Hewlett Packard Enterprise

ProLiant DL365 Gen11
(2.45 GHz, AMD EPYC 9534)

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

Test Date: Jan-2023
Hardware Availability: Dec-2022
Software Availability: Nov-2022

Software:
OS: Ubuntu 22.04.1 LTS
Kernel 5.15.0-50-generic
Compiler: C/C++/Fortran: Version 4.0.0 of AOCC
Parallel: Yes
Firmware: HPE BIOS Version v1.12 11/24/2022 released
File System: ext4
System State: Run level 5 (multi-user)
Base Pointers: 64-bit
Peak Pointers: 64-bit
Power Management: BIOS and OS set to prefer performance at the cost of additional power usage

Hardware:
CPU Name: AMD EPYC 9534
Max MHz: 3700
Nominal: 2450
Enabled: 128 cores, 2 chips
Orderable: 1,2 chips
Cache L1: 32 KB I + 32 KB D on chip per core
L2: 1 MB I+D on chip per core
L3: 256 MB I+D on chip per chip, 32 MB shared / 8 cores
Other: None
Memory: 1536 GB (24 x 64 GB 2Rx4 PC5-4800B-R)
Storage: 1 x 480 GB SATA SSD
Other: None

SPECspeed®2017_fp_base = 397
SPECspeed®2017_fp_peak = 408
Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL365 Gen11
(2.45 GHz, AMD EPYC 9534)

SPEC CPU®2017 Floating Point Speed Result

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Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
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<tbody>
<tr>
<td>603.bwaves_s</td>
<td>128</td>
<td>34.4</td>
<td>1720</td>
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<td>20.1</td>
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<td>621.wrf_s</td>
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<td>74.0</td>
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<td>64.1</td>
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<td>205</td>
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<tr>
<td>627.cam4_s</td>
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<td>266</td>
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<td>21.8</td>
<td>723</td>
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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 limit
'ulimit -l 2097152' was used to set environment locked pages in memory limit
runcpu command invoked through numactl i.e.:
numactl --interleave=all runcpu <etc>

To limit dirty cache to 8% of memory, 'sysctl -w vm.dirty_ratio=8' run as root.
To limit swap usage to minimum necessary, 'sysctl -w vm.swappiness=1' run as root.
To free node-local memory and avoid remote memory usage, 'sysctl -w vm.zone_reclaim_mode=1' run as root.
To clear filesystem caches, 'sync; sysctl -w vm.drop_caches=3' run as root.
To disable address space layout randomization (ASLR) to reduce run-to-run variability, 'sysctl -w kernel.randomize_va_space=0' run as root.

To enable Transparent Hugepages (THP) for all allocations,
Operating System Notes (Continued)

'echo always > /sys/kernel/mm/transparent_hugepage/enabled' and
'echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root.
To always enable THP for peak runs of:
603.bwaves_s, 607.cactuBSSN_s, 619.lbm_s, 627.cam4_s, 628.pop2_s, 638.imagick_s, 644.nab_s, 649.fotonik3d_s:
'echo madvise > /sys/kernel/mm/transparent_hugepage/enabled; echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root.
To disable THP for peak runs of 621.wrf_s:
'echo never > /sys/kernel/mm/transparent_hugepage/enabled; echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root.
To enable THP only on request for peak runs of 654.roms_s:
'echo madvise > /sys/kernel/mm/transparent_hugepage/enabled; echo madvise > /sys/kernel/mm/transparent_hugepage/defrag' run as root.

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
GOMP_CPU_AFFINITY = "0-127"
LD_LIBRARY_PATH = "/home/new_cpu2017/amd_speed_aocc400_genoa_B_lib/lib:"
LIBOMP_NUM_HIDDEN_HELPER_THREADS = "0"
MALLOC_CONF = "oversize_threshold:0,retain:true"
OMP_DYNAMIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "128"

Environment variables set by runcpu during the 603.bwaves_s peak run:
GOMP_CPU_AFFINITY = "0-127"

Environment variables set by runcpu during the 619.lbm_s peak run:
GOMP_CPU_AFFINITY = "0-127"

Environment variables set by runcpu during the 621.wrf_s peak run:
GOMP_CPU_AFFINITY = "0-127"

Environment variables set by runcpu during the 627.cam4_s peak run:
GOMP_CPU_AFFINITY = "0-127"

Environment variables set by runcpu during the 628.pop2_s peak run:
GOMP_CPU_AFFINITY = "0-127"

Environment variables set by runcpu during the 649.fotonik3d_s peak run:
GOMP_CPU_AFFINITY = "0-127"
PGHPF_ZMEM = "yes"
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General Notes

Binaries were compiled on a system with 2x AMD EPYC 9174F CPU + 1.5TiB Memory using RHEL 8.6

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.

Platform Notes

BIOS Configuration

- Workload Profile set to General Peak Frequency Compute
- Determinism Control set to Manual
- Performance Determinism set to Power Deterministic
- AMD SMT Option set to Disabled
- Last-Level Cache (LLC) as NUMA Node set to Enabled
- ACPI C2 LATENCY set to 18 microseconds
- Memory PStates set to Disabled
- Thermal Configuration set to Maximum Cooling

The system ROM used for this result contains microcode version 0xa10110e for the AMD EPYC 9nn4X family of processors. The reference code/AGESA version used in this ROM is version GenoaPI 1.0.0.1-L6

Sysinfo program /home/new_cpu2017/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acfc64d
running on admin1 Tue Jun 28 03:30:20 2022

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 9534 64-Core Processor
- 2 "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 : 64
- physical 0: cores 0 1 2 3 4 5 6 7 16 17 18 19 20 21 22 23 32 33 34 35 36 37 38 39
- physical 1: cores 0 1 2 3 4 5 6 7 16 17 18 19 20 21 22 23 32 33 34 35 36 37 38 39

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**Platform Notes (Continued)**

From lscpu from util-linux 2.37.2:

Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Address sizes: 52 bits physical, 57 bits virtual
Byte Order: Little Endian
CPU(s): 128
On-line CPU(s) list: 0-127
Vendor ID: AuthenticAMD
Model name: AMD EPYC 9534 64-Core Processor
CPU family: 25
Model: 17
Thread(s) per core: 1
Core(s) per socket: 64
Socket(s): 2
Stepping: 1
Frequency boost: enabled
CPU max MHz: 3719.0000
CPU min MHz: 400.0000
BogoMIPS: 4892.78
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 mmxt ext fxsr_opt pdpe1gb rdtscp lm constant_tsc rep_good nopl nonstop_tsc cpuid extd_apicid aperfmperf rafi pni pclmulqdq monitor ssse3 fma cx16 pcid sse4_1 sse4_2 x2apic movbe popcnt aes xsave avx avx2 rdtsc-id lahf_lm cmp_legacy svm extatic cr8 legacy abm sse4a misalignsse 3nowprefetch osvw ibs skinit wdt tce topoext perfctr_core perfctr_nb bpext perfctr_l1l mwaltx cpb cat_l3 cdp_l3 invpcid_single hw_pstate ssbd mba ibrs ibp sbp stick fpicore mtrr msr aperfmperf avx pmca kvm vcpu num %pm %pm
Virtualization: AMD-V
L1d cache: 4 MiB (128 instances)
L1i cache: 4 MiB (128 instances)
L2 cache: 128 MiB (128 instances)
L3 cache: 512 MiB (16 instances)
NUMA node(s): 16
NUMA node0 CPU(s): 0-7
NUMA node1 CPU(s): 32-39
NUMA node2 CPU(s): 16-23
NUMA node3 CPU(s): 48-55

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</tr>
</tbody>
</table>

**Platform Notes (Continued)**

- NUMA node4 CPU(s): 24–31
- NUMA node5 CPU(s): 56–63
- NUMA node6 CPU(s): 8–15
- NUMA node7 CPU(s): 40–47
- NUMA node8 CPU(s): 64–71
- NUMA node9 CPU(s): 96–103
- NUMA node10 CPU(s): 80–87
- NUMA node11 CPU(s): 112–119
- NUMA node12 CPU(s): 88–95
- NUMA node13 CPU(s): 120–127
- NUMA node14 CPU(s): 72–79
- NUMA node15 CPU(s): 104–111

Vulnerability Itlb multihit: Not affected
Vulnerability L1tf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Mmio stale data: Not affected
Vulnerability Retbleed: 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; Retpolines, IBPB conditional, IBRS_FW, STIBP disabled, RSB filling, PBRSB-eIBRS Not affected
Vulnerability Srbds: Not affected
Vulnerability Tsx async abort: Not affected

From lscpu --cache:

<table>
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<tr>
<th>NAME</th>
<th>ONE-SIZE</th>
<th>ALL-SIZE</th>
<th>WAYS</th>
<th>TYPE</th>
<th>LEVEL</th>
<th>SETS</th>
<th>PHY-LINE</th>
<th>COHERENCY-SIZE</th>
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<tr>
<td>L1d</td>
<td>32K</td>
<td>4M</td>
<td>8</td>
<td>Data</td>
<td>1</td>
<td>64</td>
<td>1</td>
<td>64</td>
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<tr>
<td>L1i</td>
<td>32K</td>
<td>4M</td>
<td>8</td>
<td>Instruction</td>
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<td>1</td>
<td>64</td>
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<tr>
<td>L2</td>
<td>1M</td>
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<td>8</td>
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<td>2</td>
<td>2048</td>
<td>1</td>
<td>64</td>
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<tr>
<td>L3</td>
<td>32M</td>
<td>512M</td>
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<td>3</td>
<td>32768</td>
<td>1</td>
<td>64</td>
</tr>
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</table>

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 6 7
node 0 size: 96455 MB
node 0 free: 96171 MB
node 1 cpus: 32 33 34 35 36 37 38 39
node 1 size: 96765 MB
node 1 free: 95809 MB
node 2 cpus: 16 17 18 19 20 21 22 23

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Platform Notes (Continued)

node 2 size: 96765 MB
node 2 free: 95916 MB
node 3 cpus: 48 49 50 51 52 53 54 55
node 3 size: 96765 MB
node 3 free: 96041 MB
node 4 cpus: 24 25 26 27 28 29 30 31
node 4 size: 96765 MB
node 4 free: 95969 MB
node 5 cpus: 56 57 58 59 60 61 62 63
node 5 size: 96730 MB
node 5 free: 96027 MB
node 6 cpus: 8 9 10 11 12 13 14 15
node 6 size: 96765 MB
node 6 free: 96329 MB
node 7 cpus: 40 41 42 43 44 45 46 47
node 7 size: 96765 MB
node 7 free: 96427 MB
node 8 cpus: 64 65 66 67 68 69 70 71
node 8 size: 96765 MB
node 8 free: 96642 MB
node 9 cpus: 96 97 98 99 100 101 102 103
node 9 size: 96765 MB
node 9 free: 96652 MB
node 10 cpus: 80 81 82 83 84 85 86 87
node 10 size: 96765 MB
node 10 free: 96659 MB
node 11 cpus: 112 113 114 115 116 117 118 119
node 11 size: 96765 MB
node 11 free: 96632 MB
node 12 cpus: 88 89 90 91 92 93 94 95
node 12 size: 96765 MB
node 12 free: 96652 MB
node 13 cpus: 120 121 122 123 124 125 126 127
node 13 size: 96765 MB
node 13 free: 96606 MB
node 14 cpus: 72 73 74 75 76 77 78 79
node 14 size: 96765 MB
node 14 free: 96654 MB
node 15 cpus: 104 105 106 107 108 109 110 111
node 15 size: 96765 MB
node 15 free: 96621 MB

node distances:

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<tr>
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<th>0</th>
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<th>2</th>
<th>3</th>
<th>4</th>
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<td>32</td>
<td>32</td>
<td>32</td>
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</table>

From /proc/meminfo
MemTotal: 1585007824 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 22.04.1 LTS

From /etc/*release* /etc/*version*
debian_version: bookworm/sid
os-release:
PRETTY_NAME="Ubuntu 22.04.1 LTS"
NAME="Ubuntu"
VERSION_ID="22.04"
VERSION="22.04.1 LTS (Jammy Jellyfish)"
VERSION_CODENAME=jammy
ID=ubuntu
ID_LIKE=debian
HOME_URL="https://www.ubuntu.com/

uname -a:
Linux admin1 5.15.0-50-generic #56-Ubuntu SMP Tue Sep 20 13:23:26 UTC 2022 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

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</table>

**Microarchitectural Data Sampling:** Not affected

- CVE-2017-5754 (Meltdown):
- mmio_stale_data: Not affected
- retbleed: 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: Retpolines, IBPB: conditional, IBRS_FW, STIBP: disabled, RSB filling, PBRSB-eIBRS: Not affected

- CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
- CVE-2019-11135 (TSX Asynchronous Abort): Not affected

**run-level 5 Jun 28 00:00**

**SPEC is set to: /home/new_cpu2017**

Filesystem | Type | Size | Used | Avail | Use% | Mounted on
---|---|---|---|---|---|---
/dev/mapper/ubuntu--vg-ubuntu--lv | ext4 | 437G | 62G | 357G | 15% | /

**From /sys/devices/virtual/dmi/id**

- Vendor: HPE
- Product: ProLiant DL365 Gen11
- Product Family: ProLiant
- Serial: DL365G11-001

Additional information from dmidecode 3.3 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:**

- 24x Hynix HMCG94AEBRA103N 64 GB 2 rank 4800

**BIOS:**

- BIOS Vendor: HPE
- BIOS Version: 1.12
- BIOS Date: 11/24/2022
- BIOS Revision: 1.12
- Firmware Revision: 1.10

(End of data from sysinfo program)
## Compiler Version Notes

### C

<table>
<thead>
<tr>
<th>619.lbm_s (base, peak)</th>
<th>638.imagick_s (base, peak)</th>
</tr>
</thead>
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<tr>
<td>644.nab_s (base, peak)</td>
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</tr>
</tbody>
</table>

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### AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)

Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

---

### C++, C, Fortran

| 607.cactuBSSN_s (base, peak) |

---

### AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)

Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

### Fortran

<table>
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<tr>
<th>603.bwaves_s (base, peak)</th>
<th>649.fotonik3d_s (base, peak)</th>
</tr>
</thead>
<tbody>
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<td>654.roms_s (base, peak)</td>
<td></td>
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### AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)

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### Fortran, C

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<th>621.wrf_s (base, peak)</th>
<th>627.cam4_s (base, peak)</th>
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<td>628.pop2_s (base, peak)</td>
<td></td>
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</tbody>
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### AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)

Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin
Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL365 Gen11
(2.45 GHz, AMD EPYC 9534)

SPECspeed®2017_fp_base = 397
SPECspeed®2017_fp_peak = 408

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

Test Date: Jan-2023
Hardware Availability: Dec-2022
Software Availability: Nov-2022

Compiler Version Notes (Continued)

LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin
AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on
LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/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
SPEC CPU®2017 Floating Point Speed Result

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL365 Gen11
(2.45 GHz, AMD EPYC 9534)

SPECspeed®2017_fp_base = 397
SPECspeed®2017_fp_peak = 408

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

Base Optimization Flags

C benchmarks:
-m64, -Wl, -mllvm -Wl, -align-all-nofallthru-blocks=6
-Wl, -mllvm -Wl, -reduce-array-computations=3 -O3 -march=znver4
-fveclib=AMDLIBM -ffast-math -fopenmp -flto -fstruct-layout=7
-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000
-freemap-arrays -fstrip-mining -mllvm -reduce-array-computations=3
-DSPEC_OPENMP -zopt -fopenmp=libomp -lomp -lamdlibm -lamdalloc
-lflang

Fortran benchmarks:
-m64, -Wl, -mllvm -Wl, -align-all-nofallthru-blocks=6
-Wl, -mllvm -Wl, -reduce-array-computations=3
-Wl, -mllvm -Wl, -enable-X86-prefetching -DSPEC_OPENMP -O3 -march=znver4
-fveclib=AMDLIBM -ffast-math -fopenmp -flto -Mrecursive
-funroll-loops -mllvm -lsr-in-nested-loop
-mllvm -reduce-array-computations=3 -zopt -fopenmp=libomp -lomp
-lamdlibm -lamdalloc -lflang

Benchmarks using both Fortran and C:
-m64, -Wl, -mllvm -Wl, -align-all-nofallthru-blocks=6
-Wl, -mllvm -Wl, -reduce-array-computations=3
-Wl, -mllvm -Wl, -enable-X86-prefetching -O3 -march=znver4
-fveclib=AMDLIBM -ffast-math -fopenmp -flto -fstruct-layout=7
-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000
-freemap-arrays -fstrip-mining -mllvm -reduce-array-computations=3
-DSPEC_OPENMP -zopt -Mrecursive -funroll-loops
-mllvm -lsr-in-nested-loop -fopenmp=libomp -lomp -lamdlibm -lamdalloc
-lflang

Benchmarks using Fortran, C, and C++:
-m64, -Wl, -mllvm -Wl, -align-all-nofallthru-blocks=6
-Wl, -mllvm -Wl, -reduce-array-computations=3
-Wl, -mllvm -Wl, -x86-use-vzeroupper=false -O3 -march=znver4
-fveclib=AMDLIBM -ffast-math -fopenmp -flto -fstruct-layout=7
-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000
-freemap-arrays -fstrip-mining -mllvm -reduce-array-computations=3
-DSPEC_OPENMP -zopt -mllvm -unroll-threshold=100 -finline-aggressive
-mllvm -loop-unswitch-threshold=200000 -Mrecursive -funroll-loops
-mllvm -lsr-in-nested-loop -fopenmp=libomp -lomp -lamdlibm -lamdalloc
-lflang
Hewlett Packard Enterprise  
ProLiant DL365 Gen11  
(2.45 GHz, AMD EPYC 9534)

SPECspeed®2017_fp_base = 397
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CPU2017 License: 3
Test Sponsor: HPE
Test Date: Jan-2023

Tested by: HPE
Hardware Availability: Dec-2022

Software Availability: Nov-2022

Base Other Flags

C benchmarks:
-Wno-return-type -Wno-unused-command-line-argument

Fortran benchmarks:
-Wno-unused-command-line-argument

Benchmarks using both Fortran and C:
-Wno-return-type -Wno-unused-command-line-argument

Benchmarks using Fortran, C, and C++:
-Wno-return-type -Wno-unused-command-line-argument

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: -m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6  
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast  
-march=znver4 -fveclib=AMDLIBM -ffast-math -fopenmp  
-flto -fstruct-layout=9 -mllvm -unroll-threshold=50  
-fremap-arrays -fstrip-mining  
-mllvm -inline-threshold=1000

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

619.lbm_s (continued):
-llvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt
-fopenmp=libomp -lomp -lamdlibm -lamdalloc -lflang

638.imagick_s: basepeak = yes
644.nab_s: basepeak = yes

Fortran benchmarks:

603.bwaves_s: -m64 -W1, -llvm -W1, -align-all-nofallthru-blocks=6
-W1, -llvm -W1, -reduce-array-computations=3
-W1, -llvm -W1, -enable-X86-prefetching -DSPEC_OPENMP
-Ofast -march=znver4 -fveclib=AMDLIBM -ffast-math
-fopenmp -flto -Mrecursive -mlvm -reduce-array-computations=3
-fvector-transform -fscalar-transform -fopenmp=libomp
-lomp -lamdlibm -lamdalloc -lflang

649.fotonik3d_s: -m64 -W1, -llvm -W1, -align-all-nofallthru-blocks=6
-W1, -llvm -W1, -reduce-array-computations=3
-W1, -llvm -W1, -enable-X86-prefetching -DSPEC_OPENMP
-Ofast -march=znver4 -fveclib=AMDLIBM -ffast-math
-fopenmp -flto -Mrecursive
-mlvm -reduce-array-computations=3 -zopt -fopenmp=libomp
-lomp -lamdlibm -lamdalloc -lflang

654.roms_s: basepeak = yes

Benchmarks using both Fortran and C:

621.wrf_s: -m64 -W1, -llvm -W1, -align-all-nofallthru-blocks=6
-W1, -llvm -W1, -reduce-array-computations=3
-W1, -llvm -W1, -enable-X86-prefetching -Ofast
-march=znver4 -fveclib=AMDLIBM -ffast-math -fopenmp
-flto -fstruct-layout=9 -mlvm -unroll-threshold=50
-fremap-arrays -fstrip-mining
-mlvm -inline-threshold=1000
-mlvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt
-O3 -Mrecursive -funroll-loops -mlvm -lsr-in-nested-loop
-fopenmp=libomp -lomp -lamdlibm -lamdalloc -lflang

627.cam4_s: -m64 -W1, -llvm -W1, -align-all-nofallthru-blocks=6
-W1, -llvm -W1, -reduce-array-computations=3
-W1, -llvm -W1, -enable-X86-prefetching -Ofast
-march=znver4 -fveclib=AMDLIBM -ffast-math -fopenmp
-flto -fstruct-layout=9 -mlvm -unroll-threshold=50

(Continued on next page)
Hewlett Packard Enterprise
(Proprietary: HPE)
ProLiant DL365 Gen11
(2.45 GHz, AMD EPYC 9534)

<table>
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CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE
Test Date: Jan-2023
Hardware Availability: Dec-2022
Software Availability: Nov-2022

### Peak Optimization Flags (Continued)

627.cam4_s (continued):
- fremap-arrays -fstrip-mining
- mllvm -inline-threshold=1000
- mllvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt
- Mrecursive -fopenmp=libomp -lomp -lamdlibm -lamdalloc
- lflang

628.pop2_s -m64 -Wl, -mllvm -Wl, -align-all-nofallthru-blocks=6
- Wl, -mllvm -Wl, -reduce-array-computations=3
- Wl, -mllvm -Wl, -enable-X86-prefetching -Ofast
- march=znver4 -fveclib=AMDLIBM -ffast-math -fopenmp
- flto -fstruct-layout=9 -mllvm -unroll-threshold=50
- fremap-arrays -fstrip-mining
- mllvm -inline-threshold=1000
- mllvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt
- Mrecursive -fvector-transform -fscalar-transform
- fopenmp=libomp -lomp -lamdlibm -lamdalloc -lflang

### Peak Other Flags

C benchmarks:
- Wno-return-type -Wno-unused-command-line-argument

Fortran benchmarks:
- Wno-unused-line-argument

Benchmarks using both Fortran and C:
- Wno-return-type -Wno-unused-command-line-argument

Benchmarks using Fortran, C, and C++:
- Wno-return-type -Wno-unused-command-line-argument

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You can also download the XML flags sources by saving the following links:
[http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-Genoa-rev2.1.xml](http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-Genoa-rev2.1.xml)

The flags files that were used to format this result can be browsed at
Hewlett Packard Enterprise
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ProLiant DL365 Gen11
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</table>

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