### Hewlett Packard Enterprise

*Test Sponsor: HPE*

**ProLiant DL345 Gen10 Plus**  
(3.50 GHz, AMD EPYC 73F3)

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<table>
<thead>
<tr>
<th>Test Sponsor:</th>
<th>HPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU2017 License:</td>
<td>3</td>
</tr>
<tr>
<td>Tested by:</td>
<td>HPE</td>
</tr>
<tr>
<td>Test Date:</td>
<td>Mar-2021</td>
</tr>
<tr>
<td>Hardware Availability:</td>
<td>Jun-2021</td>
</tr>
<tr>
<td>Software Availability:</td>
<td>Mar-2021</td>
</tr>
</tbody>
</table>

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#### Hardware

| CPU Name: | AMD EPYC 73F3 |
| Max MHz: | 4000 |
| Nominal: | 3300 |
| Enabled: | 16 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 / 2 cores |
| Other: | None |
| Memory: | 1 TB (8 x 128 GB 4Rx4 PC4-3200AA-L) |
| Storage: | 1 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 Feb-2021 |
| File System: | ext4 |
| System State: | Run level 5 (multi-user) |
| Base Pointers: | 64-bit |
| Peak Pointers: | 64-bit |
| Other: | jemalloc: jemalloc memory allocator library v5.1.0 |
| Power Management: | BIOS and OS set to prefer performance at the cost of additional power usage |

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#### Performance

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>SPECspeed\textsuperscript{2017_fp_base}</th>
<th>SPECspeed\textsuperscript{2017_fp_peak}</th>
</tr>
</thead>
<tbody>
<tr>
<td>603.bwaves_s</td>
<td>16</td>
<td>160</td>
<td>155</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>16</td>
<td>160</td>
<td>155</td>
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<tr>
<td>619.lbm_s</td>
<td>32</td>
<td>155</td>
<td>151</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>16</td>
<td>151</td>
<td>141</td>
</tr>
<tr>
<td>627.cam4_s</td>
<td>32</td>
<td>141</td>
<td>132</td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>16</td>
<td>132</td>
<td>131</td>
</tr>
<tr>
<td>638.imagick_s</td>
<td>16</td>
<td>131</td>
<td>130</td>
</tr>
<tr>
<td>644.nab_s</td>
<td>32</td>
<td>130</td>
<td>130</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>16</td>
<td>130</td>
<td>130</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>16</td>
<td>130</td>
<td>130</td>
</tr>
</tbody>
</table>

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SPEC CPU\textsuperscript{2017 Floating Point Speed Result}  
Copyright 2017-2021 Standard Performance Evaluation Corporation
### Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Base</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Peak</th>
<th>Seconds</th>
<th>Ratio</th>
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</thead>
<tbody>
<tr>
<td>603.bwaves_s</td>
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<td>144</td>
<td>409</td>
<td>145</td>
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<td>16</td>
<td>144</td>
<td>409</td>
<td>145</td>
<td>408</td>
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<td>408</td>
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<tr>
<td>607.cactuBSSN_s</td>
<td>16</td>
<td>100</td>
<td>166</td>
<td>101</td>
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<td>16</td>
<td>100</td>
<td>166</td>
<td>104</td>
<td>161</td>
<td>100</td>
<td>166</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>16</td>
<td>87.6</td>
<td>59.7</td>
<td>87.6</td>
<td>59.8</td>
<td>87.3</td>
<td>60.0</td>
<td>32</td>
<td>72.5</td>
<td>72.2</td>
<td>72.4</td>
<td>72.3</td>
<td>72.5</td>
<td>72.2</td>
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<tr>
<td>621.wrf_s</td>
<td>16</td>
<td>87.6</td>
<td>151</td>
<td>87.6</td>
<td>151</td>
<td>86.7</td>
<td>151</td>
<td>16</td>
<td>89.2</td>
<td>148</td>
<td>87.6</td>
<td>151</td>
<td>87.6</td>
<td>151</td>
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<tr>
<td>627.cam4_s</td>
<td>16</td>
<td>121</td>
<td>73.5</td>
<td>120</td>
<td>73.6</td>
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<td>16</td>
<td>133</td>
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<td>134</td>
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<td>16</td>
<td>113</td>
<td>155</td>
<td>112</td>
<td>155</td>
<td>113</td>
<td>155</td>
<td>32</td>
<td>89.4</td>
<td>195</td>
<td>89.5</td>
<td>195</td>
<td>89.4</td>
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</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>16</td>
<td>122</td>
<td>74.5</td>
<td>123</td>
<td>74.2</td>
<td>123</td>
<td>74.4</td>
<td>16</td>
<td>122</td>
<td>74.5</td>
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<td>74.2</td>
<td>123</td>
<td>74.4</td>
</tr>
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<td>141</td>
<td>16</td>
<td>103</td>
<td>153</td>
<td>103</td>
<td>147</td>
<td>103</td>
<td>147</td>
</tr>
</tbody>
</table>

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

### Compiler Notes


### Submit Notes

The config file option 'submit' was used.

### Operating System Notes

- 'ulimit -s unlimited' was used to set environment stack size.
- 'ulimit -l 2097152' was used to set environment locked pages in memory limit.
- runcpu command invoked through numactl i.e.:
  `numactl --interleave=all runcpu <etc>`
- 'echo 8 > /proc/sys/vm/dirty_ratio' run as root to limit dirty cache to 8% of memory.
- 'echo 1 > /proc/sys/vm/swappiness' run as root to limit swap usage to minimum necessary.
- 'echo 1 > /proc/sys/vm/zone_reclaim_mode' run as root to free node-local memory and avoid remote memory usage.
- 'sync; echo 3 > /proc/sys/vm/drop_caches' run as root to reset filesystem caches.
- 'sysctl -w kernel.randomize_va_space=0' run as root to disable address space layout randomization (ASLR) to reduce run-to-run variability.

To enable Transparent Hugepages (THP) for all allocations,
Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL345 Gen10 Plus
(3.50 GHz, AMD EPYC 73F3)

SPECspeed®2017_fp_base = 121
SPECspeed®2017_fp_peak = 130

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 enable THP only on request for peak runs of 628.pop2_s, and 638.imagick_s,
'echo madvise > /sys/kernel/mm/transparent_hugepage/enabled' run as root.
To disable THP for peak runs of 627.cam4_s, 644.nab_s, 649.fotonik3d_s, and 654.roms_s,
'echo never > /sys/kernel/mm/transparent_hugepage/enabled' run as root.

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
GOMP_CPU_AFFINITY = "0-31"
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_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "32"

Environment variables set by runcpu during the 607.cactuBSSN_s peak run:
GOMP_CPU_AFFINITY = "0-15"

Environment variables set by runcpu during the 619.lbm_s peak run:
GOMP_CPU_AFFINITY = "0 16 1 17 2 18 3 19 4 20 5 21 6 22 7 23 8 24 9 25 10 26 11 27 12 28 13 29 14 30 15 31"

Environment variables set by runcpu during the 621.wrf_s peak run:
GOMP_CPU_AFFINITY = "0-15"

Environment variables set by runcpu during the 627.cam4_s peak run:
GOMP_CPU_AFFINITY = "0 16 1 17 2 18 3 19 4 20 5 21 6 22 7 23 8 24 9 25 10 26 11 27 12 28 13 29 14 30 15 31"

Environment variables set by runcpu during the 644.nab_s peak run:
GOMP_CPU_AFFINITY = "0 16 1 17 2 18 3 19 4 20 5 21 6 22 7 23 8 24 9 25 10 26 11 27 12 28 13 29 14 30 15 31"

Environment variables set by runcpu during the 654.roms_s peak run:
GOMP_CPU_AFFINITY = "0-15"
SPEC CPU®2017 Floating Point Speed Result

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL345 Gen10 Plus
(3.50 GHz, AMD EPYC 73F3)

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<th>SPECspeed®2017_fp_peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>121</td>
<td>130</td>
</tr>
</tbody>
</table>

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

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

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.

jemalloc: configured and built with GCC v4.8.2 in RHEL 7.4
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
Thermal Configuration set to Maximum Cooling
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
Infinity Fabric Power Management set to Disabled
Infinity Fabric Performance State set to P0
Workload Profile set to Custom
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 Wed Apr 1 17:33:26 2020

SUT (System Under Test) info as seen by some common utilities. For more information on this section, see
https://www.spec.org/cpu2017/Docs/config.html#sysinfo

From /proc/cpuinfo
  model name : AMD EPYC 73F3 16-Core Processor
  1 "physical id"s (chips)
  32 "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 : 16
siblings : 32
physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

From lscpu:

(Continued on next page)
Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL345 Gen10 Plus
(3.50 GHz, AMD EPYC 73F3)

SPECspeed®2017_fp_base = 121
SPECspeed®2017_fp_peak = 130

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

Platform Notes (Continued)

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): 32
On-line CPU(s) list: 0-31
Thread(s) per core: 2
Core(s) per socket: 16
Socket(s): 1
NUMA node(s): 8
Vendor ID: AuthenticAMD
CPU family: 25
Model: 1
Model name: AMD EPYC 73F3 16-Core Processor
Stepping: 1
Frequency boost: enabled
CPU MHz: 1793.590
CPU max MHz: 3500.0000
CPU min MHz: 1500.0000
BogoMIPS: 6986.82
Virtualization: AMD-V
L1d cache: 512 KiB
L1i cache: 512 KiB
L2 cache: 8 MiB
L3 cache: 256 MiB
NUMA node0 CPU(s): 0,1,16,17
NUMA node1 CPU(s): 2,3,18,19
NUMA node2 CPU(s): 4,5,20,21
NUMA node3 CPU(s): 6,7,22,23
NUMA node4 CPU(s): 8,9,24,25
NUMA node5 CPU(s): 10,11,26,27
NUMA node6 CPU(s): 12,13,28,29
NUMA node7 CPU(s): 14,15,30,31
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 and seccomp
Vulnerability Spectre v1: Mitigation; usercopy/swapgs barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Full AMD retpoline, IBFB conditional, IBRS_FW, STIBF 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

(Continued on next page)
Hewlett Packard Enterprise  
(Test Sponsor: HPE)  
ProLiant DL345 Gen10 Plus  
(3.50 GHz, AMD EPYC 73F3)  
SPEC speed  
SPECspeed®2017_fp_base = 121  
SPECspeed®2017_fp_peak = 130

Platform Notes (Continued)

dpdep1gb rdtscp lm constant_tsc rep_good nop1 nonstop_tsc cpuid extd_apicid aperfmpref pni pclmulqdq monitor ssse3 fma cx16 pcid sse4.1 sse4.2 movbe popcnt aes xsave avx f16c rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse 3nowprefetch osvw ibs skinit wdt tce topoext perfctr_core perfctr_nb bext perfctr_llc mwaitx cpb cat_l3 cdp_l3 invpcid_single hw_pstate ssbd mba ibrs ibpb stibp vmmcall fsqsbme bml1 avx2 smp bmi2 invpcid cqm rdt_a rdseed adx smap clfushopt clwb sha_ni xsaveopt xsavec xgetbv1 xseaves cqm_llc cqm_occup_llc cqm_mmb_total cqm_mmb_local clzero irperf xsaver pr xsaveopt wboinvd arat npt lbv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter pfthreshold v_vmsave_vmload vgiff umip pk us pcke 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 16 17
node 0 size: 128777 MB
node 0 free: 128401 MB
node 1 cpus: 2 3 18 19
node 1 size: 129022 MB
node 1 free: 128811 MB
node 2 cpus: 4 5 20 21
node 2 size: 129022 MB
node 2 free: 128872 MB
node 3 cpus: 6 7 22 23
node 3 size: 129022 MB
node 3 free: 128811 MB
node 4 cpus: 8 9 24 25
node 4 size: 129022 MB
node 4 free: 128884 MB
node 5 cpus: 10 11 26 27
node 5 size: 129022 MB
node 5 free: 128884 MB
node 6 cpus: 12 13 28 29
node 6 size: 129022 MB
node 6 free: 128916 MB
node 7 cpus: 14 15 30 31
node 7 size: 129022 MB
node 7 free: 128968 MB
node distances:

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

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Hewlett Packard Enterprise
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SPECspeed®2017_fp_base = 121
SPECspeed®2017_fp_peak = 130

Platform Notes (Continued)

4:  12  12  12  12  10  11  11  11
5:  12  12  12  12  11  10  11  11
6:  12  12  12  12  11  11  10  11
7:  12  12  12  12  11  11  11  10

From /proc/meminfo
MemTotal:            1056661932 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
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 and seccomp
CVE-2018-3639 (Speculative Store Bypass): Mitigation: usercopy/swapsgs barriers and __user pointer sanitization
CVE-2017-5753 (Spectre variant 1): Mitigation: Full AMD retpoline, IBPB: conditional, IBRS_FW, STIBP: always-on, RSB filling
CVE-2017-5715 (Spectre variant 2):
Hewlett Packard Enterprise
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SPECspeed®2017_fp_peak = 130

CPU2017 License: 3
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Platform Notes (Continued)

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

run-level 5 Apr 1 17:23

SPEC is set to: /home/SPEC_CPU2017/cpu2017
Filesystem Type Size Used Avail Use% Mounted on
/dev/mapper/ubuntu--vg-ubuntu--lv ext4 196G 81G 106G 44% /

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

(Continued on next page)
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SPECspeed®2017_fp_base = 121
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Compiler Version Notes (Continued)

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

AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on
LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin

AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on
LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin

Fortran | 603.bwaves_s(base, peak) 649.fotonik3d_s(base, peak) 654.roms_s(base, peak)

AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on
LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin

Fortran, C | 621.wrf_s(base, peak) 627.cam4_s(base, peak) 628.pop2_s(base, peak)

AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on
LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin
Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL345 Gen10 Plus
(3.50 GHz, AMD EPYC 73F3)

SPECspeed®2017_fp_base = 121
SPECspeed®2017_fp_peak = 130

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

Base Compiler Invocation

C benchmarks:
clang

Fortran benchmarks:
flang

Benchmarks using both Fortran and C:
flang clang

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

Base Portability Flags

603.bwaves_s: -DSPEC_LP64
607.cactuBSSN_s: -DSPEC_LP64
619.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
-fvcclib=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-lcm-vrp -mllvm -reduce-array-computations=3 -z muldefs
-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc
-lflang -lflangrti

Fortran benchmarks:
-m64 -mno-adx -mno-sse4a -Wl,-mllvm -Wl,-enable-X86-prefetching

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

### Fortran benchmarks (continued):
- `-Wl,-mllvm -Wl,-enable-licm-vrp -Wl,-mllvm -Wl,-region-vectorize`
- `-Wl,-mllvm -Wl,-function-specialize`
- `-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6`
- `-Wl,-mllvm -Wl,-reduce-array-computations=3 -Hz,1,0x1 -O3`
- `-march=znver3 -fveclib=AMDLIBM -ffast-math -Mrecursive`
- `-mllvm -fuse-tile-inner-loop -funroll-loops`
- `-mllvm -extra-vectorizer-passes -mllvm -lsr-in-nested-loop`
- `-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3`
- `-mllvm -global-vectorize-slp=true -z muldefs -DSPEC_OPENMP -fopenmp`
- `-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang -lflangrti`

### Benchmarks using both Fortran and C:
- `-m64 -mno-adx -mno-sse4a -Wl,-mllvm -Wl,-enable-X86-prefetching`
- `-Wl,-mllvm -Wl,-enable-licm-vrp -Wl,-mllvm -Wl,-region-vectorize`
- `-Wl,-mllvm -Wl,-function-specialize`
- `-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6`
- `-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver3`
- `-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5`
- `-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000`
- `-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,1,0x1`
- `-Mrecursive -mllvm -fuse-tile-inner-loop -funroll-loops`
- `-mllvm -extra-vectorizer-passes -mllvm -lsr-in-nested-loop -z muldefs`
- `-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc`
- `-lflang -lflangrti`

### Benchmarks using Fortran, C, and C++:
- `-m64 -mno-adx -mno-sse4a -std=c++98`
- `-Wl,-mllvm -Wl,-x86-use-vzeroupper=false`
- `-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-function-specialize`
- `-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6`
- `-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver3`
- `-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5`
- `-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000`
- `-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,1,0x1 -Mrecursive -mllvm -fuse-tile-inner-loop -funroll-loops`
- `-mllvm -lsr-in-nested-loop -z muldefs -DSPEC_OPENMP -fopenmp`
- `-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang -lflangrti`
SPEC CPU®2017 Floating Point Speed Result

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL345 Gen10 Plus
(3.50 GHz, AMD EPYC 73F3)

<table>
<thead>
<tr>
<th>SPECspeed®2017_fp_base</th>
<th>121</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECspeed®2017_fp_peak</td>
<td>130</td>
</tr>
</tbody>
</table>

CPU2017 License: 3
Test Sponsor: HPE
Test Date: Mar-2021

Tested by: HPE
Hardware Availability: Jun-2021

Software Availability: Mar-2021

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
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-mllvm -global-vectorize-slp=true
-mllvm -function-specialize -mllvm -enable-licm-vrp
-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -fopenmp
-fopenmp=libomp -lomp -ljemalloc -lflang

638.imagick_s: basepeak = yes

644.nab_s: -m64 -mno-adx -mno-sse4a -Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-function-specialize -Ofast -march=znver3
-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5
-mllvm -unroll-threshold=50 -fremap-arrays
-flv-function-specialization -mllvm -inline-threshold=1000
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true
-mllvm -function-specialize -mllvm -enable-licm-vrp
-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -fopenmp
-fopenmp=libomp -lomp -ljemalloc -lflang

Fortran benchmarks:

603.bwaves_s: basepeak = yes

649.fotonik3d_s: basepeak = yes

654.roms_s: -m64 -mno-adx -mno-sse4a
-Wl,-mllvm -Wl,-enable-X86-prefetching
-Wl,-mllvm -Wl,-enable-licm-vrp
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math -Mrecursive
-mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -mllvm -enable-licm-vrp
-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -ljemalloc -lflang

Benchmarks using both Fortran and C:

621.wrf_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

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

621.wrf_s (continued):
-arch=znver3 -fveclib=AMDLIBM -ffast-math -flto
-fstruct-layout=5 -mllvm -unroll-threshold=50
-fremap-arrays -flv-function-specialization
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-mllvm -global-vectorize-slp=true
-mllvm -function-specialize -mllvm -enable-lcm-vrp
-mllvm -reduce-array-computations=3 -Hz,1,0xl -O3
-Mrecursive -mllvm -fuse-tile-inner-loop -funroll-loops
-mllvm -extra-vectorizer-passes -mllvm -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-lcm-vrp
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthr-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-arch=znver3 -fveclib=AMDLIBM -ffast-math -flto
-fstruct-layout=5 -mllvm -unroll-threshold=50
-fremap-arrays -flv-function-specialization
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-mllvm -global-vectorize-slp=true
-mllvm -function-specialize -mllvm -enable-lcm-vrp
-mllvm -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++:
-m64 -mno-adx -mno-sse4a -std=c++98
-Wl,-mllvm -Wl,-x86-use-vzeroupper=false -Wl,-mllvm -Wl,-enable-lcm-vrp
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthr-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast -arch=znver3
-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5
-mllvm -unroll-threshold=50 -fremap-arrays -flv-function-specialization
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-mllvm -global-vectorize-slp=true -mllvm -function-specialize
-mllvm -enable-lcm-vrp -mllvm -reduce-array-computations=3
-finline-aggressive -mllvm -unroll-threshold=100 -mllvm -reroll-loops
-mllvm -aggressive-loop-unswitch -Mrecursive -DSPEC_OPENMP -fopenmp
-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
# SPEC CPU®2017 Floating Point Speed Result

## Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL345 Gen10 Plus

(3.50 GHz, AMD EPYC 73F3)

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<td>130</td>
<td>121</td>
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</table>

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

## Peak Other Flags

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

**Fortran benchmarks:**  
-Wno-unused-command-line-argument -Wno-return-type

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

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

The flags files that were used to format this result can be browsed at

http://www.spec.org/cpu2017/flags/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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For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

Tested with SPEC CPU®2017 v1.1.5 on 2020-04-01 13:33:26-0400.  
Originally published on 2021-05-25.