Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL345 Gen10 Plus
(2.45 GHz, AMD EPYC 7763)

CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE
Test Date: Feb-2021
Hardware Availability: Apr-2021
Software Availability: Mar-2021

<table>
<thead>
<tr>
<th>Threads</th>
<th>SPECspeed®2017_fp_base</th>
<th>SPECspeed®2017_fp_peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>603.bwaves_s 64</td>
<td>283</td>
<td>392</td>
</tr>
<tr>
<td>607.cactuBSSN_s 64</td>
<td>74.9</td>
<td>392</td>
</tr>
<tr>
<td>619.lbm_s 64</td>
<td>75.2</td>
<td>205</td>
</tr>
<tr>
<td>621.wrf_s 64</td>
<td>206</td>
<td>206</td>
</tr>
<tr>
<td>627.cam4_s 64</td>
<td>114</td>
<td>115</td>
</tr>
<tr>
<td>628.pop2_s 64</td>
<td>84.9</td>
<td>427</td>
</tr>
<tr>
<td>638.imagick_s 64</td>
<td>277</td>
<td>392</td>
</tr>
<tr>
<td>644.nab_s 64</td>
<td>128</td>
<td>427</td>
</tr>
<tr>
<td>649.fotonik3d_s 64</td>
<td>74.9</td>
<td>162</td>
</tr>
<tr>
<td>654.roms_s 64</td>
<td>178</td>
<td>178</td>
</tr>
</tbody>
</table>

Hardware

| CPU Name: | AMD EPYC 7763 |
| Max MHz: | 3500 |
| Nominal: | 2450 |
| Enabled: | 64 cores, 1 chip, 2 threads/core |
| Orderable: | 1 chip |
| 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 / 8 cores |
| Other: | None |
| Memory: | 1 TB (8 x 128 GB 4Rx4 PC4-3200AA-L) |
| Storage: | 4 x 480 GB SAS 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 A43 v2.40 02/15/2021 released Mar-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 |
Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Base Seconds</th>
<th>Base Ratio</th>
<th>Peak Seconds</th>
<th>Peak Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>603.bwaves_s</td>
<td>64</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>64</td>
<td>58.9</td>
<td>58.9</td>
<td>58.9</td>
<td>58.9</td>
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<tr>
<td>619.lbm_s</td>
<td>64</td>
<td>70.0</td>
<td>74.9</td>
<td>69.9</td>
<td>70.0</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>64</td>
<td>65.1</td>
<td>203</td>
<td>64.2</td>
<td>206</td>
</tr>
<tr>
<td>627.cam4_s</td>
<td>64</td>
<td>77.7</td>
<td>114</td>
<td>77.4</td>
<td>115</td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>64</td>
<td>140</td>
<td>84.9</td>
<td>140</td>
<td>84.8</td>
</tr>
<tr>
<td>638.imagick_s</td>
<td>64</td>
<td>52.3</td>
<td>276</td>
<td>52.1</td>
<td>277</td>
</tr>
<tr>
<td>644.nab_s</td>
<td>64</td>
<td>44.5</td>
<td>392</td>
<td>44.5</td>
<td>392</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>64</td>
<td>122</td>
<td>74.9</td>
<td>122</td>
<td>75.0</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>64</td>
<td>97.0</td>
<td>162</td>
<td>97.0</td>
<td>162</td>
</tr>
</tbody>
</table>

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.

Operating System Notes

'ulimit -s unlimited' was used to set environment stack size
'ulimit -1 2097152' was used to set environment locked pages in memory limit
runcpu command invoked through numacl 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 to enable Transparent Hugepages (THP) for this run.
'echo madvise > /sys/kernel/mm/transparent_hugepage/enabled' run as root for peak

(Continued on next page)
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SPECspeed\textsuperscript{©}2017\textsubscript{-}fp\textsubscript{peak} = 175

SPECspeed\textsuperscript{©}2017\textsubscript{-}fp\textsubscript{base} = 171

CPU2017 License: 3
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Running System Notes (Continued)

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
GOMP\_CPU\_AFFINITY = "0-127"
LD\_LIBRARY\_PATH = 
"/home/SPEC\_CPU2017/cpu2017/amd\_speed\_aocc300\_milan\_B\_lib/64;/home/SPEC\_CPU2017/cpu2017/amd\_speed\_aocc300\_milan\_B\_lib/32;"
MALLOC\_CONF = "retain\:true"
OMP\_DYNAMIC = "false"
OMP\_SCHEDULE = "static"
OMP\_STACK\_SIZE = "128M"
OMP\_THREAD\_LIMIT = "128"

Environment variables set by runcpu during the 619.lbm\_s peak run:
GOMP\_CPU\_AFFINITY = "0-63"

Environment variables set by runcpu during the 621.wrf\_s peak run:
GOMP\_CPU\_AFFINITY = "0-63"

Environment variables set by runcpu during the 627.cam4\_s peak run:
GOMP\_CPU\_AFFINITY = "0-63"

Environment variables set by runcpu during the 644.nab\_s peak run:
GOMP\_CPU\_AFFINITY = "0 64 1 65 2 66 3 67 4 68 5 69 6 70 7 71 8 72 9 73 10 74 11 75 12 76 13 77 14 78 15 79 16 80 17 81 18 82 19 83 20 84 21 85 22 86 23 87 24 88 25 89 26 90 27 91 28 92 29 93 30 94 31 95 32 96 33 97 34 98 35 99 36 100 37 101 38 102 39 103 40 104 41 105 42 106 43 107 44 108 45 109 46 110 47 111 48 112 49 113 50 114 51 115 52 116 53 117 54 118 55 119 56 120 57 121 58 122 59 123 60 124 61 125 62 126 63 127"

Environment variables set by runcpu during the 654.roms\_s peak run:
GOMP\_CPU\_AFFINITY = "0-63"

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.

(Continued on next page)
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 Configuration
Workload Profile set to General Peak Frequency Compute
AMD SMT Option set to Enabled
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/SPEC_CPU2017/cpu2017/bin/sysinfo
Rev: r6538 of 2020-09-24 e8664e66d2d7080afeaa89d4b38e2f1c
running on admin Mon Mar  1 08:49:47 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 7763 64-Core Processor
 1 "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 : 128
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

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian

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**SPEC CPU®2017 Floating Point Speed Result**

**SPECspeed®2017_fp_base = 171**  
**SPECspeed®2017_fp_peak = 175**

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**Platform Notes (Continued)**

Address sizes: 48 bits physical, 48 bits virtual
CPU(s): 128
On-line CPU(s) list: 0-127
Thread(s) per core: 2
Core(s) per socket: 64
Socket(s): 1
NUMA node(s): 8
Vendor ID: AuthenticAMD
CPU family: 25
Model: 1
Model name: AMD EPYC 7763 64-Core Processor
Stepping: 1
Frequency boost: enabled
CPU MHz: 3125.488
CPU max MHz: 2450.0000
CPU min MHz: 1500.0000
BogoMIPS: 4891.00
Virtualization: AMD-V
L1d cache: 2 MiB
L1i cache: 2 MiB
L2 cache: 32 MiB
L3 cache: 256 MiB
NUMA node0 CPU(s): 0-7,64-71
NUMA node1 CPU(s): 8-15,72-79
NUMA node2 CPU(s): 16-23,80-87
NUMA node3 CPU(s): 24-31,88-95
NUMA node4 CPU(s): 32-39,96-103
NUMA node5 CPU(s): 40-47,104-111
NUMA node6 CPU(s): 48-55,112-119
NUMA node7 CPU(s): 56-63,120-127
Vulnerability Itlb multihit: Not affected
Vulnerability L1t: 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 sanitation
Vulnerability Spectre v2: Mitigation; Full AMD retpoline, IBPB conditional, IBRS_FW, STIBP always-on, RSB filling
Vulnerability Srbds: Not affected
Vulnerability Tsx async abort: Not affected
Flags: fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse sse2 ht syscall nx mmxext fxsr_opt pdelpgb 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

(Continued on next page)
Platform Notes (Continued)

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 vmcall fsqsbse bml1 avx2 smep bmi2 invpcid cqm rdt_a rdseed adx smap
clflushopt clwb sha ni xsaveopt xsaves xgetbv1 xsaves cqm_llc cqm_occup_llc
cqm_mbb_total cqm_mbb_local clzero irperf xsaveeprtr wbnoinvd arat npt lbv svm_lock
nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter pfthreshold
v_vmsave_vmload vgic 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 7 64 65 66 67 68 69 70 71
  node 0 size: 128774 MB
  node 0 free: 128255 MB
  node 1 cpus: 8 9 10 11 12 13 14 15 72 73 74 75 76 77 78 79
  node 1 size: 129020 MB
  node 1 free: 128815 MB
  node 2 cpus: 16 17 18 19 20 21 22 23 80 81 82 83 84 85 86 87
  node 2 size: 129020 MB
  node 2 free: 128836 MB
  node 3 cpus: 24 25 26 27 28 29 30 31 88 89 90 91 92 93 94 95
  node 3 size: 129020 MB
  node 3 free: 128820 MB
  node 4 cpus: 32 33 34 35 36 37 38 39 96 97 98 99 100 101 102 103
  node 4 size: 129020 MB
  node 4 free: 128796 MB
  node 5 cpus: 40 41 42 43 44 45 46 47 104 105 106 107 108 109 110 111
  node 5 size: 129020 MB
  node 5 free: 128827 MB
  node 6 cpus: 48 49 50 51 52 53 54 55 112 113 114 115 116 117 118 119
  node 6 size: 129020 MB
  node 6 free: 128818 MB
  node 7 cpus: 56 57 58 59 60 61 62 63 120 121 122 123 124 125 126 127
  node 7 size: 116882 MB
  node 7 free: 116284 MB
node distances:
  node 0 1 2 3 4 5 6 7
  0: 10 11 11 11 11 11 11 11
  1: 11 10 11 11 11 11 11 11
  2: 11 11 10 11 11 11 11 11
  3: 11 11 11 10 11 11 11 11
  4: 11 11 11 11 10 11 11 11
  5: 11 11 11 11 11 10 11 11
  6: 11 11 11 11 11 11 10 11
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SPEC CPU®2017 Floating Point Speed Result

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SPECspeed®2017_fp_base = 171
SPECspeed®2017_fp_peak = 175

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Platform Notes (Continued)

7: 11 11 11 11 11 11 11 10

From /proc/meminfo
MemTotal: 1044253836 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

/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 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 sanitation
CVE-2017-5715 (Spectre variant 2): Mitigation: Full AMD retpoline, IBFB: 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 Mar 1 08:45
SPEC is set to: /home/SPEC_CPU2017/cpu2017
Filesystem Type Size Used Avail Use% Mounted on
/dev/mapper/ubuntu--vg-ubuntu--lv ext4 196G 78G 109G 42% /

From /sys/devices/virtual/dmi/id
Vendor: HPE
Product: ProLiant DL345 Gen10 Plus
Product Family: ProLiant
Serial: J20APP000K

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:
8x UNKNOWN M386AAG40AM3-CWE 128 GB 4 rank 3200
8x UNKNOWN NOT AVAILABLE

BIOS:
BIOS Vendor: HPE
BIOS Version: A43
BIOS Date: 02/15/2021
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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**SPECspeed®2017_fp_base = 171**  
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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: A0CC_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: A0CC_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: A0CC_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: A0CC_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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SPECspeed®2017_fp_base = 171
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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 -03 -march=znver3
-fvecclib=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_OPedMP -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)
### 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-nofallback-throws=6`
- `-Wl,-mllvm -Wl,-reduce-array-computations=3 -Hz,1,0xl -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-nofallback-throws=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 -Hz,1,0xl`
- `-Mrecursive -mllvm -fuse-tile-inner-loop -funroll-loops`

#### Benchmarks using Fortran, C, and C++:
- `-m64 -mno-adx -mno-sse4a -std=c++98`
- `-Wl,-mllvm -Wl,-x86-use-vzeroupper=true`
- `-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-function-specialize`
- `-Wl,-mllvm -Wl,-align-all-nofallback-throws=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,1,0xl -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`
### SPEC CPU®2017 Floating Point Speed Result

#### Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL345 Gen10 Plus  
(2.45 GHz, AMD EPYC 7763)

<table>
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<tr>
<th>SPECspeed®2017_fp_base</th>
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<td>SPECspeed®2017_fp_peak</td>
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- **CPU2017 License**: 3  
- **Test Sponsor**: HPE  
- **Tested by**: HPE

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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: -m64 -mno-adx -mno-sse4a`
- `-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`

(Continued on next page)
Peak Optimization Flags (Continued)

619.lbm_s (continued):
-fremap-arrays -flv-function-specialization
-mlllvm -inline-threshold=1000 -mlllvm -enable-gvn-hoist
-mlllvm -global-vectorize-slp=true
-mlllvm -function-specialize -mlllvm -enable-licm-vrp
-mlllvm -reduce-array-computations=3 -DSPEC_OPENMP -fopenmp
-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang

638.imagick_s: basepeak = yes

644.nab_s: -m64 -mno-adx -mno-sse4a -Wl,-mlllvm -Wl,-region-vectorize
-Wl,-mlllvm -Wl,-function-specialize -Ofast -march=znode3
-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5
-mlllvm -unroll-threshold=50 -fremap-arrays
-flv-function-specialization -mlllvm -inline-threshold=1000
-mlllvm -enable-gvn-hoist -mlllvm -global-vectorize-slp=true
-mlllvm -function-specialize -mlllvm -enable-licm-vrp
-mlllvm -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,-mlllvm -Wl,-enable-X86-prefetching
-Wl,-mlllvm -Wl,-enable-licm-vrp
-Wl,-mlllvm -Wl,-function-specialize
-Wl,-mlllvm -Wl,-align-all-no fallback-thru-blocks=6
-Wl,-mlllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znode3 -fveclib=AMDLIBM -ffast-math -Mrecursive
-mlllvm -reduce-array-computations=3
-mlllvm -global-vectorize-slp=true -mlllvm -enable-licm-vrp
-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lamdlibm
-ljemalloc -lflang

Benchmarks using both Fortran and C:

621.wrf_s: -m64 -mno-adx -mno-sse4a
-Wl,-mlllvm -Wl,-enable-X86-prefetching
-Wl,-mlllvm -Wl,-enable-licm-vrp
-Wl,-mlllvm -Wl,-function-specialize
-Wl,-mlllvm -Wl,-align-all-no fallback-thru-blocks=6
-Wl,-mlllvm -Wl,-reduce-array-computations=3 -Ofast

(Continued on next page)
Peak Optimization Flags (Continued)

621.wrf_s (continued):
- march=znver3 -fveclib=AMDLIBM -ffast-math -flto
- fstruct-layout=5 -mlirvm -unroll-threshold=50
- freemap-arrays -flv-function-specialization
- mlirvm -inline-threshold=1000 -mlirvm -enable-gvn-hoist
- mlirvm -global-vectorize-slp=true
- mlirvm -function-specialize -mlirvm -enable-licm-vrp
- mlirvm -reduce-array-computations=3 -Hz,1,0x1 -O3
- Mrecursive -mlirvm -fuse-tile-inner-loop -funroll-loops
- mlirvm -extra-vectorizer-passes -mlirvm -lsr-in-nested-loop
- DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lamdlibm
- ljemalloc -lflang

627.cam4_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 -flto
- fstruct-layout=5 -mlirvm -unroll-threshold=50
- freemap-arrays -flv-function-specialization
- mlirvm -inline-threshold=1000 -mlirvm -enable-gvn-hoist
- mlirvm -global-vectorize-slp=true
- mlirvm -function-specialize -mlirvm -enable-licm-vrp
- mlirvm -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

(Continued on next page)


**Hewlett Packard Enterprise**
(Test Sponsor: HPE)
ProLiant DL345 Gen10 Plus
(2.45 GHz, AMD EPYC 7763)

**SPECspeed®2017_fp_base = 171**

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### Peak Other Flags (Continued)

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/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/HPE-Platform-Flags-AMD-V1.2-EPYC-revP.xml

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