# SPEC CPU®2017 Integer Speed Result

**Hewlett Packard Enterprise**

(Test Sponsor: HPE)

ProLiant DL345 Gen10 Plus

(3.70 GHz, AMD EPYC 72F3)

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

---

<table>
<thead>
<tr>
<th>Threads</th>
<th>SPECspeed®2017_int_base = 13.3</th>
<th>SPECspeed®2017_int_peak = 13.3</th>
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<tbody>
<tr>
<td>600.perlbench_s</td>
<td>8</td>
<td>7.68</td>
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<tr>
<td>602.gcc_s</td>
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<td>641.leela_s</td>
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<td>648.exchange2_s</td>
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</tr>
<tr>
<td>657.xz_s</td>
<td>8</td>
<td>19.4</td>
</tr>
</tbody>
</table>

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**Hardware**

- **CPU Name:** AMD EPYC 72F3  
- **Max MHz:** 4100  
- **Nominal:** 3700  
- **Enabled:** 8 cores, 1 chip  
- **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 per core  
- **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:** 5.4.0-42-generic  
- **Compiler:** C/C++/Fortran: Version 3.0.0 of AOCC  
- **Parallel:** Yes  
- **Firmware:** HPE BIOS Version A43 v2.42 04/15/2021 released Apr-2021  
- **File System:** ext4  
- **System State:** Run level 5 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 64-bit  
- **Other:** jemalloc: jemalloc memory allocator library v5.1.0  
- **Power Management:** BIOS set to prefer performance at the cost of additional power usage
## Results Table

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<td>19.4</td>
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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 AOCC Compiler Suite is available at http://developer.amd.com/amd-aocc/

## Submit Notes

The config file option 'submit' was used.

## Operating System Notes

'ulimit -s unlimited' was used to set environment stack size
'ulimit -1 2097152' was used to set environment locked pages in memory limit

runcpu command invoked through 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.
'echo always > /sys/kernel/mm/transparent_hugepage/enabled' and
'echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root to enable

(Continued on next page)
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SPECspeed®2017_int_peak = 13.3

Operating System Notes (Continued)

Transparent Hugepages (THP) for this run.
'echo madvise > /sys/kernel/mm/transparent_hugepage/enabled' run as root for peak
runs of 628.pop2_s and 638.imagick_s to enable THP only on request.

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
GOMP_CPU_AFFINITY = "0-7"
LD_LIBRARY_PATH =
"/home/SPEC_CPU2017/amd_speed_aocc300_milan_B_lib/64;/home/SPEC_CPU2017/
    amd_speed_aocc300_milan_B_lib/32:"
MALLOC_CONF = "retain:true"
OMP_DYNMATIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "8"

Environment variables set by runcpu during the 657.xz_s peak run:
GOMP_CPU_AFFINITY = "0-7"

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

Submitted_by: "Bhatnagar, Prateek" <prateek.bhatnagar@hpe.com>
Submitted: Mon May 24 12:30:16 EDT 2021
Submission: cpu2017-20210524-26392.sub

Platform Notes

BIOS Configuration
Workload Profile set to General Peak Frequency Compute
AMD SMT Option set to Disabled
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Hewlett Packard Enterprise
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ProLiant DL345 Gen10 Plus
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SPECspeed®2017_int_base = 13.3
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CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Platform Notes (Continued)

Determinism Control set to Manual
Performance Determinism set to Power Deterministic
Last-Level Cache (LLC) as NUMA Node set to Enabled
NUMA memory domains per socket set to One memory domain per socket
Thermal Configuration set to Maximum Cooling
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/bin/sysinfo
Rev: r6538 of 2020-09-24 e8664e66d2d7080afea89d4b38e2f1c
running on ubuntu Wed Apr 1 10:31:01 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 72F3 8-Core Processor
   "physical id"s (chips)
   8 "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 : 8
   siblings : 8
   physical 0: cores 0 1 2 3 4 5 6 7

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): 8
   On-line CPU(s) list: 0-7
   Thread(s) per core: 1
   Core(s) per socket: 8
   Socket(s): 1
   NUMA node(s): 8
   Vendor ID: AuthenticAMD
   CPU family: 25
   Model: 1
   Model name: AMD EPYC 72F3 8-Core Processor
   Stepping: 1
   Frequency boost: enabled
   CPU MHz: 1437.355
   CPU max MHz: 3700.000

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Hewlett Packard Enterprise  
ProLiant DL345 Gen10 Plus  
(3.70 GHz, AMD EPYC 72F3)  

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

Platform Notes (Continued)

- CPU min MHz: 1500.0000
- BogoMIPS: 7386.67
- Virtualization: AMD-V
- L1d cache: 256 KiB
- L1i cache: 256 KiB
- L2 cache: 4 MiB
- L3 cache: 256 MiB
- NUMA node0 CPU(s): 0
- NUMA node1 CPU(s): 1
- NUMA node2 CPU(s): 2
- NUMA node3 CPU(s): 3
- NUMA node4 CPU(s): 4
- NUMA node5 CPU(s): 5
- NUMA node6 CPU(s): 6
- NUMA node7 CPU(s): 7
- 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 sanitation
- Vulnerability Spectre v2: Mitigation; Full AMD retpoline, IBPB conditional, IBRS_FW, STIBF disabled, RSB filling
- Vulnerability Srbds: Not affected
- Vulnerability Tsz async abort: Not affected
- Flags: fpu vme de pse36 cmov pat pse36 clflush mmx fxsr sse sse2 ht syscall nx mmxext fxsr_opt pdpe1gb rdtscp lm constant_tsc rep_good nopl nonstop_tsc cpuid extd_apicid aperfmperf pni pclmulqdq monitor ssse3 fma cx16 pcid sse4_1 sse4_2 movbe popcnt aes xsave avx f16c rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse 3dnowprefetch osvw ibr mbind mce lms init wdt tce topoext perfctr_core perfctr_nb bext perfctr_llc mwaitx cpb cat_l3 dcp_l3 invpcid_single hw_pstate ssbd mba ibrs ibpb stibp vmmcall fsgsbase bni avx2 smep bmi2 invpcid cqm rdt_a rdseed adx smap clflushopt clwb sha ni xsaveopt xsaves xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbb_total cqm_mbb_local clzero irperf xsaveprtr wbinvd arat npt lbv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid codecassists pausefilter pfthreshold v_vmsave_vmload vgif umip pku ospke vaes vpcmlogdq rdpid overflow_reco exit 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

(Continued on next page)
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ProLiant DL345 Gen10 Plus
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SPECspeed®2017_int_base = 13.3
SPECspeed®2017_int_peak = 13.3

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

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

Platform Notes (Continued)

node 0 size: 128776 MB
node 0 free: 128324 MB
node 1 cpus: 1
node 1 size: 129023 MB
node 1 free: 128916 MB
node 2 cpus: 2
node 2 size: 129023 MB
node 2 free: 128935 MB
node 3 cpus: 3
node 3 size: 129023 MB
node 3 free: 128929 MB
node 4 cpus: 4
node 4 size: 129023 MB
node 4 free: 128823 MB
node 5 cpus: 5
node 5 size: 129023 MB
node 5 free: 128916 MB
node 6 cpus: 6
node 6 size: 128999 MB
node 6 free: 128823 MB
node 7 cpus: 7
node 7 size: 116910 MB
node 7 free: 116810 MB
node distances:

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</table>

From /proc/meminfo
MemTotal: 1044279788 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

/sys/devices/system/cpu/cpu*/cpufreq/scaling_governor has ondemand

/usr/bin/lsb_release -d
Ubuntu 20.04.1 LTS

From /etc/*release* /etc/*version*
debian_version: bullseye/sid

(Continued on next page)
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SPECspeed®2017_int_base = 13.3
SPECspeed®2017_int_peak = 13.3

CPU2017 License: 3
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Tested by: HPE

Platform Notes (Continued)

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 ubuntu 5.4.0-42-generic #46-Ubuntu SMP Fri Jul 10 00:24:02 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/swappgs barriers and __user pointer sanitization
CVE-2017-5753 (Spectre variant 1): Mitigation: Full AMD retpoline, IBPB: conditional, IBRS_FW, STIBP: disabled, RSB filling
CVE-2017-5715 (Spectre variant 2):
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort): Not affected

run-level 5 Apr 1 10:23

SPEC is set to: /home/SPEC_CPU2017
Filesystem Type Size Used Avail Use% Mounted on
/dev/mapper/vgubuntu-root ext4 365G 25G 322G 8% /

From /sys/devices/virtual/dmi/id
Vendor: HPE
Product: ProLiant DL345 Gen10 Plus
Product Family: ProLiant
Serial: J20APP0014

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

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

frequent changes to hardware, firmware, and the "DMTF SMBIOS" standard.

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

| BIOS:   | BIOS Vendor: HPE  
|         | BIOS Version: A43  
|         | BIOS Date: 04/15/2021  
|         | BIOS Revision: 2.42  
|         | Firmware Revision: 2.40 |

(End of data from sysinfo program)

## Compiler Version Notes

<table>
<thead>
<tr>
<th>C</th>
<th>600.perlbench_s(base, peak) 602.gcc_s(base, peak) 605.mcf_s(base, peak) 625.x264_s(base, peak) 657.xz_s(base, peak)</th>
</tr>
</thead>
</table>

- **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

<table>
<thead>
<tr>
<th>C++</th>
<th>620.omnetpp_s(base, peak) 623.xalancbmk_s(base, peak) 631.deepsjeng_s(base, peak) 641.leela_s(base, peak)</th>
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</table>

- **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

<table>
<thead>
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<th>Fortran</th>
<th>648.exchange2_s(base, peak)</th>
</tr>
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- **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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Hardware Availability: Jun-2021
Software Availability: Mar-2021

Compiler Version Notes (Continued)

Base Compiler Invocation

C benchmarks:
clang

C++ benchmarks:
clang++

Fortran benchmarks:
flang

Base Portability Flags

600.perlbench_s: -DSPEC_LINUX_X64 -DSPEC_LP64
602.gcc_s: -DSPEC_LP64
605.mcf_s: -DSPEC_LP64
620.omnetpp_s: -DSPEC_LP64
623.xalancbmk_s: -DSPEC_LINUX -DSPEC_LP64
625.x264_s: -DSPEC_LP64
631.deepsjeng_s: -DSPEC_LP64
641.leela_s: -DSPEC_LP64
648.exchange2_s: -DSPEC_LP64
657.xz_s: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-m64 -mno-adx -mno-sse4a -Wl,-allow-multiple-definition
-Wl,-mllvm -Wl,-enable-lcm-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 -03 -march=znver3
-fveclib=AMDLIBM -ffast-math -f1to -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

(Continued on next page)
Hewlett Packard Enterprise

ProLiant DL345 Gen10 Plus
(3.70 GHz, AMD EPYC 72F3)

SPEC CPU®2017 Integer Speed Result

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SPECspeed®2017_int_base = 13.3
SPECspeed®2017_int_peak = 13.3

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

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

Base Optimization Flags (Continued)

C++ benchmarks:
- -m64 -std=c++98 -mno-adx -mno-sse4a
- -Wl,-mllvm -Wl,-do-block-reorder=aggressive
- -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 -mllvm -enable-partial-unswitch
- -mllvm -unroll-threshold=100 -finline-aggressive
- -flv-function-specialization -mllvm -loop-unswitch-threshold=200000
- -mllvm -reroll-loops -mllvm -aggressive-loop-unswitch
- -mllvm -extra-vectorizer-passes -mllvm -reduce-array-computations=3
- -mllvm -global-vectorize-slp=true -mllvm -convert-pow-exp-to-int=false
- -z muldefs -mllvm -do-block-reorder=aggressive
- -fvirtual-function-elimination -fvisibility=hidden -DSPEC_OPENMP
- -fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
- -lflangrti

Fortran benchmarks:
- -m64 -mno-adx -mno-sse4a -Wl,-mllvm -Wl,-inline-recursion=4
- -Wl,-mllvm -Wl,-lsr-in-nested-loop -Wl,-mllvm -Wl,-enable-iv-split
- -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 -z muldefs
- -mllvm -unroll-aggressive -mllvm -unroll-threshold=150 -DSPEC_OPENMP
- -fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
- -lflangrti

Base Other Flags

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

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

Fortran benchmarks:
- -Wno-return-type
# SPEC CPU®2017 Integer Speed Result

## Hewlett Packard Enterprise

(3.70 GHz, AMD EPYC 72F3)

<table>
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<th>SPECspeed®2017_int_base</th>
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**CPU2017 License:** 3  
**Test Sponsor:** HPE  
**Tested by:** HPE  
**Test Date:** May-2021  
**Hardware Availability:** Jun-2021  
**Software Availability:** Mar-2021

## Peak Compiler Invocation

**C benchmarks:**  
clang

**C++ benchmarks:**  
clang++

**Fortran benchmarks:**  
flang

## Peak Portability Flags

Same as Base Portability Flags

## Peak Optimization Flags

**C benchmarks:**

- 600.perlbench_s: basepeak = yes
- 602.gcc_s: basepeak = yes
- 605.mcf_s: basepeak = yes
- 625.x264_s: basepeak = yes

- 657.xz_s: -m64 -mno-adx -mno-sse4a -Wl,-allow-multiple-definition
- -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
- -freemap-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 -lamdlibm -ljemalloc -lflang

**C++ benchmarks:**

(Continued on next page)
Hewlett Packard Enterprise  
(Tes Sponsor: HPE)  
ProLiant DL345 Gen10 Plus  
(3.70 GHz, AMD EPYC 72F3)  

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

### Peak Optimization Flags (Continued)

620.omnetpp_s: basepeak = yes  
623.xalancbmk_s: basepeak = yes  
631.deepsjeng_s: basepeak = yes  
641.leela_s: basepeak = yes  

Fortran benchmarks:  
648.exchange2_s: basepeak = yes

### Peak Other Flags

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

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

Fortran benchmarks:  
-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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