**SPEC CPU®2017 Integer Speed Result**

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL385 Gen11
(3.25 GHz, AMD EPYC 9354)

<table>
<thead>
<tr>
<th>SPECspeed®2017_int_base</th>
<th>SPECspeed®2017_int_peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.2</td>
<td>14.5</td>
</tr>
</tbody>
</table>

**CPU2017 License:** 3  
**Test Date:** Dec-2022  
**Test Sponsor:** HPE  
**Hardware Availability:** Dec-2022  
**Tested by:** HPE  
**Software Availability:** Nov-2022

<table>
<thead>
<tr>
<th>Threads</th>
<th>SPECspeed®2017_int_base (14.2)</th>
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<tbody>
<tr>
<td>600.perlbench_s</td>
<td>8.61</td>
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<tr>
<td>602.gcc_s</td>
<td>14.7</td>
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<tr>
<td>605.mcf_s</td>
<td>10.5</td>
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<tr>
<td>620.omnetpp_s</td>
<td>20.6</td>
</tr>
<tr>
<td>623.xalancbmk_s</td>
<td>21.4</td>
</tr>
<tr>
<td>625.x264_s</td>
<td>18.4</td>
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<tr>
<td>631.deepsjeng_s</td>
<td>21.0</td>
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<td>641.leela_s</td>
<td>21.9</td>
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<tr>
<td>648.exchange2_s</td>
<td>26.7</td>
</tr>
<tr>
<td>657.xz_s</td>
<td>27.1</td>
</tr>
</tbody>
</table>

**Hardware**

- **CPU Name:** AMD EPYC 9354  
- **Max MHz:** 3800  
- **Nominal:** 3250  
- **Enabled:** 64 cores, 2 chips  
- **Orderable:** 1.2 chips  
- **Cache L1:** 32 KB I + 32 KB D on chip per core  
- **Cache L2:** 1 MB I+D on chip per core  
- **Cache L3:** 256 MB I+D on chip per chip, 32 MB shared / 4 cores  
- **Other:** None

**Software**

- **OS:** Ubuntu 22.04.1 LTS  
- **Compiler:** C/C++/Fortran: Version 4.0.0 of AOCC  
- **Parallel:** Yes  
- **Firmware:** HPE BIOS Version v1.12 11/24/2022 released  
- **File System:** ext4  
- **System State:** Run level 5 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 64-bit  
- **Other:** None

**Other:**

- **Power Management:** BIOS and OS set to prefer performance at the cost of additional power usage
Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
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<td>10.5</td>
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<td>18.5</td>
<td>77.1</td>
<td>18.4</td>
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<tr>
<td>625.x264_s</td>
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<td>80.9</td>
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<td>21.9</td>
<td>80.6</td>
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<td>21.9</td>
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<td>26.7</td>
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<td>228</td>
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<td>27.2</td>
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**Compiled on next page**
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ProLiant DL385 Gen11  
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**Test Sponsor:** HPE  
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### Operating System Notes (Continued)

To enable Transparent Hugepages (THP) for all allocations, 
'echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root.

### Environment Variables Notes

Environment variables set by runcpu before the start of the run:
- `GOMP_CPU_AFFINITY = "0-63"`
- `LD_LIBRARY_PATH = "/home/cpu2017/amd_speed_aocc400_genoa_B_lib/lib:"`
- `LIBOMP_NUM_HIDDEN_HELPER_THREADS = "0"`
- `MALLOC_CONF = "oversize_threshold:0,retain:true"`
- `OMP_DYNAMIC = "false"
- `OMP_SCHEDULER = "static"
- `OMP_STACKSIZE = "128M"
- `OMP_THREAD_LIMIT = "64"

Environment variables set by runcpu during the 605.mcf_s peak run:
- `GOMP_CPU_AFFINITY = "15"

Environment variables set by runcpu during the 623.xalancbmk_s peak run:
- `GOMP_CPU_AFFINITY = "15"

Environment variables set by runcpu during the 657.xz_s peak run:
- `GOMP_CPU_AFFINITY = "0-63"
- `LIBOMP_NUM_HIDDEN_HELPER_THREADS = "8"

### 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

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

- Performance Determinism set to Power Deterministic
- AMD SMT Option set to Disabled
- NUMA memory domains per socket set to Four memory domains per socket
- 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 0xa10110e for the AMD EPYC 9nn4X family of processors. The reference code/AGESA version used in this ROM is version GenoaPI 1.0.0.1-L6

Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acaf64d
running on admin1 Mon Jun 27 18:41:04 2022

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

From /proc/cpuinfo
model name : AMD EPYC 9354 32-Core Processor
  2 "physical id"s (chips)
  64 "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 : 32
siblings : 32
physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

From lscpu from util-linux 2.37.2:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Address sizes: 52 bits physical, 57 bits virtual
Byte Order: Little Endian
CPU(s): 64
On-line CPU(s) list: 0-63
Vendor ID: AuthenticAMD
Model name: AMD EPYC 9354 32-Core Processor
CPU family: 25
Model: 17
Thread(s) per core: 1

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---
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SPECspeak®2017_int_peak = 14.5

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

Core(s) per socket: 32
Socket(s): 2
Stepping: 1
Frequency boost: enabled
CPU max MHz: 3800.0000
CPU min MHz: 400.0000
BogoMIPS: 6489.63
Flags:
    fpu    vme   de    pse   msr   mcr   pae   mce   pse36
    cmov   tsc   tcl    fpu73   mmu   cbp    sse   sse2
    movbe  xmm    cx16  xmovq  pkx8env

Virtualization: AMD-V
L1d cache: 2 MiB (64 instances)
L1i cache: 2 MiB (64 instances)
L2 cache: 64 MiB (64 instances)
L3 cache: 512 MiB (16 instances)
NUMA node(s): 16
NUMA node0 CPU(s): 0-3
NUMA node1 CPU(s): 16-19
NUMA node2 CPU(s): 8-11
NUMA node3 CPU(s): 24-27
NUMA node4 CPU(s): 12-15
NUMA node5 CPU(s): 28-31
NUMA node6 CPU(s): 4-7
NUMA node7 CPU(s): 20-23
NUMA node8 CPU(s): 32-35
NUMA node9 CPU(s): 48-51
NUMA node10 CPU(s): 40-43
NUMA node11 CPU(s): 56-59
NUMA node12 CPU(s): 44-47
NUMA node13 CPU(s): 60-63
NUMA node14 CPU(s): 36-39
NUMA node15 CPU(s): 52-55

Vulnerability Itlb multihit: Not affected
Vulnerability L1tf: Not affected
Vulnerability Mds: Not affected

(Continued on next page)
SPEC CPU®2017 Integer Speed Result
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Hewlett Packard Enterprise
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ProLiant DL385 Gen11
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| SPECspeed®2017_int_base = 14.2 |
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CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

From lscpu --cache:

<table>
<thead>
<tr>
<th>NAME</th>
<th>ONE-SIZE</th>
<th>ALL-SIZE</th>
<th>WAYS</th>
<th>TYPE</th>
<th>LEVEL</th>
<th>SETS</th>
<th>PHY-LINE</th>
<th>COHERENCY-SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1d</td>
<td>32K</td>
<td>2M</td>
<td>8</td>
<td>Data</td>
<td>1</td>
<td>64</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L1i</td>
<td>32K</td>
<td>2M</td>
<td>8</td>
<td>Instruction</td>
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<td>64</td>
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<td>64</td>
</tr>
<tr>
<td>L2</td>
<td>1M</td>
<td>64M</td>
<td>8</td>
<td>Unified</td>
<td>2</td>
<td>2048</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L3</td>
<td>32M</td>
<td>512M</td>
<td>16</td>
<td>Unified</td>
<td>3</td>
<td>32768</td>
<td>1</td>
<td>64</td>
</tr>
</tbody>
</table>

/proc/cpuinfo cache data

cache size : 1024 KB

From numactl --hardware

WARNING: a numactl 'node' might or might not correspond to a physical chip.
available: 16 nodes (0-15)
node 0 cpus: 0 1 2 3
node 0 size: 96456 MB
node 0 free: 96229 MB
node 1 cpus: 16 17 18 19
node 1 size: 96766 MB
node 1 free: 96687 MB
node 2 cpus: 8 9 10 11
node 2 size: 96766 MB
node 2 free: 96605 MB
node 3 cpus: 24 25 26 27
node 3 size: 96766 MB
node 3 free: 96667 MB
node 4 cpus: 12 13 14 15
node 4 size: 96733 MB
node 4 free: 96620 MB
node 5 cpus: 28 29 30 31
node 5 size: 96766 MB
node 5 free: 96692 MB
node 6 cpus: 4 5 6 7
node 6 size: 96766 MB
node 6 free: 96668 MB
node 7 cpus: 20 21 22 23
node 7 size: 96766 MB

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

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SPECSpeed®2017_int_base = 14.2
SPECSpeed®2017_int_peak = 14.5

CPU2017 License: 3  
Test Sponsor: HPE  
Test Date: Dec-2022  
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Platform Notes (Continued)

node 7 free: 96582 MB
node 8 cpus: 32 33 34 35
node 8 size: 96766 MB
node 8 free: 96663 MB
node 9 cpus: 48 49 50 51
node 9 size: 96766 MB
node 9 free: 96671 MB
node 10 cpus: 40 41 42 43
node 10 size: 96766 MB
node 10 free: 96676 MB
node 11 cpus: 56 57 58 59
node 11 size: 96766 MB
node 11 free: 96588 MB
node 12 cpus: 44 45 46 47
node 12 size: 96766 MB
node 12 free: 96686 MB
node 13 cpus: 60 61 62 63
node 13 size: 96766 MB
node 13 free: 96686 MB
node 14 cpus: 36 37 38 39
node 14 size: 96766 MB
node 14 free: 96671 MB
node 15 cpus: 52 53 54 55
node 15 size: 96719 MB
node 15 free: 96541 MB
node distances:

node distances:

node 0  1  2  3  4  5  6  7  8  9  10  11  12  13  14  15
0:  10  11  12  12  12  12  12  12  32  32  32  32  32  32  32  32
1:  11  10  12  12  12  12  12  12  32  32  32  32  32  32  32  32
2:  12  12  10  11  12  12  12  12  32  32  32  32  32  32  32  32
3:  12  12  11  10  12  12  12  12  32  32  32  32  32  32  32  32
4:  12  12  12  12  10  11  12  12  32  32  32  32  32  32  32  32
5:  12  12  12  12  11  10  12  12  32  32  32  32  32  32  32  32
6:  12  12  12  12  12  12  10  11  32  32  32  32  32  32  32  32
7:  12  12  12  12  12  12  11  10  32  32  32  32  32  32  32  32
8:  32  32  32  32  32  32  32  32  10  11  12  12  12  12  12  12
9:  32  32  32  32  32  32  32  32  11  10  12  12  12  12  12  12
10: 32  32  32  32  32  32  32  32  12  12  10  11  12  12  12  12
11: 32  32  32  32  32  32  32  32  12  12  12  12  12  12  12  12
12: 32  32  32  32  32  32  32  32  12  12  12  12  12  12  12  12
13: 32  32  32  32  32  32  32  32  12  12  12  12  12  12  12  12
14: 32  32  32  32  32  32  32  32  12  12  12  12  12  12  12  12
15: 32  32  32  32  32  32  32  32  12  12  12  12  12  12  12  12

From /proc/meminfo
MemTotal: 1585027260 kB
HugePages_Total: 0

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

- **Hugepagesize:** 2048 kB

- `/sbin/tuned-adm active`
  - Current active profile: balanced

- `/sys/devices/system/cpu/cpu*/cpufreq/scaling_governor`
  - Has performance

- `/usr/bin/lsb_release -d`
  - Ubuntu 22.04.1 LTS

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

- `uname -a`:
  - Linux admin1 5.15.0-43-generic #46-Ubuntu SMP Tue Jul 12 10:30:17 UTC 2022 x86_64
  - x86_64 x86_64 GNU/Linux

**Kernel self-reported vulnerability status:**

- **CVE-2018-12207 (iTLB Multihit):** Not affected
- **CVE-2018-3620 (L1 Terminal Fault):** Not affected
- **Microarchitectural Data Sampling:** Not affected
- **CVE-2017-5754 (Meltdown):** Not affected
- **mmio_stale_data:** 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/swaps barriers and __user pointer sanitization
- **CVE-2017-5715 (Spectre variant 2):** Mitigation: Retpolines, IBPB: 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**
  - Jun 27 18:30

(Continued on next page)
Platform Notes (Continued)

SPEC is set to: /home/cpu2017

Filesystem                        Type  Size  Used Avail Use% Mounted on
/dev/mapper/ubuntu--vg-ubuntu--lv ext4   98G   18G   76G  19% /

From /sys/devices/virtual/dmi/id
Vendor:         HPE
Product:        ProLiant DL385 Gen11
Product Family: ProLiant
Serial:         DL385GEN11-003

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:
13x Hynix HMCG94MEBRA121N 64 GB 2 rank 4800
11x Hynix HMCG94MEBRA123N 64 GB 2 rank 4800

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

(End of data from sysinfo program)

Compiler Version Notes

C
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 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/aoccr/aoccr-compiler-rel-4.0-3206-389/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 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on
Hewlett Packard Enterprise
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SPECspeed®2017_int_base = 14.2
SPECspeed®2017_int_peak = 14.5

Compiler Version Notes (Continued)

LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

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
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**Software Availability:** Nov-2022

### Base Optimization Flags

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

**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 -ftlo`  
- `-mllvm -unroll-threshold=100 -finline-aggressive`  
- `-mllvm -loop-unswitch-threshold=200000`  
- `-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt`  
- `-fvirtual-function-elimination -fvisibility=hidden -fopenmp=libomp`  
- `-lomp -lamdlibm -lflang -lamdalloc-ext`

**Fortran benchmarks:**
- `-m64`  
- `-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6`  
- `-Wl,-mllvm -Wl,-reduce-array-computations=3`  
- `-Wl,-mllvm -Wl,-inline-recursion=4 -Wl,-mllvm -Wl,-lsr-in-nested-loop`  
- `-Wl,-mllvm -Wl,-enable-iv-split -O3 -march=znver4 -fveclib=AMDLIBM`  
- `-ffast-math -fopenmp -ftlo -mllvm -optimize-strided-mem-cost`  
- `-mllvm -unroll-aggressive -mllvm -unroll-threshold=150 -fopenmp=libomp`  
- `-lomp -lamdlibm -lflang -lamdalloc`

### Base Other Flags

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

**C++ benchmarks:**
- `-Wno-unused-command-line-argument`

**Fortran benchmarks:**
- `-Wno-unused-command-line-argument`
SPEC CPU®2017 Integer Speed Result
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Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL385 Gen11
(3.25 GHz, AMD EPYC 9354)

SPECspeed®2017_int_base = 14.2
SPECspeed®2017_int_peak = 14.5

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
625.x264_s: basepeak = yes
657.xz_s: Same as 605.mcf_s

C++ benchmarks:
620.omnetpp_s: basepeak = yes
623.xalancbmk_s: -m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6 -Wl,-mllvm -Wl,-reduce-array-computations=3 -Wl,-mllvm -Wl,-do-block-reorder=aggressive -Ofast

(Continued on next page)
Hewlett Packard Enterprise
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| SPECspeak®2017_int_base = 14.2 |
| SPECspeak®2017_int_peak = 14.5 |

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

Peak Optimization Flags (Continued)

```
623.xalancbmk_s (continued):
-march=znver4 -fveclib=AMDLIBM -ffast-math -fopenmp
-flto -finline-aggressive -mlirvm -unroll-threshold=100
-mlirvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt
-mlirvm -do-block-reorder=aggressive
-fvirtual-function-elimination -fvisibility=hidden
-fopenmp=libomp -lomp -lamdlibm -lamdalloca-ext -lflag
631.deepsjeng_s: basepeak = yes
641.leela_s: basepeak = yes
```

Fortran benchmarks:
```
648.exchange2_s: basepeak = yes
```

Peak Other Flags

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

C++ benchmarks:
```
-Wno-unused-command-line-argument
```

Fortran benchmarks:
```
-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

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