# SPEC® CPU2017 Floating Point Speed Result

**Lenovo Global Technology**  
ThinkSystem ST550  
(2.00 GHz, Intel Xeon Silver 4109T)  

<table>
<thead>
<tr>
<th>SPECspeed2017_fp_base = 58.9</th>
<th>SPECspeed2017_fp_peak = 60.4</th>
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**CPU2017 License:** 9017  
**Test Date:** Oct-2017  
**Test Sponsor:** Lenovo Global Technology  
**Hardware Availability:** Aug-2017  
**Tested by:** Lenovo Global Technology  
**Software Availability:** Sep-2017

## Threads

<table>
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<tr>
<th>Benchmark</th>
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<td>67.6</td>
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<td>16</td>
<td>31.4</td>
<td>33.4</td>
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<tr>
<td>619.lbm_s</td>
<td>16</td>
<td>48.4</td>
<td>52.7</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>16</td>
<td>32.2</td>
<td>32.7</td>
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<tr>
<td>627.cam4_s</td>
<td>16</td>
<td>43.4</td>
<td>45.8</td>
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<td>628.pop2_s</td>
<td>16</td>
<td>40.6</td>
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</tr>
<tr>
<td>638.imagick_s</td>
<td>16</td>
<td>73.3</td>
<td></td>
</tr>
<tr>
<td>644.nab_s</td>
<td>16</td>
<td>60.1</td>
<td></td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>16</td>
<td>60.1</td>
<td></td>
</tr>
<tr>
<td>654.roms_s</td>
<td>16</td>
<td>67.5</td>
<td></td>
</tr>
</tbody>
</table>

### Hardware

- **CPU Name:** Intel Xeon Silver 4109T  
- **Max MHz.:** 3000  
- **Nominal:** 2000  
- **Enabled:** 16 cores, 2 chips  
- **Orderable:** 1,2 chips  
- **Cache L1:** 32 KB I + 32 KB D on chip per core  
- **Cache L2:** 1 MB I+D on chip per core  
- **Cache L3:** 11 MB I+D on chip per chip  
- **Other:** None  
- **Memory:** 384 GB (12 x 32 GB 2Rx4 PC4-2666V-R, running at 2400)  
- **Storage:** 1 x 800 GB SAS SSD  
- **Other:** None

### Software

- **OS:** SUSE Linux Enterprise Server 12 SP2 (x86_64)  
- **Kernel:** 4.4.21-69-default  
- **Compiler:** C/C++: Version 18.0.0.128 of Intel C/C++ Compiler for Linux; Fortran: Version 18.0.0.128 of Intel Fortran Compiler for Linux  
- **Parallel:** Yes  
- **Firmware:** Lenovo BIOS Version O0E107W 1.01 released Aug-2017  
- **File System:** btrfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 64-bit  
- **Other:** None
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Results Table

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<th>Seconds Base</th>
<th>Ratio</th>
<th>Seconds Peak</th>
<th>Ratio</th>
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<th>Ratio</th>
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<td>238</td>
<td>73.3</td>
<td>238</td>
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<td>62.7</td>
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</tr>
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SPECspeed2017_fp_base = 58.9
SPECspeed2017_fp_peak = 60.4

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"

General Notes

Environment variables set by runcpu before the start of the run:
KMP_AFFINITY = "granularity=fine,compact"
LD_LIBRARY_PATH = "/home/cpu2017.1.0.2.ic18.0/lib/ia32:/home/cpu2017.1.0.2.ic18.0/lib/intel64"
LD_LIBRARY_PATH = "$LD_LIBRARY_PATH:/home/cpu2017.1.0.2.ic18.0/je5.0.1-32:/home/cpu2017.1.0.2.ic18.0/je5.0.1-64"

Binaries compiled on a system with 1x Intel Core i7-4790 CPU + 32GB RAM
memory using Redhat Enterprise Linux 7.4
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

Platform Notes

BIOS configuration:
Choose Operating Mode set to Maximum Performance
Hyper-Threading set to Disable
Adjacent Cache Prefetch set to Disable
DCU Streamer Prefetcher set to Disable
DCA set to Enable
Uncore Frequency Scaling set to Disable
MONITORMWAIT set to Enable
XET Prefetcher set to Enable

(Continued on next page)
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Platform Notes (Continued)

Sysinfo program /home/cpu2017.1.0.2.ic18.0/bin/sysinfo
Rev: r5797 of 2017-06-14 96c45e4568ad54c135fd618bcc091c0f
running on ST550 Thu Oct 26 17:12:32 2017

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) Silver 4109T CPU @ 2.00GHz
2 "physical id"s (chips)
16 "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 : 8
siblings : 8
physical 0: cores 0 1 2 3 4 5 6 7
physical 1: cores 0 1 2 3 4 5 6 7

From lscpu:
Architecture:           x86_64
CPU op-mode(s):         32-bit, 64-bit
Byte Order:             Little Endian
CPU(s):                 16
On-line CPU(s) list:    0-15
Thread(s) per core:     1
Core(s) per socket:     8
Socket(s):              2
NUMA node(s):           2
Vendor ID:              GenuineIntel
CPU family:             6
Model:                  85
Model name:             Intel(R) Xeon(R) Silver 4109T CPU @ 2.00GHz
Stepping:               4
CPU MHz:                1995.293
BogoMIPS:               3990.58
Virtualization:         VT-x
L1d cache:              32K
L1i cache:              32K
L2 cache:               1024K
L3 cache:               11264K
NUMA node0 CPU(s):      0-7
NUMA node1 CPU(s):      8-15
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 rdtsscp
lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc
aperfmperf eagerfpu pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg

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Platform Notes (Continued)

```plaintext
fma cx16 xtpr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes
xsave avx f16c rdrand lahf_lm abm 3dnowprefetch ida arat epb pln pts dtherm intel_pt
tpr_shadow vmx flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2
ermi invpcid rtm cqm mpx avx512f avx512dq rdseed adx smap clflushopt clwb avx512cd
avx512bw avx512vl xsaveopt xsaveset xgetbv1 cqm_llc cqm_occpi_llc
```

/proc/cpuinfo cache data
```
cache size : 11264 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
node 0 size: 193101 MB
node 0 free: 192415 MB
node 1 cpus: 8 9 10 11 12 13 14 15
node 1 size: 193504 MB
node 1 free: 192742 MB
node distances:
  node   0   1
  0:  10  21
  1:  21  10
```

From /proc/meminfo
```
MemTotal:       395884172 kB
HugePages_Total:       0
Hugepagesize:       2048 kB
```

From /etc/*release* /etc/*version*
```
SuSE-release:
  SUSE Linux Enterprise Server 12 (x86_64)
  VERSION = 12
  PATCHLEVEL = 2
  # This file is deprecated and will be removed in a future service pack or release.
  # Please check /etc/os-release for details about this release.
  os-release:
    NAME="SLES"
    VERSION="12-SP2"
    VERSION_ID="12.2"
    PRETTY_NAME="SUSE Linux Enterprise Server 12 SP2"
    ID="sles"
    ANSI_COLOR="0;32"
    CPE_NAME="cpe:/o:suse:sles:12:sp2"
```

uname -a:
```
Linux ST550 4.4.21-69-default #1 SMP Tue Oct 25 10:58:20 UTC 2016 (9464f67) x86_64
x86_64 x86_64 GNU/Linux
```

(Continued on next page)
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Platform Notes (Continued)

run-level 3 Oct 26 17:11

SPEC is set to: /home/cpu2017.1.0.2.ic18.0

Filesystem     Type   Size  Used Avail Use% Mounted on
/dev/sda2      btrfs  744G  113G  631G  16% /home

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.

BIOS Lenovo -[00E107W-1.01]- 08/11/2017
Memory:
12x Hynix HMA84GR7AFR4N-VK 32 GB 2 rank 2666, configured at 2400

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
CC  619.lbm_s(base) 638.imagick_s(base, peak) 644.nab_s(base, peak)
==============================================================================
icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
==============================================================================
FC  607.cactuBSSN_s(base)

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**Test Date:** Oct-2017  
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### Compiler Version Notes (Continued)

```plaintext
icpc (ICC) 18.0.0 20170811  
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
icc (ICC) 18.0.0 20170811  
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
ifort (IFORT) 18.0.0 20170811  
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
```

**FC**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Base Version</th>
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<tbody>
<tr>
<td>603.bwaves_s</td>
<td>icc (base)</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>icc (base)</td>
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<tr>
<td>654.roms_s</td>
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**ifort**

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<td>627.cam4_s</td>
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<td>628.pop2_s</td>
<td>ifort (peak)</td>
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### Base Compiler Invocation

**C benchmarks:**

`icc`

(Continued on next page)
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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:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=3 -qopenmp -DSPEC_OPENMP

Fortran benchmarks:
-DSPEC_OPENMP -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
   -ffinite-math-only -qopt-mem-layout-trans=3 -qopenmp
   -nostandard-realloc-lhs -align array32byte

Benchmarks using both Fortran and C:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=3 -qopenmp -DSPEC_OPENMP
   -nostandard-realloc-lhs -align array32byte

Benchmarks using Fortran, C, and C++:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
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**Base Optimization Flags (Continued)**

Benchmarks using Fortran, C, and C++ (continued):
- nostandard-realloc-lhs
- align array32byte

**Base Other Flags**

C benchmarks:
- m64
- std=c11

Fortran benchmarks:
- m64

Benchmarks using both Fortran and C:
- m64
- std=c11

Benchmarks using Fortran, C, and C++:
- m64
- std=c11

**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
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### Peak Optimization Flags

#### C benchmarks:

- 619.lbm_s: `-prof-gen(pass 1) -prof-use(pass 2) -O2 -xCORE-AVX2`  
- `-qopt-prefetch -ipo -O3 -ffinite-math-only -no-prec-div`  
- `-qopt-mem-layout-trans=3 -DSPEC_SUPPRESS_OPENMP -qopenmp`  
- `-DSPEC_OPENMP`

- 638.imagick_s: `-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch`  
- `-ffinite-math-only -qopt-mem-layout-trans=3 -qopenmp`  
- `-DSPEC_OPENMP`

- 644.nab_s: Same as 638.imagick_s

#### Fortran benchmarks:

- `-prof-gen(pass 1) -prof-use(pass 2) -DSPEC_SUPPRESS_OPENMP`  
- `-DSPEC_OPENMP -O2 -xCORE-AVX2 -qopt-prefetch -ipo -O3`  
- `-ffinite-math-only -no-prec-div -qopt-mem-layout-trans=3 -qopenmp`  
- `-nostandard-realloc-lhs -align array32byte`

#### Benchmarks using both Fortran and C:

- 621.wrf_s: `-prof-gen(pass 1) -prof-use(pass 2) -O2 -xCORE-AVX2`  
- `-qopt-prefetch -ipo -O3 -ffinite-math-only -no-prec-div`  
- `-qopt-mem-layout-trans=3 -DSPEC_SUPPRESS_OPENMP -qopenmp`  
- `-DSPEC_OPENMP -nostandard-realloc-lhs -align array32byte`

- 627.cam4_s: `-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch`  
- `-ffinite-math-only -qopt-mem-layout-trans=3 -qopenmp`  
- `-DSPEC_OPENMP -nostandard-realloc-lhs -align array32byte`

- 628.pop2_s: Same as 621.wrf_s

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

- `-prof-gen(pass 1) -prof-use(pass 2) -O2 -xCORE-AVX2 -qopt-prefetch`  
- `-ipo -O3 -ffinite-math-only -no-prec-div -qopt-mem-layout-trans=3`  
- `-DSPEC_SUPPRESS_OPENMP -qopenmp -DSPEC_OPENMP -nostandard-realloc-lhs`  
- `-align array32byte`

### Peak Other Flags

#### C benchmarks:

- `-m64 -std=c11`

*(Continued on next page)*
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Peak Other Flags ( Continued )

Fortran benchmarks:
- m64

Benchmarks using both Fortran and C:
- m64 -std=c11

Benchmarks using Fortran, C, and C++:
- m64 -std=c11

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.html
http://www.spec.org/cpu2017/flags/Lenovo-Platform-Flags-V1.2-SKL-F.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.xml
http://www.spec.org/cpu2017/flags/Lenovo-Platform-Flags-V1.2-SKL-F.xml

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

Tested with SPEC CPU2017 v1.0.2 on 2017-10-26 05:12:31-0400.
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