



SPEC CPU®2017 Integer Speed Result

Copyright 2017-2023 Standard Performance Evaluation Corporation

Lenovo Global Technology

ThinkSystem SR645 V3
(3.85 GHz, AMD EPYC 9374F)

SPECSpeed®2017_int_base = 16.0

SPECSpeed®2017_int_peak = 16.2

CPU2017 License: 9017

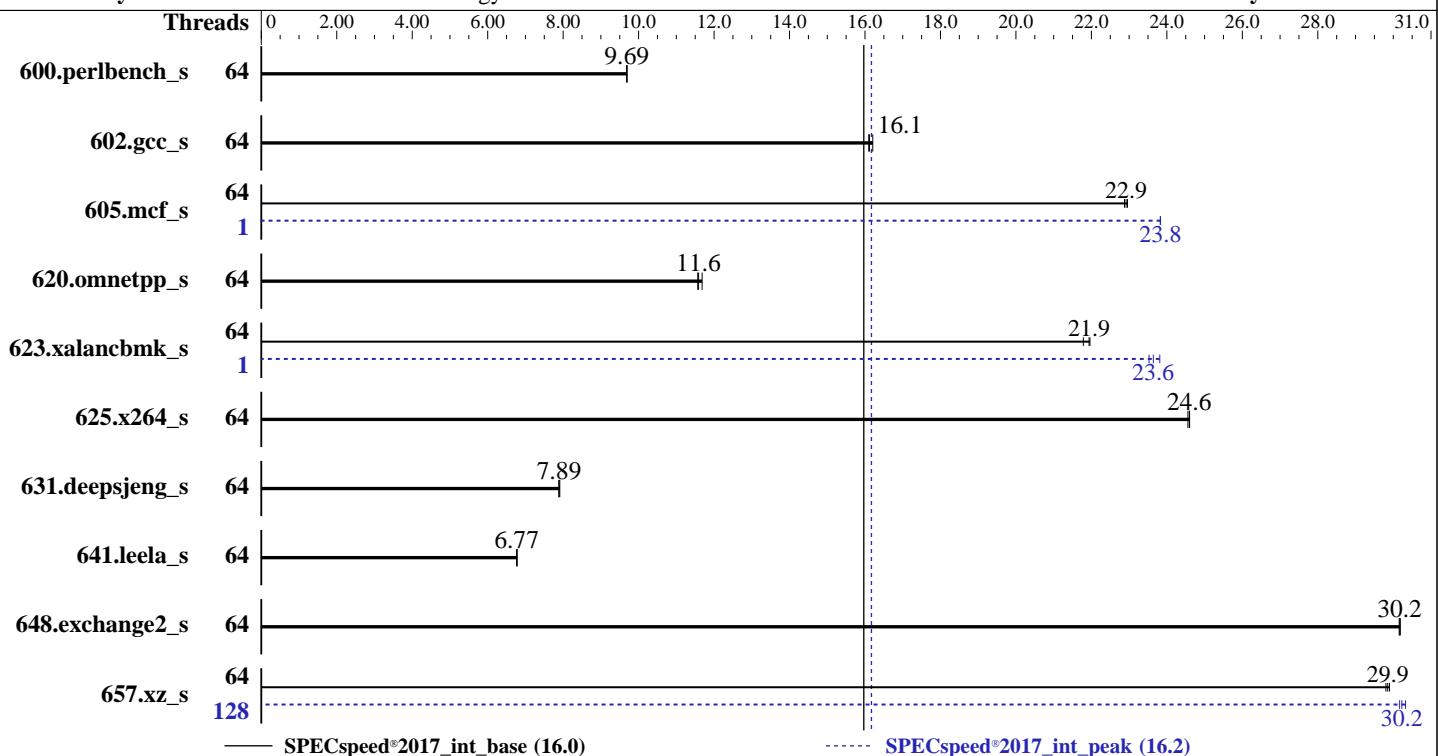
Test Date: Jan-2023

Test Sponsor: Lenovo Global Technology

Hardware Availability: Feb-2023

Tested by: Lenovo Global Technology

Software Availability: Nov-2022



Hardware		Software	
CPU Name:	AMD EPYC 9374F	OS:	SUSE Linux Enterprise Server 15 SP4 (x86_64)
Max MHz:	4300		Kernel 5.14.21-150400.22-default
Nominal:	3850	Compiler:	C/C++/Fortran: Version 4.0.0 of AOCC
Enabled:	64 cores, 2 chips, 2 threads/core	Parallel:	Yes
Orderable:	1,2 chips	Firmware:	Lenovo BIOS Version KAE105L 1.20 released Dec-2022
Cache L1:	32 KB I + 32 KB D on chip per core	File System:	xfs
L2:	1 MB I+D on chip per core	System State:	Run level 3 (multi-user)
L3:	256 MB I+D on chip per chip, 32 MB shared / 4 cores	Base Pointers:	64-bit
Other:	None	Peak Pointers:	64-bit
Memory:	768 GB (24 x 32 GB 2Rx8 PC5-4800B-R)	Other:	None
Storage:	1 x 480 GB SATA SSD	Power Management:	BIOS and OS set to prefer performance at the cost of additional power usage
Other:	None		



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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	64	<u>183</u>	9.69	183	9.69	183	9.68	64	<u>183</u>	9.69	183	9.69	183	9.68
602.gcc_s	64	<u>247</u>	16.1	246	16.2	247	16.1	64	<u>247</u>	16.1	246	16.2	247	16.1
605.mcf_s	64	206	23.0	206	22.9	<u>206</u>	22.9	1	198	23.8	<u>198</u>	23.8	198	23.8
620.omnetpp_s	64	<u>141</u>	11.6	141	11.6	140	11.7	64	<u>141</u>	11.6	141	11.6	140	11.7
623.xalancbmk_s	64	64.5	22.0	<u>64.6</u>	21.9	65.0	21.8	1	59.5	23.8	<u>59.9</u>	23.6	60.2	23.5
625.x264_s	64	<u>71.7</u>	24.6	71.8	24.6	71.7	24.6	64	<u>71.7</u>	24.6	71.8	24.6	71.7	24.6
631.deepsjeng_s	64	181	7.91	<u>182</u>	7.89	182	7.89	64	181	7.91	<u>182</u>	7.89	182	7.89
641.leela_s	64	252	6.78	<u>252</u>	6.77	252	6.77	64	252	6.78	<u>252</u>	6.77	252	6.77
648.exchange2_s	64	97.4	30.2	97.5	30.2	<u>97.4</u>	30.2	64	97.4	30.2	97.5	30.2	<u>97.4</u>	30.2
657.xz_s	64	207	29.9	207	29.8	<u>207</u>	29.9	128	204	30.3	205	30.2	<u>205</u>	30.2

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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) 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 = "0-127"
LD_LIBRARY_PATH =
 "/home/cpu2017-1.1.8-amd-aocc400-genoa-B1b/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 = "128"

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 = "0-127"

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.



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Platform Notes

BIOS configuration:

Operating Mode set to Maximum Performance and then set it to Custom Mode
NUMA Nodes per Socket set to NPS4

```
Sysinfo program /home/cpu2017-1.1.8-amd-aocc400-genoa-B1b/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
running on localhost Fri Apr 29 20:11:22 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 9374F 32-Core Processor
  2 "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 : 32
  siblings : 64
  physical 0: cores 0 1 2 3 10 11 16 17 18 19 24 25 26 27 32 33 34 35 40 41 42 43 48
  49 50 51 56 57 58 59
  physical 1: cores 0 1 2 3 10 11 16 17 18 19 24 25 26 27 32 33 34 35 40 41 42 43 48
  49 50 51 56 57 58 59
```

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 9374F 32-Core Processor
CPU family: 25
Model: 17
Thread(s) per core: 2
Core(s) per socket: 32
Socket(s): 2
Stepping: 1
Frequency boost: enabled
CPU max MHz: 4304.9312
CPU min MHz: 1500.0000
BogoMIPS: 7688.32
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
```

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Platform Notes (Continued)

```

aperfmpfperf rapl pnpi 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 cqmq rdt_a avx512f
avx512dq rdseed adx smap avx512ifma clflushopt clwb avx512cd sha_ni avx512bw
avx512vl xsaveopt xsavec xgetbv1 xsaves cqmq_llc cqmq_occup_llc cqmq_mbm_total
cqmq_mbm_local avx512_bf16 clzero irperf xsaveerptr rdpru wbnoinvd amd_ppin arat npt
lbrv svm_lock nrrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter
pfthreshold avic v_vmsave_vmlload 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_ll1d

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): 8
NUMA node0 CPU(s): 0-7,64-71
NUMA node1 CPU(s): 8-15,72-79
NUMA node2 CPU(s): 16-23,80-87
NUMA node3 CPU(s): 24-31,88-95
NUMA node4 CPU(s): 32-39,96-103
NUMA node5 CPU(s): 40-47,104-111
NUMA node6 CPU(s): 48-55,112-119
NUMA node7 CPU(s): 56-63,120-127
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/swaps barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Retpolines, IBPB conditional, IBRS_FW, STIBP always-on, 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	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	512M	16	Unified	3	32768	1	64

/proc/cpuinfo cache data

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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 4 5 6 7 64 65 66 67 68 69 70 71
node 0 size: 96505 MB
node 0 free: 95172 MB
node 1 cpus: 8 9 10 11 12 13 14 15 72 73 74 75 76 77 78 79
node 1 size: 96752 MB
node 1 free: 96504 MB
node 2 cpus: 16 17 18 19 20 21 22 23 80 81 82 83 84 85 86 87
node 2 size: 96752 MB
node 2 free: 96433 MB
node 3 cpus: 24 25 26 27 28 29 30 31 88 89 90 91 92 93 94 95
node 3 size: 96717 MB
node 3 free: 96187 MB
node 4 cpus: 32 33 34 35 36 37 38 39 96 97 98 99 100 101 102 103
node 4 size: 96752 MB
node 4 free: 96446 MB
node 5 cpus: 40 41 42 43 44 45 46 47 104 105 106 107 108 109 110 111
node 5 size: 96752 MB
node 5 free: 96457 MB
node 6 cpus: 48 49 50 51 52 53 54 55 112 113 114 115 116 117 118 119
node 6 size: 96752 MB
node 6 free: 96361 MB
node 7 cpus: 56 57 58 59 60 61 62 63 120 121 122 123 124 125 126 127
node 7 size: 96553 MB
node 7 free: 96244 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:      792101432 kB
HugePages_Total:      0
Hugepagesize:     2048 kB
```

/sys/devices/system/cpu/cpu*/cpufreq/scaling_governor has
performance

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Platform Notes (Continued)

```
From /etc/*release* /etc/*version*
os-release:
  NAME="SLES"
  VERSION="15-SP4"
  VERSION_ID="15.4"
  PRETTY_NAME="SUSE Linux Enterprise Server 15 SP4"
  ID="sles"
  ID_LIKE="suse"
  ANSI_COLOR="0;32"
  CPE_NAME="cpe:/o:suse:sles:15:sp4"

uname -a:
Linux localhost 5.14.21-150400.22-default #1 SMP PREEMPT_DYNAMIC Wed May 11 06:57:18
UTC 2022 (49db222) 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/swaps barriers and __user pointer sanitization
CVE-2017-5715 (Spectre variant 2):	Mitigation: Retpolines, IBPB: conditional, IBRS_FW, STIBP: always-on, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling):	Not affected
CVE-2019-11135 (TSX Asynchronous Abort):	Not affected

run-level 3 Apr 29 20:00

```
SPEC is set to: /home/cpu2017-1.1.8-amd-aocc400-genoa-B1b
Filesystem      Type  Size  Used Avail Use% Mounted on
/dev/sdb3        xfs   442G   46G  397G  11%  /
```

From /sys/devices/virtual/dmi/id

```
Vendor:          Lenovo
Product:         ThinkSystem SR645 V3 MB, Genoa, DDR5, Oahu, 1U
Product Family:  ThinkSystem
Serial:          1234567890
```

Additional information from dmidecode 3.2 follows. WARNING: Use caution when you

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Platform Notes (Continued)

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:

7x SK Hynix HMCG88AEBRA115N 32 GB 2 rank 4800
17x SK Hynix HMCG88AEBRA168N 32 GB 2 rank 4800

BIOS:

BIOS Vendor: Lenovo
BIOS Version: KAE105L-1.20
BIOS Date: 12/29/2022
BIOS Revision: 1.20
Firmware Revision: 1.20

(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
```

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Compiler Version Notes (Continued)

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

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 -fvecelib=AMDLIBM
-ffast-math -fopenmp -futo -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
-lamdaloc

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Base Optimization Flags (Continued)

C++ benchmarks:

```
-m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver4
-fvec/lib=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
-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 -fvec/lib=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
```



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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: -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 -lamdaloc -lflang

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
-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 -lamdaloc-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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Lenovo Global Technology

ThinkSystem SR645 V3
(3.85 GHz,AMD EPYC 9374F)

SPECspeed®2017_int_base = 16.0

SPECspeed®2017_int_peak = 16.2

CPU2017 License: 9017

Test Date: Jan-2023

Test Sponsor: Lenovo Global Technology

Hardware Availability: Feb-2023

Tested by: Lenovo Global Technology

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/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Genoa-P.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/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Genoa-P.xml>
<http://www.spec.org/cpu2017/flags/aocc400-flags.xml>

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