Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7702P)

SPEC CPU®2017 Floating Point Rate Result
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Hewlett Packard Enterprise
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ProLiant DL325 Gen10
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SPECrate®2017_fp_base = 248
SPECrate®2017_fp_energy_base = 721
SPECrate®2017_fp_peak = 273
SPECrate®2017_fp_energy_peak = 785

Hardware
CPU Name: AMD EPYC 7702P
Max MHz: 3350
Nominal: 2000
Enabled: 64 cores, 1 chip, 2 threads/core
Orderable: 1 chip

OS:
SUSE Linux Enterprise Server 15 (x86_64) SP1
Kernel 4.12.14-195-default

Compiler:
C/C++/Fortran: Version 2.0.0 of AOCC

Parallel:
No

Firmware:
HPE BIOS Version A41 07/20/2019 released Aug-2019

(Continued on next page)

Software

(Continued on next page)
Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7702P)

CPU2017 License: 003
Test Sponsor: HPE
Tested by: HPE

Hardware (Continued)
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,
    16 MB shared / 4 cores
Other: None
Memory: 256 GB (8 x 32 GB 2Rx4 PC4-2933Y-L)
Storage: 1 x HPE 480 GB SATA 6G SSD
Other: None

Software (Continued)
File System: btrfs
System State: Run level 3 (multi-user)
Base Pointers: 64-bit
Peak Pointers: 64-bit
Other: jemalloc: jemalloc memory allocator library v5.2.0
Power Management: Disabled

Power
Max. Power (W): 411.98
Idle Power (W): 191.52
Min. Temperature (C): 20.63
Elevation (m): 132
Line Standard: 208 V / 60 Hz / 1 phase / 2 wires
Provisioning: Line-powered

Power Settings
Management FW: Version 1.43 of iLO5 released May 23 2019
Memory Mode: Normal

Power-Relevant Hardware
Power Supply: 1 x 800 W (non-redundant)
Details:
    HPE 800W Flex Slot Titanium Hot Plug Low Halogen
    Power Supply Kit (865438-B21)
Backplane: 8 SFF NVMe with optional optical drive
Other Storage: Embedded SATA Controller
Storage Model #s: P05976-B21
NICs Installed:
    1 x HPE Ethernet 4-port 331i Adapter @ 1 Gb
NICs Enabled (FW/OS): 4 / 4
NICs Connected/Speed:
    2 @ 1 Gb
Other HW Model #s: 7 x High Performance fans

Power Analyzer
Power Analyzer: 10.216.1.15:8888
Hardware Vendor: Yokogawa
Model: YokogawaWT210
Serial Number: 91K308562
Input Connection: GPIB via NI GIPB-USB-HS
Metrology Institute: NIST
Calibration By: TRANSCAT
Calibration Label: 5-E553M-20-1
Calibration Date: 21-May-2019
PTDaemon® Version: 1.9.1 (a2d19f26; 2019-07-17)
Setup Description:
    SUT Power Supply 1 via neoXt NXB 20815
Current Ranges Used: 1A, 2A
Voltage Range Used: 300V

Temperature Meter
Temperature Meter: 10.216.1.15:8889
Hardware Vendor: Digi International Inc.
Model: DigiWATCHPORT_H
Serial Number: V45297862
Input Connection: USB
PTDaemon Version: 1.9.1 (a2d19f26; 2019-07-17)
Setup Description: 5 mm in front of SUT main intake

Base Results Table

Table continues on next page. Results appear in the order in which they were run. Bold underlined text indicates a median measurement.
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Base Results Table (Continued)

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Energy (kJ)</th>
<th>Energy Ratio</th>
<th>Average Power</th>
<th>Maximum Power</th>
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Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

Peak Results Table

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<th>Seconds</th>
<th>Ratio</th>
<th>Energy (kJ)</th>
<th>Energy Ratio</th>
<th>Average Power</th>
<th>Maximum Power</th>
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</tr>
</tbody>
</table>

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

Compiler Notes

The AMD64 AOC Compiler Suite is available at http://developer.amd.com/amd-aoc/

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>

Set dirty_ratio=8 to limit dirty cache to 8% of memory
Set swappiness=1 to swap only if necessary
Set zone_reclaim_mode=1 to free local node memory and avoid remote memory
sync then drop_caches=3 to reset caches before invoking runcpu

dirty_ratio, swappiness, zone_reclaim_mode and drop_caches were
all set using privileged echo (e.g. echo 1 > /proc/sys/vm/swappiness).

Transparent huge pages set to 'always' for this run (OS default)

## Environment Variables Notes

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH =
"/cpu2017/amd_rate_aocc200_rome_C_lib/64;/cpu2017/amd_rate_aocc200_rome_C_lib/32:"
MALLOCS_CONF = "retain:true"

## General Notes

Binaries were compiled on a system with 2x AMD EPYC 7601 CPU + 512GB Memory using Fedora 26

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 v9.1.0 in Ubuntu 19.04 with -O3 -znver2 -flto
jemalloc 5.2.0 is available here:
https://github.com/jemalloc/jemalloc/releases/download/5.2.0/jemalloc-5.2.0.tar.bz2

Submitted_by: "Bucek, James" <james.bucek@hpe.com>
Submitted: Tue Sep 17 00:02:18 EDT 2019

(Continued on next page)
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CPU2017 License: 003
Test Sponsor: HPE
Tested by: HPE

General Notes (Continued)
Submission: cpu2017-20190903-17793.sub

Platform Notes

BIOS Configuration:
Thermal Configuration set to Maximum Cooling
Determinism Control set to Manual
Performance Determinism set to Power Deterministic
Memory Patrol Scrubbing set to Disabled
NUMA memory domains per socket set to Four memory domains per socket
Last-Level Cache (LLC) as NUMA Node set to Enabled
Workload Profile set to General Throughput Compute
Minimum Processor Idle Power Core C-State set to C6 State

Sysinfo program /cpu2017/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7edble6e46a485a0011
running on dl325gen10 Fri Aug 30 23:38:11 2019

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 7702P 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
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

(Continued on next page)
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Test Date: Aug-2019
Hardware Availability: Oct-2019
Software Availability: Aug-2019

Platform Notes (Continued)

NUMA node(s): 16
Vendor ID: AuthenticAMD
CPU family: 23
Model: 49
Model name: AMD EPYC 7702P 64-Core Processor
Stepping: 0
CPU MHz: 2000.000
CPU max MHz: 2000.0000
CPU min MHz: 1500.0000
BogoMIPS: 3992.24
Virtualization: AMD-V
L1d cache: 32K
L1i cache: 32K
L2 cache: 512K
L3 cache: 16384K
NUMA node0 CPU(s): 0-3,64-67
NUMA node1 CPU(s): 4-7,68-71
NUMA node2 CPU(s): 8-11,72-75
NUMA node3 CPU(s): 12-15,76-79
NUMA node4 CPU(s): 16-19,80-83
NUMA node5 CPU(s): 20-23,84-87
NUMA node6 CPU(s): 24-27,88-91
NUMA node7 CPU(s): 28-31,92-95
NUMA node8 CPU(s): 32-35,96-99
NUMA node9 CPU(s): 36-39,100-103
NUMA node10 CPU(s): 40-43,104-107
NUMA node11 CPU(s): 44-47,108-111
NUMA node12 CPU(s): 48-51,112-115
NUMA node13 CPU(s): 52-55,116-119
NUMA node14 CPU(s): 56-59,120-123
NUMA node15 CPU(s): 60-63,124-127
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 xtopology nonstop_tsc cpld extd_apicid aperfmperf pni pclmulqdq monitor ssse3 fma cx16 sse4_1 sse4_2 movbe popcnt aes xsave avx fl16c rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse 3dnowprefetch osw ibs kinit wdt tce topoext perfctr_core perfctr_nb perfctr_l2 mwaitx cpb cat_l3 cdp_l3 hw_pstate ssbd ibrs ibpb stibp vmmcall fsgsbase bmi1 avx2 smep bmi2 cqm rdt_a rdseed adx clflushopt clwb sha ni xsaveopt xsaves xsavevc xsetbv1 xsave xsaveopt xsaveopt xsaves cqm_llc cqm_occum llc cqm_mbb_total cqm_mbb_local clzero irperf xsaverptr arat npt lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter pfthreshold avic v_vmsave_vmload vgif umip rdpld overflow_recov succor smca

/proc/cpuinfo cache data
cache size : 512 KB

(Continued on next page)
### Platform Notes (Continued)

From numactl --hardware  **WARNING:** a numactl 'node' might or might not correspond to a physical chip.

| node 0 cpus: | 0 1 2 3 64 65 66 67 |
| node 0 size: | 15908 MB |
| node 0 free: | 15808 MB |
| node 1 cpus: | 4 5 6 7 68 69 70 71 |
| node 1 size: | 16126 MB |
| node 1 free: | 16013 MB |
| node 2 cpus: | 8 9 10 11 72 73 74 75 |
| node 2 size: | 16126 MB |
| node 2 free: | 16032 MB |
| node 3 cpus: | 12 13 14 15 76 77 78 79 |
| node 3 size: | 16125 MB |
| node 3 free: | 16049 MB |
| node 4 cpus: | 16 17 18 19 80 81 82 83 |
| node 4 size: | 16126 MB |
| node 4 free: | 16032 MB |
| node 5 cpus: | 20 21 22 23 84 85 86 87 |
| node 5 size: | 16126 MB |
| node 5 free: | 16051 MB |
| node 6 cpus: | 24 25 26 27 88 89 90 91 |
| node 6 size: | 16126 MB |
| node 6 free: | 16056 MB |
| node 7 cpus: | 28 29 30 31 92 93 94 95 |
| node 7 size: | 16125 MB |
| node 7 free: | 16055 MB |
| node 8 cpus: | 32 33 34 35 96 97 98 99 |
| node 8 size: | 16126 MB |
| node 8 free: | 16055 MB |
| node 9 cpus: | 36 37 38 39 100 101 102 103 |
| node 9 size: | 16126 MB |
| node 9 free: | 16053 MB |
| node 10 cpus: | 40 41 42 43 104 105 106 107 |
| node 10 size: | 16126 MB |
| node 10 free: | 16053 MB |
| node 11 cpus: | 44 45 46 47 108 109 110 111 |
| node 11 size: | 16125 MB |
| node 11 free: | 16049 MB |
| node 12 cpus: | 48 49 50 51 112 113 114 115 |
| node 12 size: | 16126 MB |
| node 12 free: | 16051 MB |
| node 13 cpus: | 52 53 54 55 116 117 118 119 |
| node 13 size: | 16126 MB |

(Continued on next page)
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<table>
<thead>
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<th>SPECrate®2017 fp_energy_base</th>
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<tr>
<td>SPECrate®2017 fp_energy_peak</td>
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### Platform Notes (Continued)

```
node 13 free: 16047 MB
node 14 cpus: 56 57 58 59 120 121 122 123
node 14 size: 16126 MB
node 14 free: 16050 MB
node 15 cpus: 60 61 62 63 124 125 126 127
node 15 size: 16082 MB
node 15 free: 16011 MB
node distances:
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</tbody>
</table>
```

From /proc/meminfo

- MemTotal: 263943500 kB
- HugePages_Total: 0
- Hugepagesize: 2048 kB

From /etc/*release* /etc/*version*
```
os-release:
NAME="SLES"
VERSION="15-SP1"
VERSION_ID="15.1"
PRETTY_NAME="SUSE Linux Enterprise Server 15 SP1"
ID="sles"
ID_LIKE="suse"
ANSI_COLOR="0;32"
CPE_NAME="cpe:/o:suse:sles:15:sp1"
```
```
uname -a:
Linux dl325gen10 4.12.14-195-default #1 SMP Tue May 7 10:55:11 UTC 2019 (8fba516)
x86_64 x86_64 x86_64 GNU/Linux
```

(Continued on next page)
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ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7702P)

| SPECrate\textsuperscript{2017 fp base} = 248 |
| SPECrate\textsuperscript{2017 fp energy base} = 721 |
| SPECrate\textsuperscript{2017 fp peak} = 273 |
| SPECrate\textsuperscript{2017 fp energy peak} = 785 |

Platform Notes (Continued)

Kernel self-reported vulnerability status:

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: __user pointer sanitation
CVE-2017-5715 (Spectre variant 2): Mitigation: Full AMD retpoline, IBPB: conditional, IBRS-fw, STIBP: conditional, RSB filling

run-level 3 Aug 30 17:56

SPEC is set to: /cpu2017
FromFilesystem Type Size Used Avail Use% Mounted on
/dev/sda2 btrfs 40G 11G 29G 28% /

From /sys/devices/virtual/dmi/id
BIOS: HPE A41 07/20/2019
Vendor: HPE
Product: ProLiant DL325 Gen10
Product Family: ProLiant
Serial: CN781302PS

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 NOT AVAILABLE
8x UNKNOWN NOT AVAILABLE 32 GB 2 rank 2933

Power Settings Notes

PTDaemon to measure power and temperature was run on a ProLiant DL360 Gen9 as a controller
with 2x Intel Xeon E5-2660 v3 CPU and 128 GB of memory using Windows Server 2012 R2.
Power management in the OS was disabled by setting Linux CPU governor to performance for all cores:
cpupower frequency-set -r -g performance
Power management in the BIOS was default except for any settings mentioned in BIOS Configuration.
No power management settings were set in the management firmware.

(Continued on next page)
Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7702P)

| CPU2017 License: | 003 |
| Test Sponsor:    | HPE |
| Tested by:       | HPE |

SPECraten®2017_fp_base = 248
SPECraten®2017_fp_energy_base = 721
SPECraten®2017_fp_peak = 273
SPECraten®2017_fp_energy_peak = 785

Test Date: Aug-2019
Hardware Availability: Oct-2019
Software Availability: Aug-2019

Power Settings Notes (Continued)

The optional optical drive was not installed.
The system was configured with 7 HPE Small Form Factor Hard Drive Blanks (666987-B21), 8 DIMM blanks
2 high performance heatsinks and baffles that fit over the high performance
heatsinks in order to produce correct airflow and cooling.
The run was started and observed through the management firmware.
The Embedded SATA controller was the HPE Smart Array S100i SR Gen10 SW RAID.

Compiler Version Notes

C  |
519.lbm_r(base, peak) 538.imagick_r(base, peak)
544.nab_r(base, peak)

AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
AOCC_2.0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin

C++  |
508.namd_r(base, peak) 510.parest_r(base, peak)

AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
AOCC_2.0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
 InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin

C++, C  |
511.povray_r(base, peak) 526.blender_r(base, peak)

AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
AOCC_2.0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin

(Continued on next page)
## Compiler Version Notes (Continued)

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<tr>
<th>C++, C, Fortran</th>
<th>507.cactuBSSN_r(base, peak)</th>
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| AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins |
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| Thread model: posix |
| InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin |

<table>
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<th>503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak)</th>
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| AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins |
| AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19) |
| Thread model: posix |
| InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin |

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<th>521.wrf_r(base, peak) 527.cam4_r(base, peak)</th>
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| AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins |
| AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19) |
| Thread model: posix |
| InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin |

(Continued on next page)
**Compiler Version Notes (Continued)**

---

### Base Compiler Invocation

C benchmarks:
- *clang*

C++ benchmarks:
- *clang++*

Fortran benchmarks:
- *flang*

Benchmarks using both Fortran and C:
- *flang clang*

Benchmarks using both C and C++:
- *clang++ clang*

Benchmarks using Fortran, C, and C++:
- *clang++ clang flang*

---

### Base Portability Flags

- 503.bwaves_r: -DSPEC_LP64
- 507.cactuBSSN_r: -DSPEC_LP64
- 508.namd_r: -DSPEC_LP64
- 510.parest_r: -DSPEC_LP64
- 511.povray_r: -DSPEC_LP64
- 519.lbm_r: -DSPEC_LP64
- 521.wrf_r: -DSPEC_CASE_FLAG -Mbyteswapio -DSPEC_LP64
- 526.blender_r: -funsigned-char -D__BOOL_DEFINED -DSPEC_LP64
- 527.cam4_r: -DSPEC_CASE_FLAG -DSPEC_LP64
- 538.imagemick_r: -DSPEC_LP64
- 544.nab_r: -DSPEC_LP64
- 549.fotonik3d_r: -DSPEC_LP64
- 554.roms_r: -DSPEC_LP64
## Base Optimization Flags

**C benchmarks:**
- `-flto -Wl,-mllvm -Wl,-function-specialize`
- `-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC`
- `-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -ffast-math`
- `-march=znver2 -fstruct-layout=3 -mllvm -unroll-threshold=50`
- `-fremap-arrays -mllvm -function-specialize -mllvm -enable-gvn-hoist`
- `-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp`
- `-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000`
- `-flv-function-specialization -z muldefs -lmvec -lamdlibm -ljemalloc -lflang`

**C++ benchmarks:**
- `-std=c++98 -flto -Wl,-mllvm -Wl,-function-specialize`
- `-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC`
- `-Wl,-mllvm -Wl,-reduce-array-computations=3`
- `-Wl,-mllvm -Wl,-suppress-fmas -O3 -ffast-math -march=znver2`
- `-mllvm -loop-unswitch-threshold=200000 -mllvm -vector-library=LIBMVEC`
- `-mllvm -unroll-threshold=100 -flv-function-specialization`
- `-mllvm -enable-partial-unswitch -z muldefs -lmvec -lamdlibm -ljemalloc -lflang`

**Fortran benchmarks:**
- `-flto -Wl,-mllvm -Wl,-function-specialize`
- `-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC`
- `-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver2`
- `-funroll-loops -Mrecursive -mllvm -vector-library=LIBMVEC -z muldefs`
- `-Klee -fno-finite-math-only -lmvec -lamdlibm -ljemalloc -lflang`

**Benchmarks using both Fortran and C:**
- `-flto -Wl,-mllvm -Wl,-function-specialize`
- `-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC`
- `-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -ffast-math`
- `-march=znver2 -fstruct-layout=3 -mllvm -unroll-threshold=50`
- `-fremap-arrays -mllvm -function-specialize -mllvm -enable-gvn-hoist`
- `-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp`
- `-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000`
- `-flv-function-specialization -funroll-loops -Mrecursive -z muldefs`
- `-Klee -fno-finite-math-only -lmvec -lamdlibm -ljemalloc -lflang`

**Benchmarks using both C and C++:**
- `-std=c++98 -flto -Wl,-mllvm -Wl,-function-specialize`
- `-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC`
- `-Wl,-mllvm -Wl,-reduce-array-computations=3`
- `-Wl,-mllvm -Wl,-suppress-fmas -O3 -ffast-math -march=znver2`

(Continued on next page)
**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
**ProLiant DL325 Gen10**  
(2.00 GHz, AMD EPYC 7702P)  

| SPECrate®2017_fp_base = 248 |  
| SPECrate®2017_fp_energy_base = 721 |  
| SPECrate®2017_fp_peak = 273 |  
| SPECrate®2017_fp_energy_peak = 785 |  

**CPU2017 License:** 003  
**Test Sponsor:** HPE  
**Tested by:** HPE  
**Test Date:** Aug-2019  
**Hardware Availability:** Oct-2019  
**Software Availability:** Aug-2019  

### Base Optimization Flags (Continued)

Benchmarks using both C and C++ (continued):
- `fstruct-layout=3`  
- `-mllvm -unroll-threshold=50 -fremap-arrays`  
- `-mllvm -function-specialize`  
- `-mllvm -enable-gvn-hoist`  
- `-mllvm -reduce-array-computations=3`  
- `-mllvm -global-vectorize-slp`  
- `-mllvm -vector-library=LIBMVEC`  
- `-mllvm -inline-threshold=1000`  
- `-fllvm-function-specialization`  
- `-mllvm -loop-unswitch-threshold=200000`  
- `-mllvm -unroll-threshold=100`  
- `-mllvm -enable-partial-unswitch`  
- `-z muldefs`  
- `-lmvec`  
- `-lamdlibm`  
- `-ljemalloc`  
- `-lflang`

Benchmarks using Fortran, C, and C++:
- `-std=c++98`  
- `-flto`  
- `-Wl,-mllvm -Wl,-function-specialize`  
- `-Wl,-mllvm -Wl,-region-vectorize`  
- `-Wl,-mllvm -Wl,-vector-library=LIBMVEC`  
- `-Wl,-mllvm -Wl,-reduce-array-computations=3`  
- `-Wl,-mllvm -Wl,-suppress-fmas`  
- `-O3`  
- `-ffast-math`  
- `-march=znver2`  
- `fstruct-layout=3`  
- `-mllvm -unroll-threshold=50 -fremap-arrays`  
- `-mllvm -function-specialize`  
- `-mllvm -enable-gvn-hoist`  
- `-mllvm -reduce-array-computations=3`  
- `-mllvm -global-vectorize-slp`  
- `-mllvm -vector-library=LIBMVEC`  
- `-mllvm -inline-threshold=1000`  
- `-fllvm-function-specialization`  
- `-mllvm -loop-unswitch-threshold=200000`  
- `-mllvm -unroll-threshold=100`  
- `-mllvm -enable-partial-unswitch`  
- `-funroll-loops -Mrecursive -z muldefs -Kieee -fno-finite-math-only`  
- `-lmvec`  
- `-lamdlibm`  
- `-ljemalloc`  
- `-lflang`

### Peak Compiler Invocation

**C benchmarks:**
- `clang`

**C++ benchmarks:**
- `clang++`

**Fortran benchmarks:**
- `flang`

Benchmarks using both Fortran and C:
- `flang clang`

Benchmarks using both C and C++:
- `clang++ clang`

Benchmarks using Fortran, C, and C++:
- `clang++ clang flang`
SPEC CPU® 2017 Floating Point Rate Result

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7702P)

SPECr@2017_fp_base = 248
SPECr@2017_fp_energy_base = 721
SPECr@2017_fp_peak = 273
SPECr@2017_fp_energy_peak = 785

CPU2017 License: 003
Test Sponsor: HPE
Tested by: HPE

Peak Portability Flags
Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

519.lbm_r: basepeak = yes
538.imagick_r: -flto -Wl,-mlllvm -Wl,-function-specialize
-Wl,-mlllvm -Wl,-region-vectorize
-Wl,-mlllvm -Wl,-vector-library=LIBMVEC
-Wl,-mlllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver2 -mno-sse4a -fstruct-layout=5
-mlllvm -vectorize-memory-aggressively
-mlllvm -function-specialize -mlllvm -enable-gvn-hoist
-mlllvm -unroll-threshold=50 -fremap-arrays
-mlllvm -vector-library=LIBMVEC
-mlllvm -reduce-array-computations=3
-mlllvm -global-vectorize-slp -mlllvm -inline-threshold=1000
-flv-function-specialization -lmvec -lamdlibm -ljemalloc
-lflang
544.nab_r: Same as 538.imagick_r

C++ benchmarks:

508.namd_r: -std=c++98 -flto -Wl,-mlllvm -Wl,-function-specialize
-Wl,-mlllvm -Wl,-region-vectorize
-Wl,-mlllvm -Wl,-vector-library=LIBMVEC
-Wl,-mlllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver2 -flv-function-specialization
-mlllvm -unroll-threshold=100
-mlllvm -enable-partial-unswitch
-mlllvm -loop-unswitch-threshold=200000
-mlllvm -vector-library=LIBMVEC
-mlllvm -inline-threshold=1000 -lmvec -lamdlibm -ljemalloc
-lflang
510.parest_r: basepeak = yes

Fortran benchmarks:

(Continued on next page)
## SPEC CPU®2017 Floating Point Rate Result

### Hewlett Packard Enterprise

*(Test Sponsor: HPE)*

**ProLiant DL325 Gen10**

*(2.00 GHz, AMD EPYC 7702P)*

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### Peak Optimization Flags (Continued)

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Flags</th>
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<tbody>
<tr>
<td>549.fotonik3d_r</td>
<td>Same as 503.bwaves_r</td>
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</table>

Benchmarks using both Fortran and C:

<table>
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<th>Benchmark</th>
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<tr>
<td>521.wrf_r</td>
<td>basepeak = yes</td>
</tr>
</tbody>
</table>

<table>
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</tr>
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Benchmarks using both C and C++:

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<th>Benchmark</th>
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<tr>
<td>511.povray_r</td>
<td>-std=c++98 -flto -Wl,-mlllvm -Wl,-function-specialize -Wl,-mlllvm -Wl,-region-vectorize -Wl,-mlllvm -Wl,-vector-library=LIBMVEC</td>
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(Continued on next page)
SPEC CPU®2017 Floating Point Rate Result

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Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7702P)

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CPU2017 License: 003
Test Sponsor: HPE
Test Date: Aug-2019
Tested by: HPE
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Software Availability: Aug-2019

Peak Optimization Flags (Continued)

511.povray_r (continued):
-Wl,-mlirv -Wl,-reduce-array-computations=3
-Wl,-mlirv -Wl,-x86-use-vzeroupper=false -Ofast
-march=znver2 -mno-sse4a -fstruct-layout=5
-mlirv -vectorize-memory-aggressively
-mlirv -function-specialize -mlirv -enable-gvn-hoist
-mlirv -unroll-threshold=50 -fremap-arrays
-mlirv -vector-library=LIBMVEC
-mlirv -reduce-array-computations=3
-mlirv -global-vectorize-slp -mlirv -inline-threshold=1000
-flv-function-specialization -mlirv -unroll-threshold=100
-mlirv -enable-partial-unswitch
-mlirv -loop-unswitch-threshold=200000 -lmvec -lamdlibm
-ljemalloc -liflang

526.blender_r: -std=c++98 -flto -Wl,-mlirv -Wl,-function-specialize
-Wl,-mlirv -Wl,-region-vectorize
-Wl,-mlirv -Wl,-vector-library=LIBMVEC
-Wl,-mlirv -Wl,-reduce-array-computations=3 -Ofast
-march=znver2 -mno-sse4a -fstruct-layout=5
-mlirv -vectorize-memory-aggressively
-mlirv -function-specialize -mlirv -enable-gvn-hoist
-mlirv -unroll-threshold=50 -fremap-arrays
-mlirv -vector-library=LIBMVEC
-mlirv -reduce-array-computations=3
-mlirv -global-vectorize-slp -mlirv -inline-threshold=1000
-flv-function-specialization -mlirv -unroll-threshold=100
-mlirv -enable-partial-unswitch
-mlirv -loop-unswitch-threshold=200000 -lmvec -lamdlibm
-ljemalloc -liflang

Benchmarks using Fortran, C, and C++:

507.cactusBSSN_r: basepeak = yes

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-revF.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-revF.xml
**SPEC CPU®2017 Floating Point Rate Result**

**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)

**ProLiant DL325 Gen10**  
(2.00 GHz, AMD EPYC 7702P)

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

Tested with SPEC CPU®2017 v1.1.0 on 2019-08-31 00:38:10-0400.

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