## Lenovo Global Technology

**ThinkSystem SR655**  
2.35 GHz, AMD EPYC 7452

<table>
<thead>
<tr>
<th>SPECspeed®2017_fp_base = 105</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECspeed®2017_fp_peak = 105</td>
</tr>
</tbody>
</table>

### CPU2017 License: 9017  
**Test Sponsor:** Lenovo Global Technology  
**Tested by:** Lenovo Global Technology  
**Test Date:** Sep-2019  
**Hardware Availability:** Aug-2019  
**Software Availability:** Jun-2019

<table>
<thead>
<tr>
<th>Threads</th>
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<th>SPECspeed®2017_fp_peak</th>
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<tr>
<td>607.cactuBSSN_s</td>
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<tr>
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<tr>
<td>628.pop2_s</td>
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<td>638.imagick_s</td>
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<td>649.fotonik3d_s</td>
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<tr>
<td>654.roms_s</td>
<td>32</td>
<td>654.roms_s</td>
</tr>
</tbody>
</table>

### Hardware

- **CPU Name:** AMD EPYC 7452  
- **Max MHz:** 3350  
- **Nominal:** 2350  
- **Enabled:** 32 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:** 128 MB I+D on chip per core,  
  16 MB shared / 4 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++: Version 1.3.0 of AOCC  
  Fortran: Version 4.8.2 for GCC  
- **Parallel:** Yes  
- **Firmware:** Lenovo BIOS Version CFE103L released Aug-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 version 5.1.0  
- **Power Management:** --
### Lenovo Global Technology

ThinkSystem SR655

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---

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---

### Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
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<tbody>
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<td>110</td>
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<td><strong>143</strong></td>
</tr>
</tbody>
</table>

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### Compiler Notes

The AMD64 AOCC Compiler Suite is available at http://developer.amd.com/amd-aocc/

The AOCC Fortran Plugin version 1.3.0 was used to leverage AOCC optimizers with gfortran. It is available here: 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 -1 2097152' was used to set environment locked pages in memory limit

runspec command invoked through numactl i.e.:  
numactl --interleave=all runspec <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

---

Note: All results appear in the order in which they were run. Bold underlined text indicates a median measurement.
Lenovo Global Technology
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**Operating System Notes (Continued)**

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)

**General Notes**

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = "/home/cpu2017-1.0.5-amd-na/amd_speed_aocc130_naples_A_lib/64"
LD_LIBRARY_PATH = "$LD_LIBRARY_PATH:/home/cpu2017-1.0.5-amd-na/amd_speed_aocc130_naples_A_lib/32"
OMP_DYNAMIC = "false"
OMP_PLACES = "cores"
OMP_PROC_BIND = "close"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "192M"
OMP_WAIT_POLICY = "active"

Binaries were compiled on a system with 2p AMD EPYC 7601 CPU + 512GB Memory using RHEL 7.6

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.
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 v4.8.5 in RHEL v7.2 under default conditions.
https://github.com/jemalloc/jemalloc/releases/download/5.1.0/jemalloc-5.1.0.tar.bz2

**Platform Notes**

BIOS settings:
Operating Mode set to Maximum Performance
SMT Mode set to Disabled
EfficiencyModeEn set to Auto
Sysinfo program /home/cpu2017-1.0.5-amd-na/bin/sysinfo
Rev: r5974 of 2018-05-19 9bcde8f29999c3d61f64985e45859ea9
running on linux-01om Fri Sep 6 02:29:39 2019

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

(Continued on next page)
Lenovo Global Technology

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SPECspeed®2017_fp_base = 105
SPECspeed®2017_fp_peak = 105

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Test Date: Sep-2019
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Hardware Availability: Aug-2019
Software Availability: Jun-2019

Platform Notes (Continued)

From /proc/cpuinfo
model name : AMD EPYC 7452 32-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 : 32
siblings : 32
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

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): 32
On-line CPU(s) list: 0-31
Thread(s) per core: 1
Core(s) per socket: 32
Socket(s): 1
NUMA node(s): 1
Vendor ID: AuthenticAMD
CPU family: 23
Model: 49
Model name: AMD EPYC 7452 32-Core Processor
Stepping: 0
CPU MHz: 2350.000
CPU max MHz: 2350.0000
CPU min MHz: 1500.0000
BogoMIPS: 4691.17
Virtualization: AMD-V
L1d cache: 32K
L1i cache: 32K
L2 cache: 512K
L3 cache: 16384K
NUMA node0 CPU(s): 0-31
Flags: fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse sse2 ssse2 ht syscall nx mmxext fxsr_opt pdperr gdbm rdtscp lm constant_tsc rep_good nopl xtopology nonstop_tsc cpuid extd_apicid aperfmperf pni pclmulqdq monitor ssse3 fma cx16 sse4_1 sse4_2 movbe popcnt aes avx avx2 f16c rdrand lahf_lm cmp_legacy svm extapic cr4_legacy abc misalignsse 3dnowprefetch osvw ibs skinit wdt tce topoext perfctr_core perfctr Nb perfctr_L2 mwaitx cpb cat L3 cdp L3 hw_pstate sme ssbd sseb cmp ibpb stibp vmcall fsgsbse bni avx2 smep bmi2 cqm rdte_a rdseed adx snap clflushopt clwb sha_li xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mmb_total cqm_mmb_local clzero irperf xsaveprtr ar arpt lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter

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

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Test Date: Sep-2019
Hardware Availability: Aug-2019
Software Availability: Jun-2019

Platform Notes (Continued)

pfthreshold avic v_vmsave_vmload vgif umip rdpid overflow_recov succor 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
    node 0 size: 257760 MB
    node 0 free: 256999 MB
    node distances:
      node 0
      0: 10

From /proc/meminfo
  MemTotal: 263946396 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-2017-5754 (Meltdown): Not affected
CVE-2017-5753 (Spectre variant 1): Mitigation: __user pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Full AMD retpoline, IBPB: conditional, IBRS_FW, STIBP: disabled, RSB filling

run-level 3 Sep 6 02:28

SPEC is set to: /home/cpu2017-1.0.5-amd-na

Filesystem Type Size Used Avail Use% Mounted on

(Continued on next page)
Lenovo Global Technology
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Platform Notes (Continued)
/dev/sda2 xfs 893G 66G 827G 8% /

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.

BIOS Lenovo CFE103L 08/19/2019
Memory:
8x Samsung M393A4K40DB2-CWE 32 kB 2 rank 3200
8x Unknown Unknown

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
<table>
<thead>
<tr>
<th>C</th>
<th>619.lbm_s(base, peak) 638.imagick_s(base, peak) 644.nab_s(base, peak)</th>
</tr>
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<tbody>
<tr>
<td>AICC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins</td>
<td></td>
</tr>
<tr>
<td>AICC_1_3_0_Release-Build#34) (based on LLVM AICC.LLVM.1.3.0.B34.2018_10_22)</td>
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</tr>
<tr>
<td>Target: x86_64-unknown-linux-gnu</td>
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</tr>
<tr>
<td>Thread model: posix</td>
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</tr>
<tr>
<td>InstalledDir: /root/work/compilers/aocc1.3.0/AOCC-1.3.0-Compiler/bin</td>
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==============================================================================
<table>
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<tr>
<th>C++</th>
<th>607.cactuBSSN_s(base, peak)</th>
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<tr>
<td>AICC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins</td>
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<td>AICC_1_3_0_Release-Build#34) (based on LLVM AICC.LLVM.1.3.0.B34.2018_10_22)</td>
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<td>Target: x86_64-unknown-linux-gnu</td>
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<tr>
<td>Thread model: posix</td>
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</tr>
<tr>
<td>InstalledDir: /root/work/compilers/aocc1.3.0/AOCC-1.3.0-Compiler/bin</td>
<td></td>
</tr>
</tbody>
</table>
==============================================================================

GNU Fortran (GCC) 4.8.2
Copyright (C) 2013 Free Software Foundation, Inc.
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You may redistribute copies of GNU Fortran under the terms of the GNU General Public License.
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Software Availability: Jun-2019

Base Compiler Invocation

C benchmarks:
clang

Fortran benchmarks:
clang gfortran

Benchmarks using both Fortran and C:
clang gfortran

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

Compiler Version Notes (Continued)

==============================================================================
Fortran         | 603.bwaves_s(base, peak) 649.fotonik3d_s(base, peak)
                | 654.roms_s(base, peak)

GNU Fortran (GCC) 4.8.2
Copyright (C) 2013 Free Software Foundation, Inc.
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You may redistribute copies of GNU Fortran
under the terms of the GNU General Public License.
For more information about these matters, see the file named COPYING
==============================================================================

Fortran, C      | 621.wrf_s(base, peak) 627.cam4_s(base, peak)
                | 628.pop2_s(base, peak)

GNU Fortran (GCC) 4.8.2
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AOCC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
AOCC_1_3_0_Release-Build#34) (based on LLVM AOCC.LLVM.1.3.0.B34.2018_10_22)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aoccl.3.0/AOCC-1.3.0-Compiler/bin
Lenovo Global Technology
ThinkSystem SR655
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SPECspeed®2017_fp_base = 105
SPECspeed®2017_fp_peak = 105

Base Portability Flags

603.bwaves_s: -DSPEC_LP64
607.cactuBSSN_s: -DSPEC_LP64
619.lbm_s: -DSPEC_LP64
621.wrf_s: -DSPEC_CASE_FLAG -fconvert=big-endian -DSPEC_LP64
627.cam4_s: -DSPEC_CASE_FLAG -DSPEC_LP64
628.pop2_s: -DSPEC_CASE_FLAG -fconvert=big-endian -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:
-fflto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop
-Wl,-plugin-opt=-enable-vectorize-compare=false -O3 -ffast-math
-march=znver1 -mno-avx2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-fremap-arrays -mllvm -inline-threshold=1000
-flv-function-specialization -mllvm -enable-gvn-hoist
-mllvm -function-specialize -z muldefs -DSPEC_OPENMP -fopenmp
-DUSE_OPENMP -fopenmp=libomp -lomp -lpthread -ldl -ljemalloc
-lamdlibm

Fortran benchmarks:
-fflto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop
-Wl,-plugin-opt=-enable-vectorize-compare=false -O3 -mavx -madx
-funroll-loops -ffast-math -z muldefs -fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-enable-vectorize-compare=false
-DUSE_OPENMP -DUSE_OPENMP -fopenmp -fopenmp=libomp -lomp -lpthread
-ldl -ljemalloc -lamdlibm -lgfortran

Benchmarks using both Fortran and C:
-fflto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop
-Wl,-plugin-opt=-enable-vectorize-compare=false -O3 -ffast-math
-march=znver1 -mno-avx2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-fremap-arrays -mllvm -inline-threshold=1000
-flv-function-specialization -mllvm -enable-gvn-hoist
-mllvm -function-specialize -z muldefs -mavx -madx -funroll-loops -z muldefs
-fplugin=dragonegg.so -fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-enable-vectorize-compare=false

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SPECspeed®2017_fp_base = 105
SPECspeed®2017_fp_peak = 105

Base Optimization Flags (Continued)

Benchmarks using both Fortran and C (continued):
-DSPEC_OPENMP -DUSE_OPENMP -fopenmp -fopenmp=libomp -lomp -lpthread
-ldl -ljemalloc -lamlidlibm -lgfortran

Benchmarks using Fortran, C, and C++:
-std=c++98 -flto -Wl,-plugin-opt=-merge-constant
-std=c++11 -fplugin-opt=-lsr-in-nested-loop
-Wl,-plugin-opt=-enable-vectorize-compares=false -O3 -ffast-math
-march=znver1 -mno-avx2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-fremap-arrays -mllvm -inline-threshold=1000
-lgfortran -fplugin-arg-dragonegg-so

C benchmarks:
-Wno-return-type

Fortran benchmarks:
-Wno-return-type

Base Other Flags

C benchmarks:
-Wno-return-type

Fortran benchmarks:
-Wno-return-type

(Benchmark using both Fortran and C):
-Wno-return-type

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

Peak Compiler Invocation

C benchmarks:
clang

Fortran benchmarks:
clang gfortran

(Continued on next page)
Lenovo Global Technology
ThinkSystem SR655
2.35 GHz, AMD EPYC 7452

SPECspeed®2017_fp_base = 105
SPECspeed®2017_fp_peak = 105

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

Test Date: Sep-2019
Hardware Availability: Aug-2019
Software Availability: Jun-2019

Peak Compiler Invocation (Continued)

Benchmarks using both Fortran and C:
clang gfortran

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

Peak Portability Flags
Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

619.lbm_s: -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Ofast -march=znver1
-fstruct-layout=3 -mllvm -vectorize-memory-aggressively
-mno-avx2 -mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -DSPEC_OPENMP -fopenmp
-DUSE_OPENMP -fopenmp=libomp -lomp -lpthread -ldl
-ljemalloc -lamdlibm

638.imagick_s: basepeak = yes

644.nab_s: basepeak = yes

Fortran benchmarks:

603.bwaves_s: basepeak = yes

649.fotonik3d_s: basepeak = yes

654.roms_s: -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -O3 -mavx2 -mavx
-funroll-loops -ffast-math -fplugin=dragonegg.so
-fplugin-arg=dragonegg-1llvm-option=-merge-constant
-fplugin-arg=dragonegg-1llvm-option=-inline-threshold:1000
-DSPEC_OPENMP -DUSE_OPENMP -fopenmp -fopenmp=libomp
-lomp -lpthread -ldl -ljemalloc -lamdlibm -lgfortran

Benchmarks using both Fortran and C:

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

621.wrf_s: basepeak = yes

627.cam4_s: basepeak = yes

628.pop2_s: -flto -Wl,-plugin-opt=-merge-constant
            -Wl,-plugin-opt=-1sr-in-nested-loop -Ofast -march=znver1
            -fstruct-layout=3 -mlirv -vectorize-memory-aggressively
            -mno-avx2 -mlirv -unroll-threshold=100 -fremap-arrays
            -mlirv -inline-threshold=1000 -O3 -mavx2 -madx
            -funroll-loops -ffast-math -fplugin=dragonegg.so
            -funroll-loops -ffast-math -fplugin=dragonegg-llvm-option=-merge-constant
            -funroll-loops -ffast-math -fplugin=dragonegg-llvm-option=-inline-threshold:1000
            -DSPEC_OPENMP -DUSE_OPENMP -fopenmp -fopenmp=libomp
            -lomp -lpthread -ldl -ljemalloc -lamdlibm -lgfortran

Benchmarks using Fortran, C, and C++:
-std=c++98 -flto -Wl,-plugin-opt=-merge-constant
            -Wl,-plugin-opt=-1sr-in-nested-loop -Ofast -march=znver1
            -fstruct-layout=3 -mlirv -vectorize-memory-aggressively -mno-avx2
            -mlirv -unroll-threshold=100 -fremap-arrays
            -mlirv -inline-threshold=1000 -finline-aggressive -O3 -mavx2 -madx
            -funroll-loops -ffast-math -fplugin=dragonegg.so
            -funroll-loops -ffast-math -fplugin=dragonegg-llvm-option=-merge-constant
            -funroll-loops -ffast-math -fplugin=dragonegg-llvm-option=-inline-threshold:1000 -DSPEC_OPENMP
            -fopenmp -DUSE_OPENMP -fopenmp=libomp -lomp -lpthread -ldl
            -ljemalloc -lamdlibm

Peak Other Flags

C benchmarks:
-Wno-return-type

Fortran benchmarks:
-Wno-return-type

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

Benchmarks using Fortran, C, and C++:
-Wno-return-type
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ThinkSystem SR655
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The flags files that were used to format this result can be browsed at

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-A.xml

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