# Lenovo Global Technology

## ThinkSystem ST50
*(4.00 GHz, Intel Xeon E-2274G)*

### SPEC CPU 2017 Floating Point Speed Result

**Lenovo Global Technology**

<table>
<thead>
<tr>
<th>Test Sponsor</th>
<th>Lenovo Global Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tested by</td>
<td>Lenovo Global Technology</td>
</tr>
</tbody>
</table>

**CPU2017 License:** 9017  
**Test Date:** Jun-2020  
**Hardware Availability:** Mar-2020  
**Software Availability:** Apr-2020

<table>
<thead>
<tr>
<th>Benchmark</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>4</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>4</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>4</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>4</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>627.cam4_s</td>
<td>4</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>4</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>638.imagick_s</td>
<td>4</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>644.nab_s</td>
<td>4</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>4</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>4</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

### Software

**OS:** Red Hat Enterprise Linux 8.1 (Ootpa)  
**Kernel:** 4.18.0-147.el8.x86_64  
**Compiler:** C/C++: Version 19.1.1.217 of Intel  
**C/C++ Compiler for Linux:** Compiler for Linux;  
**Fortran:** Version 19.1.1.217 of Intel Fortran  
**Compiler for Linux:** Compiler for Linux  
**Parallel:** Yes  
**Firmware:** Lenovo BIOS Version ITE109B released Apr-2020  
**File System:** xfs  
**System State:** Run level 3 (multi-user)  
**Base Pointers:** 64-bit  
**Peak Pointers:** 64-bit  
**Other:** jemalloc memory allocator V5.0.1  
**Power Management:** BIOS set to prefer performance at the cost of additional power usage

### Hardware

**CPU Name:** Intel Xeon E-2274G  
**Max MHz:** 4900  
**Nominal:** 4000  
**Enabled:** 4 cores, 1 chip  
**Orderable:** 1 chip  
**Cache L1:** 32 KB I + 32 KB D on chip per core  
**L2:** 256 KB I+D on chip per core  
**L3:** 8 MB I+D on chip per chip  
**Other:** None  
**Memory:** 64 GB (4 x 16 GB 2Rx8 PC4-2666V-E)  
**Storage:** 1 x 960 GB SATA SSD  
**Other:** None
Lenovo Global Technology
ThinkSystem ST50
(4.00 GHz, Intel Xeon E-2274G)

SPECspeed®2017_fp_base = 27.4
SPECspeed®2017_fp_peak = 27.7

Results Table

<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>
</tr>
</thead>
<tbody>
<tr>
<td>603.bwaves_s</td>
<td>4</td>
<td>751</td>
<td>78.5</td>
<td>751</td>
<td>78.6</td>
<td>750</td>
<td>78.6</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>4</td>
<td>393</td>
<td>42.4</td>
<td>394</td>
<td>42.3</td>
<td>394</td>
<td>42.3</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>4</td>
<td>326</td>
<td>31.9</td>
<td>327</td>
<td>32.2</td>
<td>326</td>
<td>31.8</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>4</td>
<td>414</td>
<td>19.3</td>
<td>459</td>
<td>19.3</td>
<td>459</td>
<td>19.3</td>
</tr>
<tr>
<td>627.cam4_s</td>
<td>4</td>
<td>459</td>
<td>32.5</td>
<td>366</td>
<td>32.5</td>
<td>366</td>
<td>32.5</td>
</tr>
<tr>
<td>638.imagick_s</td>
<td>4</td>
<td>686</td>
<td>21.0</td>
<td>685</td>
<td>21.1</td>
<td>685</td>
<td>21.1</td>
</tr>
<tr>
<td>644.nab_s</td>
<td>4</td>
<td>450</td>
<td>38.8</td>
<td>449</td>
<td>38.9</td>
<td>449</td>
<td>38.9</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>4</td>
<td>508</td>
<td>17.9</td>
<td>508</td>
<td>17.9</td>
<td>508</td>
<td>17.9</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>4</td>
<td>1020</td>
<td>15.4</td>
<td>1021</td>
<td>15.4</td>
<td>1021</td>
<td>15.4</td>
</tr>
</tbody>
</table>

SPECspeed®2017_fp_base = 27.4
SPECspeed®2017_fp_peak = 27.7

Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

Operating System Notes
Stack size set to unlimited using "ulimit -s unlimited"

Environment Variables Notes
Environment variables set by runcpu before the start of the run:
KMP_AFFINITY = "granularity=fine,compact"
LD_LIBRARY_PATH = "/home/cpu2017-1.1.0-ic19.1.1/lib/intel64:/home/cpu2017-1.1.0-ic19.1.1/jee5.0.1-64"
MALLOC_CONF = "retain:true"
OMP_STACKSIZE = "192M"

General Notes
Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM memory using Redhat Enterprise Linux 8.0
Transparent Huge Pages enabled by default
Prior to runcpu invocation
Filesystem page cache synced and cleared with:
sync; echo 3> /proc/sys/vm/drop_caches
Yes: 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)...
SPEC CPU®2017 Floating Point Speed Result

Lenovo Global Technology
ThinkSystem ST50
(4.00 GHz, Intel Xeon E-2274G)

SPECspeed®2017_fp_base = 27.4
SPECspeed®2017_fp_peak = 27.7

Lenovo Global Technology

CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Test Date: Jun-2020
Tested by: Lenovo Global Technology
Hardware Availability: Mar-2020
Software Availability: Apr-2020

General Notes (Continued)
is mitigated in the system as tested and documented.
jemalloc, a general purpose malloc implementation
built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5

Platform Notes

BIOS configuration:
Hyper-Threading set to Disable

Sysinfo program /home/cpu2017-1.1.0-ic19.1.1/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7ed61e6e46a485a0011
running on localhost.localdomain Mon Jun 15 09:24:12 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 : Intel(R) Xeon(R) E-2274G CPU @ 4.00GHz
  1 "physical id"s (chips)
  4 "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 : 4
siblings : 4
physical 0: cores 0 1 2 3

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 4
On-line CPU(s) list: 0-3
Thread(s) per core: 1
Core(s) per socket: 4
Socket(s): 1
NUMA node(s): 1
Vendor ID: GenuineIntel
CPU family: 6
Model: 158
Model name: Intel(R) Xeon(R) E-2274G CPU @ 4.00GHz
Stepping: 10
CPU MHz: 4503.415
CPU max MHz: 4900.0000
CPU min MHz: 800.0000

(Continued on next page)
Lenovo Global Technology
ThinkSystem ST50
(4.00 GHz, Intel Xeon E-2274G)

SPECspeed®2017_fp_base = 27.4
SPECspeed®2017_fp_peak = 27.7

<table>
<thead>
<tr>
<th>CPU2017 License:</th>
<th>9017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Sponsor:</td>
<td>Lenovo Global Technology</td>
</tr>
<tr>
<td>Tested by:</td>
<td>Lenovo Global Technology</td>
</tr>
<tr>
<td>Test Date:</td>
<td>Jun-2020</td>
</tr>
<tr>
<td>Hardware Availability:</td>
<td>Mar-2020</td>
</tr>
<tr>
<td>Software Availability:</td>
<td>Apr-2020</td>
</tr>
</tbody>
</table>

Platform Notes (Continued)

BogoMIPS: 8016.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 256K
L3 cache: 8192K
NUMA node0 CPU(s): 0-3
Flags: fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp
lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid
aperfmperf tsc_known_freq pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3
sdkg fma cx16 xtpr pdcm pcid sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer
aes xsave avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb invpcid_single
pti ssbd ibrs ibpb stibp tpr_shadow vmi flexpriority ept vpid fsgsbase tsc_adjust
bmi1 hel avx2 smep bmi2 erms invpcid rtm mpx rdseed adx smap clflushopt intel_pt
xsaveopt xsavec xgetbv1 xsaves dtherm ida arat pln pts hwp hwp_notify hwp_act_window
hwp_epp md_clear flush_l1d

From /proc/cpuinfo cache data
  cache size : 8192 KB

From numactl --hardware WARNING: a numactl 'node' might or might not correspond to a
physical chip.
  available: 1 nodes (0)
  node 0 cpus: 0 1 2 3
  node 0 size: 64256 MB
  node 0 free: 63954 MB
  node distances:
    node 0
      0: 10

From /proc/meminfo
  MemTotal: 65798296 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)

(Continued on next page)
Lenovo Global Technology  
ThinkSystem ST50  
(4.00 GHz, Intel Xeon E-2274G)  

**SPEC** speed\textsuperscript{\textregistered}2017 fp\_base = 27.4  
**SPEC** speed\textsuperscript{\textregistered}2017 fp\_peak = 27.7

<table>
<thead>
<tr>
<th>CPU2017 License:</th>
<th>9017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Sponsor:</td>
<td>Lenovo Global Technology</td>
</tr>
<tr>
<td>Tested by:</td>
<td>Lenovo Global Technology</td>
</tr>
<tr>
<td>Test Date:</td>
<td>Jun-2020</td>
</tr>
<tr>
<td>Hardware Availability:</td>
<td>Mar-2020</td>
</tr>
<tr>
<td>Software Availability:</td>
<td>Apr-2020</td>
</tr>
</tbody>
</table>

---

**Platform Notes (Continued)**

```
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  
x86_64 x86_64 x86_64 GNU/Linux
```

Kernel self-reported vulnerability status:

- CVE-2018-3620 (L1 Terminal Fault): Mitigation: PTE Inversion; VMX: conditional cache flushes, SMT disabled
- Microarchitectural Data Sampling: Mitigation: Clear CPU buffers; SMT disabled
- CVE-2017-5754 (Meltdown): Mitigation: PTI
- 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 generic retpoline, IBPB: conditional, IBRS\_FW, RSB filling

```
run-level 3 Jun 15 09:23
```

```
SPEC is set to: /home/cpu2017-1.1.0-ic19.1.1
```

```
Filesystem   Type  Size  Used Avail Use% Mounted on  
/dev/sda3     xfs    812G  66G  747G   9% /home
```

From /sys/devices/virtual/dmi/id  
BIOS: LENOVO ITE109B 04/24/2020  
Vendor: LENOVO  
Product: INVALID  
Product Family: Lenovo Product  
Serial: INVALID

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:  
- 4x SK Hynix HMA82GU7CJR8N-VK 16 GB 2 rank 2666

(End of data from sysinfo program)

---

**Compiler Version Notes**

```
C       | 619.lbm\_s(base, peak) 638.imagick\_s(base, peak)
```

(Continued on next page)
## Lenovo Global Technology

<table>
<thead>
<tr>
<th>Lenovo Global Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>ThinkSystem ST50</td>
</tr>
<tr>
<td>(4.00 GHz, Intel Xeon E-2274G)</td>
</tr>
</tbody>
</table>

### SPEC CPU 2017 Floating Point Speed Result

<table>
<thead>
<tr>
<th>SPECspeed®2017_fp_base</th>
<th>SPECspeed®2017_fp_peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.4</td>
<td>27.7</td>
</tr>
</tbody>
</table>

**CPU2017 License:** 9017

**Test Sponsor:** Lenovo Global Technology

**Test Date:** Jun-2020

**CPU2017 License:** 9017

**Test Sponsor:** Lenovo Global Technology

**Test Date:** Jun-2020

**Hardware Availability:** Mar-2020

**Software Availability:** Apr-2020

**CPU2017 License:** 9017

**Test Sponsor:** Lenovo Global Technology

**Test Date:** Jun-2020

**Hardware Availability:** Mar-2020

**Software Availability:** Apr-2020

### Compiler Version Notes (Continued)

<table>
<thead>
<tr>
<th>Base Compiler Invocation</th>
</tr>
</thead>
</table>

#### C benchmarks

- `icc` (Continued on next page)

### Base Compiler Invocation

- C benchmarks:
  - `icc`

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

Fortran benchmarks:
ifort

Benchmarks using both Fortran and C:
ifort icc

Benchmarks using Fortran, C, and C++:
icpc icc ifort

Base Portability Flags

603.bwaves_s: -DSPEC_LP64
607.cactuBSSN_s: -DSPEC_LP64
619.lbm_s: -DSPEC_LP64
621.wrf_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
627.cam4_s: -DSPEC_LP64 -DSPEC_CASE_FLAG
628.pop2_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
-assume byterecl
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 -std=c11 -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP
-mbranches-within-32B-boundaries

Fortran benchmarks:
-m64 -Wl,-z,muldefs -DSPEC_OPENMP -xCORE-AVX2 -ipo -O3 -no-prec-div
-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp
-nostandard-realloc-lhs -mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Benchmarks using both Fortran and C:
-m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div
-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp
-DSPEC_OPENMP -mbranches-within-32B-boundaries -nostandard-realloc-lhs
Lenovo Global Technology
ThinkSystem ST50
(4.00 GHz, Intel Xeon E-2274G)

<table>
<thead>
<tr>
<th>SPECspeed®2017_fp_base = 27.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECspeed®2017_fp_peak = 27.7</td>
</tr>
</tbody>
</table>

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

Base Optimization Flags (Continued)

Benchmarks using both Fortran and C (continued):
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Benchmarks using Fortran, C, and C++:
-m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div
-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp
-DSPEC_OPENMP -mbranches-within-32B-boundaries -nostandard-realloc-lhs
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Peak Compiler Invocation

C benchmarks:
icc

Fortran benchmarks:
ifort

Benchmarks using both Fortran and C:
ifort icc

Benchmarks using Fortran, C, and C++:
icpc icc ifort

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

619.lbm_s: basepeak = yes

638.imagick_s: basepeak = yes

644.nab_s: -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX2 -ipo -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP
-mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

(Continued on next page)
Lenovo Global Technology
ThinkSystem ST50
(4.00 GHz, Intel Xeon E-2274G)

<table>
<thead>
<tr>
<th>SPECspeed®2017_fp_base</th>
<th>SPECspeed®2017_fp_peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.4</td>
<td>27.7</td>
</tr>
</tbody>
</table>

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

Test Date: Jun-2020
Hardware Availability: Mar-2020
Software Availability: Apr-2020

Peak Optimization Flags (Continued)

Fortran benchmarks:

603.bwaves_s: -m64 -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2)
-DSPEC_SUPPRESS_OPENMP -DSPEC_OPENMP -ipo -xCORE-AVX2
-O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -qopenmp -nostandard-realloc-lhs
-mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

649.fotonik3d_s: Same as 603.bwaves_s

654.roms_s: basepeak = yes

Benchmarks using both Fortran and C:

621.wrf_s: -m64 -std=c11 -Wl,-z,muldefs -prof-gen(pass 1)
-prof-use(pass 2) -ipo -xCORE-AVX2 -O3 -no-prec-div
-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4
-DSPEC_SUPPRESS_OPENMP -qopenmp -DSPEC_OPENMP
-mbranches-within-32B-boundaries -nostandard-realloc-lhs
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

627.cam4_s: basepeak = yes

628.pop2_s: basepeak = yes

Benchmarks using Fortran, C, and C++:

607.cactuBSSN_s: basepeak = yes

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-CFL-B.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/Intel-ic19.1u1-official-linux64_revA.xml
http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-CFL-B.xml
### Lenovo Global Technology

**ThinkSystem ST50**  
(4.00 GHz, Intel Xeon E-2274G)

<table>
<thead>
<tr>
<th>SPECspeed®2017_fp_base</th>
<th>27.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECspeed®2017_fp_peak</td>
<td>27.7</td>
</tr>
</tbody>
</table>

- **CPU2017 License:** 9017  
- **Test Sponsor:** Lenovo Global Technology  
- **Tested by:** Lenovo Global Technology  
- **Test Date:** Jun-2020  
- **Hardware Availability:** Mar-2020  
- **Software Availability:** Apr-2020  

---

SPEC CPU and SPECspeed are registered trademarks of the Standard Performance Evaluation Corporation. All other brand and product names appearing in this result are trademarks or registered trademarks of their respective holders.

For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

Tested with SPEC CPU®2017 v1.1.0 on 2020-06-14 21:24:11-0400.  
Originally published on 2020-07-07.