## SPEC CPU®2017 Floating Point Speed Result

**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
ProLiant DL345 Gen11  
(2.25 GHz, AMD EPYC 9634)

| SPECspeed®2017_fp_base = 283 | SPECspeed®2017_fp_peak = 293 |

<table>
<thead>
<tr>
<th>CPU2017 License:</th>
<th>3</th>
<th>Test Date:</th>
<th>Jan-2023</th>
</tr>
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<tbody>
<tr>
<td>Test Sponsor:</td>
<td>HPE</td>
<td>Hardware Availability:</td>
<td>Dec-2022</td>
</tr>
<tr>
<td>Tested by:</td>
<td>HPE</td>
<td>Software Availability:</td>
<td>Nov-2022</td>
</tr>
</tbody>
</table>

### Hardware

- **CPU Name:** AMD EPYC 9634  
- **Max MHz:** 3700  
- **Nominal:** 2250  
- **Enabled:** 84 cores, 1 chip  
- **Orderable:** 1 chip  
- **Cache L1:** 32 KB I + 32 KB D on chip per core  
- **L2:** 1 MB I+D on chip per core  
- **L3:** 384 MB I+D on chip per chip, 32 MB shared / 7 cores  
- **Other:** None  
- **Memory:** 384 GB (12 x 32 GB 2Rx8 PC5-4800B-R)  
- **Storage:** 1 x 1.6 TB NVMe SSD, RAID 0  
- **Other:** None

### Software

- **OS:** Red Hat Enterprise Linux 9.0 (Plow)  
- **Kernel:** 5.14.0-70.13.1.el9_0.x86_64  
- **Compiler:** C/C++/Fortran: Version 4.0.0 of AOCC  
- **Parallel:** Yes  
- **Firmware:** HPE BIOS Version v1.12 11/24/2022 releasedNov-2022  
- **File System:** xfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 64-bit  
- **Other:** None  
- **Power Management:** BIOS and OS set to prefer performance at the cost of additional power usage

### Thread Results

<table>
<thead>
<tr>
<th>SPECspeed®2017_fp_base (283)</th>
<th>SPECspeed®2017_fp_peak (293)</th>
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<tbody>
<tr>
<td>Threads</td>
<td>0</td>
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<tr>
<td>603.bwaves_s</td>
<td>84</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>84</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>84</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>84</td>
</tr>
<tr>
<td>627.cam4_s</td>
<td>84</td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>84</td>
</tr>
<tr>
<td>638.imagick_s</td>
<td>84</td>
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<tr>
<td>644.nab_s</td>
<td>84</td>
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<tr>
<td>649.fotonik3d_s</td>
<td>84</td>
</tr>
<tr>
<td>654.roms_s</td>
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Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Base</th>
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<th></th>
<th>Peak</th>
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<tr>
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<td>Seconds</td>
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<td>Seconds</td>
<td>Ratio</td>
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<tr>
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<td><strong>63.9</strong></td>
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<tr>
<td>607.cactuBSSN_s</td>
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<td>461</td>
<td>36.3</td>
<td>460</td>
<td><strong>36.2</strong></td>
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<td>619.ibm_s</td>
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<td><strong>28.8</strong></td>
<td><strong>182</strong></td>
<td>27.8</td>
<td>189</td>
<td>30.0</td>
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<tr>
<td>621.wrf_s</td>
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<td>627.cam4_s</td>
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<td>200</td>
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<td>628.pop2_s</td>
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<td><strong>92.1</strong></td>
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<td>92.0</td>
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<tr>
<td>638.imagick_s</td>
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<td>452</td>
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<tr>
<td>644.nab_s</td>
<td>84</td>
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<td><strong>621</strong></td>
<td>28.1</td>
<td>621</td>
<td>28.2</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>84</td>
<td><strong>63.5</strong></td>
<td><strong>144</strong></td>
<td>62.7</td>
<td>145</td>
<td>63.7</td>
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<td>654.roms_s</td>
<td>84</td>
<td>56.6</td>
<td>278</td>
<td>49.7</td>
<td>317</td>
<td><strong>54.5</strong></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.
'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.

(Continued on next page)
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 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:

To disable THP for peak runs of 621.wrf_s:

To enable THP only on request for peak runs of 654.roms_s:

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
GOMP_CPU_AFFINITY = "0-83"
LD_LIBRARY_PATH = "/home/CPU2017/amd_speed_aocc400_genoa_B_lib/lib:"
LIBOMP_NUM_HIDDEN_HELPER_THREADS = "0"
MALLOCCONF = "oversize_threshold:0,retain:true"
OMP_DYNAM = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "84"

Environment variables set by runcpu during the 621.wrf_s peak run:
GOMP_CPU_AFFINITY = "0-83"

Environment variables set by runcpu during the 627.cam4_s peak run:
GOMP_CPU_AFFINITY = "0-83"

Environment variables set by runcpu during the 628.pop2_s peak run:
GOMP_CPU_AFFINITY = "0-83"

Environment variables set by runcpu during the 649.fotonik3d_s peak run:
GOMP_CPU_AFFINITY = "0-83"
PGHPF_ZMEM = "yes"

Environment variables set by runcpu during the 654.roms_s peak run:
GOMP_CPU_AFFINITY = "0 42 1 43 2 44 3 45 4 46 5 47 6 48 7 49 8 50 9 51 10 52 11 53 12 54 13 55 14 56 15 57 16 58 17 59 18 60 19 61 20 62 21 63 22 64 23 65 24 66 25 67 26 68 27 69 28 70 29 71 30 72 31 73 32 74 33 75 34 76 35 77 36 78 37 79 38 80 39 81 40 82 41 83"
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</table>

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 CST C2 Latency set to 18 microseconds
Memory PStates set to Disabled
Thermal Configuration set to Maximum Cooling
Workload Profile set to Custom
Power Regulator set to OS Control Mode

The system ROM used for this result contains microcode version 0x0A10110e 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/CPU2017/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16aca6d65dunning on localhost.localdomain Thu Apr 7 05:43:33 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

<table>
<thead>
<tr>
<th>model name</th>
<th>AMD EPYC 9634 84-Core Processor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&quot;physical id&quot;s (chips)</td>
</tr>
<tr>
<td>84</td>
<td>&quot;processors&quot;</td>
</tr>
<tr>
<td>cores, siblings</td>
<td>(Caution: counting these is hw and system dependent. The following excerpts from /proc/cpuinfo might not be reliable. Use with caution.)</td>
</tr>
<tr>
<td>cpu cores</td>
<td>84</td>
</tr>
<tr>
<td>siblings</td>
<td>84</td>
</tr>
<tr>
<td>physical 0:</td>
<td>cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 16 17 18 19 20 21 22 24 25 26 27 28 29 30 32 33 34 35 36 37 38 40 41 42 43 44 45 46 48 49 50 51 52 53 54 56 57 58 59 60 61 62 64 65 66 67 68 69 70 72 73 74 75 76 77 78 80 81 82 83 84 85 86 88 89 90 91</td>
</tr>
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Platform Notes (Continued)

From lscpu from util-linux 2.37.4:
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): 84
On-line CPU(s) list: 0-83
Vendor ID: AuthenticAMD
BIOS Vendor ID: Advanced Micro Devices, Inc.
Model name: AMD EPYC 9634 84-Core Processor
BIOS Model name: AMD EPYC 9634 84-Core Processor
CPU family: 25
Model: 17
Thread(s) per core: 1
Core(s) per socket: 84
Socket(s): 1
Stepping: 1
BogoMIPS: 4493.40
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
pdpesmb rdtscl rm constant_tsc rep_good nopl nonstop_tsc cpuid extd_apicid
aperfmon rapl pni pclmulqdq monitor ssse3 fma cx16 pcid sse4_1 sse4_2 x2apic movbe
popcnt aes xsave avx fl64c rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a
misalignment 3nowprefetch osvw 1bs skinit wdt tce topoext perfctr_core perfctr_nb
bpxef perfctr_llc mwaitx cpb cat_l3 cd1_c3 invpcid_single hw_pstate ssbd mba ibrs
ibpb 1stib vmmcall fsqsgbase bmi1 avx2 smep bmis invpcid cqm rdt_a avx512f
avx512dq rdseed adx smap avx512ifma clflushopt clwb avx512cd sha ni avx512bw
avx512vl xsaveopt xsave xgetbv1 xsavevs cqm_llc cqm_occup_llc cqm_mem_total
cqm_mbms_local avx512_bf16 clzero irperfect xsaveerptr rdpdir wbinvd amd_pplin arat
npt lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter
pfthreshold avic v_vmsave_vmload vgif v_spec_ctrl avx512vbmi umip pkp ospe
kax512_vbmi2 gfni vaes vcpclmulqdq avx512_vnni avx512_bitalg avx512_vpopcntdq 1a57
rdpid overflow_recover succor smca fsrm flush_lid

Virtualization:
L1d cache: 2.6 MiB (84 instances)
L1i cache: 2.6 MiB (84 instances)
L2 cache: 84 MiB (84 instances)
L3 cache: 384 MiB (12 instances)
NUMA node(s): 12
NUMA node0 CPU(s): 0-6
NUMA node1 CPU(s): 28-34
NUMA node2 CPU(s): 56-62
NUMA node3 CPU(s): 14-20
NUMA node4 CPU(s): 42-48
NUMA node5 CPU(s): 70-76

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Platform Notes (Continued)

NUMA node6 CPU(s): 21-27
NUMA node7 CPU(s): 49-55
NUMA node8 CPU(s): 77-83
NUMA node9 CPU(s): 7-13
NUMA node10 CPU(s): 35-41
NUMA node11 CPU(s): 63-69
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl
Vulnerability Spectre v1: Mitigation; usercopy/swapgs barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Retpolines, IBPB conditional, IBRS_FW, STIBF disabled, RSB filling
Vulnerability Srbds: Not affected
Vulnerability Txs async abort: Not affected

From lscpu --cache:
NAME ONE-SIZE ALL-SIZE WAYS TYPE LEVEL SETS PHY-LINE COHERENCY-SIZE
L1d 32K 2.6M 8 Data 1 64 1 64
L1i 32K 2.6M 8 Instruction 1 64 1 64
L2 1M 84M 8 Unified 2 2048 1 64
L3 32M 384M 16 Unified 3 32768 1 64

From numactl --hardware
WARNING: a numactl 'node' might or might not correspond to a physical chip.
available: 12 nodes (0-11)
node 0 cpus: 0 1 2 3 4 5 6
node 0 size: 32008 MB
node 0 free: 31699 MB
node 1 cpus: 28 29 30 31 32 33 34
node 1 size: 32254 MB
node 1 free: 31994 MB
node 2 cpus: 56 57 58 59 60 61 62
node 2 size: 32254 MB
node 2 free: 32035 MB
node 3 cpus: 14 15 16 17 18 19 20
node 3 size: 32254 MB
node 3 free: 32116 MB
node 4 cpus: 42 43 44 45 46 47 48
node 4 size: 32254 MB
node 4 free: 32130 MB

(Continued on next page)
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Platform Notes (Continued)

node 5 cpus: 70 71 72 73 74 75 76  
node 5 size: 32254 MB  
node 5 free: 32137 MB  
node 6 cpus: 21 22 23 24 25 26 27  
node 6 size: 32254 MB  
node 6 free: 32132 MB  
node 7 cpus: 49 50 51 52 53 54 55  
node 7 size: 32254 MB  
node 7 free: 31934 MB  
node 8 cpus: 77 78 79 80 81 82 83  
node 8 size: 32254 MB  
node 8 free: 32130 MB  
node 9 cpus: 7 8 9 10 11 12 13  
node 9 size: 32254 MB  
node 9 free: 32138 MB  
node 10 cpus: 35 36 37 38 39 40 41  
node 10 size: 32254 MB  
node 10 free: 32133 MB  
node 11 cpus: 63 64 65 66 67 68 69  
node 11 size: 32167 MB  
node 11 free: 32039 MB  

node distances:
node 0 1 2 3 4 5 6 7 8 9 10 11  
0: 10 11 11 12 12 12 12 12 12 12 12 12  
1: 11 10 11 12 12 12 12 12 12 12 12 12  
2: 11 11 10 12 12 12 12 12 12 12 12 12  
3: 12 12 12 10 11 11 12 12 12 12 12 12  
4: 12 12 12 11 10 11 12 12 12 12 12 12  
5: 12 12 12 11 11 10 12 12 12 12 12 12  
6: 12 12 12 12 12 12 10 11 11 12 12 12  
7: 12 12 12 12 12 12 12 11 10 11 12 12  
8: 12 12 12 12 12 12 11 11 10 12 12 12  
9: 12 12 12 12 12 12 12 12 12 10 11 11  
10: 12 12 12 12 12 12 12 12 12 11 10 11  
11: 12 12 12 12 12 12 12 12 12 11 11 10

From /proc/meminfo
MemTotal: 396000520 kB  
HugePages_Total: 0  
Hugepagesize: 2048 kB

From /etc/*release* /etc/*version*
  os-release:
    NAME="Red Hat Enterprise Linux"
    VERSION="9.0 (Plow)"
    ID="rhel"
    ID_LIKE="fedora"

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

```
VERSION_ID="9.0"
PLATFORM_ID="platform:el9"
PRETTY_NAME="Red Hat Enterprise Linux 9.0 (Plow)"
ANSI_COLOR="0;31"
   redhat-release: Red Hat Enterprise Linux release 9.0 (Plow)
system-release: Red Hat Enterprise Linux release 9.0 (Plow)
system-release-cpe: cpe:/o:redhat:enterprise_linux:9::baseos
```

```
uname -a:
   Linux localhost.localdomain 5.14.0-70.13.1.el9_0.x86_64 #1 SMP PREEMPT Thu Apr 14 12:42:38 EDT 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
- Microarchitectural Data Sampling: Not affected
- CVE-2017-5754 (Meltdown): Mitigation: Speculative Store Bypass disabled via prctl
- CVE-2018-3639 (Speculative Store Bypass): Mitigation: usercopy/swapgs barriers and __user pointer sanitation
- CVE-2017-573 (Spectre variant 1): Mitigation: Retpolines, IBPB: conditional, IBRS_FW, STIBP: disabled, RSB filling
- CVE-2017-5715 (Spectre variant 2): Not affected
- CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
- CVE-2019-11135 (TSX Asynchronous Abort): Not affected

```
runit-level 3 Apr 7 05:30
```

```
SPEC is set to: /home/CPU2017
```

```
Filesystem  Type Size Used Avail Use% Mounted on
/dev/mapper/rhel-home xfs  819G  23G  796G  3% /home
```

From /sys/devices/virtual/dmi/id
```
Vendor:          HPE
Product:         ProLiant DL345 Gen11
Product Family:  ProLiant
Serial:          DL345G11-004
```

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:
   12x Hynix HMCG88MEBRA113N 32 GB 2 rank 4800
```

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

**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

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<td>AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)</td>
<td></td>
</tr>
</tbody>
</table>
| Target: x86_64-unknown-linux-gnu  
| Thread model: posix  
| InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin |

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| 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 |
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| InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin |

<table>
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<tr>
<th>Fortran</th>
<th>603.bwaves_s(base, peak) 649.fotonik3d_s(base, peak) 654.roms_s(base, peak)</th>
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</table>
(Continued on next page)
Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL345 Gen11
(2.25 GHz, AMD EPYC 9634)

SPECspeed®2017_fp_base = 283
SPECspeed®2017_fp_peak = 293

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

Compiler Version Notes (Continued)

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, C      | 621.wrf_s(base, peak) 627.cam4_s(base, peak)
| 628.pop2_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
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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

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

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL345 Gen11
(2.25 GHz, AMD EPYC 9634)

SPECspeed®2017_fp_base = 283
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CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

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Base Portability Flags (Continued)

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 -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-limit=50 -mllvm -inline-limit=1000
-freemap-arrays -fstrip-mining -mllvm -reduce-array-computations=3
-DSPEC_OPENMP -zopt -fopenmp=libomp -lomp -lamdlibm -lamdaloc
-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 -lamdaloc -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-limit=50 -mllvm -inline-limit=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 -lamdaloc -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

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

Benchmarks using Fortran, C, and C++ (continued):
-mlir -unroll-threshold=50 -mlir -inline-threshold=1000
-fremap-arrays -fstrip-mining -mlir -reduce-array-computations=3
-DSPEC_OPENMP -zopt -mlir -unroll-threshold=100 -finline-aggressive
-mlir -loop-unswitch-threshold=200000 -Mrecursive -funroll-loops
-mlir -lsr-in-nested-loop -fopenmp=libomp -lomp -lamdlibm -lamdaloc
-lflang

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
Hewlett Packard Enterprise  
(Test Sponsor: HPE)  
ProLiant DL345 Gen11  
(2.25 GHz, AMD EPYC 9634)  

<table>
<thead>
<tr>
<th>SPECspeed®2017_fp_base</th>
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<tr>
<td>SPECspeed®2017_fp_peak</td>
<td>293</td>
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CPU2017 License: 3  
Test Sponsor: HPE  
Tested by: HPE  

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<td>Hardware Availability</td>
<td>Dec-2022</td>
</tr>
<tr>
<td>Software Availability</td>
<td>Nov-2022</td>
</tr>
</tbody>
</table>

Peak Optimization Flags

C benchmarks:
- 619.lbm_s: basepeak = yes
- 638.imagick_s: basepeak = yes
- 644.nab_s: basepeak = yes

Fortran benchmarks:
- 603.bwaves_s: basepeak = yes

Fortran benchmarks:
- 649.fotonik3d_s: -m64 -Wl,-mlvm -Wl,-align-all-nofallthru-blocks=6
- Wl,-mlvm -Wl,-reduce-array-computations=3
- Wl,-mlvm -Wl,-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 -flang

Benchmarks using both Fortran and C:
- 621.wrf_s: -m64 -Wl,-mlvm -Wl,-align-all-nofallthru-blocks=6
- Wl,-mlvm -Wl,-reduce-array-computations=3
- Wl,-mlvm -Wl,-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 -flang

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

Hewlett Packard Enterprise
(Test Sponsor: HPE)
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Test Sponsor: HPE
Tested by: HPE
Test Date: Jan-2023
Hardware Availability: Dec-2022
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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
-1flang

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
-ffto -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 -1flang

Benchmarks using Fortran, C, and C++:
607.cactuBSSN_s: basepeak = yes

Peak 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

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-Genoa-rev2.1.html
http://www.spec.org/cpu2017/flags/aocc400-flags.html

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/aocc400-flags.xml
Hewlett Packard Enterprise
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