



SPEC CPU®2017 Integer Speed Result

Copyright 2017-2023 Standard Performance Evaluation Corporation

Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL345 Gen11

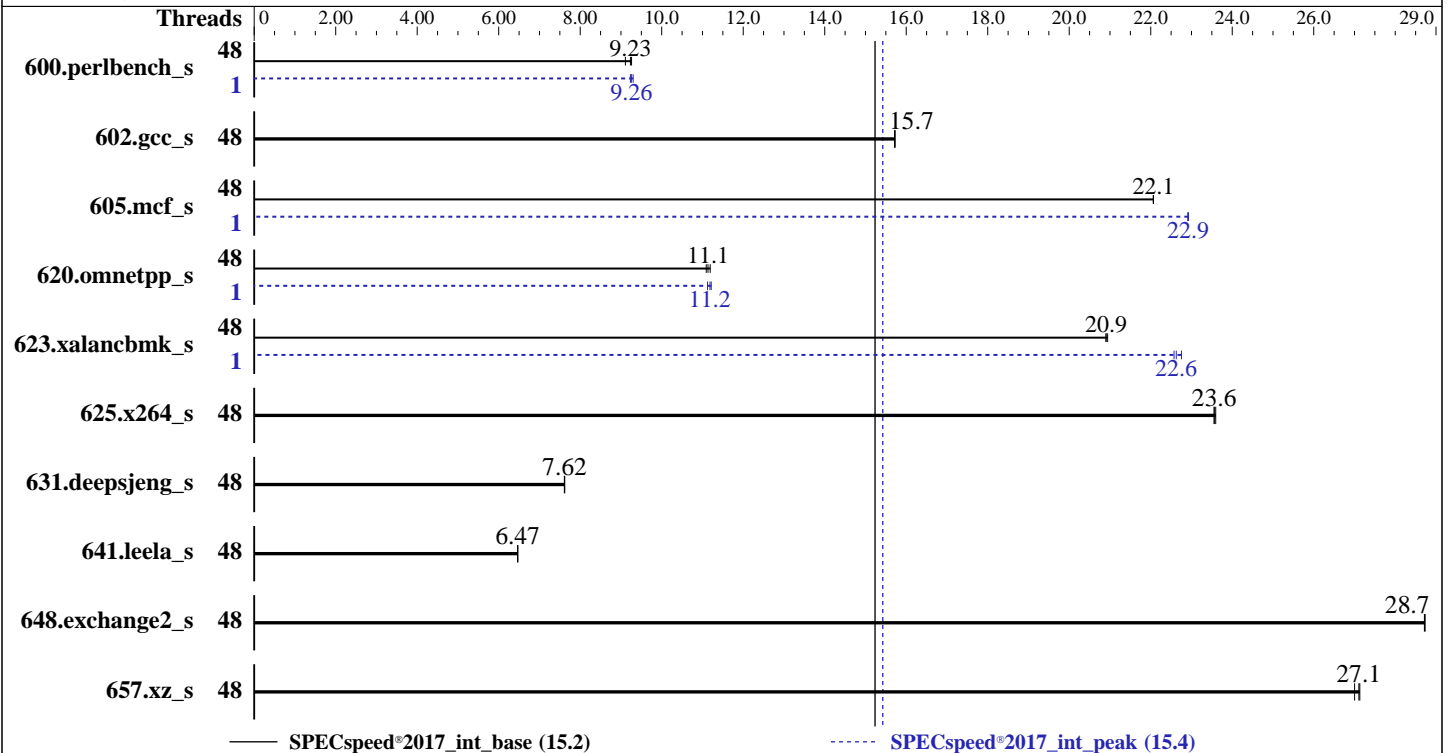
(3.60 GHz, AMD EPYC 9474F)

SPECspeed®2017_int_base = 15.2

SPECspeed®2017_int_peak = 15.4

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 9474F
 Max MHz: 4100
 Nominal: 3600
 Enabled: 48 cores, 1 chip
 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 / 6 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: Red Hat Enterprise Linux 9.0 (Plow)
 Kernel 5.14.0-70.13.1.el9_0.x86_64
 Compiler: C/C++/Fortran: Version 4.0.0 of AOCC
 Parallel: Yes
 Firmware: HPE BIOS Version v1.12 11/24/2022 released
 Nov-2022
 File System: xfs
 System State: Run level 3 (multi-user)
 Base Pointers: 64-bit
 Peak Pointers: 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						
	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
600.perlbench_s	48	192	9.26	195	9.11	192	9.23	1	192	9.26	191	9.30	192	9.23
602.gcc_s	48	253	15.7	253	15.7	253	15.7	48	253	15.7	253	15.7	253	15.7
605.mcf_s	48	214	22.1	214	22.1	214	22.1	1	206	22.9	206	22.9	206	22.9
620.omnetpp_s	48	147	11.1	146	11.1	146	11.2	1	147	11.1	145	11.2	146	11.2
623.xalancbmk_s	48	67.8	20.9	67.7	20.9	67.8	20.9	1	62.6	22.6	62.8	22.6	62.3	22.8
625.x264_s	48	74.8	23.6	74.9	23.6	74.9	23.6	48	74.8	23.6	74.9	23.6	74.9	23.6
631.deepsjeng_s	48	188	7.61	188	7.62	188	7.62	48	188	7.61	188	7.62	188	7.62
641.leela_s	48	264	6.47	264	6.47	264	6.47	48	264	6.47	264	6.47	264	6.47
648.exchange2_s	48	102	28.7	102	28.7	102	28.7	48	102	28.7	102	28.7	102	28.7
657.xz_s	48	228	27.1	228	27.1	229	27.0	48	228	27.1	228	27.1	229	27.0

SPECspeed®2017_int_base = **15.2**

SPECspeed®2017_int_peak = **15.4**

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) for all allocations,
'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:
GOMP_CPU_AFFINITY = "0-47"
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_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "48"

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
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

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

(Continued on next page)



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Platform Notes (Continued)

ROM is version GenoaPI 1.0.0.1-L6

```
Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
running on localhost.localdomain Sun Jun  4 12:00:02 2023
```

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 9474F 48-Core Processor
 1 "physical id"s (chips)
 48 "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 : 48
siblings  : 48
physical 0: cores 0 1 2 3 4 5 8 9 10 11 12 13 16 17 18 19 20 21 24 25 26 27 28 29
          32 33 34 35 36 37 40 41 42 43 44 45 48 49 50 51 52 53 56 57 58 59 60 61
```

From lscpu from util-linux 2.37.4:

```
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): 48
On-line CPU(s) list: 0-47
Vendor ID: AuthenticAMD
BIOS Vendor ID: Advanced Micro Devices, Inc.
Model name: AMD EPYC 9474F 48-Core Processor
BIOS Model name: AMD EPYC 9474F 48-Core Processor
CPU family: 25
Model: 17
Thread(s) per core: 1
Core(s) per socket: 48
Socket(s): 1
Stepping: 1
BogoMIPS: 7189.31
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
aperfmpperf 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
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
```

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Platform Notes (Continued)

```

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 arat npt
lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter
pfthreshold avic v_ymSAVE_ymload 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: 1.5 MiB (48 instances)

L1i cache: 1.5 MiB (48 instances)

L2 cache: 48 MiB (48 instances)

L3 cache: 256 MiB (8 instances)

NUMA node(s):

8

NUMA node0 CPU(s):

0-5

NUMA node1 CPU(s):

24-29

NUMA node2 CPU(s):

12-17

NUMA node3 CPU(s):

36-41

NUMA node4 CPU(s):

18-23

NUMA node5 CPU(s):

42-47

NUMA node6 CPU(s):

6-11

NUMA node7 CPU(s):

30-35

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

Vulnerability Spectre v1: Mitigation; usercopy/swapgs barriers and __user pointer sanitization

Vulnerability Spectre v2: Mitigation; Retpolines, IBPB conditional, IBRS_FW, STIBP disabled, RSB filling

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	1.5M	8	Data	1	64	1	64
L1i	32K	1.5M	8	Instruction	1	64	1	64
L2	1M	48M	8	Unified	2	2048	1	64
L3	32M	256M	16	Unified	3	32768	1	64

/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)

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Platform Notes (Continued)

```

node 0 cpus: 0 1 2 3 4 5
node 0 size: 48136 MB
node 0 free: 47912 MB
node 1 cpus: 24 25 26 27 28 29
node 1 size: 48346 MB
node 1 free: 48072 MB
node 2 cpus: 12 13 14 15 16 17
node 2 size: 48382 MB
node 2 free: 48204 MB
node 3 cpus: 36 37 38 39 40 41
node 3 size: 48382 MB
node 3 free: 48006 MB
node 4 cpus: 18 19 20 21 22 23
node 4 size: 48382 MB
node 4 free: 48255 MB
node 5 cpus: 42 43 44 45 46 47
node 5 size: 48382 MB
node 5 free: 48291 MB
node 6 cpus: 6 7 8 9 10 11
node 6 size: 48382 MB
node 6 free: 48259 MB
node 7 cpus: 30 31 32 33 34 35
node 7 size: 48334 MB
node 7 free: 48219 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:      396010920 kB
HugePages_Total:      0
Hugepagesize:    2048 kB

```

From /etc/*release* /etc/*version*

```

os-release:
NAME="Red Hat Enterprise Linux"
VERSION="9.0 (Plow)"
ID="rhel"
ID_LIKE="fedora"
VERSION_ID="9.0"

```

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Platform Notes (Continued)

```
PLATFORM_ID="platform:el9"
PRETTY_NAME="Red Hat Enterprise Linux 9.0 (Plow)"
ANSI_COLOR="0;31"
```

```
redhat-release: Red Hat Enterprise Linux release 9.0 (Plow)
system-release: Red Hat Enterprise Linux release 9.0 (Plow)
system-release-cpe: cpe:/o:redhat:enterprise_linux:9::baseos
```

uname -a:

```
Linux localhost.localdomain 5.14.0-70.13.1.el9_0.x86_64 #1 SMP PREEMPT Thu Apr 14
12:42:38 EDT 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
CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store
Bypass disabled via prctl
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:
disabled, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort): Not affected
```

run-level 3 Jun 4 11:03

SPEC is set to: /home/cpu2017

```
Filesystem Type Size Used Avail Use% Mounted on
/dev/mapper/rhel-home xfs 819G 12G 807G 2% /home
```

From /sys/devices/virtual/dmi/id

```
Vendor: HPE
Product: ProLiant DL345 Gen11
Product Family: ProLiant
Serial: DL345G11-004
```

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:

```
12x Hynix HMC88MEBRA113N 32 GB 2 rank 4800
```

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Platform Notes (Continued)

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/aocc/aocc-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
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 | 648.exchange2_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/aocc/aocc-compiler-rel-4.0-3206-389/bin



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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 -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 -flto -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 -flto
-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
```

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Base Optimization Flags (Continued)

C++ benchmarks (continued):

-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 -flto -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

Peak Compiler Invocation

C benchmarks:

clang

C++ benchmarks:

clang++

Fortran benchmarks:

flang

Peak Portability Flags

Same as Base Portability Flags



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Peak Optimization Flags

C benchmarks:

```
600.perlbench_s: -m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-allow-multiple-definition -Ofast -march=znver4
-fveclib=AMDLIBM -ffast-math -fopenmp -flto
-fstruct-layout=9 -mllvm -unroll-threshold=50
-fremap-arrays -fstrip-mining
-mllvm -inline-threshold=1000
-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt
-fopenmp=libomp -lomp -lamdlibm -lamdalloc -lflang
```

602.gcc_s: basepeak = yes

605.mcf_s: Same as 600.perlbench_s

625.x264_s: basepeak = yes

657.xz_s: basepeak = yes

C++ benchmarks:

```
620.omnetpp_s: -m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver4 -fveclib=AMDLIBM -ffast-math -fopenmp
-flto -finline-aggressive -mllvm -unroll-threshold=100
-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt
-fvirtual-function-elimination -fvisibility=hidden
-fopenmp=libomp -lomp -lamdlibm -lamdalloc-ext -lflang
```

```
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
-march=znver4 -fveclib=AMDLIBM -ffast-math -fopenmp
-flto -finline-aggressive -mllvm -unroll-threshold=100
-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt
-mllvm -do-block-reorder=aggressive
-fvirtual-function-elimination -fvisibility=hidden
-fopenmp=libomp -lomp -lamdlibm -lamdalloc-ext -lflang
```

631.deepsjeng_s: basepeak = yes

641.leela_s: basepeak = yes

Fortran benchmarks:

(Continued on next page)



SPEC CPU®2017 Integer Speed Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL345 Gen11

(3.60 GHz, AMD EPYC 9474F)

SPECspeed®2017_int_base = 15.2

SPECspeed®2017_int_peak = 15.4

CPU2017 License: 3

Test Sponsor: HPE

Tested by: HPE

Test Date: Dec-2022

Hardware Availability: Dec-2022

Software Availability: Nov-2022

Peak Optimization Flags (Continued)

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-rev2.0.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>

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