## Lenovo Global Technology

**ThinkSystem SR665 V3**  
(2.50 GHz, AMD EPYC 9224)

<table>
<thead>
<tr>
<th>SPECspeed®2017_fp_base</th>
<th>256</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECspeed®2017_fp_peak</td>
<td>274</td>
</tr>
</tbody>
</table>

### Hardware

**CPU Name:** AMD EPYC 9224  
**Max MHz:** 3700  
**Nominal:** 2500  
**Enabled:** 48 cores, 2 chips, 2 threads/core  
**Orderable:** 1.2 chips  
**Cache L1:** 32 KB I + 32 KB D on chip per core  
**L2:** 1 MB I+D on chip per core  
**L3:** 64 MB I+D on chip per chip,  
16 MB shared / 6 cores  
**Other:** None  
**Memory:** 1536 GB (24 x 64 GB 2Rx4 PC5-4800B-R)  
**Storage:** 1 x 480 GB SATA SSD  
**Other:** None

### Software

**OS:** SUSE Linux Enterprise Server 15 SP4 (x86_64)  
**Compiler:** C/C++/Fortran: Version 4.0.0 of AOCC  
**Parallel:** Yes  
**Firmware:** Lenovo BIOS Version KAE105L 1.20 released Dec-2022  
**File System:** xfs  
**System State:** Run level 3 (multi-user)  
**Base Pointers:** 64-bit  
**Peak Pointers:** 64-bit  
**Other:** None  
**Power Management:** BIOS and OS set to prefer performance at the cost of additional power usage

### Threads

<table>
<thead>
<tr>
<th>Application</th>
<th>Threads</th>
<th>SPECspeed®2017_fp_base</th>
<th>SPECspeed®2017_fp_peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>603.bwaves_s</td>
<td>48</td>
<td>141</td>
<td>405</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>48</td>
<td>142</td>
<td>424</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>96</td>
<td>181</td>
<td>196</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>48</td>
<td>166</td>
<td>210</td>
</tr>
<tr>
<td>627.cam4_s</td>
<td>96</td>
<td>74.6</td>
<td>76.1</td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>48</td>
<td>317</td>
<td>350</td>
</tr>
<tr>
<td>638.imagick_s</td>
<td>96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>644.nab_s</td>
<td>96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>48</td>
<td>187</td>
<td>188</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>96</td>
<td>361</td>
<td>389</td>
</tr>
</tbody>
</table>
## Lenovo Global Technology

ThinkSystem SR665 V3  
(2.50 GHz, AMD EPYC 9224)

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Threads</th>
<th>Seconds</th>
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<th>Seconds</th>
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<tbody>
<tr>
<td>603.bwaves_s</td>
<td>48</td>
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<td>64.6</td>
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<td>48</td>
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<td>955</td>
<td>64.6</td>
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<td>63.1</td>
<td>936</td>
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<tr>
<td>607.cactuBSSN_s</td>
<td>48</td>
<td>41.1</td>
<td>405</td>
<td>41.0</td>
<td>406</td>
<td>41.4</td>
<td>403</td>
<td>96</td>
<td>39.3</td>
<td>424</td>
<td>39.5</td>
<td>422</td>
<td>39.1</td>
<td>427</td>
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<tr>
<td>619.lbm_s</td>
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<td>141</td>
<td>37.3</td>
<td>141</td>
<td>37.0</td>
<td>142</td>
<td>48</td>
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<tr>
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<td>181</td>
<td>73.0</td>
<td>181</td>
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</tr>
<tr>
<td>627.cam4_s</td>
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<td>53.5</td>
<td>166</td>
<td>53.5</td>
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<td>628.pop2_s</td>
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<td>160</td>
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<td>159</td>
<td>74.6</td>
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<td>76.1</td>
<td>156</td>
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<td>638.imagick_s</td>
<td>48</td>
<td>45.5</td>
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<td>45.6</td>
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<td>45.4</td>
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<td>351</td>
<td>41.2</td>
<td>350</td>
<td>41.2</td>
<td>350</td>
</tr>
<tr>
<td>644.nab_s</td>
<td>48</td>
<td>36.8</td>
<td>475</td>
<td>36.8</td>
<td>474</td>
<td>36.9</td>
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<td>96</td>
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<td>523</td>
<td>33.4</td>
<td>523</td>
<td>33.4</td>
<td>523</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>48</td>
<td>48.7</td>
<td>187</td>
<td>48.5</td>
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<td>48.9</td>
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<td>48.7</td>
<td>187</td>
<td>48.2</td>
<td>189</td>
<td>48.6</td>
<td>188</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>48</td>
<td>43.6</td>
<td>361</td>
<td>43.6</td>
<td>361</td>
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<td>40.4</td>
<td>389</td>
<td>40.5</td>
<td>389</td>
<td>40.6</td>
<td>388</td>
</tr>
</tbody>
</table>

**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 limit  
'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>

To limit dirty cache to 8% of memory, 'sysctl -w vm.dirty_ratio=8' run as root.  
To limit swap usage to minimum necessary, 'sysctl -w vm.swappiness=1' run as root.  
To free node-local memory and avoid remote memory usage,  
'sysctl -w vm.zone_reclaim_mode=1' run as root.  
To clear filesystem caches, 'sync; sysctl -w vm.drop_caches=3' run as root.  
To disable address space layout randomization (ASLR) to reduce run-to-run variability, 'sysctl -w kernel.randomize_va_space=0' run as root.
Lenovo Global Technology  
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**SPECspeed®2017_fp_base = 256**

**SPECspeed®2017_fp_peak = 274**

<table>
<thead>
<tr>
<th>CPU2017 License: 9017</th>
<th>Test Date: Jan-2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Sponsor: Lenovo Global Technology</td>
<td>Hardware Availability: Feb-2023</td>
</tr>
<tr>
<td>Tested by: Lenovo Global Technology</td>
<td>Software Availability: Nov-2022</td>
</tr>
</tbody>
</table>

### Operating System Notes (Continued)

To enable Transparent Hugepages (THP) for all allocations,
'echo always > /sys/kernel/mm/transparent_hugepage/enabled' and
'echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root.
To always enable THP for peak runs of:
603.bwaves_s, 607.cactuBSSN_s, 619.lbm_s, 627.cam4_s, 628.pop2_s, 638.imagick_s, 644.nab_s, 649.fotonik3d_s:
'echo madvise > /sys/kernel/mm/transparent_hugepage/enabled; echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root.
To disable THP for peak runs of 621.wrf_s:
'echo never > /sys/kernel/mm/transparent_hugepage/enabled; echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root.
To enable THP only on request for peak runs of 654.roms_s:
'echo madvise > /sys/kernel/mm/transparent_hugepage/enabled; echo madvise > /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 = "0-95"
LD_LIBRARY_PATH = 
"/home/cpu2017-1.1.8-amd-aocc400-genoa-B1b/amd_speed_aocc400_genoa_B_lib
/lib;"
LIBOMP_NUM_HIDDEN_HELPER_THREADS = "0"
MALLOC_CONF = "oversize_threshold:0,retain:true"
OMP_DYNAMIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "96"

Environment variables set by runcpu during the 607.cactuBSSN_s peak run:
GOMP_CPU_AFFINITY = "0-95"

Environment variables set by runcpu during the 619.lbm_s peak run:
GOMP_CPU_AFFINITY = "0-47"

Environment variables set by runcpu during the 621.wrf_s peak run:
GOMP_CPU_AFFINITY = "0-47"

Environment variables set by runcpu during the 627.cam4_s peak run:
GOMP_CPU_AFFINITY = "0-95"

Environment variables set by runcpu during the 628.pop2_s peak run:
GOMP_CPU_AFFINITY = "0-47"

Environment variables set by runcpu during the 638.imagick_s peak run:
GOMP_CPU_AFFINITY = "0-95"

(Continued on next page)
Environment Variables Notes (Continued)

Environment variables set by runcpu during the 644.nab_s peak run:
GOMP_CPU_AFFINITY = "0-95"

Environment variables set by runcpu during the 649.fotonik3d_s peak run:
GOMP_CPU_AFFINITY = "0-47"
PGHPF_ZMEM = "yes"

Environment variables set by runcpu during the 654.roms_s peak run:
GOMP_CPU_AFFINITY = "0 48 1 49 2 50 3 51 4 52 5 53 6 54 7 55 8 56 9 57 10 58
11 59 12 60 13 61 14 62 15 63 16 64 17 65 18 66 19 67 20 68 21 69 22 70
23 71 24 72 25 73 26 74 27 75 28 76 29 77 30 78 31 79 32 80 33 81 34 82
35 83 36 84 37 85 38 86 39 87 40 88 41 89 42 90 43 91 44 92 45 93 46 94
47 95"

General Notes

Binaries were compiled on a system with 2x AMD EPYC 9174F CPU + 1.5TiB Memory using RHEL 8.6

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.

Platform Notes

BIOS configuration:
Operating Mode set to Maximum Performance

Sysinfo program /home/cpu2017-1.1.8-amd-aocc400-genoa-B1b/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16a6aefc64d
running on localhost Thu Jan 12 22:58:04 2023

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 9224 24-Core Processor
2 "physical id"s (chips)
96 "processors"
cores, siblings (Caution: counting these is hw and system dependent. The following excerpts from /proc/cpuinfo might not be reliable. Use with caution.)

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

```
cpu cores : 24
siblings : 48
physical 0: cores 0 1 2 3 4 5 10 11 12 13 16 17 18 19 20 21 24 25 26 27 28 29
physical 1: cores 0 1 2 3 4 5 10 11 12 13 16 17 18 19 20 21 24 25 26 27 28 29

From lscpu from util-linux 2.37.2:
Architecture:                    x86_64
CPU op-mode(s):                  32-bit, 64-bit
Address sizes:                   52 bits physical, 57 bits virtual
Byte Order:                      Little Endian
CPU(s):                          96
On-line CPU(s) list:             0-95
Vendor ID:                       AuthenticAMD
Model name:                      AMD EPYC 9224 24-Core Processor
CPU family:                      25
Model:                           17
Thread(s) per core:              2
Core(s) per socket:              24
Socket(s):                       2
Stepping:                        1
Frequency boost:                 enabled
CPU max MHz:                     3706.0540
CPU min MHz:                     1500.0000
BogoMIPS:                        4992.38
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 rdscv8l lm constant_tsc rep_good nopl
                                 nonstop_tsc cpuid extd_apicid aperfmperf rafi pni pclmulqdq
                                 monitor ssse3 fma cx16 pcid sse4_1 sse4_2 x2apic movbe
                                 popcnt aes xsave avx fi64c rdrand lahf_lm cmp_legacy svm
                                 extapic cr8_legacy abm sse4a misalignsse 3nowprefetch osuw ibs
                                 skinit wdt tce topoext perfctr_core perfctr_nb bpt
                                 perfctr_llc mwmitx cpb cat_l3 cdp_l3 invpcid_single hw_pausestate
                                 ssbd mba ibrs ibpb stibp vmcall vsqsave bmi1 avx2 smep bmi2 erts
                                 invpcid cmqm rdt_a avx512f
                                 avx512dq rdseed adv smap avx512ifma clflushopt clwb avx512cd
                                 sha ni avx512bw
                                 avx512vl xsaveopt xsave xsetbv xsave xsave cqm_llc cqm_occup_llc
                                 cqm_mbb_total
                                 cqm_mbb_local avx512_bf16 clzero irperf xsaveoptr rdpru wnoipv vmd
                                 amd_pimp arat npt
                                 lbv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassist
                                 pausefilter
                                 ptfun import avic v_vmsave_vmload vglf v_spec_ctrl avx512vmbi
                                 umip pku ospe
                                 avx512_vbm12 gfnv vpcmulqdq avx512_vnni avx512_bitalg
                                 avx512_vpopcntdq 1a57
                                 rdpid overflow_recover sucorg smca fcsr flush_l1d
                                 Virtualization: AMD-V
                                 L1d cache: 1.5 MiB (48 instances)
                                 L1i cache: 1.5 MiB (48 instances)
                                 L2 cache: 48 MiB (48 instances)
                                 L3 cache: 128 MiB (8 instances)
                                 NUMA node(s): 2
                                 NUMA node0 CPU(s): 0-23, 48-71
                                 NUMA node1 CPU(s): 24-47, 72-95
```

(Continued on next page)
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CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Tested by: Lenovo Global Technology

SPECspeed®2017_fp_base = 256
SPECspeed®2017_fp_peak = 274

Test Date: Jan-2023
Hardware Availability: Feb-2023
Software Availability: Nov-2022

Platform Notes (Continued)

Vulnerability Itlb multihit: Not affected
Vulnerability L1tf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
Vulnerability Spectre v1: Mitigation; usercopy/swapgs barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Retpolines, IBPB conditional, IBRS_FW, STIBP always-on, RSB filling
Vulnerability Srbds: Not affected
Vulnerability Tlx async abort: Not affected

From lscpu --cache:
NAME ONE-SIZE ALL-SIZE WAYS TYPE LEVEL SETS PHY-LINE COHERENCY-SIZE
L1d  32K  1.5M  8 Data  1  64 1  64
L1i  32K  1.5M  8 Instruction  1  64 1  64
L2   1M  48M  8 Unified  2  2048 1  64
L3   16M 128M 16 Unified  3 16384 1  64

/proc/cpuinfo cache data
    cache size : 1024 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 12 13 14 15 16 17 18 19 20 21 22 23 48 49 50 51
               52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
    node 0 size: 773833 MB
    node 0 free: 772313 MB
    node 1 cpus: 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 72
               73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95
    node 1 size: 773851 MB
    node 1 free: 772721 MB
    node distances:
    node 0 1
    0: 10 32
    1: 32 10

From /proc/meminfo
    MemTotal: 1584829956 kB
    HugePages_Total: 0
    Hugepagesize: 2048 kB

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

(Continued on next page)
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SPECspeed®2017_fp_base = 256
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CPU2017 License: 9017
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Test Date: Jan-2023
Hardware Availability: Feb-2023
Tested by: Lenovo Global Technology
Software Availability: Nov-2022

Platform Notes (Continued)

From /etc/*release* /etc/*version*
  os-release:
    NAME="SLES"
    VERSION="15-SP4"
    VERSION_ID="15.4"
    PRETTY_NAME="SUSE Linux Enterprise Server 15 SP4"
    ID="sles"
    ID_LIKE="suse"
    ANSI_COLOR="0;32"
    CPE_NAME="cpe:/o:suse:sles:15:sp4"

uname -a:
  Linux localhost 5.14.21-150400.22-default #1 SMP PREEMPT_DYNAMIC Wed May 11 06:57:18 UTC 2022 (49db222) 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 barrier and __user pointer sanitation
CVE-2017-5715 (Spectre variant 2): Mitigation: Retpolines, 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 Jan 12 19:45

SPEC is set to: /home/cpu2017-1.1.8-amd-aocc400-genoa-B1b
  Filesystem Type  Size  Used Avail Use% Mounted on
  /dev/sda2    xfs  446G  32G  415G   8% /

From /sys/devices/virtual/dmi/id
  Vendor: Lenovo
  Product: ThinkSystem SR665 V3 MB, Genoa, Kauai, DDR5, Kauai, 2U
  Product Family: ThinkSystem
  Serial: 1234567890

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
Platform Notes (Continued)

allow hardware to be accurately determined", but the intent may not be met, as there are
dependent changes to hardware, firmware, and the "DMTF SMBIOS" standard.

Memory:
22x SK Hynix HMCG94AEBRA102N 64 GB 2 rank 4800
2x SK Hynix HMCG94AEBRA109N 64 GB 2 rank 4800

BIOS:
BIOS Vendor: Lenovo
BIOS Version: KAE105L-1.20
BIOS Date: 12/29/2022
BIOS Revision: 1.20
Firmware Revision: 1.20

(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 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on
LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

==============================================================================
| C++, C, Fortran | 607.cactuBSSN_s(base, peak) |
==============================================================================
AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on
LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin
AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on
LLVM Mirror.Version.14.0.6)
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Thread model: posix
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Hardware Availability: Feb-2023
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Compiler Version Notes (Continued)

------------------------------------------------------------------------------
Fortran                   | 603.bwaves_s(base, peak) 649.fotonik3d_s(base, peak)
                         | 654.roms_s(base, peak)
------------------------------------------------------------------------------
AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on
LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin
------------------------------------------------------------------------------
Fortran, C                | 621.wrf_s(base, peak) 627.cam4_s(base, peak)
                         | 628.pop2_s(base, peak)
------------------------------------------------------------------------------
AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on
LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin
AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on
LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin
------------------------------------------------------------------------------

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
Lenovo Global Technology
ThinkSystem SR665 V3 (2.50 GHz, AMD EPYC 9224)

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

SPECspeed®2017_fp_base = 256
SPECspeed®2017_fp_peak = 274

Test Date: Jan-2023
Hardware Availability: Feb-2023
Software Availability: Nov-2022

Base Portability Flags

603.bwaves_s: -DSPEC_LP64
607.cactuBSSN_s: -DSPEC_LP64
619.libm_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 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver4
-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=7
-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000
-fremap-arrays -fstrip-mining -mllvm -reduce-array-computations=3
-DSPEC_OPENMP -zopt -fopenmp=libomp -lomp -lamdlibm -lamdalloc
-lflang

Fortran benchmarks:
-m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -DSPEC_OPENMP -O3 -march=znver4
-fveclib=AMDLIBM -ffast-math -fopenmp -flto -Mrecursive
-funroll-loops -mllvm -lsr-in-nested-loop
-mllvm -reduce-array-computations=3 -zopt -fopenmp=libomp -lomp
-lamdlibm -lamdalloc -lflang

Benchmarks using both Fortran and C:
-m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -O3 -march=znver4
-fveclib=AMDLIBM -ffast-math -fopenmp -flto -fstruct-layout=7
-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000
-fremap-arrays -fstrip-mining -mllvm -reduce-array-computations=3
-DSPEC_OPENMP -zopt -Mrecursive -funroll-loops
-mllvm -lsr-in-nested-loop -fopenmp=libomp -lomp -lamdlibm -lamdalloc
-lflang

Benchmarks using Fortran, C, and C++:
-m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6

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

Benchmarks using Fortran, C, and C++ (continued):

- `-Wl,-mllvm -Wl,-reduce-array-computations=3`
- `-Wl,-mllvm -Wl,-x86-use-vzeroupper=false` `-O3 -march=znver4`
- `-fveclib=AMDLIBM -ffast-math -fopenmp -flto -fstruct-layout=7`
- `-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000`
- `-fremap-arrays -fstrip-mining -mllvm -reduce-array-computations=3`
- `-DSPEC_OPENMP -zopt -mllvm -unroll-threshold=100 -finline-aggressive`
- `-mllvm -loop-unswitch-threshold=200000 -Mrecursive -funroll-loops`
- `-mllvm -lsr-in-nested-loop -fopenmp=libomp -lomp -lamdlibm -lamdalloc`
- `-lflang`

## Base Other Flags

C benchmarks:

- `-Wno-return-type -Wno-unused-command-line-argument`

Fortran benchmarks:

- `-Wno-unused-command-line-argument`

Benchmarks using both Fortran and C:

- `-Wno-return-type -Wno-unused-command-line-argument`

Benchmarks using Fortran, C, and C++:

- `-Wno-return-type -Wno-unused-command-line-argument`

## 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`
Lenovo Global Technology
ThinkSystem SR665 V3
(2.50 GHz, AMD EPYC 9224)

**SPECspeed®2017_fp_base = 256**
**SPECspeed®2017_fp_peak = 274**

<table>
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</tbody>
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**Peak Portability Flags**

Same as Base Portability Flags

**Peak Optimization Flags**

C benchmarks:

619.lbm_s: -m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver4 -fveclib=AMDLIBM -ffast-math -fopenmp
-flto -fstruct-layout=9 -mllvm -unroll-threshold=50
-frempa-arrays -fstrip-mining
-mllvm -inline-threshold=1000
-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt
-fopenmp=libomp -lomp -lamdlibm -lamdalloc -lflang
638.imagick_s: Same as 619.lbm_s
644.nab_s: -m64 -Wl,-mllvm -Wl,-region-vectorize -Ofast
-march=znver4 -fveclib=AMDLIBM -ffast-math -fopenmp
-flto -fstruct-layout=9 -mllvm -unroll-threshold=50
-frempa-arrays -fstrip-mining
-mllvm -inline-threshold=1000
-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt
-fopenmp=libomp -lomp -lamdlibm -lamdalloc -lflang
Fortran benchmarks:

603.bwaves_s: basepeak = yes
649.fotonik3d_s: -m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -DSPEC_OPENMP
-Ofast -march=znver4 -fveclib=AMDLIBM -ffast-math
-fopenmp -flto -Mrecursive
-mllvm -reduce-array-computations=3 -zopt -fopenmp=libomp
-lomp -lamdlibm -lamdalloc -lflang
654.roms_s: -m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -DSPEC_OPENMP
-Ofast -march=znver4 -fveclib=AMDLIBM -ffast-math
-fopenmp -Mrecursive -mllvm -reduce-array-computations=3
-fvector-transform -fscalar-transform -fopenmp=libomp
-lomp -lamdlibm -lamdalloc -lflang

(Continued on next page)
Lenovo Global Technology
ThinkSystem SR665 V3
(2.50 GHz, AMD EPYC 9224)

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Tested by: Lenovo Global Technology
Software Availability: Nov-2022

Peak Optimization Flags (Continued)

**Benchmarks using both Fortran and C:**

```
621.wrf_s: -m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -Ofast
-arch=znver4 -fveclib=AMDLIBM -ffast-math -fopenmp
-flto -fstruct-layout=9 -mllvm -unroll-threshold=50
-fremap-arrays -fstrip-mining
-mllvm -inline-threshold=1000
-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt
-O3 -Mrecursive -funroll-loops -mllvm -lsr-in-nested-loop
-fopenmp=libomp -lomp -lamdlibm -lamdalloc -lflang

627.cam4_s: -m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -Ofast
-arch=znver4 -fveclib=AMDLIBM -ffast-math -fopenmp
-flto -fstruct-layout=9 -mllvm -unroll-threshold=50
-fremap-arrays -fstrip-mining
-mllvm -inline-threshold=1000
-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt
-Mrecursive -fopenmp=libomp -lomp -lamdlibm -lamdalloc
-lflang

628.pop2_s: -m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -Ofast
-arch=znver4 -fveclib=AMDLIBM -ffast-math -fopenmp
-flto -fstruct-layout=9 -mllvm -unroll-threshold=50
-fremap-arrays -fstrip-mining
-mllvm -inline-threshold=1000
-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt
-Mrecursive -fvector-transform -fscalar-transform
-fopenmp=libomp -lomp -lamdlibm -lamdalloc -lflang
```

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

```
-m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-x86-use-vzeroupper=false -Ofast -arch=znver4
-fveclib=AMDLIBM -ffast-math -fopenmp -flto -fstruct-layout=9
-mllvm -unroll-threshold=50 -fremap-arrays -fstrip-mining
-mllvm -inline-threshold=1000 -mllvm -reduce-array-computations=3
-DSPEC_OPENMP -zopt -finline-aggressive -mllvm -unroll-threshold=100
-Mrecursive -fopenmp=libomp -lomp -lamdlibm -lamdalloc -lflang
```
Lenovo Global Technology
ThinkSystem SR665 V3
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CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
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Peak Other Flags

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

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

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

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

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-Genoa-P.html
http://www.spec.org/cpu2017/flags/aocc400-flags.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-Genoa-P.xml
http://www.spec.org/cpu2017/flags/aocc400-flags.xml

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