



SPEC CPU®2017 Floating Point Speed Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

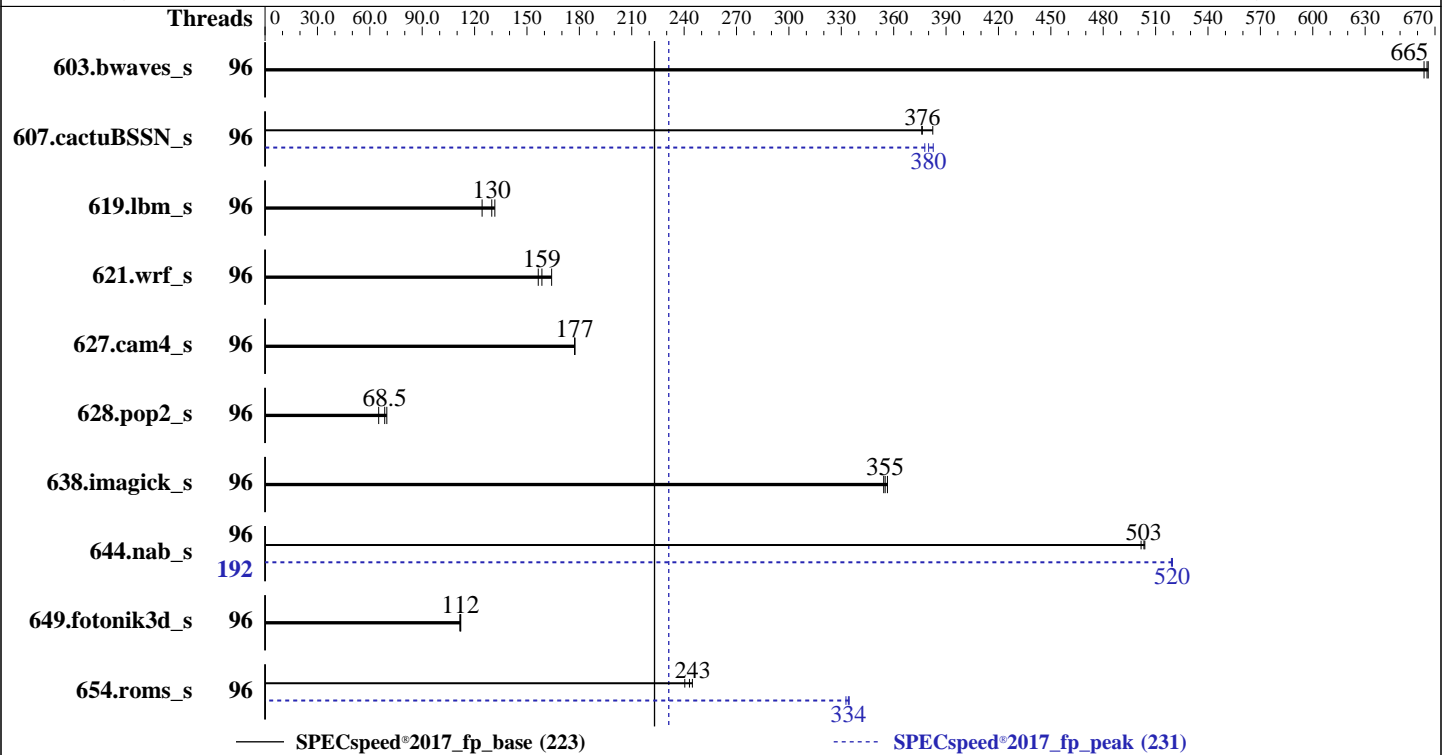
ProLiant DL365 Gen10 Plus
(2.30 GHz, AMD EPYC 7643)

SPECspeed®2017_fp_base = 223

SPECspeed®2017_fp_peak = 231

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

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



Hardware

CPU Name: AMD EPYC 7643
 Max MHz: 3600
 Nominal: 2300
 Enabled: 96 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: 256 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 196 GB SATA SSD, RAID 0
 Other: None

Software

OS: Ubuntu 20.04.1 LTS (x86_64)
 Kernel 5.4.0-56-generic
 Compiler: C/C++/Fortran: Version 3.0.0 of AOCC
 Parallel: Yes
 Firmware: HPE BIOS Version A42 v2.40 02/23/2021 released Feb-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 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	96	88.6	666	<u>88.7</u>	<u>665</u>	88.9	664	96	88.6	666	<u>88.7</u>	<u>665</u>	88.9	664
607.cactuBSSN_s	96	<u>44.3</u>	<u>376</u>	43.6	382	44.3	376	96	43.6	383	<u>43.9</u>	<u>380</u>	44.1	378
619.lbm_s	96	<u>40.3</u>	<u>130</u>	42.1	124	39.8	132	96	<u>40.3</u>	<u>130</u>	42.1	124	39.8	132
621.wrf_s	96	84.5	156	<u>83.4</u>	<u>159</u>	80.6	164	96	84.5	156	<u>83.4</u>	<u>159</u>	80.6	164
627.cam4_s	96	<u>50.0</u>	<u>177</u>	50.0	177	49.9	177	96	<u>50.0</u>	<u>177</u>	50.0	177	49.9	177
628.pop2_s	96	<u>173</u>	<u>68.5</u>	170	69.7	182	65.1	96	<u>173</u>	<u>68.5</u>	170	69.7	182	65.1
638.imagick_s	96	40.7	354	<u>40.6</u>	<u>355</u>	40.5	356	96	40.7	354	<u>40.6</u>	<u>355</u>	40.5	356
644.nab_s	96	34.8	502	<u>34.7</u>	<u>503</u>	34.7	504	192	33.7	519	33.6	520	<u>33.6</u>	<u>520</u>
649.fotonik3d_s	96	81.3	112	81.7	112	<u>81.4</u>	<u>112</u>	96	81.3	112	81.7	112	<u>81.4</u>	<u>112</u>
654.roms_s	96	<u>64.8</u>	<u>243</u>	64.3	245	65.5	240	96	<u>47.1</u>	<u>334</u>	47.3	333	47.1	335

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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 = "0-191"
LD_LIBRARY_PATH =
    "/home/cpu2017n/amd_speed_aocc300_milan_B_lib/64;/home/cpu2017n/amd_spee
    d_aocc300_milan_B_lib/32:"
MALLOCONF = "retain:true"
OMP_DYNAMIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "192"
```

Environment variables set by runcpu during the 607.cactuBSSN_s peak run:

```
GOMP_CPU_AFFINITY = "0-95"
```

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

```
GOMP_CPU_AFFINITY = "0 96 1 97 2 98 3 99 4 100 5 101 6 102 7 103 8 104 9 105
10 106 11 107 12 108 13 109 14 110 15 111 16 112 17 113 18 114 19 115 20
116 21 117 22 118 23 119 24 120 25 121 26 122 27 123 28 124 29 125 30
126 31 127 32 128 33 129 34 130 35 131 36 132 37 133 38 134 39 135 40
136 41 137 42 138 43 139 44 140 45 141 46 142 47 143 48 144 49 145 50
146 51 147 52 148 53 149 54 150 55 151 56 152 57 153 58 154 59 155 60
156 61 157 62 158 63 159 64 160 65 161 66 162 67 163 68 164 69 165 70
166 71 167 72 168 73 169 74 170 75 171 76 172 77 173 78 174 79 175 80
176 81 177 82 178 83 179 84 180 85 181 86 182 87 183 88 184 89 185 90
186 91 187 92 188 93 189 94 190 95 191"
```

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

```
GOMP_CPU_AFFINITY = "0-95"
```

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)

(Continued on next page)



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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 (No options specified)

jemalloc 5.1.0 is available here:

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

Platform Notes

BIOS Configuration

Workload Profile set to General Peak Frequency Compute

Determinism Control set to Manual

Performance Determinism set to Power Deterministic

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

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

Thermal Configuration set to Maximum Cooling

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/cpu2017n/bin/sysinfo

Rev: r6538 of 2020-09-24 e8664e66d2d7080afeaa89d4b38e2f1c

running on admin Wed Apr 1 17:26:39 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 7643 48-Core Processor

2 "physical id"s (chips)

192 "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 : 48

siblings : 96

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
32 33 34 35 36 37 40 41 42 43 44 45 48 49 50 51 52 53 56 57 58 59 60 61

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
32 33 34 35 36 37 40 41 42 43 44 45 48 49 50 51 52 53 56 57 58 59 60 61

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Platform Notes (Continued)

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):                192
On-line CPU(s) list:   0-191
Thread(s) per core:    2
Core(s) per socket:    48
Socket(s):              2
NUMA node(s):         16
Vendor ID:              AuthenticAMD
CPU family:             25
Model:                  1
Model name:            AMD EPYC 7643 48-Core Processor
Stepping:               1
Frequency boost:       enabled
CPU MHz:                1698.633
CPU max MHz:           2300.0000
CPU min MHz:           1500.0000
BogoMIPS:               4591.31
Virtualization:        AMD-V
L1d cache:              3 MiB
L1i cache:              3 MiB
L2 cache:               48 MiB
L3 cache:               512 MiB
NUMA node0 CPU(s):     0-5,96-101
NUMA node1 CPU(s):     6-11,102-107
NUMA node2 CPU(s):     12-17,108-113
NUMA node3 CPU(s):     18-23,114-119
NUMA node4 CPU(s):     24-29,120-125
NUMA node5 CPU(s):     30-35,126-131
NUMA node6 CPU(s):     36-41,132-137
NUMA node7 CPU(s):     42-47,138-143
NUMA node8 CPU(s):     48-53,144-149
NUMA node9 CPU(s):     54-59,150-155
NUMA node10 CPU(s):    60-65,156-161
NUMA node11 CPU(s):    66-71,162-167
NUMA node12 CPU(s):    72-77,168-173
NUMA node13 CPU(s):    78-83,174-179
NUMA node14 CPU(s):    84-89,180-185
NUMA node15 CPU(s):    90-95,186-191
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

```

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Platform Notes (Continued)

```

prctl and seccomp
Vulnerability Spectre v1:      Mitigation; usercopy/swaps barriers and __user
pointer sanitization
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 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 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 bml 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: 16 nodes (0-15)
node 0 cpus: 0 1 2 3 4 5 96 97 98 99 100 101
node 0 size: 128775 MB
node 0 free: 128521 MB
node 1 cpus: 6 7 8 9 10 11 102 103 104 105 106 107
node 1 size: 129021 MB
node 1 free: 128869 MB
node 2 cpus: 12 13 14 15 16 17 108 109 110 111 112 113
node 2 size: 129021 MB
node 2 free: 128859 MB
node 3 cpus: 18 19 20 21 22 23 114 115 116 117 118 119
node 3 size: 129021 MB
node 3 free: 128871 MB
node 4 cpus: 24 25 26 27 28 29 120 121 122 123 124 125
node 4 size: 129021 MB
node 4 free: 128778 MB
node 5 cpus: 30 31 32 33 34 35 126 127 128 129 130 131
node 5 size: 129021 MB
node 5 free: 128808 MB
node 6 cpus: 36 37 38 39 40 41 132 133 134 135 136 137
node 6 size: 129021 MB
node 6 free: 128832 MB

```

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Platform Notes (Continued)

```

node 7 cpus: 42 43 44 45 46 47 138 139 140 141 142 143
node 7 size: 116908 MB
node 7 free: 116762 MB
node 8 cpus: 48 49 50 51 52 53 144 145 146 147 148 149
node 8 size: 129021 MB
node 8 free: 128859 MB
node 9 cpus: 54 55 56 57 58 59 150 151 152 153 154 155
node 9 size: 129021 MB
node 9 free: 128864 MB
node 10 cpus: 60 61 62 63 64 65 156 157 158 159 160 161
node 10 size: 128997 MB
node 10 free: 128626 MB
node 11 cpus: 66 67 68 69 70 71 162 163 164 165 166 167
node 11 size: 129021 MB
node 11 free: 128867 MB
node 12 cpus: 72 73 74 75 76 77 168 169 170 171 172 173
node 12 size: 129021 MB
node 12 free: 128867 MB
node 13 cpus: 78 79 80 81 82 83 174 175 176 177 178 179
node 13 size: 129021 MB
node 13 free: 128904 MB
node 14 cpus: 84 85 86 87 88 89 180 181 182 183 184 185
node 14 size: 129021 MB
node 14 free: 128877 MB
node 15 cpus: 90 91 92 93 94 95 186 187 188 189 190 191
node 15 size: 129016 MB
node 15 free: 128818 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 32 10 11 11 11 11 11 11
  9: 32 32 32 32 32 32 32 32 32 11 10 11 11 11 11 11
 10: 32 32 32 32 32 32 32 32 32 11 11 10 11 11 11 11
 11: 32 32 32 32 32 32 32 32 32 11 11 11 10 11 11 11
 12: 32 32 32 32 32 32 32 32 32 11 11 11 11 10 11 11
 13: 32 32 32 32 32 32 32 32 32 11 11 11 11 11 10 11
 14: 32 32 32 32 32 32 32 32 32 11 11 11 11 11 11 10
 15: 32 32 32 32 32 32 32 32 32 11 11 11 11 11 11 10

```

From /proc/meminfo

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Platform Notes (Continued)

MemTotal: 2101198628 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

/sbin/tuned-adm active
Current active profile: balanced

/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 admin 5.4.0-56-generic #62-Ubuntu SMP Mon Nov 23 19:20:19 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 seccomp
CVE-2017-5753 (Spectre variant 1):	Mitigation: usercopy/swaps barriers and __user pointer sanitization
CVE-2017-5715 (Spectre variant 2):	Mitigation: Full AMD retpoline, IBPB: conditional, IBRS_FW, STIBP: always-on, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling):	Not affected
CVE-2019-11135 (TSX Asynchronous Abort):	Not affected

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Platform Notes (Continued)

run-level 5 Apr 1 17:24

SPEC is set to: /home/cpu2017n

Filesystem	Type	Size	Used	Avail	Use%	Mounted on
/dev/mapper/ubuntu--vg-ubuntu--lv	ext4	196G	50G	137G	27%	/

From /sys/devices/virtual/dmi/id

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

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

BIOS:

BIOS Vendor: HPE
BIOS Version: A42
BIOS Date: 02/23/2021
BIOS Revision: 2.40
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
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

```

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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
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
  LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin

```



SPEC CPU®2017 Floating Point Speed Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL365 Gen10 Plus
(2.30 GHz, AMD EPYC 7643)

SPECspeed®2017_fp_base = 223

SPECspeed®2017_fp_peak = 231

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

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

Base Compiler Invocation

C benchmarks:

clang

Fortran benchmarks:

flang

Benchmarks using both Fortran and C:

flang clang

Benchmarks using Fortran, C, and C++:

clang++ clang flang

Base Portability Flags

603.bwaves_s: -DSPEC_LP64
607.cactuBSSN_s: -DSPEC_LP64
619.ibm_s: -DSPEC_LP64
621.wrf_s: -DSPEC_CASE_FLAG -Mbyteswapio -DSPEC_LP64
627.cam4_s: -DSPEC_CASE_FLAG -DSPEC_LP64
628.pop2_s: -DSPEC_CASE_FLAG -Mbyteswapio -DSPEC_LP64
638.imagick_s: -DSPEC_LP64
644.nab_s: -DSPEC_LP64
649.fotonik3d_s: -DSPEC_LP64
654.roms_s: -DSPEC_LP64

Base Optimization Flags

C benchmarks:

-m64 -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

(Continued on next page)



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Base Optimization Flags (Continued)

Fortran benchmarks (continued):

```
-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
-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
-fininline-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
```



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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

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

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Peak Optimization Flags (Continued)

644.nab_s (continued):

```
-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: 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
```

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Peak Optimization Flags (Continued)

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

```
-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-A1.html>

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

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