



SPEC CPU®2017 Integer Rate Result

Copyright 2017-2023 Standard Performance Evaluation Corporation

Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL345 Gen11

(2.45 GHz, AMD EPYC 9534)

SPECrate®2017_int_base = 602

SPECrate®2017_int_peak = 638

CPU2017 License: 3

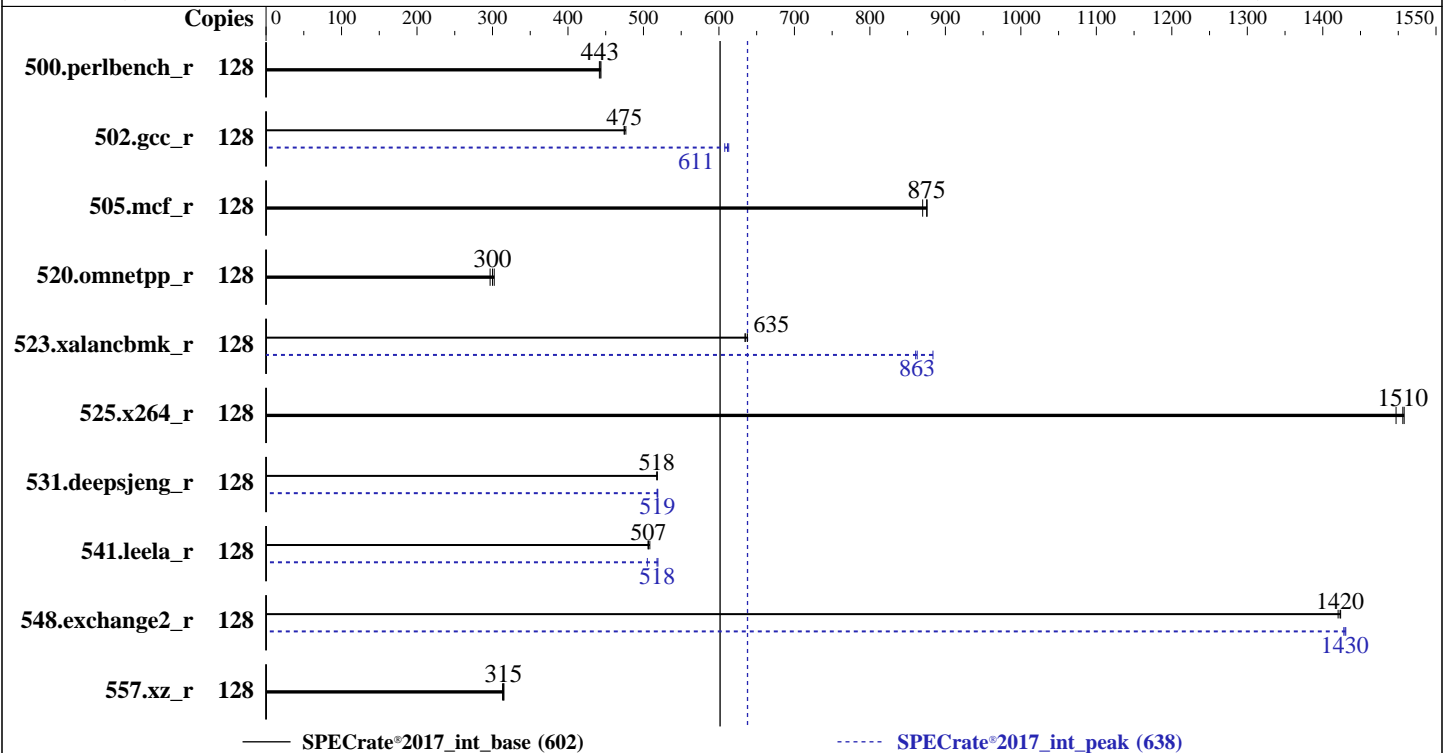
Test Sponsor: HPE

Tested by: HPE

Test Date: Dec-2022

Hardware Availability: Dec-2022

Software Availability: Nov-2022



Hardware

CPU Name: AMD EPYC 9534
 Max MHz: 3700
 Nominal: 2450
 Enabled: 64 cores, 1 chip, 2 threads/core
 Orderable: 1 chip
 Cache L1: 32 KB I + 32 KB D on chip per core
 L2: 1 MB I+D on chip per core
 L3: 256 MB I+D on chip per chip,
 32 MB shared / 8 cores
 Other: None
 Memory: 384 GB (12 x 32 GB 2Rx8 PC5-4800B-R)
 Storage: 1 x 1.6 TB NVMe SSD, RAID 0
 Other: None

Software

OS: Ubuntu 22.04.1 LTS
 Kernel 5.15.0-53-generic
 Compiler: C/C++/Fortran: Version 4.0.0 of AOCC
 Parallel: No
 Firmware: HPE BIOS Version v1.12 11/24/2022 released
 Nov-2022
 File System: ext4
 System State: Run level 5 (multi-user)
 Base Pointers: 64-bit
 Peak Pointers: 32/64-bit
 Other: None
 Power Management: BIOS and OS set to prefer performance at the cost of additional power usage



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Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
500.perlbench_r	128	460	443	461	442	459	444	128	460	443	461	442	459	444
502.gcc_r	128	380	477	382	475	382	475	128	298	608	296	611	296	613
505.mcf_r	128	238	870	236	876	236	875	128	238	870	236	876	236	875
520.omnetpp_r	128	566	297	556	302	560	300	128	566	297	556	302	560	300
523.xalancbmk_r	128	213	634	213	635	212	638	128	157	863	153	884	157	861
525.x264_r	128	149	1510	150	1500	149	1510	128	149	1510	150	1500	149	1510
531.deepsjeng_r	128	283	518	283	518	283	518	128	283	518	283	519	283	519
541.leela_r	128	419	506	417	508	418	507	128	408	519	420	505	409	518
548.exchange2_r	128	236	1420	236	1420	236	1420	128	235	1430	234	1430	235	1430
557.xz_r	128	441	313	439	315	439	315	128	441	313	439	315	439	315

SPECrate®2017_int_base = **602**

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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.

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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/amd_rate_aocc400_genoa_B_lib/lib:/home/cpu2017/amd_rate_a
occ400_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
Thermal Configuration set to Maximum Cooling
ACPI CST C2 Latency set to 18 microseconds
Workload Profile set to Custom
Power Regulator set to OS Control Mode

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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-L6

```
Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
running on admin1 Tue Jun 28 00:56:23 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 9534 64-Core Processor
 1 "physical id"s (chips)
128 "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 : 64
siblings : 128
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 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
53 54 55 56 57 58 59 60 61 62 63
```

```
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):                 128
On-line CPU(s) list:   0-127
Vendor ID:              AuthenticAMD
Model name:             AMD EPYC 9534 64-Core Processor
CPU family:             25
Model:                  17
Thread(s) per core:    2
Core(s) per socket:    64
Socket(s):              1
Stepping:               1
Frequency boost:       enabled
CPU max MHz:           3719.0000
CPU min MHz:           400.0000
BogoMIPS:               4892.54
Flags:                  fpu vme de pse tsc msr pae mce cx8 apic sep mtrr
pge mca cmov pat pse36 clflush mmx fxsr sse2 ht syscall nx mmxext fxsr_opt
pdpe1gb rdtscp lm constant_tsc rep_good nopl nonstop_tsc cpuid extd_apicid
aperfmpperf rapl pni pclmulqdq monitor ssse3 fma cx16 pcid sse4_1 sse4_2 x2apic movbe
```

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Platform Notes (Continued)

popcnt aes xsave avx f16c rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse 3dnowprefetch osvw ibs skinit wdt tce topoext perfctr_core perfctr_nb bpext perfctr_llc mwaitx cpb cat_l3 cdp_l3 invpcid_single hw_pstate ssbd mba ibrs ibpb stibp vmmcall fsgsbase bmi1 avx2 smep bmi2 erms invpcid cqm rdt_a avx512f avx512dq rdseed adx smap avx512ifma clflushopt clwb avx512cd sha_ni avx512bw avx512vl xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local avx512_bf16 clzero irperf xsaveerptr rdpru wbnoinvd amd_ppin cppc arat npt lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter pfthreshold avic v_vmsave_vmload vgif v_spec_ctrl avx512vbmi umip pku ospke avx512_vbmi2 gfni vaes vpclmulqdq avx512_vnni avx512_bitalg avx512_vpopcntdq la57 rdpid overflow_recov succor smca fsrm flush_lld

Virtualization: AMD-V
L1d cache: 2 MiB (64 instances)
L1i cache: 2 MiB (64 instances)
L2 cache: 64 MiB (64 instances)
L3 cache: 256 MiB (8 instances)
NUMA node(s): 8
NUMA node0 CPU(s): 0-7,64-71
NUMA node1 CPU(s): 32-39,96-103
NUMA node2 CPU(s): 16-23,80-87
NUMA node3 CPU(s): 48-55,112-119
NUMA node4 CPU(s): 24-31,88-95
NUMA node5 CPU(s): 56-63,120-127
NUMA node6 CPU(s): 8-15,72-79
NUMA node7 CPU(s): 40-47,104-111
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf: 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; usercopy/swapgs barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Retpolines, IBPB conditional, IBRS_FW, STIBP always-on, RSB filling, PBRSE-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	2M	8	Data	1	64	1	64
L1i	32K	2M	8	Instruction	1	64	1	64
L2	1M	64M	8	Unified	2	2048	1	64
L3	32M	256M	16	Unified	3	32768	1	64

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Platform Notes (Continued)

```
/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: 8 nodes (0-7)
node 0 cpus: 0 1 2 3 4 5 6 7 64 65 66 67 68 69 70 71
node 0 size: 48069 MB
node 0 free: 47425 MB
node 1 cpus: 32 33 34 35 36 37 38 39 96 97 98 99 100 101 102 103
node 1 size: 48344 MB
node 1 free: 47800 MB
node 2 cpus: 16 17 18 19 20 21 22 23 80 81 82 83 84 85 86 87
node 2 size: 48380 MB
node 2 free: 47668 MB
node 3 cpus: 48 49 50 51 52 53 54 55 112 113 114 115 116 117 118 119
node 3 size: 48380 MB
node 3 free: 47745 MB
node 4 cpus: 24 25 26 27 28 29 30 31 88 89 90 91 92 93 94 95
node 4 size: 48380 MB
node 4 free: 47846 MB
node 5 cpus: 56 57 58 59 60 61 62 63 120 121 122 123 124 125 126 127
node 5 size: 48380 MB
node 5 free: 47849 MB
node 6 cpus: 8 9 10 11 12 13 14 15 72 73 74 75 76 77 78 79
node 6 size: 48380 MB
node 6 free: 47850 MB
node 7 cpus: 40 41 42 43 44 45 46 47 104 105 106 107 108 109 110 111
node 7 size: 48335 MB
node 7 free: 47803 MB
```

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

From /proc/meminfo

```
MemTotal: 395929632 kB
HugePages_Total: 0
Hugepagesize: 2048 kB
```

```
/sbin/tuned-adm active
```

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Platform Notes (Continued)

Current active profile: throughput-performance

```
/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 5.15.0-53-generic #59-Ubuntu SMP Mon Oct 17 18:53:30 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
retbleed:	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/swapgs barriers and __user pointer sanitization
CVE-2017-5715 (Spectre variant 2):	Mitigation: Retpolines, IBPB: conditional, IBRS_FW, STIBP: always-on, RSB filling, PBRSE-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
```

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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	19G	75G	20%	/

```

From /sys/devices/virtual/dmi/id
Vendor:          HPE
Product:         ProLiant DL345 Gen11
Product Family: ProLiant
Serial:          DL345G11-002

```

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:
  4x Hynix HMC88AEBRA168N 32 GB 2 rank 4800
  4x Hynix HMC88MEBRA113N 32 GB 2 rank 4800
  4x Hynix HMC88MEBRA115N 32 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 | 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)

```

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Compiler Version Notes (Continued)

Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

=====
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)
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C | 500.perlbench_r(base, peak) 502.gcc_r(base) 505.mcf_r(base, peak)
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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

=====
C++ | 523.xalancbmk_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++ | 520.omnetpp_r(base, peak) 523.xalancbmk_r(base)
| 531.deepsjeng_r(base, peak) 541.leela_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
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Compiler Version Notes (Continued)

=====
C++ | 523.xalancbmk_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++ | 520.omnetpp_r(base, peak) 523.xalancbmk_r(base)
531.deepsjeng_r(base, peak) 541.leela_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
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

=====
Fortran | 548.exchange2_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
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

Base Compiler Invocation

C benchmarks:
clang

C++ benchmarks:
clang++

Fortran benchmarks:
flang



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Base Portability Flags

```

500.perlbench_r: -DSPEC_LINUX_X64 -DSPEC_LP64
502.gcc_r: -DSPEC_LP64
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

```

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 -unroll-threshold=50
-mllvm -inline-threshold=1000 -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-iv-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

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL345 Gen11

(2.45 GHz, AMD EPYC 9534)

SPECrate®2017_int_base = 602

SPECrate®2017_int_peak = 638

CPU2017 License: 3

Test Sponsor: HPE

Tested by: HPE

Test Date: Dec-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

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Peak Optimization Flags (Continued)

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

505.mcf_r: basepeak = yes

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  
-mllvm -unroll-threshold=100  
-mllvm -reduce-array-computations=3 -zopt  
-mllvm -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  
-mllvm -unroll-threshold=100 -finline-aggressive  
-mllvm -loop-unswitch-threshold=200000  
-mllvm -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  
-march=znver4 -fveclib=AMDLIBM -ffast-math  
-finline-aggressive -mllvm -unroll-threshold=100  
-mllvm -reduce-array-computations=3 -zopt  
-fvirtual-function-elimination -fvisibility=hidden  
-lamdlibm -lflang -lamdalloc-ext
```

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Peak Optimization Flags (Continued)

Fortran benchmarks:

```
-m64 -flt0 -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 -fepilog-vectorization-of-inductions  
-mllvm -optimize-strided-mem-cost -floop-transform  
-mllvm -unroll-aggressive -mllvm -unroll-threshold=500 -lamdlibm  
-lflang -lamdalloc
```

Peak Other Flags

C benchmarks (except as noted below):

```
-Wno-unused-command-line-argument
```

```
502.gcc_r: -L/usr/lib32 -Wno-unused-command-line-argument
```

```
-L/home/work/cpu2017/v118/aocc4/b1/rate/amd_rate_aocc400_genoa_B_lib/lib32
```

C++ benchmarks (except as noted below):

```
-Wno-unused-command-line-argument
```

```
523.xalancbmk_r: -L/usr/lib32 -Wno-unused-command-line-argument
```

```
-L/home/work/cpu2017/v118/aocc4/b1/rate/amd_rate_aocc400_genoa_B_lib/lib32
```

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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