**Lenovo Global Technology**

ThinkSystem SR655  
2.90 GHz, AMD EPYC 7272

**SPECspeed®2017_int_base = 8.03**  
**SPECspeed®2017_int_peak = 8.21**

**CPU2017 License:** 9017  
**Test Date:** Mar-2020  
**Test Sponsor:** Lenovo Global Technology  
**Hardware Availability:** Jan-2020

**Tested by:** Lenovo Global Technology  
**Software Availability:** Nov-2019

**Hardware**

- **CPU Name:** AMD EPYC 7272  
- **Max MHz:** 3200  
- **Nominal:** 2900  
- **Enabled:** 12 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:** 64 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

**Software**

- **OS:** Red Hat Enterprise Linux 8.1 (Ootpa)  
- **Kernel:** 4.18.0-147.el8.x86_64  
- **Compiler:** C/C++/Fortran: Version 2.0.0 of AOCC  
- **Parallel:** Yes  
- **Firmware:** Lenovo BIOS Version CFE107O released Dec-2019  
- **File System:** xfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 32/64-bit  
- **Other:** jemalloc: jemalloc memory allocator library v5.1.0  
- **Power Management:** BIOS set to prefer performance at the cost of additional power usage
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CPU2017 License: 9017
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Tested by: Lenovo Global Technology

Test Date: Mar-2020
Hardware Availability: Jan-2020
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Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
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<td>648.exchange2_s</td>
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<td>186</td>
<td>15.8</td>
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</tbody>
</table>

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/

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 numacl i.e.:
numactl --interleave=all runcpu <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

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)
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Tested by: Lenovo Global Technology

Environment Variables Notes
Environment variables set by runcpu before the start of the run:
GOMP_CPU_AFFINITY = "0-11"
LD_LIBRARY_PATH =
    "/home/cpu2017-1.1.0-amd-rome-aoccc200-C1/amd_speed_aoccc200_rome_C_lib/64
    ;/home/cpu2017-1.1.0-amd-rome-aoccc200-C1/amd_speed_aoccc200_rome_C_lib/32
"
MALLOCONF = "retain:true"
OMP_DYNAMIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "12"

Environment variables set by runcpu during the 600.perlbench_s peak run:
GOMP_CPU_AFFINITY = "0"

Environment variables set by runcpu during the 605.mcf_s peak run:
GOMP_CPU_AFFINITY = "0"

Environment variables set by runcpu during the 623.xalancbmk_s peak run:
GOMP_CPU_AFFINITY = "0"
OMP_STACKSIZE = "128M"

Environment variables set by runcpu during the 625.x264_s peak run:
GOMP_CPU_AFFINITY = "0"

Environment variables set by runcpu during the 631.deepsjeng_s peak run:
GOMP_CPU_AFFINITY = "0"

General Notes
Binaries were compiled on a system with 2x AMD EPYC 7601 CPU + 512GB Memory using Fedora 26

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 v9.1.0 in Ubuntu 19.04 with -O3 -znver2 -flto
jemalloc 5.1.0 is available here:
https://github.com/jemalloc/jemalloc/releases/download/5.1.0/jemalloc-5.1.0.tar.bz2
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Platform Notes

BIOS settings:
Set Operating Mode set to Maximum Performance
SMT Mode set to Disabled

Sysinfo program /home/cpu2017-1.1.0-amd-rome-aocc200-C1/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7ed8e6e46a0011
running on localhost.localdomain Wed Mar 18 18:26:34 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 7272 12-Core Processor
  1 "physical id"s (chips)
  12 "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 : 12
siblings : 12
physical 0: cores 0 1 2 4 5 6 8 9 10 12 13 14

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 12
On-line CPU(s) list: 0-11
Thread(s) per core: 1
Core(s) per socket: 12
Socket(s): 1
NUMA node(s): 1
Vendor ID: AuthenticAMD
CPU family: 23
Model: 49
Model name: AMD EPYC 7272 12-Core Processor
Stepping: 0
CPU MHz: 3048.822
CPU max MHz: 2900.0000
CPU min MHz: 1500.0000
BogoMIPS: 5789.06
Virtualization: AMD-V
L1d cache: 32K
L1i cache: 32K
L2 cache: 512K
L3 cache: 16384K
NUMA node0 CPU(s): 0-11

(Continued on next page)
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Platform Notes (Continued)

Flags:

fpu vme de pse mre mca cmov pat pse36 clflush mmx fxsr sse sse2 ht syscall nx mmxext fxsr_opt pdpe1gb rdtscp lm constant_tsc rep_good nop flush infect nonstop_tsc cpuid extad_apicid aperf perf perf vmu
pmlmuluniq monitor ssse3 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 bpext perfctr_llc mwaitx cpb cat_l3 cdp_l3 hw_pstate sme ssbd mba sev ibrs ibpb stibp vmmcall bsfi base mmx avx2 smp bmi2 cmq rd_a rdseed adx smal clflushopt clwb sha ni xsaveopt xsave xsaveopt xsaves cmq llc cmq_occup llc cmq_mbb_total cmq_mbb local clzero irperf xsaveerptr wbnoinvd arat npt lbv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassist pausefilter pfthreshold avic v_vmsave_vmload vg if umip rdpid

overf low_recov succor smca

/cache data

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
node 0 size: 257770 MB
node 0 free: 256866 MB
node distances:
node 0
0: 10

From /proc/meminfo

MemTotal: 263957020 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

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

os-release:
NAME="Red Hat Enterprise Linux"
VERSION="8.1 (Ootpa)"
ID="rhel"
ID_LIKE="fedora"
VERSION_ID="8.1"
PLATFORM_ID="platform:el8"
PRETTY_NAME="Red Hat Enterprise Linux 8.1 (Ootpa)"
ANSI_COLOR="0;31"
redhat-release: Red Hat Enterprise Linux release 8.1 (Ootpa)
system-release: Red Hat Enterprise Linux release 8.1 (Ootpa)
system-release-cpe: cpe:/o:redhat:enterprise_linux:8.1:ga

uname -a:
Linux localhost.localdomain 4.18.0-147.el8.x86_64 #1 SMP Thu Sep 26 15:52:44 UTC 2019

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**SPEC CPU®2017 Integer Speed Result**

<table>
<thead>
<tr>
<th>SPECspeed®2017_int_base</th>
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<tr>
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CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Test Date: Mar-2020
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Software Availability: Nov-2019

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**Platform Notes (Continued)**

x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

- **CVE-2018-3620 (L1 Terminal Fault):** Not affected
- **Microarchitectural Data Sampling:** Not affected
- **CVE-2017-5754 (Meltdown):** Not affected
- **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 sanitation
- **CVE-2017-5715 (Spectre variant 2):** Mitigation: Full AMD retpoline, IBPB: conditional, IBRS_FW, STIBP: disabled, RSB filling

run-level 3 Mar 18 18:19

SPEC is set to: /home/cpu2017-1.1.0-amd-rome-aocc200-C1

```
Filesystem     Type  Size  Used Avail Use% Mounted on
/dev/sdb2      xfs   838G   26G  812G   4% /home
```

From /sys/devices/virtual/dmi/id

- **BIOS:** Lenovo CFE107O 12/28/2019
- **Vendor:** Lenovo
- **Product:** ThinkSystem SR655 _-[7Y0000000]_
- **Product Family:** ThinkSystem
- **Serial:** 0123456789

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.

**Memory:**
- 8x Samsung M393A4K40DB2-CWE 32 kB 2 rank 3200
- 8x Unknown Unknown

(End of data from sysinfo program)

---

**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)
```

AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)

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SPEC CPU®2017 Integer Speed Result

SPECspeed®2017_int_base = 8.03
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CPU2017 License: 9017
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Compiler Version Notes (Continued)

Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin

C++  | 623.xalancbmk_s(peak)

AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin

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

AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin

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SPECspeed\textsuperscript{\textregistered}2017\textsubscript{int}\textsubscript{peak} = 8.21
SPECspeed\textsuperscript{\textregistered}2017\textsubscript{int}\textsubscript{base} = 8.03

Compiler Version Notes (Continued)

Fortran | 648.exchange2\_s(base, peak)

AOCC.LLVM.2.0.0.B191.2019\_07\_19 clang version 8.0.0 (CLANG: Jenkins
AOCC\_2\_0\_0\_Build\#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019\_07\_19)
Target: x86\_64\_unknown\_linux\_gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin

Base Compiler Invocation

C benchmarks:
clang

C++ benchmarks:
clang++

Fortran benchmarks:
flang

Base Portability Flags

600.perlbench\_s: \textendash\ DSPEC\_LINUX\_X64\textendash\ DSPEC\_LP64
602.gcc\_s: \textendash\ DSPEC\_LP64
605.mcf\_s: \textendash\ DSPEC\_LP64
620.omnetpp\_s: \textendash\ DSPEC\_LP64
623.xalancbmk\_s: \textendash\ DSPEC\_LINUX\textendash\ DSPEC\_LP64
625.x264\_s: \textendash\ DSPEC\_LP64
631.deepsjeng\_s: \textendash\ DSPEC\_LP64
641.leela\_s: \textendash\ DSPEC\_LP64
648.exchange2\_s: \textendash\ DSPEC\_LP64
657.xz\_s: \textendash\ DSPEC\_LP64

Base Optimization Flags

C benchmarks:
\texttt{-f\_flto \_W1, -m\_llvm \_W1, -function-specialize}
\texttt{-W1, -m\_llvm \_W1, -region-vectorize \_W1, -m\_llvm \_W1, -vector-library=LIBMVEC}
\texttt{-W1, -m\_llvm \_W1, -reduce-array-computations=3 \_O3 \_ffast-math}
\texttt{-march=znver2 \_f\_struct\_layout=3 \_m\_llvm \_unroll\_threshold=50}

(Continued on next page)
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**Base Optimization Flags (Continued)**

C benchmarks (continued):
- `-fremap-arrays`  
- `-mllvm -function-specialize`  
- `-mllvm -enable-gvn-hoist`  
- `-mllvm -reduce-array-computations=3`  
- `-mllvm -global-vectorize-slp`  
- `-mllvm -vector-library=LIBMVEC`  
- `-mllvm -inline-threshold=1000`  
- `-flv-function-specialization`  
- `-z muldefs`  
- `-DSPEC_OPENMP`  
- `-fopenmp`  
- `-DUSE_OPENMP`  
- `-fopenmp=libomp`  
- `-lomp`  
- `-lpthread`  
- `-ldl`  
- `-lmvec`  
- `-lamdlibm`  
- `-ljemalloc`  
- `-lflang`  

C++ benchmarks:
- `-flto`  
- `-Wl,-mllvm -Wl,-function-specialize`  
- `-Wl,-mllvm -Wl,-region-vectorize`  
- `-Wl,-mllvm -Wl,-vector-library=LIBMVEC`  
- `-Wl,-mllvm -Wl,-reduce-array-computations=3`  
- `-Wl,-mllvm -Wl,-suppress-fmas -O3 -ffast-math -march=znver2`  
- `-mllvm -loop-unswitch-threshold=200000`  
- `-mllvm -vector-library=LIBMVEC`  
- `-mllvm -unroll-threshold=100`  
- `-flv-function-specialization`  
- `-mllvm -enable-partial-unswitch -z muldefs`  
- `-DSPEC_OPENMP`  
- `-fopenmp`  
- `-DUSE_OPENMP`  
- `-fopenmp=libomp`  
- `-lomp`  
- `-lpthread`  
- `-ldl`  
- `-lmvec`  
- `-lamdlibm`  
- `-ljemalloc`  
- `-lflang`

Fortran benchmarks:
- `-flto`  
- `-Wl,-mllvm -Wl,-function-specialize`  
- `-Wl,-mllvm -Wl,-region-vectorize`  
- `-Wl,-mllvm -Wl,-vector-library=LIBMVEC`  
- `-Wl,-mllvm -Wl,-reduce-array-computations=3`  
- `-ffast-math`  
- `-Wl,-mllvm -Wl,-inline-recursion=4`  
- `-Wl,-mllvm -Wl,-lsr-in-nested-loop`  
- `-Wl,-mllvm -Wl,-enable-iv-split -O3 -march=znver2 -funroll-loops`  
- `-Mrecursive`  
- `-Mllvm -vector-library=LIBMVEC -z muldefs`  
- `-mllvm -disable-indvar-simplify`  
- `-mllvm -unroll-aggressive`  
- `-mllvm -unroll-threshold=150`  
- `-DSPEC_OPENMP`  
- `-fopenmp`  
- `-DUSE_OPENMP`  
- `-fopenmp=libomp`  
- `-lomp`  
- `-lpthread`  
- `-ldl`  
- `-lmvec`  
- `-lamdlibm`  
- `-ljemalloc`  
- `-lflang`

**Base Other Flags**

C benchmarks:
- `-Wno-return-type`

C++ benchmarks:
- `-Wno-return-type`

Fortran benchmarks:
- `-Wno-return-type`
# SPEC CPU®2017 Integer Speed Result

## Lenovo Global Technology

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<td>Tested by</td>
<td>Lenovo Global Technology</td>
<td>Software Availability</td>
<td>Nov-2019</td>
</tr>
</tbody>
</table>

## Peak Compiler Invocation

**C benchmarks:**  
clang

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

**Fortran benchmarks:**  
flang

## Peak 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 -D_FILE_OFFSET_BITS=64  
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

## Peak Optimization Flags

**C benchmarks:**

- 600.perlbench_s: -flto -Wl,-mllvm -Wl,-function-specialize  
- Wl,-mllvm -Wl,-region-vectorize  
- Wl,-mllvm -Wl,-vector-library=LIBMVEC  
- Wl,-mllvm -Wl,-reduce-array-computations=3  
- fprofile-instr-generate(pass 1)  
- fprofile-instr-use(pass 2) -Ofast -march=znver2  
- mno-sse4a -fstruct-layout=5  
- mllvm -vectorize-memory-aggressively  
- mllvm -function-specialize -mllvm -enable-gvn-hoist  
- mllvm -unroll-threshold=50 -fremap-arrays  
- mllvm -vector-library=LIBMVEC  
- mllvm -reduce-array-computations=3  
- mllvm -global-vectorize-slp -mllvm -inline-threshold=1000  
- flv-function-specialization -DSPEC_OPENMP -fopenmp  
- DUSE_OPENMP -lmvec -lamdlibm -fopenmp=libomp -lomp  
- lpthread -ldl -ljemalloc -lflang

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

602.gcc_s: basepeak = yes

605.mcf_s: --flto -Wl,-ml1vm -Wl,-function-specialize
-Wl,-ml1vm -Wl,-region-vectorize
-Wl,-ml1vm -Wl,-vector-library=LIBMVEC
-Wl,-ml1vm -Wl,-reduce-array-computations=3 -Ofast
-march=znver2 -mno-sse4a -fstruct-layout=5
-ml1vm -vectorize-memory-aggressively
-ml1vm -function-specialize -ml1vm -enable-gvn-hoist
-ml1vm -unroll-threshold=50 -fremap-arrays
-ml1vm -vector-library=LIBMVEC
-ml1vm -reduce-array-computations=3
-ml1vm -global-vectorize-slp -ml1vm -inline-threshold=1000
-flv-function-specialization -DSPEC_OPENMP -fopenmp
-DUSE_OPENMP -lmvec -landlibm -fopenmp=libomp -lomp
-lpthread -ldl -ljemalloc -lflang

625.x264_s: Same as 600.perlbench_s

657.xz_s: basepeak = yes

C++ benchmarks:

620.omnetpp_s: basepeak = yes

623.xalancbmk_s: -m32 -flto -Wl,-ml1vm -Wl,-function-specialize
-Wl,-ml1vm -Wl,-region-vectorize
-Wl,-ml1vm -Wl,-vector-library=LIBMVEC
-Wl,-ml1vm -Wl,-reduce-array-computations=3 -Ofast
-march=znver2 -flv-function-specialization
-ml1vm -unroll-threshold=100
-ml1vm -enable-partial-unswitch
-ml1vm -loop-unswitch-threshold=200000
-ml1vm -vector-library=LIBMVEC
-ml1vm -inline-threshold=1000 -DSPEC_OPENMP -fopenmp
-DUSE_OPENMP -fopenmp=libomp -lomp -lpthread -ldl
-lemalloc

631.deepsjeng_s: --flto -Wl,-ml1vm -Wl,-function-specialize
-Wl,-ml1vm -Wl,-region-vectorize
-Wl,-ml1vm -Wl,-vector-library=LIBMVEC
-Wl,-ml1vm -Wl,-reduce-array-computations=3 -Ofast
-march=znver2 -flv-function-specialization
-ml1vm -unroll-threshold=100
Lenovo Global Technology
ThinkSystem SR655
2.90 GHz, AMD EPYC 7272

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Test Sponsor: Lenovo Global Technology
Tested by: Lenovo Global Technology

Peak Optimization Flags (Continued)

631.deepsjeng_s (continued):
-mlirv -enable-partial-unswitch
-mlirv -loop-unswitch-threshold=200000
-mlirv -vector-library=LIBMVEC
-mlirv -inline-threshold=10000 -DSPEC_OPENMP -fopenmp
-DUSE_OPENMP -fopenmp=libomp -lomp -lpthread -ldl
-lmvcc -lamlbirm -ljemalloc -lflang

641.leela_s: basepeak = yes
Fortran benchmarks:
648.exchange2_s: basepeak = yes

Peak Other Flags

C benchmarks:
-Wno-return-type

C++ benchmarks (except as noted below):
-Wno-return-type

623.xalancbmk_s: -Wno-return-type
-L/sppo/dev/cpu2017/v110/amd_speed_aocc200_rome_C_lib/32

Fortran benchmarks:
-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-E.html

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-E.xml

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Tested with SPEC CPU®2017 v1.1.0 on 2020-03-18 06:26:33-0400.
Report generated on 2020-04-14 14:14:36 by CPU2017 PDF formatter v6255.
Originally published on 2020-04-14.