Lenovo Global Technology
ThinkSystem ST550
(2.70 GHz, Intel Xeon Gold 5220S)

<table>
<thead>
<tr>
<th>SPECspeed®2017_fp_base</th>
<th>120</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECspeed®2017_fp_peak</td>
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</table>

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

<table>
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<tr>
<th>Threads</th>
<th>SPECspeed®2017_fp_base (120)</th>
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<tr>
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<tr>
<td>607.cactuBSSN_s</td>
<td>36</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>36</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>36</td>
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<tr>
<td>627.cam4_s</td>
<td>36</td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>36</td>
</tr>
<tr>
<td>638.imagick_s</td>
<td>36</td>
</tr>
<tr>
<td>644.nab_s</td>
<td>36</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>36</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>36</td>
</tr>
</tbody>
</table>

### Software
- **OS:** Red Hat Enterprise Linux Server release 7.6 (Maipo)  
  Kernel 3.10.0-957.el7.x86_64
- **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
- **Parallel:** Yes
- **Firmware:** Lenovo BIOS Version 0OE142D 2.30 released Aug-2019 tested as 0OE141D 2.30 Jul-2019
- **File System:** btrfs
- **System State:** Run level 3 (multi-user)
- **Base Pointers:** 64-bit
- **Peak Pointers:** Not Applicable
- **Other:** None
- **Power Management:** --

### Hardware
- **CPU Name:** Intel Xeon Gold 5220S
- **Max MHz:** 3900
- **Nominal:** 2700
- **Enabled:** 36 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:** 24.75 MB I+D on chip per chip
- **Other:** None
- **Memory:** 384 GB (12 x 32 GB 2Rx4 PC4-2933Y-R, running at 2666)
- **Storage:** 1 x 480 GB SATA SSD
- **Other:** None

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Lenovo Global Technology  
Test Date: Aug-2019  
Hardware Availability: Apr-2019  
Software Availability: Nov-2018
## Lenovo Global Technology

**ThinkSystem ST550**  
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---

### SPECspeed\textsuperscript{2017} fp Base Results

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
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<tr>
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<td>134</td>
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<td>132</td>
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<td>58.2</td>
<td>90.0</td>
<td>58.2</td>
<td>90.0</td>
<td>58.8</td>
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<td>111</td>
<td>119</td>
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<tr>
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<td>82.2</td>
<td>108</td>
<td>82.2</td>
<td>108</td>
<td>82.1</td>
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<tr>
<td>536.628.pop2_s</td>
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<td>64.6</td>
<td>183</td>
<td>65.0</td>
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<tr>
<td>536.638.imagick_s</td>
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<td>141</td>
<td>102</td>
<td>141</td>
<td>102</td>
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<tr>
<td>536.644.nab_s</td>
<td>36</td>
<td>94.4</td>
<td>185</td>
<td>94.3</td>
<td>185</td>
<td>94.4</td>
<td>185</td>
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<tr>
<td>536.649.fotonik3d_s</td>
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<td>81.9</td>
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<td>79.1</td>
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<tr>
<td>536.654.roms_s</td>
<td>36</td>
<td>143</td>
<td>110</td>
<td>142</td>
<td>111</td>
<td>142</td>
<td>111</td>
</tr>
</tbody>
</table>

### 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.
Lenovo Global Technology
ThinkSystem ST550
(2.70 GHz, Intel Xeon Gold 5220S)

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

SPECspeed®2017_fp_base = 120
SPECspeed®2017_fp_peak = Not Run

Test Date: Aug-2019
Hardware Availability: Apr-2019
Software Availability: Nov-2018

Platform Notes

BIOS configuration:
Choose Operating Mode set to Maximum Performance and then set it to Custom Mode
CPU P-state Control set to Cooperative
C-States set to legacy
Adjacent Cache Prefetcher set to Disable
DCU Streamer Prefetcher set to Disable
DCA set to Disable
Uncore Frequency Scaling set to Disable

Sysinfo program /home/cpu2017-1.0.5-ic19.0u1/bin/sysinfo
Rev: r5974 of 2018-05-19 9bcede8f2999c33d61f64985e45859ea9
running on localhost.localdomain Thu Aug 15 00:01:04 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 5220S CPU @ 2.70GHz
  2 "physical id"s (chips)
  72 "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 : 18
 siblings : 36
 physical 0: cores 0 1 2 3 4 8 9 10 11 16 17 18 19 20 24 25 26 27
 physical 1: cores 0 1 2 3 4 8 9 10 11 16 17 18 19 20 24 25 26 27

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 72
On-line CPU(s) list: 0-71
Thread(s) per core: 2
Core(s) per socket: 18
Socket(s): 2
NUMA node(s): 2
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Gold 5220S CPU @ 2.70GHz
Stepping: 7
CPU MHz: 2700.000
BogoMIPS: 5400.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K

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SPECspeed®2017_fp_base = 120
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Platform Notes (Continued)

- L2 cache: 1024K
- L3 cache: 25344K
- NUMA node0 CPU(s): 0-17,36-53
- NUMA node1 CPU(s): 18-35,54-71
- Flags: fpu vme de pse tsc msr pae mca cmov pat pse36 clflush dts acpica mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp lm constant_tsc arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc aperfmpreperf eagerfpu pni pclmulqdq dtes64 monitor 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 fl64 rdrand lahf_lm abm 3dnowprefetch epb cat_l3 cdp_l3 intel_pt ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm cqm mpx rdt_a avx512f avx512dq rdseed adx smap clfflushopt clwb avx512cd avx512bw avx512vl xsaveopt xsavec xgetbv1 cqm_llc cqm_occup_llc cqm_mbb_total cqm_mbb_local dtherm ida arat pln pts pkus pku ospke avx512_vnni spec_ctrl intel_stibp flush_l1d arch_capabilities

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 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
- node 0 size: 196280 MB
- node 0 free: 190544 MB
- node 1 cpus: 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
- node 1 size: 196608 MB
- node 1 free: 191292 MB
- node distances:
  - node 0 1
  - 0: 10 21
  - 1: 21 10

From /proc/meminfo

- MemTotal: 395878616 kB
- HugePages_Total: 0
- Hugepagesize: 2048 kB

From /etc/*release*/etc/*version*

- os-release:
  - NAME="Red Hat Enterprise Linux Server"
  - VERSION="7.6 (Maipo)"
  - ID="rhel"
  - ID_LIKE="fedora"
  - VARIANT="Server"

(Continued on next page)
Platform Notes (Continued)

```
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)
```

```
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

```
run-level 3 Aug 14 22:55
SPECSPEC is set to: /home/cpu2017-1.0.5-ic19.0u1
  Filesystem  Type     Size  Used  Avail Use% Mounted on
  /dev/sdb2    btrfs   442G   29G  412G   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 -[O0E141D-2.30]- 07/03/2019
Memory:
  12x Samsung M393A4K40CB2-CVF 32 GB 2 rank 2933, configured at 2666
```

(End of data from sysinfo program)

Compiler Version Notes

```
C               | 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.
```

```
C++, C, Fortran | 607.cactuBSSN_s(base)
```

(Continued on next page)
# 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
```

**Benchmarks using Fortran, C, and C++:**
```
icpc -m64 icc -m64 -std=c11 ifort -m64
```
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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 -assume byterecl
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-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 -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP
   -nostandard-realloc-lhs

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-F.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-F.xml
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