:      HPE
Product:     ProLiant DL385 Gen10 Plus
Product Family: ProLiant
Serial:      CN79340HC3

```

Additional information from dmidecode follows. WARNING: Use caution when you interpret this section. The 'dmidecode' program reads system data which is "intended to allow hardware to be accurately determined", but the intent may not be met, as there are frequent changes to hardware, firmware, and the "DMTF SMBIOS" standard.

```

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

```

BIOS:

```

BIOS Vendor:      HPE
BIOS Version:     A42
BIOS Date:        04/29/2021
BIOS Revision:    2.42
Firmware Revision: 2.40

```

(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

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Compiler Version Notes (Continued)

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
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

=====
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

(Continued on next page)



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Compiler Version Notes (Continued)

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
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

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SPECspeed®2017_fp_peak = 189

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

Test Date: May-2021
Hardware Availability: Apr-2021
Software Availability: Mar-2021

Base Optimization Flags (Continued)

C benchmarks (continued):

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

Benchmarks using Fortran, C, and C++:

```
-m64 -mno-adx -mno-sse4a -std=c++98
-Wl,-mllvm -Wl,-x86-use-vzeroupper=false
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver3
-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5
-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000
-freemap-arrays -mllvm -function-specialize -flv-function-specialization
```

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Base Optimization Flags (Continued)

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

```
-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
```

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
```



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Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

619.lbm_s: basepeak = yes

638.imagick_s: basepeak = yes

644.nab_s: -m64 -mno-adx -mno-sse4a -Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-function-specialize -Ofast -march=znver3
-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5
-mllvm -unroll-threshold=50 -fremap-arrays
-flv-function-specialization -mllvm -inline-threshold=1000
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true
-mllvm -function-specialize -mllvm -enable-licm-vrp
-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -fopenmp
-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang

Fortran benchmarks:

603.bwaves_s: basepeak = yes

649.fotonik3d_s: basepeak = yes

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

Benchmarks using both Fortran and C:

621.wrf_s: basepeak = yes

627.cam4_s: -m64 -mno-adx -mno-sse4a
-Wl,-mllvm -Wl,-enable-X86-prefetching

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Peak Optimization Flags (Continued)

627.cam4_s (continued):

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

628.pop2_s: basepeak = yes

Benchmarks using Fortran, C, and C++:

607.cactuBSSN_s: basepeak = yes

Peak Other Flags

C benchmarks:

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

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-A1.html>

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

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

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

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



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