SPEC CPU®2017 Integer Rate Result

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL365 Gen11
(3.00 GHz, AMD EPYC 9124)

SPECrate®2017_int_base = 348
SPECrate®2017_int_peak = 356

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

Test Date: Nov-2022
Hardware Availability: Dec-2022
Software Availability: Nov-2022

<table>
<thead>
<tr>
<th>Copies</th>
<th>SPECrate®2017_int_base (348)</th>
<th>SPECrate®2017_int_peak (356)</th>
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<tbody>
<tr>
<td>500.perlbench_r</td>
<td>64</td>
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</tr>
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<td>502.gcc_r</td>
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<td>505.mcf_r</td>
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<td>520.omnetpp_r</td>
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<td>523.xalancbmk_r</td>
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<td>525.x264_r</td>
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<td>531.deepsjeng_r</td>
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<tr>
<td>548.exchange2_r</td>
<td>64</td>
<td>800</td>
</tr>
<tr>
<td>557.xz_r</td>
<td>64</td>
<td>812</td>
</tr>
</tbody>
</table>

Hardware

CPU Name: AMD EPYC 9124
Max MHz: 3700
Nominal: 3000
Enabled: 32 cores, 2 chips, 2 threads/core
Orderable: 1,2 chips
Cache L1: 32 KB I + 32 KB D on chip per core
L2: 1 MB I+D on chip per core
L3: 64 MB I+D on chip per chip,
16 MB shared / 4 cores
Other: None
Memory: 1536 GB (24 x 64 GB 2Rx4 PC5-4800B-R)
Storage: 2 x 480 GB SATA SSD
Other: None

Software

OS: Ubuntu 22.04.1 LTS
Compiler: Kernel 5.15.0-50-generic
Parallel: No
Firmware: HPE BIOS Version v1.10 10/18/2022 released Oct-2022
File System: ext4
System State: Run level 5 (multi-user)
Base Pointers: 64-bit
Peak Pointers: 32/64-bit
Power Management: BIOS and OS set to prefer performance at the cost of additional power usage
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### Results Table

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**SPECrate®2017_int_base = 348**  
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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)
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Operating System Notes (Continued)

To enable Transparent Hugepages (THP) only on request for base runs, 'echo madvise > /sys/kernel/mm/transparent_hugepage/enabled' run as root.
To enable THP for all allocations for peak runs, 'echo always > /sys/kernel/mm/transparent_hugepage/enabled' and '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:
LD_LIBRARY_PATH =
    "'/home/cpu2017_new/amd_rate_aocc400_genoa_B_lib/lib:/home/cpu2017_new/amd_rate_aocc400_genoa_B_lib/lib32:"
MALLOC_CONF = "retain:true"

Environment variables set by runcpu during the 523.xalancbmk_r peak run:
MALLOC_CONF = "thp:never"

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 Throughput Compute
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 Four memory domains per socket
ACPI C2 Latency set to 18 microseconds
Thermal Configuration set to Maximum Cooling
Workload Profile set to Custom
    Power Regulator set to OS Control Mode

(Continued on next page)
Platform Notes (Continued)

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-L3

Sysinfo program /home/cpu2017_new/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
running on admin1 Mon Jun 27 18:49:25 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 9124 16-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 : 16
siblings : 32
  physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
  physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
```

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 9124 16-Core Processor
CPU family:                      25
Model:                           17
Thread(s) per core:              2
Core(s) per socket:              16
Socket(s):                       2
Stepping:                        1
Frequency boost:                 enabled
CPU max MHz:                     3713.0000
CPU min MHz:                     400.0000
BogoMIPS:                        5991.15
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
                                 pdcache ltdscp lm constant_tsc rep_good nopl nonstop_tsc cpuid extd_apicid
                                 aperfmperf rapl pni pclmulqdq monitor ssse3 fma cx16 pcid sse4_1 sse4_2 x2apic movbe
                                 popcnt aes xsave avx f16c rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a
```

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Platform Notes (Continued)

misalignsse 3dnowprefetch 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 vmcall fsqsgbase bmi1 avx2 smep bmi2 erms invpcid cqm rdt_a avx512f
avx512dq rdseed adx smap avx512ifma cliflushopt clwb avx512cd sha_ni avx512bw
avx512vl xsaveopt xsaves xgetbv1 xsavees cqm_llc cqm_occup_llc cqm_mbm_total
cqm_mbm_local avx512_bf16 clzero irperf xsaverprtr rdpru wbnoinvd amd_ppin cppc arat
npt lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassist
pausefilter pfthreshold avic v_vmsave_vmload vgic v_spec_ctrl avx512v bmi umip pku
ospke avx512_v bmi2 gni vaes vpcqmuldq avx512_vnni avx512_bitalg avx512_vpopcntdq
la57 rdpid overflow_recov succor smca farm flush_l1d

Virtualization: AMD-V
L1d cache: 1 MiB (32 instances)
L1i cache: 1 MiB (32 instances)
L2 cache: 32 MiB (32 instances)
L3 cache: 128 MiB (8 instances)
NUMA node(s): 8
NUMA node0 CPU(s): 0-3,32-35
NUMA node1 CPU(s): 8-11,40-43
NUMA node2 CPU(s): 12-15,44-47
NUMA node3 CPU(s): 4-7,36-39
NUMA node4 CPU(s): 16-19,48-51
NUMA node5 CPU(s): 24-27,56-59
NUMA node6 CPU(s): 28-31,60-63
NUMA node7 CPU(s): 20-23,52-55
Vulnerability ITlb multihit: Not affected
Vulnerability LItf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Mmio stale data: Not affected
Vulnerability Retbleed: Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via
prctl and seccomp
Vulnerability Spectre v1: Mitigation; userscopy/swapgs barriers and __user
pointer sanitization
Vulnerability Spectre v2: Mitigation; Retpolines, IBPB conditional, IBRS_FW,
STIBP always-on, RSB filling, PBRSB-eIBRS Not affected
Vulnerability Srbds: Not affected
Vulnerability Tsx async abort: Not affected

From lscpu --cache:
NAME ONE-SIZE ALL-SIZE WAYS TYPE LEVEL SETS PHY-LINE COHERENCY-SIZE
L1d 32K 1M 8 Data 1 64 1 64
L1i 32K 1M 8 Instruction 1 64 1 64
L2 1M 32M 8 Unified 2 2048 1 64
L3 16M 128M 16 Unified 3 16384 1 64

/pro/cpuminfo cache data

(Continued on next page)
Platform Notes (Continued)

    cache size : 1024 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 2 3 32 33 34 35
    node 0 size: 193223 MB
    node 0 free: 192907 MB
    node 1 cpus: 8 9 10 11 40 41 42 43
    node 1 size: 193533 MB
    node 1 free: 193238 MB
    node 2 cpus: 12 13 14 15 44 45 46 47
    node 2 size: 193533 MB
    node 2 free: 193271 MB
    node 3 cpus: 4 5 6 7 36 37 38 39
    node 3 size: 193498 MB
    node 3 free: 193148 MB
    node 4 cpus: 16 17 18 19 48 49 50 51
    node 4 size: 193533 MB
    node 4 free: 193327 MB
    node 5 cpus: 24 25 26 27 56 57 58 59
    node 5 size: 193533 MB
    node 5 free: 193340 MB
    node 6 cpus: 28 29 30 31 60 61 62 63
    node 6 size: 193533 MB
    node 6 free: 193353 MB
    node 7 cpus: 20 21 22 23 52 53 54 55
    node 7 size: 193490 MB
    node 7 free: 193305 MB
    node distances:
    node 0  1  2  3  4  5  6  7
    0:  10 12 12 12 32 32 32 32
    1:  12 10 12 12 32 32 32 32
    2:  12 12 10 12 32 32 32 32
    3:  12 12 12 10 32 32 32 32
    4:  32 32 32 32 10 12 12 12
    5:  32 32 32 32 12 10 12 12
    6:  32 32 32 32 12 12 10 12
    7:  32 32 32 32 12 12 12 10

From /proc/meminfo
    MemTotal:       1585030992 kB
    HugePages_Total:       0
    Hugepagesize:       2048 kB

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

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Platform Notes (Continued)

/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 5.15.0-50-generic #56-Ubuntu SMP Tue Sep 20 13:23:26 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):
mmio_stale_data:
  Not affected
retnbleed:
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:
  always-on, RSB filling,
PBRSB-eIBRS: Not affected
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

SPEC is set to: /home/cpu2017_new

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Platform Notes (Continued)

Filesystem                        Type  Size  Used  Avail  Use% Mounted on
/dev/mapper/ubuntu--vg-ubuntu--lv  ext4   437G  155G  264G   37%  /

From /sys/devices/virtual/dmi/id
Vendor:         HPE
Product:        ProLiant DL365 Gen11
Product Family: ProLiant
Serial:         DL365G11-001

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:
21x Hynix HMCG94MEBRA121N 64 GB 2 rank 4800
3x Hynix HMCG94MEBRA123N 64 GB 2 rank 4800

BIOS:
BIOS Vendor:       HPE
BIOS Version:      1.10
BIOS Date:         10/18/2022
BIOS Revision:     1.10
Firmware Revision: 1.10

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
| C       | 502.gcc_r(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: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

==============================================================================
| C       | 500.perlbench_r(base, peak) 502.gcc_r(base) 505.mcf_r(base, peak) 525.x264_r(base, peak) 557.xz_r(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

(Continued on next page)
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### Compiler Version Notes (Continued)

```
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: i386-unknown-linux-gnu
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
```

```
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
```

```
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
```

```
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
```

```
```
(Continued on next page)
Hewlett Packard Enterprise  
(Test Sponsor: HPE)  
ProLiant DL365 Gen11  
(3.00 GHz, AMD EPYC 9124)  

<table>
<thead>
<tr>
<th>SPECrate®2017_int_base = 348</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECrate®2017_int_peak = 356</td>
</tr>
</tbody>
</table>

**Compiler Version Notes (Continued)**

```plaintext
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: i386-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin
```

---

```plaintext
C++  
520.omnetpp_r(base, peak) 523.xalancbmk_r(base)  
531.deepsjeng_r(base, peak) 541.leela_r(base, peak)
```

---

```plaintext
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
```

---

```plaintext
Fortran  
548.exchange2_r(base, peak)
```

---

**Base Compiler Invocation**

- **C benchmarks:**
  - clang

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

- **Fortran benchmarks:**
  - flang

**Base Portability Flags**

```
500.perlbench_r: -DSPEC_LINUX_X64 -DSPEC_LP64
```

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

<table>
<thead>
<tr>
<th>Base Portability Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>502.gcc_r: -DSPEC_LP64</td>
</tr>
<tr>
<td>505.mcf_r: -DSPEC_LP64</td>
</tr>
<tr>
<td>520.omnetpp_r: -DSPEC_LP64</td>
</tr>
<tr>
<td>523.xalancbmk_r: -DSPEC_LINUX -DSPEC_LP64</td>
</tr>
<tr>
<td>525.x264_r: -DSPEC_LP64</td>
</tr>
<tr>
<td>531.deepsjeng_r: -DSPEC_LP64</td>
</tr>
<tr>
<td>541.leela_r: -DSPEC_LP64</td>
</tr>
<tr>
<td>548.exchange2_r: -DSPEC_LP64</td>
</tr>
<tr>
<td>557.xz_r: -DSPEC_LP64</td>
</tr>
</tbody>
</table>

## Base Optimization Flags

### C benchmarks:
- -m64 -flto -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
- -Wl,-mllvm -Wl,-reduce-array-computations=3
- -Wl,-mllvm -Wl,-ldist-scalar-expand -fenable-aggressive-gather
- -z muldefs -O3 -march=znver4 -fveclib=AMDLIBM -ffast-math
- -fstruct-layout=7 -mllvm -align-all-nofallthru-blocks=6
- -mllvm -unroll-threshold=100 -fremap-arrays -fstrip-mining
- -mllvm -reduce-array-computations=3 -zopt -lamdlibm -lflang
- -lamdalloc

### C++ benchmarks:
- -m64 -flto -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
- -Wl,-mllvm -Wl,-reduce-array-computations=3 -z muldefs -O3
- -march=znver4 -fveclib=AMDLIBM -ffast-math
- -mllvm -unroll-threshold=100 -finline-aggressive
- -mllvm -loop-unswitch-threshold=200000
- -mllvm -reduce-array-computations=3 -zopt
- -fvirtual-function-elimination -fvisibility=hidden -lamdlibm -lflang
- -lamdalloc-ext

### Fortran benchmarks:
- -m64 -flto -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-ilv-split -z muldefs -O3 -march=znver4
- -fveclib=AMDLIBM -ffast-math -fepilog-vectorization-of-inductions
- -mllvm -optimize-strided-mem-cost -floop-transform
- -mllvm -unroll-aggressive -mllvm -unroll-threshold=500 -lamdlibm
- -lflang -lamdalloc
SPEC CPU®2017 Integer Rate Result

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL365 Gen11
(3.00 GHz, AMD EPYC 9124)

SPECrate®2017_int_base = 348
SPECrate®2017_int_peak = 356

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

Test Date: Nov-2022
Hardware Availability: Dec-2022
Software Availability: Nov-2022

Base Other Flags

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

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

Fortran benchmarks:
- -Wno-unused-command-line-argument

Peak Compiler Invocation

C benchmarks:
clang

C++ benchmarks:
clang++

Fortran benchmarks:
flang

Peak Portability Flags

500.perlbench_r: -DSPEC_LINUX_X64 -DSPEC_LP64
502.gcc_r: -D_FILE_OFFSET_BITS=64
505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
523.xalancbmk_r: -DSPEC_LINUX -DSPEC_LP64
525.x264_r: -DSPEC_LP64
531.deepsjeng_r: -DSPEC_LP64
541.leela_r: -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64

Peak Optimization Flags

C benchmarks:
500.perlbench_r: basepeak = yes

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

502.gcc_r: -m32 -flto -z muldefs -Ofast -march=znver4
   -fveclib=AMDLIBM -ffast-math -fstruct-layout=7
   -mlvm -unroll-threshold=50 -fremap-arrays -fstrip-mining
   -mlvm -inline-threshold=1000
   -mlvm -reduce-array-computations=3 -zopt -fgnu89-inline
   -lamdalloc

505.mcf_r: -m64 -flto -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
   -Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
   -march=znver4 -fveclib=AMDLIBM -ffast-math
   -fstruct-layout=7 -mlvm -unroll-threshold=50
   -fremap-arrays -fstrip-mining
   -mlvm -inline-threshold=1000
   -mlvm -reduce-array-computations=3 -zopt -lamdlibm
   -lflang -lamdalloc

525.x264_r: basepeak = yes

557.xz_r: basepeak = yes

C++ benchmarks:

520.omnetpp_r: basepeak = yes

523.xalancbmk_r: -m32 -flto -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
   -Wl,-mllvm -Wl,-reduce-array-computations=3
   -Wl,-mllvm -Wl,-do-block-reorder=aggressive
   -fno-loop-reroll -Ofast -march=znver4 -fveclib=AMDLIBM
   -ffast-math -finline-aggressive
   -mlvm -unroll-threshold=100
   -mlvm -reduce-array-computations=3 -zopt
   -mlvm -do-block-reorder=aggressive
   -fvirtual-function-elimination -fvisibility=hidden
   -lamdalloc-ext

531.deepsjeng_r: -m64 -flto -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
   -Wl,-mllvm -Wl,-reduce-array-computations=3 -O3
   -march=znver4 -fveclib=AMDLIBM -ffast-math
   -mlvm -unroll-threshold=100 -finline-aggressive
   -mlvm -loop-unswitch-threshold=200000
   -mlvm -reduce-array-computations=3 -zopt
   -fvirtual-function-elimination -fvisibility=hidden
   -lamdlibm -lamdalloc-ext

541.leela_r: -m64 -flto -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
   -Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast

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

541.leela_r (continued):
-\texttt{--march=znver4} \texttt{--fveclib=AMDLIBM} \texttt{--ffast-math}
-\texttt{--mllvm \texttt{-unroll-threshold=100}}
-\texttt{--mllvm \texttt{-reduce-array-computations=3}} \texttt{--zopt}
-\texttt{--fvirtual-function-elimination} \texttt{--fvisibility=hidden}
-\texttt{--lamdlibm} \texttt{--lflang} \texttt{--lamdalloc-ext}

Fortran benchmarks:
-\texttt{--m64} \texttt{--flto} \texttt{--Wl,-mllvm \texttt{-Wl,-align-all-nofallthru-blocks=6}}
-\texttt{--Wl,-mllvm} \texttt{-Wl,-reduce-array-computations=3}
-\texttt{--Wl,-mllvm} \texttt{-Wl,-inline-recursion=4} \texttt{--Wl,-mllvm} \texttt{-Wl,-lsr-in-nested-loop}
-\texttt{--Wl,-mllvm} \texttt{-Wl,-enable-iv-split} \texttt{-O3} \texttt{--march=znver4} \texttt{--fveclib=AMDLIBM}
-\texttt{--ffast-math} \texttt{--fepilog-vectorization-of-inductions}
-\texttt{--mllvm \texttt{-optimize-strided-mem-cost}} \texttt{--floop-transform}
-\texttt{--mllvm \texttt{-unroll-aggressive} \texttt{-mllvm \texttt{-unroll-threshold=500}} \texttt{--lamdlibm}
-\texttt{--lflang} \texttt{--lamdalloca}

## Peak Other Flags

C benchmarks (except as noted below):
-\texttt{--Wno-unused-command-line-argument}

502.gcc_r: \texttt{-L/usr/lib32} \texttt{--Wno-unused-command-line-argument}
\texttt{-L/home/work/cpu2017/v118/aocc4/b1/rate/amd_rate_aocc400_genoa_B_lib/lib32}

C++ benchmarks (except as noted below):
-\texttt{--Wno-unused-command-line-argument}

523.xalancbnk_r: \texttt{-L/usr/lib32} \texttt{--Wno-unused-command-line-argument}
\texttt{-L/home/work/cpu2017/v118/aocc4/b1/rate/amd_rate_aocc400_genoa_B_lib/lib32}

Fortran benchmarks:
-\texttt{--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-rev2.0.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-rev2.0.xml
http://www.spec.org/cpu2017/flags/aocc400-flags.xml
<table>
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**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
ProLiant DL365 Gen11  
(3.00 GHz, AMD EPYC 9124)

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

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