## Lenovo Global Technology

**ThinkSystem SN550**
*(3.80 GHz, Intel Xeon Gold 5222)*

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<th>9017</th>
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<td>Nov-2018</td>
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### Hardware

- **CPU Name:** Intel Xeon Gold 5222
- **Max MHz.:** 3900
- **Nominal:** 3800
- **Enabled:** 8 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:** 16.5 MB I+D on chip per chip
- **Memory:** 768 GB (24 x 32 GB 2Rx4 PC4-2666V-R)
- **Storage:** 1 x 960 GB SATA SSD
- **Other:** None

### Software

- **OS:** Red Hat Enterprise Linux Server release 7.6 (Maipo)
- **Compiler:** C/C++: Version 19.0.1.144 of Intel C/C++ Compiler Build 20181018 for Linux;
  Fortran: Version 19.0.1.144 of Intel Fortran Compiler Build 20181018 for Linux
- **Firmware:** Lenovo BIOS Version IVE135M 2.10 released Jan-2019
- **File System:** xfs
- **System State:** Run level 3 (multi-user)
- **Base Pointers:** 64-bit
- **Peak Pointers:** Not Applicable
- **Other:** None

### SPEC® CPU2017 Floating Point Speed Result

**SPECspeed2017_fp_base = 57.9**

**SPECspeed2017_fp_peak = Not Run**
SPEC CPU2017 Floating Point Speed Result

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Results Table

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<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Base Seconds</th>
<th>Base Ratio</th>
<th>Base Seconds</th>
<th>Base Ratio</th>
<th>Peak Seconds</th>
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<tr>
<td>603.bwaves_s</td>
<td>8</td>
<td>212</td>
<td>279</td>
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<tr>
<td>607.cactuBSSN_s</td>
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<td>304</td>
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<td>54.5</td>
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<td>619.lbm_s</td>
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<td>60.8</td>
<td>219</td>
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<td>29.3</td>
<td>301</td>
<td>29.4</td>
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<tr>
<td>628.pop2_s</td>
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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,1,0"
LD_LIBRARY_PATH = "/home/cpu2017-1.0.5.ic19.0u1/lib/intel64"
OMP_STACKSIZE = "192M"

Binaries compiled on a system with 1x Intel Core i9-7900X CPU + 32GB RAM
memory using Redhat Enterprise Linux 7.5
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
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.
Platform Notes

BIOS configuration:
Choose Operating Mode set to Custom Mode
Page Policy set to Adaptive
Trusted Execution Technology set to Enable
SNC set to Enable
Sysinfo program /home/cpu2017-1.0.5-ic19.0ui/bin/sysinfo
Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9
running on localhost.localdomain Wed May 22 04:54:48 2019

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) Gold 5222 CPU @ 3.80GHz
  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: 4
siblings: 8
physical 0: cores 1 2 12 13
physical 1: cores 2 5 10 13

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: 2
Core(s) per socket: 4
Socket(s): 2
NUMA node(s): 4
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Gold 5222 CPU @ 3.80GHz
Stepping: 6
CPU MHz: 3800.000
BogoMIPS: 7600.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 16896K
NUMA node0 CPU(s): 0,1,8,9

(Continued on next page)
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**CPU2017 License:** 9017  
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**Tested by:** Lenovo Global Technology  
**Hardware Availability:** Apr-2019  
**Software Availability:** Nov-2018  
**Test Date:** May-2019

### Platform Notes (Continued)

NUMA node1 CPU(s): 2,3,10,11  
NUMA node2 CPU(s): 4,6,12,14  
NUMA node3 CPU(s): 5,7,13,15  
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 rdtscp  
- 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  
- fma cx16 xtrig pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes  
- xsave avx f16c rdrand lahf_lm abm 3dnowprefetch epb cat_l3 cdq_l3 intel_pt ssbd mba  
- ibrs ibpb stibp ibrs_enhanced tpr_shadow vnumi fexpriority vpid fsgsbase  
- tsc_adjust bm1 hle avx2 smep bmi2  
- erms invpcid rtm cqm mpx rdtd_rdt_a avx512f avx512dq  
- rdseed adx smap clflushopt clwb avx512cd avx512bw avx512vl xsaveopt xsavec xgetbv1  
- cmqm_llc cmqm_occup_llc cmqm_mbb_total cmqm_mbb_local dtherm ida arat pln pts hwp_epp  
- pku ospke avx512_vnni spec_ctrl intel_stibp flush_l1d arch_capabilities

```
From /proc/cpuinfo:
cache data
    cache size : 16896 KB
```

```
From numactl --hardware:
WARNING: a numactl 'node' might or might not correspond to a physical chip.
available: 4 nodes (0-3)
node 0 cpus: 0 1 8 9
node 0 size: 196281 MB
node 0 free: 191820 MB
node 1 cpus: 2 3 10 11
node 1 size: 196608 MB
node 1 free: 191952 MB
node 2 cpus: 4 6 12 14
node 2 size: 196608 MB
node 2 free: 192241 MB
node 3 cpus: 5 7 13 15
node 3 size: 196608 MB
node 3 free: 192247 MB
node distances:
    node 0 1 2 3
    0: 10 11 21 21
    1: 11 10 21 21
    2: 21 21 10 11
    3: 21 21 11 10
```

```
From /proc/meminfo:
    MemTotal:        792240796 kB
    HugePages_Total:       0
    Hugepagesize:          2048 kB
```

```
From /etc/*release* /etc/*version*:
os-release:
```

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**SPECspeed2017_fp_base = 57.9**

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**Platform Notes (Continued)**

```plaintext
NAME="Red Hat Enterprise Linux Server"
VERSION="7.6 (Maipo)"
ID="rhel"
ID_LIKE="fedora"
VARIANT="Server"
VARIANT_ID="server"
VERSION_ID="7.6"
PRETTY_NAME="Red Hat Enterprise Linux Server 7.6 (Maipo)"
redhat-release: Red Hat Enterprise Linux Server release 7.6 (Maipo)
system-release: Red Hat Enterprise Linux Server release 7.6 (Maipo)
```

```plaintext
uname -a:
Linux localhost.localdomain 3.10.0-957.el7.x86_64 #1 SMP Thu Oct 4 20:48:51 UTC 2018
x86_64 x86_64 x86_64 GNU/Linux
```

Kernel self-reported vulnerability status:

- CVE-2017-5754 (Meltdown): Not affected
- CVE-2017-5753 (Spectre variant 1): Mitigation: Load fences, __user pointer sanitization
- CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS

```plaintext
run-level 3 May 22 04:52
```

```plaintext
SPEC is set to: /home/cpu2017-1.0.5-ic19.0u1
```

```
Filesystem  Type  Size  Used Avail Use% Mounted on
/dev/sda2    xfs  839G  21G  819G   3% /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 -[IVE135M-2.10]- 01/16/2019
- Memory:
  - 24x Samsung M393A4K40BB2-CTD 32 GB 2 rank 2666

(End of data from sysinfo program)

**Compiler Version Notes**

```
CC 619.lbm_s(base) 638.imagick_s(base) 644.nab_s(base)
```

```
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
```

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**SPECspeed2017_fp_peak = Not Run**

---

**Compiler Version Notes (Continued)**

------------------------------------------------------------------------------
 FC 607.cactuBSSN_s(base)
------------------------------------------------------------------------------
 Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
   Version 19.0.1.144 Build 20181018
 Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
 Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
   Version 19.0.1.144 Build 20181018
 Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
 Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
   64, Version 19.0.1.144 Build 20181018
 Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------

------------------------------------------------------------------------------
 FC 603.bwaves_s(base) 649.fotonik3d_s(base) 654.roms_s(base)
------------------------------------------------------------------------------
 Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
   64, Version 19.0.1.144 Build 20181018
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 CC 621.wrf_s(base) 627.cam4_s(base) 628.pop2_s(base)
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 Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
   Version 19.0.1.144 Build 20181018
 Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------

---

**Base Compiler Invocation**

C benchmarks:
icc -m64 -std=c11

Fortran benchmarks:
ifort -m64

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

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### Base Compiler Invocation (Continued)

Benchmarks using Fortran, C, and C++:

```bash
icpc -m64 icc -m64 -std=c11 ifort -m64
```

### 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`
  - `-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-AVX512` 
  - `-ipo` 
  - `-O3` 
  - `-no-prec-div` 
  - `-qopt-prefetch`
- `-ffinite-math-only` 
  - `-qopt-mem-layout-trans=4` 
  - `-qopenmp` 
  - `-DSPEC_OPENMP`

#### Fortran benchmarks:

- `-DSPEC_OPENMP` 
  - `-xCORE-AVX512` 
  - `-ipo` 
  - `-O3` 
  - `-no-prec-div` 
  - `-qopt-prefetch`
- `-ffinite-math-only` 
  - `-qopt-mem-layout-trans=4` 
  - `-qopenmp`
  - `-nostandard-realloc-lhs`

#### Benchmarks using both Fortran and C:

- `-xCORE-AVX512` 
  - `-ipo` 
  - `-O3` 
  - `-no-prec-div` 
  - `-qopt-prefetch`
- `-ffinite-math-only` 
  - `-qopt-mem-layout-trans=4` 
  - `-qopenmp` 
  - `-DSPEC_OPENMP`
  - `-nostandard-realloc-lhs`

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

- `-xCORE-AVX512` 
  - `-ipo` 
  - `-O3` 
  - `-no-prec-div` 
  - `-qopt-prefetch`
- `-ffinite-math-only` 
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  - `-DSPEC_OPENMP`
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The flags files that were used to format this result can be browsed at:
- [Lenovo-Platform-SPECcpu2017-Flags-V1.2-CLX-A.html](http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-CLX-A.html)

You can also download the XML flags sources by saving the following links:
- [Lenovo-Platform-SPECcpu2017-Flags-V1.2-CLX-A.xml](http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-CLX-A.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 v1.0.5 on 2019-05-22 04:54:47-0400.  
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