**SPEC CPU®2017 Floating Point Speed Result**

**Lenovo Global Technology**

ThinkSystem SR635  
2.80 GHz, AMD EPYC 7402

**SPECspeed®2017_fp_base = 93.4**  
**SPECspeed®2017_fp_peak = 93.8**

**CPU2017 License:** 9017  
**Test Sponsor:** Lenovo Global Technology  
**Test Date:** Sep-2019  
**Hardware Availability:** Aug-2019

---

<table>
<thead>
<tr>
<th>Software</th>
<th>Hardware</th>
</tr>
</thead>
</table>
| 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: -- |
| CPU Name: AMD EPYC 7402  
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 |

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| Test by: Lenovo Global Technology  
**Hardware Availability:** Jun-2019 |
| Test Sponsor: Lenovo Global Technology  
**Software Availability:** June-2019 |

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<td>649.fotonik3d_s 24</td>
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<td>654.roms_s 24</td>
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## Lenovo Global Technology

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2.80 GHz, AMD EPYC 7402

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### Results Table

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<th>Benchmark</th>
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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 -l 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

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(Continued on next page)
Lenovo Global Technology

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SPECspeed®2017_fp_base = 93.4
SPECspeed®2017_fp_peak = 93.8

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-vapu Sat Sep 7 19:56:00 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)
Platform Notes (Continued)

From /proc/cpuinfo

model name : AMD EPYC 7402 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 7402 24-Core Processor
Stepping: 0
CPU MHz: 2800.000
CPU max MHz: 2800.0000
CPU min MHz: 1500.0000
BogoMIPS: 5589.02
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 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 xtopology nonstop_tsc cpuid extd_apicid aperfmperf pni
pclmulqdq monitor ssse3 fma cx16 sse4_1 sse4_2 movbe popcnt aes xsave avx fl16c
rdimm lahf_lm cmp_legacy svm extapic cr8 Legacy abi sse4a misalignsse 3dnowprefetch
osvw ibs skinit wdt tce topoext perfctr_core perfctr_nb bpext perfctr_l2 mwaitx cpb
cat_l3 cdp_l3 hw_pstate sme ssb sb ibrs lmpb stibp vmmcall fsgsbase bmi1 avx2 smep
bmi2 cqm rdt_a rdseed adx smap clflushopt cwb sha ni xsaveopt xsaveopt xsave xsave
xsaveopt xsaveopt arat npt lbrv svm_lock nrip_save tsc_scale vmcs_clean flushbyasid decodeaissers pausefilter
pfthreshold avic v_vmsave_vmload vgfl uimp rdpid overflow_recover succor smca

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Lenovo Global Technology
ThinkSystem SR635
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SPECs®2017_fp_base = 93.4
SPECs®2017_fp_peak = 93.8

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

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: 257759 MB
  node 0 free: 257015 MB
  node distances:
    node 0
    0: 10

From /proc/meminfo
  MemTotal: 263946092 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-vapu 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 7 19:45

SPEC is set to: /home/cpu2017-1.0.5-amd-na
  Filesystem  Type  Size  Used Avail Use% Mounted on
  /dev/sdb2    xfs  893G  32G  862G   4% /

(Continued on next page)
**Lenovo Global Technology**

**ThinkSystem SR635**

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**SPEC CPU®2017 Floating Point Speed Result**

**SPECspeed®2017_fp_base = 93.4**

**SPECspeed®2017_fp_peak = 93.8**

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**CPU2017 License:** 9017

**Test Sponsor:** Lenovo Global Technology

**Test Date:** Sep-2019

**Tested by:** Lenovo Global Technology

**Hardware Availability:** Aug-2019

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**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 CFE103L 08/19/2019**

**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**

---

**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)**

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**GNU Fortran (GCC) 4.8.2**

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GNU Fortran (GCC) 4.8.2
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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/aoccl3.0/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
Lenovo Global Technology
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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:
-ff32 -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lslr-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
-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:
-ff32 -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lslr-in-nested-loop
-Wl,-plugin-opt=-enable-vectorize-compares=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-compares:=-false
-DSPEC_OPENMP -DUSE_OPENMP -fopenmp -fopenmp=libomp -lomp -lpthread
-ldl -ljemalloc -lamdlibm -lgfortran

Benchmarks using both Fortran and C:
-ff32 -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lslr-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
-flv-function-specialization -mllvm -enable-gvn-hoist
-mllvm -function-specialize -mavx -madx -funroll-loops -z muldefs
-fplugin=dragonegg.so -fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-enable-vectorize-compares:=-false

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## Lenovo Global Technology

**ThinkSystem SR635**  
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<td>Jun-2019</td>
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</tbody>
</table>

### Base Optimization Flags (Continued)

#### Benchmarks using both Fortran and C (continued):

```  
-DSPEC_OPENMP -DUSE_OPENMP -fopenmp -fopenmp=libomp -lomp -lpthread  
-ldl -ljemalloc -lamlibm -lgfortran
```

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

```  
-std=c++98 -flto -Wl, -plugin-opt=-merge-constant  
-Wl, -plugin-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  
-flv-function-specialization -mllvm -enable-gvn-hoist  
-mllvm -function-specialize -mllvm -unroll-threshold=100  
-finline-aggressive -mllvm -enable-vectorize-compares=false -mavx  
-madx -funroll-loops -z muldefs -fplugin=dragonegg.so  
-fplugin-arg-dragonegg-llvm-option=-merge-constant  
-fplugin-arg-dragonegg-llvm-option=-enable-vectorize-compares=false  
-DSPEC_OPENMP -fopenmp -DUSE_OPENMP -fopenmp=libomp -lomp -lpthread  
-ldl -ljemalloc -lamlibm
```

### 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

(Continued on next page)
Lenovo Global Technology

ThinkSystem SR635
2.80 GHz, AMD EPYC 7402

SPECspeed®2017_fp_base = 93.4
SPECspeed®2017_fp_peak = 93.8

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:
çlang gfortran

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

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

619.lbm_s: basepeak = yes
638.imagick_s: basepeak = yes
644.nab_s: basepeak = yes

Fortran benchmarks:

603.bwaves_s: basepeak = yes
649.fotonik3d_s: -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -O3 -mavx2 -mavx
-ffast-math -ffast-math -fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-lmerge
-DSPEC_OPENMP -DUSE_OPENMP -fopenmp -fopenmp=libomp
-lomp -lpthread -ldl -ljemalloc -lamdlibm -lgfortran

654.roms_s: basepeak = yes

Benchmarks using both Fortran and C:

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 -mlvm -vectorize-memory-aggressively
-mno-avx2 -ml1vm -unroll-threshold=100 -fremap-arrays

(Continued on next page)
Lenovo Global Technology
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SPEC CPU®2017 Floating Point Speed Result
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Peak Optimization Flags (Continued)

627.cam4_s (continued):
-mlvm -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: basepeak = yes

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 -mlvm -vectorize-memory-aggressively -mno-avx2
-mlvm -unroll-threshold=100 -fremap-arrays
-mlvm -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

The flags files that were used to format this result can be browsed at
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