## Lenovo Global Technology

**ThinkSystem SR655**  
2.65 GHz, AMD EPYC 7413  

**SPEC CPU®2017 Integer Speed Result**

<table>
<thead>
<tr>
<th>Software Availability:</th>
</tr>
</thead>
</table>
| Test Date:             | Jul-2021  
| Hardware Availability: | Jun-2021  
| CPU2017 License:       | 9017  
| Tested by:             | Lenovo Global Technology  
| Test Sponsor:          | Lenovo Global Technology  

### Results

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>SPECspeed®2017_int_base</th>
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<tr>
<td>600.perlb</td>
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<td>12.3</td>
<td>12.3</td>
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<tr>
<td>602.gcc</td>
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<td>20.6</td>
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<td>605.mcf</td>
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<td>620.omnetp</td>
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<td>623.xalanc</td>
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<td>14.1</td>
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<tr>
<td>625.x264</td>
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<td>631.deepsj</td>
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<tr>
<td>641.leela</td>
<td>24</td>
<td>5.71</td>
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<tr>
<td>648.exchange2</td>
<td>24</td>
<td>23.1</td>
<td>23.2</td>
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<tr>
<td>657.xz</td>
<td>24</td>
<td>23.3</td>
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### Software

#### OS:
SUSE Linux Enterprise Server 15 SP2 (x86_64)  
Kernel 5.3.18-22-default

#### Compiler:
C/C++/Fortran: Version 3.0.0 of AOCC

#### Parallel:
Yes

#### Firmware:
Lenovo BIOS Version CFE125U 6.0 released May-2021

#### 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 and OS set to prefer performance at the cost of additional power usage

### Hardware

#### CPU Name:
AMD EPYC 7413

#### Max MHz:
3600

#### Nominal:
2650

#### Enabled:
24 cores, 1 chip, 2 threads/core

#### 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, 32 MB shared / 6 cores

#### Other:
None

#### Memory:
256 GB (8 x 32 GB 2Rx4 PC4-3200AA-R)

#### Storage:
1 x 960 GB SATA SSD

#### Other:
None
Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Base</th>
<th>Seconds</th>
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<th>Peak</th>
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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>
'echo 8 > /proc/sys/vm/dirty_ratio' run as root to limit dirty cache to 8% of memory.
'echo 1 > /proc/sys/vm/swappiness' run as root to limit swap usage to minimum necessary.
'echo 1 > /proc/sys/vm(zone_reclaim_mode' run as root to free node-local memory and avoid remote memory usage.
'sync; echo 3 > /proc/sys/vm/drop_caches' run as root to reset filesystem caches.
'sysctl -w kernel.randomize_va_space=0' run as root to disable address space layout randomization (ASLR) to reduce run-to-run variability.
To enable Transparent Hugepages (THP) for all allocations,
'echo always > /sys/kernel/mm/transparent_hugepage/enabled' and
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SPECspeed®2017_int_base = 12.3
SPECspeed®2017_int_peak = 12.3

Operating System Notes (Continued)
'echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root.

Environment Variables Notes
Environment variables set by runcpu before the start of the run:
GOMP_CPU_AFFINITY = "0-47"
LD_LIBRARY_PATH =
'/home/cpu2017-1.1.8-amd-aocc300-milan-B1/amd_speed_aocc300_milan_B_lib/64;/home/cpu2017-1.1.8-amd-aocc300-milan-B1/amd_speed_aocc300_milan_B_lib/32:"'
MALLOC_CONF = "retain:true"
OMP_DYNAMIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "48"

Environment variables set by runcpu during the 602.gcc_s peak run:
GOMP_CPU_AFFINITY = "0"

Environment variables set by runcpu during the 620.omnetpp_s peak run:
GOMP_CPU_AFFINITY = "0"

Environment variables set by runcpu during the 657.xz_s peak run:
GOMP_CPU_AFFINITY = "0-23"

General Notes
Binaries were compiled on a system with 2x AMD EPYC 7742 CPU + 1TiB Memory using openSUSE 15.2

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.
jemalloc: configured and built with GCC v4.8.2 in RHEL 7.4 (No options specified)
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 configuration:
Choose Operating Mode set to Maximum Performance

(Continued on next page)
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SPECspeed®2017_int_base = 12.3
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CPU2017 License: 9017
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Software Availability: Mar-2021

Platform Notes (Continued)

NUMA nodes per socket set to NPS2
SOC P-states set to P0

Sysinfo program /home/cpu2017-1.1.8-amd-aocc300-milan-B1/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acfc64d
running on localhost Fri Apr 17 23:16:15 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 7413 24-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 : 24
siblings : 48
physical 0: cores 0 1 2 3 4 5 8 9 10 11 12 13 16 17 18 19 20 21 24 25 26 27 28 29

From lscpu from util-linux 2.33.1:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
Address sizes: 48 bits physical, 48 bits virtual
CPU(s): 48
On-line CPU(s) list: 0-47
Thread(s) per core: 2
Core(s) per socket: 24
Socket(s): 1
NUMA node(s): 2
Vendor ID: AuthenticAMD
CPU family: 25
Model: 1
Model name: AMD EPYC 7413 24-Core Processor
Stepping: 1
CPU MHz: 1795.330
CPU max MHz: 2650.0000
CPU min MHz: 1500.0000
BogoMIPS: 5290.06
Virtualization: AMD-V
L1d cache: 32K
L1i cache: 32K
L2 cache: 512K
L3 cache: 32768K
NUMA node0 CPU(s): 0-11,24-35

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

NUMA node1 CPU(s): 12-23, 36-47

Flags: fpu vme de pse tsc msr pae mca cmov pat pse36 clflush mmx fxsr sse sse2 ht syscall nx mmxext fxsr_opt pdpe1gb rdtsscp lm constant_tsc rep_good nopl nonstop_tsc cpuid extd_apicid aperfmperf pni pclmulqdq monitor ssse3 fma cx16 pdi 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 bپext perfctr_llc mwaitx cbp cat_13 cdپ_13 invpcid_single hw_pstate ssbd mba ibп bпbp vмmcall fsгsбе node1 avx2 smep bп12 erms invpcid cqm rdt_a rdseed adx smаp clflushopt clwb sha ни xsaveopt xsave ecx vxsave vкс save cqm_llc cqm_occup_llc cqm_mбm_т0tal cqm_mбm_л0cal clzero 3пe rпsaver wbнoinvd arп nп tп svм_lock nпп_sаve tпc_ѕаle vмсb_cλeаn flushbyаsid decodeаssists pausefilter pfтhreshold v_vmsаve_vmлоаd vgіf umр pkп ospkе vаes vpclmulqдq rdpіd оvеrflоw_reсоv 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: 2 nodes (0-1)

node 0 cpus: 0 1 2 3 4 5 6 7 8 9 10 11 24 25 26 27 28 29 30 31 32 33 34 35

node 0 size: 128798 MB

node 0 free: 128275 MB

node 1 cpus: 12 13 14 15 16 17 18 19 20 21 22 23 36 37 38 39 40 41 42 43 44 45 46 47

node 1 size: 129004 MB

node 1 free: 128625 MB

node distances:

node 0 1

0: 10 12

1: 12 10

From /proc/meminfo

MemTotal: 263990732 kB

HugePages_Total: 0

Hugepagesize: 2048 kB

/sys/devices/system/cpu/cpu*/cpufreq/scaling_governor has performance

/usr/bin/lsb_release -d

SUSE Linux Enterprise Server 15 SP2

From /etc/*release*/etc/*version*

os-release:

NAME="SLES"

VERSION="15-SP2"

VERSION_ID="15.2"
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**Platform Notes (Continued)**

```plaintext
PRETTY_NAME="SUSE Linux Enterprise Server 15 SP2"
ID="sles"
ID_LIKE="suse"
ANSI_COLOR="0;32"
CPE_NAME="cpe:/o:suse:sles:15:sp2"

uname -a:
    Linux localhost 5.3.18-22-default #1 SMP Wed Jun 3 12:16:43 UTC 2020 (720aeba) x86_64
x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2018-12207 (iTLB Multihit): Not affected
CVE-2018-3620 (L1 Terminal Fault): Not affected
Microarchitectural Data Sampling: Not affected
CVE-2017-5754 (Meltdown): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2017-5753 (Spectre variant 1): Mitigation: usercopy/swapgs barriers and __user pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Full AMD retpoline, IBPB: conditional, IBRS_FW, STIBP: always-on, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort): Not affected

run-level 3 Apr 17 21:13
SPEC is set to: /home/cpu2017-1.1.8-amd-aocc300-milan-B1
    Filesystem Type Size Used Avail Use% Mounted on
    /dev/md126p3 xfs 892G 85G 808G 10% /

From /sys/devices/virtual/dmi/id
    Vendor: Lenovo
    Product: ThinkSystem SR655 -[7Y00000000]-
    Product Family: ThinkSystem
    Serial: 0123456789

Additional information from dmidecode 3.2 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 M393A4K40DB3-CWE 32 GB 2 rank 3200
    8x Unknown Unknown
```

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**SPECspeed®2017_int_base = 12.3**

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### Platform Notes (Continued)

**BIOS:**

- **BIOS Vendor:** Lenovo
- **BIOS Version:** CFE125U
- **BIOS Date:** 05/28/2021
- **BIOS Revision:** 6.0

(End of data from sysinfo program)

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### Compiler Version Notes

```
C
+-----------------------------------+
| 600.perlbench_s(base, peak) 602.gcc_s(base, peak) 605.mcf_s(base, peak) 625.x264_s(base, peak) 657.xz_s(base, peak) |
+-----------------------------------+

AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin
```

```
C++
+-----------------------------------+
| 620.omnetpp_s(base, peak) 623.xalancbmk_s(base, peak) 631.deepsjeng_s(base, peak) 641.leela_s(base, peak) |
+-----------------------------------+

AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin
```

```
Fortran
+-----------------------------------+
| 648.exchange2_s(base, peak) |
+-----------------------------------+

AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin
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### Base Compiler Invocation

- **C benchmarks:**
  - clang

- **C++ benchmarks:**
  - clang++

- **Fortran benchmarks:**
  - flang

### Base Portability Flags

- `600.perlbench_s`: `-DSPEC_LINUX_X64 -DSPEC_LP64`
- `602.gcc_s`: `-DSPEC_LP64`
- `605.mcf_s`: `-DSPEC_LP64`
- `620.omnetpp_s`: `-DSPEC_LP64`
- `623.xalancbmk_s`: `-DSPEC_LINUX -DSPEC_LP64`
- `625.x264_s`: `-DSPEC_LP64`
- `631.deepsjeng_s`: `-DSPEC_LP64`
- `641.leela_s`: `-DSPEC_LP64`
- `648.exchange2_s`: `-DSPEC_LP64`
- `657.xz_s`: `-DSPEC_LP64`

### Base Optimization Flags

- **C benchmarks:**
  - `-m64 -mno-adx -mno-sse4a -Wl,-allow-multiple-definition`
  - `-Wl,-mllvm -Wl,-enable-licm-vrp -Wl,-mllvm -Wl,-region-vectorize`
  - `-Wl,-mllvm -Wl,-function-specialize`
  - `-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6`
  - `-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver3`
  - `-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5`
  - `-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000`
  - `-fremap-arrays -mllvm -function-specialize -flv-function-specialization`
  - `-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true`
  - `-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3 -z muldefs`
  - `-fopenmp -fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc`
  - `-lflang -lflangrti`

- **C++ benchmarks:**
  - `-std=c++98 -mno-adx -mno-sse4a`
  - `-Wl,-mllvm -Wl,-do-block-reorder=aggressive`
  - `-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-function-specialize`

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Base Optimization Flags (Continued)

C++ benchmarks (continued):
- W1,-mllvm -W1,-align-all-nofallthru-blocks=6
- W1,-mllvm -W1,-reduce-array-computations=3 -O3 -march=znver3
- fveclib=AMDLIBM -ffast-math -flto -mllvm -enable-partial-unswitch
- mllvm -unroll-threshold=100 -finline-aggressive
- fllvm-function-specialization -mllvm -loop-unswitch-threshold=200000
- mllvm -reroll-loops -mllvm -aggressive-loop-unswitch
- mllvm -extra-vectorizer-passes -mllvm -reduce-array-computations=3
- mllvm -global-vectorize-slp=true -mllvm -convert-pow-exp-to-int=false
- z muldefs -mllvm -do-block-reorder=aggressive
- fvirtual-function-elimination -fvisibility=hidden -DSPEC_OPENMP
- fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
- lflangrti

Fortran benchmarks:
- m64 -mno-adx -mno-sse4a -W1,-mllvm -W1,-inline-recursion=4
- W1,-mllvm -W1,-lsr-in-nested-loop -W1,-mllvm -W1,-enable-iv-split
- W1,-mllvm -W1,-region-vectorize -W1,-mllvm -W1,-function-specialize
- W1,-mllvm -W1,-align-all-nofallthru-blocks=6
- W1,-mllvm -W1,-reduce-array-computations=3 -O3 -march=znver3
- fveclib=AMDLIBM -ffast-math -flto -z muldefs
- mllvm -unroll-aggressive -mllvm -unroll-threshold=150 -DSPEC_OPENMP
- fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
- lflangrti

Base Other Flags

C benchmarks:
- Wno-unused-command-line-argument -Wno-return-type

C++ benchmarks:
- Wno-unused-command-line-argument -Wno-return-type

Fortran benchmarks:
- Wno-return-type

Peak Compiler Invocation

C benchmarks:
clang

(Continued on next page)
Peak Compiler Invocation (Continued)

C++ benchmarks:
clang++

Fortran benchmarks:
flang

Peak Portability Flags
Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

600.perlbench_s: basepeak = yes


605.mcf_s: basepeak = yes

625.x264_s: basepeak = yes

657.xz_s: Same as 602.gcc_s

C++ benchmarks:

620.omnetpp_s: -m64 -std=c++98 -mno-adx -mno-sse4a -Wl,-mllvm -Wl,-do-block-reorder=aggressive -Wl,-mllvm -Wl,-function-specialize -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6

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

**ThinkSystem SR655**  
**2.65 GHz, AMD EPYC 7413**

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<td>Lenovo Global Technology</td>
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**SPECspeed®2017_int_base = 12.3**

**SPECspeed®2017_int_peak = 12.3**

#### Peak Optimization Flags (Continued)

620.omnetpp_s (continued):
- `-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast`
- `-march=znver3 -fveclib=AMDLIBM -ffast-math -flto`
- `-finline-aggressive -mllvm -unroll-threshold=100`
- `-flv-function-specialization -mllvm -enable-licm-vrp`
- `-mllvm -reroll-loops -mllvm -aggressive-loop-unswitch`
- `-mllvm -reduce-array-computations=3`
- `-mllvm -global-vectorize-slp=true`
- `-mllvm -do-block-reorder=aggressive`
- `-fvirtual-function-elimination -fvisibility=hidden`
- `-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lamdlibm`
- `-ljemalloc -llflang`

623.xalancbmk_s: basepeak = yes

631.deepsjeng_s: basepeak = yes

641.leela_s: basepeak = yes

Fortran benchmarks:

648.exchange2_s: basepeak = yes

#### Peak Other Flags

**C benchmarks:**
- `-Wno-unused-command-line-argument -Wno-return-type`

**C++ benchmarks:**
- `-Wno-unused-command-line-argument -Wno-return-type`

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

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:
## SPEC CPU®2017 Integer Speed Result

**Lenovo Global Technology**

**ThinkSystem SR655**  
*2.65 GHz, AMD EPYC 7413*

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**CPU2017 License**: 9017  
**Test Date**: Jul-2021  
**Test Sponsor**: Lenovo Global Technology  
**Hardware Availability**: Jun-2021  
**Tested by**: Lenovo Global Technology  
**Software Availability**: Mar-2021

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