SPEC CPU®2017 Integer Speed Result

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

SPECspeed®2017_int_base = 13.5
SPECspeed®2017_int_peak = 13.5

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

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

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</table>

--- SPECspeed®2017_int_base (13.5) ---

--- SPECspeed®2017_int_peak (13.5) ---

### Hardware

**CPU Name:** AMD EPYC 73F3
**Max MHz:** 4000
**Nominal:** 3500
**Enabled:** 16 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 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
Results Table

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<thead>
<tr>
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<td>115</td>
<td>25.6</td>
<td>114</td>
<td>25.7</td>
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</table>

**Resultsappear 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/defrag' run as root to enable transparent huge page (THP) usage.

(Continued on next page)
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 = "0-15"
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;"
MALLOCONF = "retain:true"
OMP_DYNAMIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "16"

Environment variables set by runcpu during the 657.xz_s peak run:
GOMP_CPU_AFFINITY = "0-15"

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
AMD SMT Option set to Disabled
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 Two memory domains per socket

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

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<td><strong>Tested by:</strong> HPE</td>
<td><strong>Software Availability:</strong> Mar-2021</td>
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</tbody>
</table>

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**Platform Notes (Continued)**

- 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/cpu2017/bin/sysinfo
Rev: r6538 of 2020-09-24 e8664e66d2d7080afeaa89d4b38e2f1c
running on admin Wed Apr 1 17:37:41 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)`
- `16 "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 : 16`
  - `physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15`

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): 16`
- `On-line CPU(s) list: 0-15`
- `Thread(s) per core: 1`
- `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`
- `CPU MHz: 3484.379`
- `BogoMIPS: 6986.45`
- `Virtualization: AMD-V`
- `L1d cache: 512 KiB`
- `L1i cache: 512 KiB`
- `L2 cache: 8 MiB`
- `L3 cache: 256 MiB`

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

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SPECspeed®2017_int_base = 13.5
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Platform Notes (Continued)

NUMA node0 CPU(s): 0,1
NUMA node1 CPU(s): 2,3
NUMA node2 CPU(s): 4,5
NUMA node3 CPU(s): 6,7
NUMA node4 CPU(s): 8,9
NUMA node5 CPU(s): 10,11
NUMA node6 CPU(s): 12,13
NUMA node7 CPU(s): 14,15

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, STIBP disabled, 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 pdpe1gb rdtscp lm constant_tsc rep_good nopl nonstop_tsc cpuid extd_apicid aperfmperf pni pclmulqdq monitor ssse3 fma cx16 pclid 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 bpext perfctr_llc mwaitx cpb cat_l3 cdpl_l3 invpcid_single hw_pstate ssbd mba ibrs ibpb stibp vmmcall fsqsbtrack bml1 avx2 smep bmi2 invpcid qm rdt_a rdseed adx smap clflushopt clwb sha ni xsaveopt xsaves xgetbv1 xsaveas qm_1lc qm_1cc qm_1mm_total qm_1mm_local clzero irperf xsavesrpr wboinvd arat npt lbrv svm_lock nrrip_save tsc_scale vmcb_clean flushbyasid decodeassist pfthreshold v_vmsave_vmload vgif umip pku ospke vaes vpclmulqdq rdpid overflow_recov succor smca

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
    node 0 size: 128777 MB
    node 0 free: 128462 MB
    node 1 cpus: 2 3
    node 1 size: 129023 MB
    node 1 free: 128857 MB
    node 2 cpus: 4 5
    node 2 size: 129023 MB

(Continued on next page)
Hewlett Packard Enterprise

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Platform Notes (Continued)

node 2 free: 128810 MB
node 3 cpus: 6 7
node 3 size: 129020 MB
node 3 free: 128891 MB
node 4 cpus: 8 9
node 4 size: 129023 MB
node 4 free: 128930 MB
node 5 cpus: 10 11
node 5 size: 128999 MB
node 5 free: 128899 MB
node 6 cpus: 12 13
node 6 size: 129023 MB
node 6 free: 128926 MB
node 7 cpus: 14 15
node 7 size: 129009 MB
node 7 free: 128899 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 11 10 11 12 12 12 12
3: 11 11 11 10 12 12 12 12
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: 1056665396 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

/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/"

(Continued on next page)
Platform Notes (Continued)

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): 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/swappgs barriers and __user pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Full AMD retpoline, IBFB: conditional, IBRS_FW, STIBP: disabled, RSB filling
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
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CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Platform Notes (Continued)

Firmware Revision: 2.40

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
C       | 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)
==============================================================================
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

==============================================================================
C++     | 620.omnetpp_s(base, peak) 623.xalancbmk_s(base, peak) 631.deepsjeng_s(base, peak) 641.leela_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 | 648.exchange2_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

Base Compiler Invocation

C benchmarks:
clang

C++ benchmarks:
clang++

(Continued on next page)
SPEC CPU®2017 Integer Speed Result
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Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL345 Gen10 Plus
(3.50 GHz, AMD EPYC 73F3)

SPECspeed®2017_int_base = 13.5
SPECspeed®2017_int_peak = 13.5

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

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

Base Compiler Invocation (Continued)

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, -mlvm -Wl, -enable-licm-vrp -Wl, -mlvm -Wl, -region-vectorize
-Wl, -mlvm -Wl, -function-specialize
-Wl, -mlvm -Wl, -align-all-nofallthru-blocks=6
-Wl, -mlvm -Wl, -reduce-array-computations=3 -O3 -march=znver3
-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5
-mlvm -unroll-threshold=50 -mlvm -inline-threshold=1000
-freemap-arrays -mlvm -function-specialize -flv-function-specialization
-mlvm -enable-gvn-hoist -mlvm -global-vectorize-slp=true
-mlvm -enable-licm-vrp -mlvm -reduce-array-computations=3 -z muldefs
-DSPEC_OPENMPP -fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc
-lflang -lflangrti

C++ benchmarks:
-m64 -std=c++98 -mno-adx -mno-sse4a
-Wl, -mlvm -Wl, -do-block-reorder=aggressive
-Wl, -mlvm -Wl, -region-vectorize -Wl, -mlvm -Wl, -function-specialize
-Wl, -mlvm -Wl, -align-all-nofallthru-blocks=6
-Wl, -mlvm -Wl, -reduce-array-computations=3 -O3 -march=znver3
-fveclib=AMDLIBM -ffast-math -flto -mlvm -enable-partial-unswitch
-mlvm -unroll-threshold=100 -finline-aggressive

(Continued on next page)
Hewlett Packard Enterprise
ProLiant DL345 Gen10 Plus
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SPEC CPU®2017 Integer Speed Result

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Test Date: Mar-2021
Hardware Availability: Jun-2021
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Base Optimization Flags (Continued)

C++ benchmarks (continued):
- flv-function-specialization
- mllvm -loop-unswitch-threshold=200000
- mllvm -reroll-loops -aggressive-loop-unswitch
- mllvm -extra-vectorizer-passes -reduce-array-computations=3
- mllvm -global-vectorize-slp=true -convert-pow-exp-to-int=false
- z muldefs -do-block-reorder=aggressive
- fvirtual-function-elimination -fvisibility=hidden -DSPEC_OPENMP
- fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
- lflangrti

Fortran benchmarks:
- m64 -no-adx -no-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-nofallthrough-blocks=6
- Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver3
- fveclib=AMDLIBM -ffast-math -f1to -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

Peak Compiler Invocation

C benchmarks:
clang

C++ benchmarks:
clang++

Fortran benchmarks:
flang
## SPEC CPU®2017 Integer Speed Result

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

<table>
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</table>

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

---

### 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

C++ benchmarks:

- 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
**SPEC CPU®2017 Integer Speed Result**

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### Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL345 Gen10 Plus

(3.50 GHz, AMD EPYC 73F3)

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<td>Software Availability: Mar-2021</td>
</tr>
</tbody>
</table>

### SPECspeed®2017_int_base = 13.5

SPECspeed®2017_int_peak = 13.5

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### 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:


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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-V1.2-EPYC-revP.xml](http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-V1.2-EPYC-revP.xml)

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Tested with SPEC CPU®2017 v1.1.5 on 2020-04-01 13:37:41-0400.
Report generated on 2021-05-25 16:48:00 by CPU2017 PDF formatter v6442.
Originally published on 2021-05-25.