## Lenovo Global Technology

### SPEC CPU®2017 Floating Point Speed Result

**ThinkSystem SR635**  
2.50 GHz, AMD EPYC 7502

<table>
<thead>
<tr>
<th>Software Availability</th>
<th>Hardware Availability</th>
<th>Test Sponsor</th>
<th>Tested by</th>
<th>CPU2017 License</th>
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</thead>
</table>

### Test Details

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

### Performance Results

<table>
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<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>SPECspeed®2017_fp_base</th>
<th>SPECspeed®2017_fp_peak</th>
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<tbody>
<tr>
<td>603.bwaves_s</td>
<td>32</td>
<td>105</td>
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<td>607.cactuBSSN_s</td>
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<tr>
<td>654.roms_s</td>
<td>32</td>
<td>110</td>
<td></td>
</tr>
</tbody>
</table>

### Hardware

- **CPU Name**: AMD EPYC 7502  
- **Max MHz**: 3350  
- **Nominal**: 2500  
- **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 CFE103B released Jul-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

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**Lenovo Global Technology**

**Test Date:** Aug-2019

**Hardware Availability:** Aug-2019

**Tested by:** Lenovo Global Technology

**Software Availability:** Jun-2019

---

### Results Table

<table>
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<tr>
<th>Benchmark</th>
<th>Base Threads</th>
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<th>Base Ratio</th>
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</table>

**SPECspeed®2017_fp_base = 105**

**SPECspeed®2017_fp_peak = 105**

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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/

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### 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)
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SPECspeed®2017_fp_base = 105
SPECspeed®2017_fp_peak = 105

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.


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 9bcd8f2999c33d61f64985e45859ea9
running on linux-vapu Thu Aug 22 18:29:49 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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#### SPECspeed®2017_fp_base = 105

#### SPECspeed®2017_fp_peak = 105

### Platform Notes (Continued)

From /proc/cpuinfo

```shell
model name : AMD EPYC 7502 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 7502 32-Core Processor
- **Stepping:** 0
- **CPU MHz:** 2500.000
- **CPU max MHz:** 2500.0000
- **CPU min MHz:** 1500.0000
- **BogoMIPS:** 4990.58
- **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 sse3 fma cx16 sse4_1 sse4_2 movbe popcnt aes xsave avx f16c rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse 3dnowprefetch osvw ibs skinit wdt tce topoext perfctr_core perfctr_nb bpxext perfctr_l2 mwaitx cpxb cat_l3 cdp_l3 hw_pstate sme ssbd sev ibrs ibpb stibp vmmcall fsgsbase bmi1 avx2 smep bmi2 cqm rdt_a rdseed adx smap clflushopt clwb sha_ni xsaveopt xsaves xsavecov cpb cpq_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local clzero irperf xsavespr arat npt lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassist pausefilter

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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: 257759 MB
  node 0 free: 256995 MB
  node distances:
    node 0
    0:  10

From /proc/meminfo
MemTotal: 263946092 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

From /etc/*release* /etc/*version*
  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 Aug 22 18:25

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

Filesystem Type Size Used Avail Use% Mounted on

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SPECspeed®2017_fp_base = 105
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CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
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Platform Notes (Continued)
/dev/sdb2  xfs  893G  55G  839G  7% /

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 CFE103B 07/11/2019
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)

A0CC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
  A0CC_1_3_0_Release-Build#34) (based on LLVM A0CC.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)

A0CC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
  A0CC_1_3_0_Release-Build#34) (based on LLVM A0CC.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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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.
GNU Fortran comes with NO WARRANTY, to the extent permitted by law.
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
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

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

**Base Portability Flags**

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**Base Optimization Flags**

**C benchmarks:**
- `-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`
- `-mlvm -function-specialize -z muldefs -DSPEC_OPENMP -fopenmp`
- `-DUSE_OPENMP -fopenmp=libomp -lomp -lpthread -ldl -ljemalloc -lamdlibm`

**Fortran benchmarks:**
- `-flto -Wl,-plugin-opt=-merge-constant`
- `-Wl,-plugin-opt=-lsr-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:**
- `-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`
- `-mlvm -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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SPECspeed®2017_fp_base = 105
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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
-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 -lamdlibm

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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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:
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: basepeak = yes

Benchmarks using both Fortran and C:
621.wrf_s: basepeak = yes
627.cam4_s: basepeak = yes
628.pop2_s: -flto -Wl,-plugin-opt=-merge-constant -Wl,-plugin-opt=-lsr-in-nested-loop -Ofast -march=znver1

(Continued on next page)
Lenovo Global Technology

ThinkSystem SR635
2.50 GHz, AMD EPYC 7502

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

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

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

Peak Optimization Flags (Continued)

628.pop2_s (continued):
-ffstruct-layout=3 -mllvm -vectorize-memory-aggressively
-mpno-avx2 -mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -O3 -mavx2 -mad

-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

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
-ffstruct-layout=3 -mllvm -vectorize-memory-aggressively -mno-avx2
-mllvm -inline-threshold=1000 -fremap-arrays
-mllvm -inline-threshold=1000 -finline-aggressive -O3 -mavx2 -mad

-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
http://www.spec.org/cpu2017/flags.Lenovo-Platform-SPECcpu2017-Flags-V1.2-Rome-C.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-C.xml

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Tested with SPEC CPU\textsuperscript{TM}2017 v1.0.5 on 2019-08-22 06:29:49-0400.