## Lenovo Global Technology

ThinkSystem SR635 V3  
(4.10 GHz, AMD EPYC 9174F)

<table>
<thead>
<tr>
<th>SPECspeed®2017_int_base</th>
<th>16.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECspeed®2017_int_peak</td>
<td>16.5</td>
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**CPU2017 License:** 9017  
**Test Sponsor:** Lenovo Global Technology  
**Tested by:** Lenovo Global Technology  
**Test Date:** Jan-2023  
**Hardware Availability:** Apr-2023  
**Software Availability:** Nov-2022

### Test Results

<table>
<thead>
<tr>
<th>SPECbench/Specspeed Benchmark</th>
<th>Threads</th>
<th>SPECspeed®2017_int_base (16.2)</th>
<th>SPECspeed®2017_int_peak (16.5)</th>
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<tbody>
<tr>
<td>600.perlbench_s</td>
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<td>9.91</td>
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<tr>
<td>602.gcc_s</td>
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<td>605.mcf_s</td>
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<tr>
<td>620.omnetpp_s</td>
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<td>623.xalancbmk_s</td>
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<td>625.x264_s</td>
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<tr>
<td>657.xz_s</td>
<td>32</td>
<td>28.6</td>
<td>30.0</td>
</tr>
</tbody>
</table>

### Hardware

- **CPU Name:** AMD EPYC 9174F  
- **Max MHz:** 4400  
- **Nominal:** 4100  
- **Enabled:** 16 cores, 1 chip, 2 threads/core  
- **Orderable:** 1 chip  
- **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 / 2 cores  
- **Other:** None  
- **Memory:** 384 GB (12 x 32 GB 2Rx8 PC5-4800B-R)  
- **Storage:** 1 x 480 GB SATA SSD  
- **Power Management:** BIOS and OS set to prefer performance at the cost of additional power usage

### Software

- **OS:** SUSE Linux Enterprise Server 15 SP4 (x86_64)  
- **Kernel:** 5.14.21-150400.22-default  
- **Compiler:** C/C++/Fortran: Version 4.0.0 of AOCC  
- **Parallel:** Yes  
- **Firmware:** Lenovo BIOS Version KAE105L 1.20 released Dec-2022  
- **File System:** xfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 64-bit  
- **Other:** None
## Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
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<th>Ratio</th>
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<td>29.8</td>
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</tbody>
</table>

### 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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SPECspeed®2017_int_base = 16.2
SPECspeed®2017_int_peak = 16.5

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 = "0-31"
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"
MALLOCONF = "oversize_threshold:0,retain:true"
OMP_DYNAMIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREADLIMIT = "32"

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 = "0-31"
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.
**SPEC CPU®2017 Integer Speed Result**

**Lenovo Global Technology**

ThinkSystem SR635 V3
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**SPECspeed®2017_int_base = 16.2**

**SPECspeed®2017_int_peak = 16.5**

---

**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-aoccg400-genoa-B1b/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16aca64d
running on localhost Tue Jan 17 16:53:26 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 9174F 16-Core Processor
  1  "physical id"s (chips)
  32 "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 16 17 24 25 32 33 40 41 48 49 56 57
```

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): 32
On-line CPU(s) list: 0-31
Vendor ID: AuthenticAMD
Model name: AMD EPYC 9174F 16-Core Processor
CPU family: 25
Model: 17
Thread(s) per core: 2
Core(s) per socket: 16
Socket(s): 1
Stepping: 1
Frequency boost: enabled
CPU max MHz: 4408.2998
CPU min MHz: 1500.0000
BogoMIPS: 8187.02
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
aperfmperf rctl pni pclmulqdq monitor sse3 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 kfnit wdt tce topoext perfctr_core perfctr_nb
```

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

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Lenovo Global Technology

SPECspeed®2017_int_base = 16.2
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Test Date: Jan-2023

Platform Notes (Continued)

bnext perfctr_llc mwaitx cpb cat_l13 cdp_l13 invpcid_single hw_pstate ssbd mba ibrs
ibpb stibp vmmcall fsqsbale bni1 avx2 smep bmi2 erms invpcid cqm rdt_a avx512f
avx512dq rdseed addx smap avx512ifma clflushopt clwb avx512cd sha ni avx512bw
avx512vl xsaveopt xsavevc xgetbv1 xsave ccq_occup_llc ccq_mbm_total
ccq_mbm_local avx512_by16 clzero irperf xsaeeprtr rdpru wbnoinvmd amd_ppin arat
npt

Virtualization:
L1d cache: 512 KiB (16 instances)
L1i cache: 512 KiB (16 instances)
L2 cache: 16 MiB (16 instances)
L3 cache: 256 MiB (8 instances)
NUMA node(s): 4
NUMA node0 CPU(s): 0-3, 16-19
NUMA node1 CPU(s): 4-7, 20-23
NUMA node2 CPU(s): 8-11, 24-27
NUMA node3 CPU(s): 12-15, 28-31
Vulnerability Itlb multihit: Not affected
Vulnerability L1t: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Spectre store bypass: Mitigation; Speculative Store Bypass disabled via
prctl and seccomp
Vulnerability Spectre v1: Mitigation; usерcopy/swapgs barriers and __user
pointer sanitization
Vulnerability Spectre v2: Mitigation; Retpolines, IBFB conditional, IBRS_FW,
STIBP always-on, RSB filling
Vulnerability Srbds: Not affected
Vulnerability Txs async abort: Not affected

From lscpu --cache:
NAME ONE-SIZE ALL-SIZE WAYS TYPE LEVEL SETS PHY-LINE COHERENCY-SIZE
L1d 32K 512K 8 Data 1 64 1 64
L1i 32K 512K 8 Instruction 1 64 1 64
L2 1M 16M 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: 4 nodes (0-3)
node 0 cpus: 0 1 2 3 16 17 18 19
node 0 size: 96490 MB

(Continued on next page)
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SPECspeed®2017_int_base = 16.2
SPECspeed®2017_int_peak = 16.5

Platform Notes (Continued)

node 0 free: 96071 MB
node 1 cpus: 4 5 6 7 20 21 22 23
node 1 size: 96736 MB
node 1 free: 96452 MB
node 2 cpus: 8 9 10 11 24 25 26 27
node 2 size: 96701 MB
node 2 free: 96494 MB
node 3 cpus: 12 13 14 15 28 29 30 31
node 3 size: 96543 MB
node 3 free: 96091 MB
node distances:
node   0   1   2   3
 0:  10  12  12  12
 1:  12  10  12  12
 2:  12  12  10  12
 3:  12  12  12  10

From /proc/meminfo
MemTotal:       395746788 kB
HugePages_Total:       0
Hugepagesize:       2048 kB

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

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

(Continued on next page)
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| Test Date: | Jan-2023 |
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### Platform Notes (Continued)

CVE-2017-5753 (Spectre variant 1):
- Bypass disabled via prctl and seccomp
- Mitigation: usercopy/swapsgs 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 Jan 17 01:04

SPEC is set to: /home/cpu2017-1.1.8-amd-aocc400-genoa-B1b

<table>
<thead>
<tr>
<th>Filesystem</th>
<th>Type</th>
<th>Size</th>
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<th>Avail</th>
<th>Use%</th>
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<tr>
<td>/dev/sda3</td>
<td>xfs</td>
<td>446G</td>
<td>27G</td>
<td>420G</td>
<td>6%</td>
<td>/</td>
</tr>
</tbody>
</table>

From /sys/devices/virtual/dmi/id
| Vendor: | Lenovo |
| Product: | ThinkSystem SR635V3 |
| Product Family: | ThinkSystem |
| Serial: | 1234567890 |

Additional information from dmidecode 3.2 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: |
| 1x SK Hynix HMC88AE8RA115N 32 GB 2 rank 4800 |
| 11x SK Hynix HMC88AE8RA168N 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: | 1.30 |

(End of data from sysinfo program)

### Compiler Version Notes

<table>
<thead>
<tr>
<th>C</th>
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<tbody>
<tr>
<td>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)</td>
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<th>Compiler Version Notes (Continued)</th>
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<tr>
<td>AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)</td>
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<tr>
<td>Target: x86_64-unknown-linux-gnu</td>
</tr>
<tr>
<td>Thread model: posix</td>
</tr>
<tr>
<td>InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin</td>
</tr>
</tbody>
</table>

--------------------------------------------------------------------------------------------------
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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<table>
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<tr>
<th>Base Compiler Invocation</th>
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<tbody>
<tr>
<td>C benchmarks: clang</td>
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<tr>
<td>C++ benchmarks: clang++</td>
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<tr>
<td>Fortran benchmarks: flang</td>
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<table>
<thead>
<tr>
<th>Base Portability Flags</th>
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<tr>
<td>600.perlbench_s: -DSPEC_LINUX_X64 -DSPEC_LP64</td>
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Hardware Availability: Apr-2023
Tested by: Lenovo Global Technology
Software Availability: Nov-2022

Base Portability Flags (Continued)

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>605.mcf_s</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>620.omnetpp_s</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>623.xalancbmk_s</td>
<td>-DSPEC_LINUX -DSPEC_LP64</td>
</tr>
<tr>
<td>625.x264_s</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>631.deepsjeng_s</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>641.leea_s</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>648.exchange2_s</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>657.xz_s</td>
<td>-DSPEC_LP64</td>
</tr>
</tbody>
</table>

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
- 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
Lenovo Global Technology
ThinkSystem SR635 V3
(4.10 GHz, AMD EPYC 9174F)

<table>
<thead>
<tr>
<th>SPECspeed®2017_int_base = 16.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECspeed®2017_int_peak = 16.5</td>
</tr>
</tbody>
</table>

**CPU2017 License:** 9017
**Test Sponsor:** Lenovo Global Technology
**Tested by:** Lenovo Global Technology
**Test Date:** Jan-2023
**Hardware Availability:** Apr-2023
**Software Availability:** Nov-2022

**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

**Peak Optimization Flags**

C benchmarks:
- `600.perlbench_s`: `basepeak = yes`
- `602.gcc_s`: `basepeak = yes`
- `605.mcf_s`: `-m64` `-Wl,-ml1vm` `-Wl,-align-all-nofallthru-blocks=6`
- `-Wl,-ml1vm` `-Wl,-reduce-array-computations=3`
- `-Wl,-allow-multiple-definition` `-Ofast` `-march=znuver4`
- `-fveclib=AMDLIBM` `-ffast-math` `-fopenmp` `-flto`
- `-fstruct-layout=9` `-ml1vm` `-unroll-threshold=50`
- `-fremap-arrays` `-fstrip-mining`
- `-ml1vm` `-inline-threshold=1000`
- `-ml1vm` `-reduce-array-computations=3` `-DSPEC_OPENMP` `-zopt`

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

605.mcf_s (continued):
-ffopenmp=libomp -lomp -lamdlibm -lamdalloc -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
-mlvm =Wl,-mllvm -Wl,-reduce-array-computations=3
-mlvm =Wl,-Wl,-do-block-reorder=aggressive -Ofast
-march=znver4 -vfeclib=AMDLIBM -ffast-math -ffopenmp
-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
-ffopenmp=libomp -lomp -lamdlibm -lamdalloc-ext -lflang

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-Q.html
http://www.spec.org/cpu2017/flags/aocc400-flags.html
SPEC CPU®2017 Integer Speed Result

Lenovo Global Technology
ThinkSystem SR635 V3
(4.10 GHz, AMD EPYC 9174F)

SPECspeed®2017_int_base = 16.2
SPECspeed®2017_int_peak = 16.5

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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-Q.xml
http://www.spec.org/cpu2017/flags/aocc400-flags.xml