# Lenovo Global Technology

**ThinkSystem SN550**  
(2.70 GHz, Intel Xeon Gold 6226)

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## Hardware

- **CPU Name:** Intel Xeon Gold 6226  
- **Max MHz:** 3700  
- **Nominal:** 2700  
- **Enabled:** 24 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:** 19.25 MB I+D on chip per chip  
- **Memory:** 768 GB (24 x 32 GB 2Rx4 PC4-2933Y-R)  
- **Storage:** 1 x 960 GB SATA SSD  
- **Other:** None

## Software

- **OS:** SUSE Linux Enterprise Server 15 (x86_64)  
- **Kernel:** 4.12.14-25.13-default  
- **Compiler:** C/C++: Version 19.0.4.227 of Intel  
- **Compiler:** C/C++  
- **Compiler:** Compiler for Linux;  
- **Fortran:** Version 19.0.4.227 of Intel Fortran  
- **Compiler:** Compiler for Linux  
- **Parallel:** No  
- **Firmware:** Lenovo BIOS Version IVE142E 2.30 released Aug-2019 tested as IVE141E 2.30 Jul-2019  
- **File System:** xfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** Not Applicable  
- **Other:** None  
- **Power Management:** --
Lenovo Global Technology
ThinkSystem SN550
(2.70 GHz, Intel Xeon Gold 6226)

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

Results Table

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

Submit Notes
The numactl mechanism was used to bind copies to processors. The config file option 'submit' was used to generate numactl commands to bind each copy to a specific processor. For details, please see the config file.

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:
LD_LIBRARY_PATH = "/home/cpu2017-1.0.5-ic19.0u4/lib/intel64"

Binaries compiled on a system with 1x Intel Core i9-799X 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
runcpu command invoked through numacll i.e.:
numactl --interleave=all runcpu <etc>
NA: The test sponsor attests, as of date of publication, that CVE-2017-5754 (Meltdown) is mitigated in the system as tested and documented.

(Continued on next page)
Lenovo Global Technology
ThinkSystem SN550
(2.70 GHz, Intel Xeon Gold 6226)

SPECrater®2017_fp_base = 165
SPECrater®2017_fp_peak = Not Run

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

Test Date: Sep-2019
Hardware Availability: Jul-2019
Software Availability: May-2019

General Notes (Continued)

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 Maximum Performance
Trusted Execution Technology set to Enable
SNC set to Enable
CPU Frequency Limits set to Restrict Maximum Frequency
Workload Configuration set to I/O Sensitive
Sysinfo program /home/cpu2017-1.0.5-ic19.0u4/bin/sysinfo
Rev: r5974 of 2018-05-19 b3cde8f2999c33d61f6ad4985e45859ea9
running on linux-cq9p Thu Sep 12 23:40:13 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 6226 CPU @ 2.70GHz
  2 "physical id"s (chips)
  48 "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 : 12
  siblings : 24
physical 0: cores 0 2 3 4 5 6 8 9 10 11 12 13
physical 1: cores 0 2 3 4 5 8 9 10 11 12 13 14

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 48
On-line CPU(s) list: 0-47
Thread(s) per core: 2
Core(s) per socket: 12
Socket(s): 2
NUMA node(s): 4

(Continued on next page)
Lenovo Global Technology
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<table>
<thead>
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CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
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| Test Date: | Sep-2019 |
| Hardware Availability: | Jul-2019 |
| Software Availability: | May-2019 |

Platform Notes (Continued)

- Vendor ID: GenuineIntel
- CPU family: 6
- Model: 85
- Model name: Intel(R) Xeon(R) Gold 6226 CPU @ 2.70GHz
- Stepping: 7
- CPU MHz: 2700.000
- CPU max MHz: 3700.0000
- CPU min MHz: 1200.0000
- BogoMIPS: 5400.00
- Virtualization: VT-x
- L1d cache: 32K
- L1i cache: 32K
- L2 cache: 1024K
- L3 cache: 19712K
- NUMA node0 CPU(s): 0-2, 6-8, 24-26, 30-32
- NUMA node1 CPU(s): 3-5, 9-11, 27-29, 33-35
- NUMA node2 CPU(s): 12-14, 17-19, 36-38, 41-43
- NUMA node3 CPU(s): 15, 16, 20-23, 39, 40, 44-47
- 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 pdelgb rdtscp lm constant_tsc arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid aperfmperf pni pclmulqdq dtes64 ds_cpl vmx smx est tm2 ssse3 sdbg 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 cpuid_fault epb cat_l3 cdp_l3 invpcid_single intel_ppln ssbd mba ibrs ibpb stibp tpr_shadow vmi flextension ept vpd fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 ersed ms invpcid rtm cmp Ms rdr _a avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd avx512bw avx512vl xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local dtherm ida arat pln pts pku ospke avx512_vnni flush_l1d arch_capabilities

/proc/cpuinfo cache data
- cache size : 19712 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 2 6 7 8 24 25 26 30 31 32
- node 0 size: 193135 MB
- node 0 free: 186835 MB
- node 1 cpus: 3 4 5 9 10 11 27 28 29 33 34 35
- node 1 size: 193523 MB
- node 1 free: 193183 MB
- node 2 cpus: 12 13 14 17 18 19 36 37 38 41 42 43
- node 2 size: 193523 MB
- node 2 free: 193254 MB
- node 3 cpus: 15 16 20 21 22 23 39 40 44 45 46 47
- node 3 size: 193491 MB

(Continued on next page)
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ThinkSystem SN550
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SPEC CPU®2017 Floating Point Rate Result
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Lenovo Global Technology
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SPECrate®2017_fp_base = 165
SPECrate®2017_fp_peak = Not Run

CPU2017 License: 9017
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Platform Notes (Continued)

node 3 free: 193239 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:       792241748 kB
HugePages_Total:       0
Hugepagesize:       2048 kB

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

uname -a:
  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: __user pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Indirect Branch Restricted Speculation, IBPB, IBRS_FW

run-level 3 Sep 12 23:39

SPEC is set to: /home/cpu2017-1.0.5-ic19.0u4
  Filesystem Type Size Used Avail Use% Mounted on
  /dev/sdb3 xfs 893G 61G 833G 7% /

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 -[IVE141E-2.30]- 07/02/2019

Memory:

(Continued on next page)
Lenovo Global Technology
ThinkSystem SN550
(2.70 GHz, Intel Xeon Gold 6226)

SPECraten017_fp_base = 165
SPECraten017_fp_peak = Not Run

CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Test Date: Sep-2019
Hardware Availability: Jul-2019
Tested by: Lenovo Global Technology
Software Availability: May-2019

Platform Notes (Continued)

24x Samsung M393A4K40CB2-CVF 32 GB 2 rank 2933

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
C               | 519.lbm_r(base) 538.imagick_r(base) 544.nab_r(base)
------------------------------------------------------------------------------
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
   Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

==============================================================================
C++             | 508.namd_r(base) 510.parest_r(base)
------------------------------------------------------------------------------
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
   Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

==============================================================================
C++, C          | 511.povray_r(base) 526.blender_r(base)
------------------------------------------------------------------------------
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
   Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
   Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
   64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

==============================================================================
C++, C, Fortran | 507.cactuBSSN_r(base)
------------------------------------------------------------------------------
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
   Version 19.0.4.227 Build 20190416
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(Continued on next page)
**SPEC CPU®2017 Floating Point Rate Result**

**Lenovo Global Technology**

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**SPECrate®2017_fp_base = 165**

**SPECrate®2017_fp_peak = Not Run**

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**Compiler Version Notes (Continued)**

```
Fortran         | 503.bwaves_r(base) 549.fotonik3d_r(base) 554.roms_r(base)
```

---

```
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.
```

---

```
Fortran, C      | 521.wrf_r(base) 527.cam4_r(base)
```

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Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.
```

---

**Base Compiler Invocation**

C benchmarks:
```bash
icc -m64 -std=c11
```

C++ benchmarks:
```bash
icpc -m64
```

Fortran benchmarks:
```bash
ifort -m64
```

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

Benchmarks using both C and C++:
```bash
icpc -m64 icc -m64 -std=c11
```

Benchmarks using Fortran, C, and C++:
```bash
icpc -m64 icc -m64 -std=c11 ifort -m64
```

---

**Base Portability Flags**

503.bwaves_r: -DSPEC_LP64

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

507.cactuBSSN_r: -DSPEC_LP64
508.namd_r: -DSPEC_LP64
510.parest_r: -DSPEC_LP64
511.povray_r: -DSPEC_LP64
519.fbm_r: -DSPEC_LP64
521.wrf_r: -DSPEC_LP64, -DSPEC_CASE_FLAG, -convert big_endian
526.blender_r: -DSPEC_LP64, -DSPEC_LINUX, -funsigned-char
527.cam4_r: -DSPEC_LP64, -DSPEC_CASE_FLAG
538.imagick_r: -DSPEC_LP64
544.nab_r: -DSPEC_LP64
549.fotonik3d_r: -DSPEC_LP64
554.roms_r: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4

C++ benchmarks:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4

Fortran benchmarks:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4, -auto -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=4, -auto -nostandard-realloc-lhs
-align array32byte

Benchmarks using both C and C++:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4

Benchmarks using Fortran, C, and C++:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4, -auto -nostandard-realloc-lhs
-align array32byte
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(2.70 GHz, Intel Xeon Gold 6226)

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Test Date: Sep-2019
Hardware Availability: Jul-2019
Software Availability: May-2019

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-CLX-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-CLX-D.xml

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Tested with SPEC CPU®2017 v1.0.5 on 2019-09-12 11:40:13-0400.
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