## Lenovo Global Technology

**ThinkSystem SR655**  
2.30 GHz, AMD EPYC 7642

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>SPECspeed®2017_fp_base</th>
<th>SPECspeed®2017_fp_peak</th>
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<tr>
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<tr>
<td>603.bwaves_s</td>
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<td>619.lbm_s</td>
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<td>621.wrf_s</td>
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<td>628.pop2_s</td>
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<td>638.imagick_s</td>
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<td>644.nab_s</td>
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<td>649.fotonik3d_s</td>
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<td></td>
</tr>
<tr>
<td>654.roms_s</td>
<td>136</td>
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</tr>
</tbody>
</table>

### Hardware

- **CPU Name:** AMD EPYC 7642  
- **Max MHz:** 3300  
- **Nominal:** 2300  
- **Enabled:** 48 cores, 1 chip  
- **Orderable:** 1 chip  
- **Cache L1:** 32 KB I + 32 KB D on chip per core  
- **L2:** 512 KB I+D on chip per core  
- **L3:** 256 MB I+D on chip per chip, 16 MB shared / 3 cores  
- **Other:** None  
- **Memory:** 256 GB (8 x 32 GB 2Rx4 PC4-3200AA-R)  
- **Storage:** 1 x 960 GB SATA SSD  
- **Other:** None  

### Software

- **OS:** SUSE Linux Enterprise Server 15 SP1 (x86_64)  
- **Kernel:** 4.12.14-195-default  
- **Compiler:** C/C++/Fortran: Version 2.0.0 of AOCC  
- **Parallel:** Yes  
- **Firmware:** Lenovo BIOS Version CFE107O released Dec-2019  
- **File System:** xfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 64-bit  
- **Other:** jemalloc: jemalloc memory allocator library v5.1.0  
- **Power Management:** BIOS set to prefer performance at the cost of additional power usage
## Lenovo Global Technology

**ThinkSystem SR655**

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---

### SPECspeed®2017_fp_base = 123

### SPECspeed®2017_fp_peak = 123

---

#### Results Table

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<th>Seconds</th>
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<td>140</td>
<td>113</td>
<td>140</td>
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</tr>
</tbody>
</table>

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
'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>

Set dirty_ratio=8 to limit dirty cache to 8% of memory
Set swappiness=1 to swap only if necessary
Set zone_reclaim_mode=1 to free local node memory and avoid remote memory sync then drop_caches=3 to reset caches before invoking runcpu

dirty_ratio, swappiness, zone_reclaim_mode and drop_caches were all set using privileged echo (e.g. echo 1 > /proc/sys/vm/swappiness).

Transparent huge pages set to 'always' for this run (OS default)
**Environment Variables Notes**

Environment variables set by runcpu before the start of the run:

- GOMP_CPU_AFFINITY = "0-47"
- LD_LIBRARY_PATH = 
  
  
  /home/cpu2017-1.1.0-amd-rome-aocc200-C3/amd_speed_aocc200_rome_C_lib/64
  /home/cpu2017-1.1.0-amd-rome-aocc200-C3/amd_speed_aocc200_rome_C_lib/32:

- MALLOC_CONF = "retain:true"
- OMP_DYNAMIC = "false"
- OMP_SCHEDULER = "static"
- OMP_STACKSIZE = "128M"
- OMP_THREAD_LIMIT = "48"

Environment variables set by runcpu during the 638.imagick_s peak run:

- GOMP_CPU_AFFINITY = "0-47"

Environment variables set by runcpu during the 654.roms_s peak run:

- GOMP_CPU_AFFINITY = "0-47"

**General Notes**

Binaries were compiled on a system with 2x AMD EPYC 7601 CPU + 512GB Memory using Fedora 26

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.

Yes: The test sponsor attests, as of date of publication, that CVE-2018-3640 (Spectre variant 3a) is mitigated in the system as tested and documented.

Yes: The test sponsor attests, as of date of publication, that CVE-2018-3639 (Spectre variant 4) is mitigated in the system as tested and documented.

jemalloc: configured and built with GCC v9.1.0 in Ubuntu 19.04 with -O3 -znver2 -flto
jemalloc 5.1.0 is available here:
https://github.com/jemalloc/jemalloc/releases/download/5.1.0/jemalloc-5.1.0.tar.bz2

**Platform Notes**

BIOS settings:
- Set Operating Mode set to Maximum Performance
- SMT Mode set to Disabled

Sysinfo program /home/cpu2017-1.1.0-amd-rome-aocc200-C3/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7ed81e6e46a485a0011

(Continued on next page)
### Platform Notes (Continued)

running on linux-01om Fri Mar 6 20:45:32 2020

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 7642 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 4 5 6 8 9 10 12 13 14 16 17 18 20 21 22 24 25 26 28 29 30 32 33 34 36 37 38 40 41 42 44 45 46 48 49 50 52 53 54 56 57 58 60 61 62

From lscpu:

- Architecture: x86_64
- CPU op-mode(s): 32-bit, 64-bit
- Byte Order: Little Endian
- Address sizes: 43 bits physical, 48 bits virtual
- CPU(s): 48
- On-line CPU(s) list: 0-47
- Thread(s) per core: 1
- Core(s) per socket: 48
- Socket(s): 1
- NUMA node(s): 0
- Vendor ID: AuthenticAMD
- CPU family: 23
- Model: 49
- Model name: AMD EPYC 7642 48-Core Processor
- Stepping: 0
- CPU MHz: 2300.000
- CPU max MHz: 2300.0000
- CPU min MHz: 1500.0000
- BogoMIPS: 4591.32
- Virtualization: AMD-V
- L1d cache: 32K
- L1i cache: 32K
- L2 cache: 512K
- L3 cache: 16384K
- NUMA node0 CPU(s): 0-47
- Flags: fpu vme de pse tsc msr pae mce cmov pat pse36 clflush mmx fxsr sse sse2 ht syscall nx mmxext fxsr_opt pdpe1gb rdtscp lm constant_tsc rep_good xtopology nonstop_tsc cpuid extd_apicid aperfmperf pni pclmulqdq monitor ssse3 fma cx16 sse4_1 sse4_2 movbe popcnt aes xsave avx f16c

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CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Tested by: Lenovo Global Technology

**Platform Notes (Continued)**

```
rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse 3dnowprefetch
osvw ibs skinit wdt tce topoext perfctr_core perfctr_nb bpret perfctr_12 mwaitx cpb
cat_l3 cdp_l3 hw_pstate sse sd sev ibs ibpbb stibp vmmcall fsqbb base bmi avx2 smep
bmi2 cqm rdt_a rdseed adx smap clflushopt clwb sha ni xsaveopt xsavec xgetbv1 xsaves
cqm_llc cqm_occup_llc cqm_mbmt_total cqm_mbmt_local clzero irperf xsaveptr arat npt
lbrv svm_lock nripsave tsc_scale vmcb_clean flushbyasid decodeassist pausefilter
pfthreshold avic v_vmsave_vmload vgif umip rdpid overflow_recoov sccor smca
```

```
/proc/cpuinfo cache data
  cache size: 512 KB

From numactl --hardware WARNING: a numactl 'node' might or might not correspond to a
  physical chip.
  available: 1 nodes (0)
  node 0 cpus: 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
  node 0 size: 257760 MB
  node 0 free: 256917 MB
  node distances:
    node 0
    0: 10

From /proc/meminfo
  MemTotal: 263947008 kB
  HugePages_Total: 0
  Hugepagesize: 2048 kB

From /etc/*release* /etc/*version*
  os-release:
    NAME="SLES"
    VERSION="15-SP1"
    VERSION_ID="15.1"
    PRETTY_NAME="SUSE Linux Enterprise Server 15 SP1"
    ID="sles"
    ID_LIKE="suse"
    ANSI_COLOR="0;32"
    CPE_NAME="cpe:/o:suse:sles:15:sp1"

uname -a:
  Linux linux-01om 4.12.14-195-default #1 SMP Tue May 7 10:55:11 UTC 2019 (8fba516)
x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

  CVE-2018-3620 (L1 Terminal Fault): Not affected
  Microarchitectural Data Sampling: Not affected
  CVE-2017-5754 (Meltdown): Not affected

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### Lenovo Global Technology

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<table>
<thead>
<tr>
<th>CPU2017 License:</th>
<th>9017</th>
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<td>Lenovo Global Technology</td>
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<td>Tested by:</td>
<td>Lenovo Global Technology</td>
</tr>
</tbody>
</table>

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**Platform Notes (Continued)**

CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2017-5753 (Spectre variant 1): Mitigation: __user pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Full AMD retropine, IBPB: conditional, IBRS_FW, STIBP: disabled, RSB filling

run-level 3 Mar 6 20:40

SPEC is set to: /home/cpu2017-1.1.0-amd-rome-aocc200-C3

From /sys/devices/virtual/dmi/id

```
BIOS: Lenovo CFE107O 12/28/2019
Vendor: Lenovo
Product: ThinkSystem SR655 -[7Y00000000]-
Product Family: ThinkSystem
Serial: 0123456789
```

Additional information from dmidecode 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:

- 8x Samsung M393A4K40DB2-CWE 32 kB 2 rank 3200
- 8x Unknown Unknown

(End of data from sysinfo program)

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### Compiler Version Notes

```
<table>
<thead>
<tr>
<th>Compiler</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>619.lbm_s(base, peak) 638.imagick_s(base, peak) 644.nab_s(base, peak)</td>
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<tr>
<td>AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19) Target: x86_64-unknown-linux-gnu Thread model: posix InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin</td>
<td></td>
</tr>
<tr>
<td>C++, C, Fortran</td>
<td>607.cactuBSSN_s(base, peak)</td>
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```

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</table>

**CPU2017 License:** 9017

**Test Date:** Mar-2020

**Hardware Availability:** Jan-2020

**Software Availability:** Aug-2019

**Compiler Version Notes (Continued)**

AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)

Target: x86_64-unknown-linux-gnu

Thread model: posix

InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin

AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)

Target: x86_64-unknown-linux-gnu

Thread model: posix

InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin

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AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
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Target: x86_64-unknown-linux-gnu

Thread model: posix

InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin

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<th>Fortran, C</th>
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Thread model: posix

InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin

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**SPECspeed®2017_fp_base = 123**

**SPECspeed®2017_fp_peak = 123**

**CPU2017 License:** 9017  
**Test Date:** Mar-2020  
**Test Sponsor:** Lenovo Global Technology  
**Hardware Availability:** Jan-2020  
**Tested by:** Lenovo Global Technology  
**Software Availability:** Aug-2019

**Base Compiler Invocation**

C benchmarks:  
```
clang
```  
Fortran benchmarks:  
```
flang
```  
Benchmarks using both Fortran and C:  
```
flang clang
```  
Benchmarks using Fortran, C, and C++:  
```
clang++ clang flang
```  

**Base Portability Flags**

603.bwaves_s: -DSPEC_LP64  
607.cactuBSSN_s: -DSPEC_LP64  
619.lbm_s: -DSPEC_LP64  
621.wrf_s: -DSPEC_CASE_FLAG -Mbyteswapio -DSPEC_LP64  
627.cam4_s: -DSPEC_CASE_FLAG -DSPEC_LP64  
628.pop2_s: -DSPEC_CASE_FLAG -Mbyteswapio -DSPEC_LP64  
638.imagick_s: -DSPEC_LP64  
644.nab_s: -DSPEC_LP64  
649.fotonik3d_s: -DSPEC_LP64  
654.roms_s: -DSPEC_LP64

**Base Optimization Flags**

C benchmarks:  
```
-ffast-math
-march=znver2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-fremap-arrays -mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp
-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000
-flv-function-specialization -z muldefs -DSPEC_OPENMP -fopenmp
-fopenmp=libomp -lopmp -lpthread -ldl -lmvec -lAMDlibm -ljemalloc
-llflang
```  
Fortran benchmarks:  
```
-ffast-math
-march=znver2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-fremap-arrays -mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp
-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000
-flv-function-specialization -z muldefs -DSPEC_OPENMP -fopenmp
-fopenmp=libomp -lopmp -lpthread -ldl -lmvec -lAMDlibm -ljemmalloc
-llflang
```  

*(Continued on next page)*
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**SPECspeed®2017_fp_base = 123**

**SPECspeed®2017_fp_peak = 123**

**CPU2017 License:** 9017  
**Test Date:** Mar-2020  
**Hardware Availability:** Jan-2020

**Test Sponsor:** Lenovo Global Technology  
**Tested by:** Lenovo Global Technology  
**Software Availability:** Aug-2019

### Base Optimization Flags (Continued)

**Fortran benchmarks (continued):**
- `-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver2`  
- `-funroll-loops -Mrecursive -mllvm -vector-library=LIBMVEC -z muldefs`  
- `-Kieee -fno-finite-math-only -DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lpthread -ldl -lmvec -ljemalloc -lflang`

**Benchmarks using both Fortran and C:**
- `-flto -Wl,-mllvm -Wl,-function-specialize`  
- `-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC`  
- `-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -ffast-math`  
- `-march=znver2 -fstruct-layout=3 -mllvm -unroll-threshold=50`  
- `-fremap-arrays -mllvm -function-specialize -mllvm -enable-gvn-hoist`  
- `-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp`  
- `-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000`  
- `-flv-function-specialization -funroll-loops -Mrecursive -z muldefs`  
- `-Kieee -fno-finite-math-only -DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lpthread -ldl -lmvec -ljemalloc -lflang`

**Benchmarks using Fortran, C, and C++:**
- `-std=c++98 -flto -Wl,-mllvm -Wl,-function-specialize`  
- `-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC`  
- `-Wl,-mllvm -Wl,-reduce-array-computations=3`  
- `-Wl,-mllvm -Wl,-suppress-fmas -O3 -ffast-math -march=znver2`  
- `-fstruct-layout=3 -mllvm -unroll-threshold=50 -fremap-arrays`  
- `-mllvm -function-specialize -mllvm -enable-gvn-hoist`  
- `-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp`  
- `-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000`  
- `-flv-function-specialization -mllvm -loop-unswitch-threshold=200000`  
- `-mllvm -unroll-threshold=100 -mllvm -enable-partial-unswitch`  
- `-funroll-loops -Mrecursive -z muldefs -Kieee -fno-finite-math-only -DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lpthread -ldl -lmvec -ljemalloc -lflang`

### Base Other Flags

**C benchmarks:**
- `-Wno-return-type`

**Fortran benchmarks:**
- `-Wno-return-type`

**Benchmarks using both Fortran and C:**
- `-Wno-return-type`

(Continued on next page)
Lenovo Global Technology
ThinkSystem SR655
2.30 GHz, AMD EPYC 7642

SPECspeed®2017_fp_base = 123
SPECspeed®2017_fp_peak = 123

CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Tested by: Lenovo Global Technology
Test Date: Mar-2020
Hardware Availability: Jan-2020
Software Availability: Aug-2019

Base Other Flags (Continued)

Benchmarks using Fortran, C, and C++:
-Wno-return-type

Peak Compiler Invocation

C benchmarks:
clang
Fortran benchmarks:
flang

Benchmarks using both Fortran and C:
flang clang

Benchmarks using Fortran, C, and C++:
clang++ clang flang

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

619.lbm_s: basepeak = yes
638.imagick_s: -f1to -Wl,-ml1vm -Wl,-function-specialize
-Wl,-ml1vm -Wl,-region-vectorize
-Wl,-ml1vm -Wl,-vector-library=LIBMVEC
-Wl,-ml1vm -Wl,-reduce-array-computations=3 -Ofast
-march=znver2 -mno-sse4a -fstruct-layout=5
-ml1vm -vectorize-memory-aggressively
-ml1vm -function-specialize -ml1vm -enable-gvn-hoist
-ml1vm -unroll-threshold=50 -fremap-arrays
-ml1vm -vector-library=LIBMVEC
-ml1vm -reduce-array-computations=3
-ml1vm -global-vectorize-slp -ml1vm -inline-threshold=1000
-flv-function-specialization -DSPEC_OPENMP -fopenmp
-lmvec -lamdlibm -fopenmp=libomp -lomp -lpthread -ldl
Lenovo Global Technology
ThinkSystem SR655
2.30 GHz, AMD EPYC 7642

SPECspeed®2017_fp_base = 123
SPECspeed®2017_fp_peak = 123

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Peak Optimization Flags (Continued)

638.imagick_s (continued):
-ijemalloc -lflang

644.nab_s: basepeak = yes

Fortran benchmarks:

603.bwaves_s: basepeak = yes
649.fotonik3d_s: basepeak = yes

654.roms_s: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -O3 -march=znver2
-ffunroll-loops -Mrecursive -mllvm -Wl,-vector-library=LIBMVEC
-Kieee -fno-finite-math-only -DSPEC_OPENMP -fopenmp
-fopenmp=libomp -lm -lpthread -ldl -lm -lmvec -lamdlibm
-ijemalloc -lflang

Benchmarks using both Fortran and C:

621.wrf_s: basepeak = yes
627.cam4_s: basepeak = yes
628.pop2_s: basepeak = yes

Benchmarks using Fortran, C, and C++:

607.cactuBSSN_s: basepeak = yes

Peak Other Flags

C benchmarks:
-Wno-return-type

Fortran benchmarks:
-Wno-return-type

Benchmarks using both Fortran and C:
-Wno-return-type

(Continued on next page)
## Lenovo Global Technology

**ThinkSystem SR655**

2.30 GHz, AMD EPYC 7642

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**Test Sponsor:** Lenovo Global Technology  
**Tested by:** Lenovo Global Technology

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**Test Date:** Mar-2020  
**Hardware Availability:** Jan-2020  
**Software Availability:** Aug-2019

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### Peak Other Flags (Continued)

Benchmarks using Fortran, C, and C++:

- `-Wno-return-type`

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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-Rome-E.html

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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-Rome-E.xml

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For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

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