## Lenovo Global Technology

**ThinkSystem SR655**  
2.80 GHz, AMD EPYC 7402P

<table>
<thead>
<tr>
<th>Threads</th>
<th>SPECspeed®2017_fp_base = 93.5</th>
<th>SPECspeed®2017_fp_peak = 93.9</th>
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<tbody>
<tr>
<td>603.bwaves_s 24</td>
<td>159</td>
<td>271</td>
</tr>
<tr>
<td>607.cactuBSSN_s 24</td>
<td>28.4</td>
<td>162</td>
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<tr>
<td>619.lbm_s 24</td>
<td>28.4</td>
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<tr>
<td>621.wrf_s 24</td>
<td>113</td>
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<tr>
<td>627.cam4_s 24</td>
<td>75.4</td>
<td>76.0</td>
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<td>628.pop2_s 24</td>
<td>56.6</td>
<td>56.7</td>
</tr>
<tr>
<td>638.imagick_s 24</td>
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</tr>
<tr>
<td>654.roms_s 24</td>
<td>93.2</td>
<td>93.2</td>
</tr>
</tbody>
</table>

### 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:** --

### Hardware

- **CPU Name:** AMD EPYC 7402P
- **Max MHz:** 3350
- **Nominal:** 2800
- **Enabled:** 24 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 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
## Lenovo Global Technology

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### SPEC speed® 2017 Floating Point Speed Result

#### Copyright 2017-2019 Standard Performance Evaluation Corporation

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**Lenovo Global Technology**

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2.80 GHz, AMD EPYC 7402P

---

**SPECspeed® 2017_fp_base = 93.5**

**SPECspeed® 2017_fp_peak = 93.9**

---

### Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
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<th>Base Seconds</th>
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</tr>
</tbody>
</table>

**SPECspeed® 2017_fp_base = 93.5**

**SPECspeed® 2017_fp_peak = 93.9**

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/

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 -l 2097152' was used to set environment locked pages in memory limit

runcpus command invoked through numactl i.e.:

numactl --interleave=all runcpus <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 runcpus

---

(Continued on next page)
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SPEC®2017_fp_base = 93.5
SPECspeed®2017_fp_peak = 93.9

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 9bcede8f2999c33d61f64985e45859ea9
running on linux-01om Wed Sep 18 00:27:19 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

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

Platform Notes (Continued)

From /proc/cpuinfo
model name: AMD EPYC 7402P 24-Core Processor
  1 "physical id"s (chips)
  24 "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: 24
siblings: 24
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

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): 24
On-line CPU(s) list: 0-23
Thread(s) per core: 1
Core(s) per socket: 24
Socket(s): 1
NUMA node(s): 1
Vendor ID: AuthenticAMD
CPU family: 23
Model: 49
Model name: AMD EPYC 7402P 24-Core Processor
Stepping: 0
CPU MHz: 2800.000
CPU max MHz: 2800.0000
CPU min MHz: 1500.0000
BogoMIPS: 5589.42
Virtualization: AMD-V
L1d cache: 32K
L1i cache: 32K
L2 cache: 512K
L3 cache: 16384K
NUMA node0 CPU(s): 0-23
Flags: fpu vme de pse tsc msr pae mca cmov pat pse36 clflush mmx fxsr sse sse2 ht syscall nx mmxext fxsr_opt pdpe1gb 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 xsave avx fl16c rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse 3dnowprefetch osvw ibr skinit wdt tce topoext perfctr_core perfctr_NB bpext perfctr_L2 mwaint cpb cat_cdp_13 hw_pstate sme ssbd sib ads ibpb stibp vmmcall fsbgnt saw mvi avx2 smep bmi2 cqm rdt_a rdseedadx smap clflushopt clwb sha_ni xsaveopt xsaveopt xsaveopt xgetbv1 xsavecs cmq_llc cmq_occupancy cmq_mbb_total cmq_mbb_local clzero irperf xsaverprtr arat npt lbrv svm_lock nrip_safe tsc_scale vmcb_clean flushbyasid decodeassist pausefilter pfthreshold avic v_msave_vmload vgfl umip rdpid overflow_recover succor smca

(Continued on next page)
Lenovo Global Technology
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SPECspeed®2017_fp_base = 93.5
SPECspeed®2017_fp_peak = 93.9

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

Platform Notes (Continued)

/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
    node 0 size: 257769 MB
    node 0 free: 257019 MB
    node distances:
      node 0
        0: 10

From /proc/meminfo
    MemTotal: 263955584 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 18 00:19

SPEC is set to: /home/cpu2017-1.0.5-amd-na
    Filesystem Type Size Used Avail Use% Mounted on
    /dev/sda2 xfs 893G 109G 784G 13% /

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

Platform Notes (Continued)

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 CPE103L 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

==============================================================================
C               | 619.lbm_s(base, peak) 638.imagick_s(base, peak)
| 644.nab_s(base, peak)
==============================================================================
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/aocc1.3.0/AOCC-1.3.0-Compiler/bin

==============================================================================
C++, C, Fortran | 607.cactuBSSN_s(base, peak)
==============================================================================
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/aocc1.3.0/AOCC-1.3.0-Compiler/bin
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/aocc1.3.0/AOCC-1.3.0-Compiler/bin
GNU Fortran (GCC) 4.8.2
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SPECspeed®2017_fp_base = 93.5
SPECspeed®2017_fp_peak = 93.9

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

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
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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

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
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:
- flto -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 -ml illum -unroll-threshold=50
- fremap-arrays -ml programm -inline-threshold=1000
- flv-function-specialization -ml illum -enable-gvn-hoist
- ml illum-function-specialize -z muldefs -DSPEC_OPENMP -fopenmp
- DUSE_OPENMP -fopenmp=libomp -lomp -lpthread -ldl -lmemalloca
- lamdilb

Fortran benchmarks:
- flto -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
- flplugin-arg=dragonegg-llv-option=-merge-constant
- flplugin-arg=dragonegg-llv-option=-enable-vectorize-compare=flase
- DSPEC_OPENMP -DUSE_OPENMP -fopenmp -fopenmp=libomp -lomp -lpthread
- ldll -lmemalloca -lamdilb -lgfortran

Benchmarks using both Fortran and C:
- flto -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 -ml illum -unroll-threshold=50
- fremap-arrays -ml illum -inline-threshold=1000
- flv-function-specialization -ml illum -enable-gvn-hoist
- ml illum-function-specialize -mavx -madx -funroll-loops -z muldefs
- flplugin=dragonegg.so -fplugin-arg=dragonegg-llv-option=-merge-constant
- fplugin-arg=dragonegg-llv-option=-enable-vectorize-compare=flase
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SPECspeed®2017_fp_base = 93.5
SPECspeed®2017_fp_peak = 93.9

Base Optimization Flags (Continued)

Benchmarks using both Fortran and C (continued):
-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
-std=c++98 -flto -Wl, -plugin-opt=-merge-constant
-Wl,-plugin-opt=-enable-vectorize-compares=false -O3 -ffast-math
-march=znver1 -mno-avx2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-ffuncattrs=functions -mllvm -inline-threshold=1000
-flv-function-specialization -mllvm -enable-gvn-hoist
-mllvm -function-specialize -mllvm -unroll-threshold=100
-ffastmath -march=znver1 -mno-avx2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-flv-function-specialization -mllvm -enable-gvn-hoist
-mllvm -function-specialize -mllvm -unroll-threshold=100

Base 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

Peak Compiler Invocation

C benchmarks:
clang

Fortran benchmarks:
clang gfortran

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SPECspeed®2017_fp_base = 93.5
SPECspeed®2017_fp_peak = 93.9

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<th>Test Date: Sep-2019</th>
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<td>Test Sponsor: Lenovo Global Technology</td>
<td>Hardware Availability: Aug-2019</td>
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<tr>
<td>Tested by: Lenovo Global Technology</td>
<td>Software Availability: Jun-2019</td>
</tr>
</tbody>
</table>

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 -ml64 -unroll-threshold=100 -fremap-arrays
-ml64 -inline-threshold=1000 -DSPEC_OPENMP -fopenmp
-DSPEC_OPENMP -fopenmp=libomp -lomp -lpthread -ldl
-1jemalloc -lamdlibm

638.imagick_s: basepeak = yes

644.nab_s: basepeak = yes

Fortran benchmarks:

603.bwaves_s: -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -O3 -mavx2 -madx
-funroll-loops -ffast-math -fplugin=dragonegg.so
-fplugin-arg1=dragonegg -ll64-option=-merge-constant
-fplugin-arg1=dragonegg -ll64-option=-inline-threshold:1000
-DSPEC_OPENMP -DUSE_OPENMP -fopenmp -fopenmp=libomp
-lomp -lpthread -ldl -ljemalloc -lamdlibm -lgfortran

649.fotonik3d_s: basepeak = yes

654.roms_s: Same as 603.bwaves_s

Benchmarks using both Fortran and C:

(Continued on next page)
## Lenovo Global Technology

**ThinkSystem SR655**  
2.80 GHz, AMD EPYC 7402P

**SPECspeed®2017_fp_base = 93.5**  
**SPECspeed®2017_fp_peak = 93.9**

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<th>Lenovo Global Technology</th>
<th>Test Date: Sep-2019</th>
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<td>Lenovo Global Technology</td>
<td>Hardware Availability: Aug-2019</td>
</tr>
<tr>
<td>Tested by:</td>
<td>Lenovo Global Technology</td>
<td>Software Availability: Jun-2019</td>
</tr>
</tbody>
</table>

### Peak Optimization Flags (Continued)

**621.wrf_s:** basepeak = yes

- `627.cam4_s`: -flto -Wl,-plugin-opt=-merge-constant  
  -Wl,-plugin-opt=-lsr-in-nested-loop -Ofast -march=znver1  
  -fstruct-layout=3 -mlirvm -vectorize-memory-aggressively  
  -mno-avx2 -mlirvm -unroll-threshold=100 -fremap-arrays  
  -mlirvm -inline-threshold=1000 -O3 -mavx2 -madx  
  -funroll-loops -ffast-math -fplugin=dragonegg.so  
  -fplugin-arg-dragonegg-llvm-option=-merge-constant  
  -fplugin-arg-dragonegg-llvm-option=-inline-threshold:1000  
  -DSPEC_OPENMP -DUSE_OPENMP -fopenmp -fopenmp=libomp  
  -lomp -lpthread -ldl -ljemalloc -lamdlibm -lgfortran

**628.pop2_s**: Same as 627.cam4_s

**Benchmarks using Fortran, C, and C++:**

- `std=c++98` -flto -Wl,-plugin-opt=-merge-constant  
  -Wl,-plugin-opt=-lsr-in-nested-loop -Ofast -march=znver1  
  -fstruct-layout=3 -mlirvm -vectorize-memory-aggressively -mno-avx2  
  -mlirvm -unroll-threshold=100 -fremap-arrays  
  -mlirvm -inline-threshold=1000 -finline-aggressive -O3 -mavx2 -madx  
  -funroll-loops -ffast-math -fplugin=dragonegg.so  
  -fplugin-arg-dragonegg-llvm-option=-merge-constant  
  -fplugin-arg-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`
Lenovo Global Technology
ThinkSystem SR655
2.80 GHz, AMD EPYC 7402P

SPECspeed®2017_fp_base = 93.5
SPECspeed®2017_fp_peak = 93.9

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

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/aocc130-flags-revA21-1.xml

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Tested with SPEC CPU® 2017 v1.0.5 on 2019-09-17 12:27:19-0400.