Lenovo Global Technology
ThinkSystem SR645
3.50 GHz, AMD EPYC 73F3

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

SPECspeed®2017_fp_peak = 203
SPECspeed®2017_fp_base = 187

<table>
<thead>
<tr>
<th>Threads</th>
<th>603.bwaves_s</th>
<th>607.cactuBSSN_s</th>
<th>619.lbm_s</th>
<th>621.wrf_s</th>
<th>627.cam4_s</th>
<th>628.pop2_s</th>
<th>638.imagick_s</th>
<th>644.nab_s</th>
<th>649.fotonik3d_s</th>
<th>654.roms_s</th>
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<tr>
<td>32</td>
<td>197</td>
<td>120</td>
<td>119</td>
<td>180</td>
<td>122</td>
<td>71.9</td>
<td>273</td>
<td>284</td>
<td>344</td>
<td>241</td>
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<td>64</td>
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<td></td>
<td></td>
<td>766</td>
<td></td>
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<td></td>
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</tbody>
</table>

**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 D8E115E 2.01 released Mar-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 set to prefer performance at the cost of additional power usage

**Hardware**

- **CPU Name:** AMD EPYC 73F3
- **Max MHz:** 4000
- **Nominal:** 3500
- **Enabled:** 32 cores, 2 chips, 2 threads/core
- **Orderable:** 1.2 chips
- **Cache L1:** 32 KB I + 32 KB D on chip per core
- **L2:** 512 KB I+D on chip per core
- **L3:** 256 MB I+D on chip per chip, 32 MB shared / 2 cores
- **Other:** None
- **Memory:** 512 GB (16 x 32 GB 2Rx4 PC4-3200AA-R)
- **Storage:** 1 x 960 GB SATA SSD
- **Other:** None

---

Test Date: Apr-2021
Hardware Availability: Apr-2021
Software Availability: Mar-2021
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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>61.0</td>
<td>273</td>
<td>61.5</td>
<td>271</td>
<td>61.1</td>
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<tr>
<td>619.lbm_s</td>
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<td>72.7</td>
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<tr>
<td>628.pop2_s</td>
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<td>72.0</td>
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<td>71.9</td>
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<td>197</td>
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<td>284</td>
<td>61.4</td>
<td>285</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>32</td>
<td>76.4</td>
<td>119</td>
<td>76.1</td>
<td>120</td>
<td>76.2</td>
<td>120</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>32</td>
<td>66.0</td>
<td>238</td>
<td>65.2</td>
<td>241</td>
<td>65.4</td>
<td>241</td>
</tr>
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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.

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 numaclt 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

(Continued on next page)
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SPECspeed®2017_fp_base = 187
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Operating System Notes (Continued)

'echo always > /sys/kernel/mm/transient_hugepage/defrag' run as root.
To enable THP only on request for peak runs of 628.pop2_s, and 638.imagick_s,
'echo madvise > /sys/kernel/mm/transient_hugepage/enabled' run as root.
To disable THP for peak runs of 627.cam4_s, 644.nab_s, 649.fotonik3d_s, and 654.roms_s,
'echo never > /sys/kernel/mm/transient_hugepage/enabled' run as root.

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
GOMP_CPU_AFFINITY = "0-63"
LD_LIBRARY_PATH = "'/home/cpu2017-1.1.5-amd-aocc300-milan-A1/amd_speed_aocc300_milan_A_lib/64';" /home/cpu2017-1.1.5-amd-aocc300-milan-A1/amd_speed_aocc300_milan_A_lib/32;"
MALLOC_CONF = "retain:true"
OMP_DYNAMIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "64"

Environment variables set by runcpu during the 603.bwaves_s peak run:
GOMP_CPU_AFFINITY = "0 32 1 33 2 34 3 35 4 36 5 37 6 38 7 39 8 40 9 41 10 42 11 43 12 44 13 45 14 46 15 47 16 48 17 49 18 50 19 51 20 52 21 53 22 54 23 55 24 56 25 57 26 58 27 59 28 60 29 61 30 62 31 63"

Environment variables set by runcpu during the 619.lbm_s peak run:
GOMP_CPU_AFFINITY = "0 32 1 33 2 34 3 35 4 36 5 37 6 38 7 39 8 40 9 41 10 42 11 43 12 44 13 45 14 46 15 47 16 48 17 49 18 50 19 51 20 52 21 53 22 54 23 55 24 56 25 57 26 58 27 59 28 60 29 61 30 62 31 63"

Environment variables set by runcpu during the 627.cam4_s peak run:
GOMP_CPU_AFFINITY = "0 32 1 33 2 34 3 35 4 36 5 37 6 38 7 39 8 40 9 41 10 42 11 43 12 44 13 45 14 46 15 47 16 48 17 49 18 50 19 51 20 52 21 53 22 54 23 55 24 56 25 57 26 58 27 59 28 60 29 61 30 62 31 63"

Environment variables set by runcpu during the 644.nab_s peak run:
GOMP_CPU_AFFINITY = "0 32 1 33 2 34 3 35 4 36 5 37 6 38 7 39 8 40 9 41 10 42 11 43 12 44 13 45 14 46 15 47 16 48 17 49 18 50 19 51 20 52 21 53 22 54 23 55 24 56 25 57 26 58 27 59 28 60 29 61 30 62 31 63"

Environment variables set by runcpu during the 654.roms_s peak run:
GOMP_CPU_AFFINITY = "0-31"
**Lenovo Global Technology**

**ThinkSystem SR645**
3.50 GHz, AMD EPYC 73F3

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

<table>
<thead>
<tr>
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**Test Sponsor:** Lenovo Global Technology  
**Tested by:** Lenovo Global Technology  
**Test Date:** Apr-2021  
**Hardware Availability:** Apr-2021  
**Software Availability:** Mar-2021

---

**General Notes**

Binaries were compiled on a system with 2x AMD EPYC 7713 CPU + 512GiB Memory using RHEL 8.2

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:**  
Operating Mode set to Maximum Performance and then set it to Custom Mode  
4-Link xGMI Max Speed set to 16Gbps  
SOC P-States set to P0  
DLWM Support set to Disabled

Sysinfo program /home/cpu2017-1.1.5-amd-aocc300-milan-A1/bin/sysinfo  
Rev: r6538 of 2020-09-24 e8664e66d2d7080afeaa89d4b38e2f1c  
running on localhost Thu Apr 8 19:08:46 2021

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 73F3 16-Core Processor  
  2 "physical id"s (chips)  
  64 "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 : 16  
  siblings : 32  
  physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15  
  physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

From lscpu:  
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): 64

(Continued on next page)
## Lenovo Global Technology

**ThinkSystem SR645**  
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### SPECspeed®2017_fp_base = 187

### SPECspeed®2017_fp_peak = 203

#### Platform Notes (Continued)

- **On-line CPU(s) list:** 0-63
- **Thread(s) per core:** 2
- **Core(s) per socket:** 16
- **Socket(s):** 2
- **NUMA node(s):** 2
- **Vendor ID:** AuthenticAMD
- **CPU family:** 25
- **Model:** 1
- **Model name:** AMD EPYC 73F3 16-Core Processor
- **Stepping:** 1
- **CPU MHz:** 1795.815
- **CPU max MHz:** 3500.0000
- **CPU min MHz:** 1500.0000
- **BogoMIPS:** 6987.11
- **Virtualization:** AMD-V
- **L1d cache:** 32K
- **L1i cache:** 32K
- **L2 cache:** 512K
- **L3 cache:** 32768K
- **NUMA node0 CPU(s):** 0-15, 32-47
- **NUMA node1 CPU(s):** 16-31, 48-63
- **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 nonstop_tsc cpuid extd_apicid aperfmperf pni pclmulqdq monitor ssse3 fma cx16 pcid sse4_1 sse4_2 movbe popcnt aes f16c rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse 3dnowprefetch osvw ibr skinit wdt tce topoext perfctr_core perfctr_nb bperfctr llc mwaitx cpb cat l3 cd p l3 invpcid_single hw_pstate ssbd mba ibrs ibpb stibp vmcall fsgsbase bni avx2 smep bmi2 ems invpcid cm runa rdseed adx smap clflushopt clwb sha ni xsaved opt xsaveopt xsaveopt xsaves xsave cqm llc cqm_occup_llc cqm_mbm_total cqm_mbm_local clzero irperf xsaveopt wbinvd arat npt lbrv svm_lock nrpl_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter ptrflush v_msave_vmload vgif umip pku ospk vaes vpcmclmulqdp rdpid overflow_recov succor smca

### /proc/cpuinfo cache data

```plaintext
memory size : 512 KB
```

From `numactl --hardware`  
**WARNING:** a numactl 'node' might or might not correspond to a physical chip.

```plaintext
available: 2 nodes (0-1)
node 0 cpus: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
node 0 size: 257836 MB
node 0 free: 257356 MB
node 1 cpus: 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63
node 1 size: 258001 MB
```

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

- **node 1 free:** 257378 MB
- **node distances:**
  - node 0 1
  - 0: 10 32
  - 1: 32 10

From `/proc/meminfo`

- **MemTotal:** 528218360 KB
- **HugePages_Total:** 0
- **Hugepagesize:** 2048 KB

From `/sys/devices/system/cpu/cpu*/cpufreq/scaling_governor`

- Has performance

From `/etc/*release*`

- **NAME:** SLES
- **VERSION:** 15-SP2
- **VERSION_ID:** 15.2
- **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):** 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/swaps barriers and __user pointer sanitation
- **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

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## Lenovo Global Technology

**ThinkSystem SR645**  
**3.50 GHz, AMD EPYC 73F3**

### SPEC CPU 2017 Floating Point Speed Result

<table>
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<th>SPECspeed®2017_fp_peak</th>
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<tr>
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<td>203</td>
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</table>

**CPU2017 License:** 9017  
**Test Sponsor:** Lenovo Global Technology  
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---

**Platform Notes (Continued)**

```
run-level 3 Apr 8 16:22

SPEC is set to: /home/cpu2017-1.1.5-amd-aocc300-milan-Al
Filesystem Type Size Used Avail Use% Mounted on
/dev/sdb3 xfs 889G 80G 810G 9% /
```

From /sys/devices/virtual/dmi/id

```
Vendor: Lenovo
Product: ThinkSystem SR645 MB
Product Family: ThinkSystem
Serial: 1234567890
```

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:
  16x Samsung M393A4K40DB3-CWE 32 GB 2 rank 3200
  16x Unknown Unknown
```

**BIOS:**

```
BIOS Vendor: Lenovo
BIOS Version: D8E115E-2.01
BIOS Date: 03/04/2021
BIOS Revision: 2.1
Firmware Revision: 3.1
```

(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)
-------------------------------
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++, C, Fortran | 607.cactuBSSN_s(base, peak)
-------------------------------
AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on
```

(Continued on next page)
## Lenovo Global Technology
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### Compiler Version Notes (Continued)

LLVM Mirror.Version.12.0.0  
Thread model: posix  
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin  

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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</tr>
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</table>

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

<table>
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<tr>
<th>Fortran, C</th>
<th>621.wrf_s(base, peak) 627.cam4_s(base, peak) 628.pop2_s(base, peak)</th>
</tr>
</thead>
</table>

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

---

**Compiler Version Notes (Continued)**

LLVM Mirror.Version.12.0.0  
Thread model: posix  
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin  

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

---

**Compiler Version Notes (Continued)**

LLVM Mirror.Version.12.0.0  
Thread model: posix  
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin  

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

---

**Compiler Version Notes (Continued)**

LLVM Mirror.Version.12.0.0  
Thread model: posix  
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin  

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

---

**Compiler Version Notes (Continued)**

LLVM Mirror.Version.12.0.0  
Thread model: posix  
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin  

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

---

**Compiler Version Notes (Continued)**

LLVM Mirror.Version.12.0.0  
Thread model: posix  
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin  

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  
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SPEC CPU®2017 Floating Point Speed Result
Copyright 2017-2021 Standard Performance Evaluation Corporation

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Base Compiler Invocation

C benchmarks:
clang

Fortran benchmarks:
flang

Benchmarks using both Fortran and C:
flang clang

Benchmarks using Fortran, C, and C++:
clang++ clang flang

Base Portability Flags

603.bwaves_s: -DSPEC_LP64
607.cactuBSSN_s: -DSPEC_LP64
619.lbm_s: -DSPEC_LP64
621.wrf_s: -DSPEC_CASE_FLAG -Mbyteswapio -DSPEC_LP64
627.cam4_s: -DSPEC_CASE_FLAG -DSPEC_LP64
628.pop2_s: -DSPEC_CASE_FLAG -Mbyteswapio -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:
-m64 -mno-adx -mno-sse4a -Wl,-mlvm -Wl,-region-vectorize
-Wl,-mlvm -Wl,-function-specialize
-Wl,-mlvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mlvm -Wl,-reduce-array-computations=3 -03 -march=znver3
-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5
-mlvm -unroll-threshold=50 -mlvm -inline-threshold=1000
-fremap-arrays -mlvm -function-specialize -flv-function-specialization
-mlvm -enable-gvn-hoist -mlvm -global-vectorize-slp=true
-mlvm -enable-lcm-vrp -mlvm -reduce-array-computations=3 -z muldefs
-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc
-lflang -lflangrti

Fortran benchmarks:
-m64 -mno-adx -mno-sse4a -Wl,-mlvm -Wl,-enable-X86-prefetching

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

Fortran benchmarks (continued):
-`-Wl,-mlllvm -Wl,-enable-licm-vrp -Wl,-mlllvm -Wl,-region-vectorize`
-`-Wl,-mlllvm -Wl,-function-specialize`
-`-Wl,-mlllvm -Wl,-align-all-nofallthru-blocks=6`
-`-Wl,-mlllvm -Wl,-reduce-array-computations=3 -Hz,1,0x1 -O3`
-`-march=znver3 -fveclib=AMDLIBM -ffast-math -Mrecursive`
-`-mlllvm -fuse-tile-inner-loop -funroll-loops`
-`-mlllvm -extra-vectorizer-passes -mlllvm -lsr-in-nested-loop`
-`-mlllvm -enable-licm-vrp -mlllvm -reduce-array-computations=3`
-`-mlllvm -global-vectorize-slp=true -z muldefs -DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lamlidlibm -ljemalloc -lflang -lflangrti`

Benchmarks using both Fortran and C:
-`-m64 -mno-adx -mno-sse4a -Wl,-mlllvm -Wl,-enable-X86-prefetching`
-`-Wl,-mlllvm -Wl,-enable-licm-vrp -Wl,-mlllvm -Wl,-region-vectorize`
-`-Wl,-mlllvm -Wl,-function-specialize`
-`-Wl,-mlllvm -Wl,-align-all-nofallthru-blocks=6`
-`-Wl,-mlllvm -Wl,-reduce-array-computations=3 -O3 -march=znver3`
-`-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5`
-`-mlllvm -unroll-threshold=50 -mlllvm -inline-threshold=1000`
-`-fremap-arrays -mlllvm -function-specialize -flv-function-specialization`
-`-mlllvm -enable-gvn-hoist -mlllvm -global-vectorize-slp=true`
-`-mlllvm -enable-licm-vrp -mlllvm -reduce-array-computations=3 -Hz,1,0x1`
-`-Mrecursive -mlllvm -fuse-tile-inner-loop -funroll-loops`
-`-mlllvm -extra-vectorizer-passes -mlllvm -lsr-in-nested-loop -z muldefs`
-`-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lamlidlibm -ljemalloc -lflang -lflangrti`

Benchmarks using Fortran, C, and C++:
-`-m64 -mno-adx -mno-sse4a -std=c++98`
-`-Wl,-mlllvm -Wl,-x86-use-vzeroupper=false`
-`-Wl,-mlllvm -Wl,-region-vectorize -Wl,-mlllvm -Wl,-function-specialize`
-`-Wl,-mlllvm -Wl,-align-all-nofallthru-blocks=6`
-`-Wl,-mlllvm -Wl,-reduce-array-computations=3 -O3 -march=znver3`
-`-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5`
-`-mlllvm -unroll-threshold=50 -mlllvm -inline-threshold=1000`
-`-fremap-arrays -mlllvm -function-specialize -flv-function-specialization`
-`-mlllvm -enable-gvn-hoist -mlllvm -global-vectorize-slp=true`
-`-mlllvm -enable-licm-vrp -mlllvm -reduce-array-computations=3`
-`-mlllvm -enable-partial-unsswitch -mlllvm -unroll-threshold=100`
-`-finline-aggressive -mlllvm -loop-unsswitch-threshold=200000`
-`-mlllvm -reroll-loops -mlllvm -aggressive-loop-unswhich`
-`-mlllvm -extra-vectorizer-passes -mlllvm -convert-pow-exp-to-int=false`
-`-Hz,1,0x1 -Mrecursive -mlllvm -fuse-tile-inner-loop -funroll-loops`
-`-mlllvm -lsr-in-nested-loop -z muldefs -DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lamlidlibm -ljemalloc -lflang -lflangrti`
Lenovo Global Technology
ThinkSystem SR645
3.50 GHz, AMD EPYC 73F3

| SPECspeed®2017_fp_base = 187 |
| SPECspeed®2017_fp_peak = 203 |

| CPU2017 License: 9017 | Test Date: Apr-2021 |
| Test Sponsor: Lenovo Global Technology | Hardware Availability: Apr-2021 |
| Tested by: Lenovo Global Technology | Software Availability: Mar-2021 |

## Base Other Flags

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

Fortran benchmarks:
- `-Wno-unused-command-line-argument` `-Wno-return-type`

Benchmarks using both Fortran and C:
- `-Wno-unused-command-line-argument` `-Wno-return-type`

Benchmarks using Fortran, C, and C++:
- `-Wno-unused-command-line-argument` `-Wno-return-type`

## Peak Compiler Invocation

C benchmarks:
```
clang
```

Fortran benchmarks:
```
flang
```

Benchmarks using both Fortran and C:
```
flang clang
```

Benchmarks using Fortran, C, and C++:
```
clang++ clang flang
```

## Peak Portability Flags

Same as Base Portability Flags

## Peak Optimization Flags

C benchmarks:
```
619.lbm_s: -m64 -mno-adx -mno-sse4a
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math -flto
-fstruct-layout=5 -mllvm -unroll-threshold=50
```

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

619.lbm_s (continued):
-ffpack-arrays -flv-function-specialization
-mlvml -inline-threshold=1000 -mlvml -enable-gvn-hoist
-mlvml -global-vectorize-slp=true
-mlvml -function-specialize -mlvml -enable-licm-vrp
-mlvml -reduce-array-computations=3 -DSPEC_OPENMP -fopenmp
-fopenmp=libomp -lomp -landlibm -ljemalloc -lfang

638.imagick_s: basepeak = yes

644.nab_s: -m64 -mno-adx -mno-sse4a -Wl,-mlvml -Wl, -region-vectorize
-Wl,-mlvml -Wl, -function-specialize -Ofast -march=znver3
-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5
-mlvml -unroll-threshold=50 -fremap-arrays
-flv-function-specialization -mlvml -inline-threshold=1000
-mlvml -enable-gvn-hoist -mlvml -global-vectorize-slp=true
-mlvml -function-specialize -mlvml -enable-licm-vrp
-mlvml -reduce-array-computations=3 -DSPEC_OPENMP -fopenmp
-fopenmp=libomp -lomp -landlibm -ljemalloc -lfang

Fortran benchmarks:

603.bwaves_s: -m64 -mno-adx -mno-sse4a
-Wl,-mlvml -Wl, -enable-X86-prefetching
-Wl,-mlvml -Wl, -enable-licm-vrp
-Wl,-mlvml -Wl, -function-specialize
-Wl,-mlvml -Wl, -align-all-nofallthru-blocks=6
-Wl,-mlvml -Wl, -reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math -Mrecursive
-mlvml -reduce-array-computations=3
-mlvml -global-vectorize-slp=true -mlvml -enable-licm-vrp
-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -landlibm
-ljemalloc -lfang

649.fotonik3d_s: basepeak = yes

654.roms_s: Same as 603.bwaves_s

Benchmarks using both Fortran and C:

621.wrf_s: basepeak = yes

627.cam4_s: -m64 -mno-adx -mno-sse4a
-Wl,-mlvml -Wl, -enable-X86-prefetching
-Wl,-mlvml -Wl, -enable-licm-vrp
-Wl,-mlvml -Wl, -function-specialize

(Continued on next page)
Lenovo Global Technology
ThinkSystem SR645
3.50 GHz, AMD EPYC 73F3

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

SPECspeed®2017_fp_base = 187
SPECspeed®2017_fp_peak = 203
Test Date: Apr-2021
Hardware Availability: Apr-2021
Software Availability: Mar-2021

Peak Optimization Flags (Continued)

627.cam4_s (continued):
-W1,-mlllvm -W1,-align-all-nofallthru-blocks=6
-W1,-mlllvm -W1,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math -flto
-fstruct-layout=5 -mlllvm -unroll-threshold=50
-fremap-arrays -flv-function-specialization
-mlllvm -inline-threshold=1000 -mlllvm -enable-gvn-hoist
-mlllvm -global-vectorize-slp=true
-mlllvm -function-specialize -mlllvm -enable-licm-vrp
-mlllvm -reduce-array-computations=3 -Mrecursive
-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lamdlibm
-ljemalloc -lflang

628.pop2_s: basepeak = yes

Benchmarks using Fortran, C, and C++:
607.cactuBSSN_s: basepeak = yes

Peak Other Flags

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

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

Benchmarks using both Fortran and C:
-Wno-unused-command-line-argument -Wno-return-type

Benchmarks using Fortran, C, and C++:
-Wno-unused-command-line-argument -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-Milan-D.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-Milan-D.xml
# SPEC CPU®2017 Floating Point Speed Result

## Lenovo Global Technology
ThinkSystem SR645 3.50 GHz, AMD EPYC 73F3

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