### Lenovo Global Technology

**ThinkSystem SR590 (2.20 GHz, Intel Xeon Gold 5220)**

**CPU2017 License:** 9017  
**Test Sponsor:** Lenovo Global Technology  
**Tested by:** Lenovo Global Technology  
**Test Date:** Apr-2019  
**Hardware Availability:** Apr-2019  
**Software Availability:** Dec-2018

<table>
<thead>
<tr>
<th>Thread</th>
<th>SPECspeed2017_fp_base</th>
<th>SPECspeed2017_fp_peak</th>
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<tr>
<td>603.bwaves_s</td>
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<tr>
<td>607.cactuBSSN_s</td>
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<td>137</td>
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<tr>
<td>619.lbm_s</td>
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<td>89.6</td>
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<td>621.wrf_s</td>
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<tr>
<td>627.cam4_s</td>
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</tr>
<tr>
<td>654.roms_s</td>
<td>36</td>
<td>111</td>
</tr>
</tbody>
</table>

### Hardware

- **CPU Name:** Intel Xeon Gold 5220  
- **Max MHz.:** 3900  
- **Nominal:** 2200  
- **Enabled:** 36 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:** 24.75 MB I+D on chip per chip  
- **Memory:** 192 GB (12 x 16 GB 2Rx8 PC4-2933Y-R, running at 2666)  
- **Storage:** 1 x 960 GB SATA SSD  
- **Other:** None

### Software

- **OS:** SUSE Linux Enterprise Server 12 SP4 (x86_64)  
- **Kernel:** 4.12.14-94.41-default  
- **Compiler:** C/C++: Version 19.0.0.117 of Intel C/C++  
- **Compiler for Linux:**  
- **Fortran:** Version 19.0.0.117 of Intel Fortran  
- **Compiler for Linux:**  
- **Parallel:** Yes  
- **Firmware:** Lenovo BIOS Version TEE135L 2.10 released Jan-2019  
- **File System:** btrfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** Not Applicable  
- **Other:** None
SPEC CPU2017 Floating Point Speed Result
Copyright 2017-2019 Standard Performance Evaluation Corporation

Lenovo Global Technology
ThinkSystem SR590
(2.20 GHz, Intel Xeon Gold 5220)

SPECspeed2017_fp_base = 121
SPECspeed2017_fp_peak = Not Run

Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
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<th>Ratio</th>
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SPECspeed2017_fp_base = 121
SPECspeed2017_fp_peak = Not Run

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/cpu2017-1.0.5-ic19/lib/intel64"
OMP_STACKSIZE = "192M"

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

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) 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

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(2.20 GHz, Intel Xeon Gold 5220)

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<td>Lenovo Global Technology</td>
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</table>

**Platform Notes**

- BIOS configuration:
  - Choose Operating Mode set to Maximum Performance
  - Choose Operating Mode set to Custom Mode
  - CPU P-state Control set to Automatic
  - MONITOR/MWAIT set to Enable
  - Hyper-Threading set to Disable
  - Adjacent Cache Prefetch set to disable
  - Sysinfo program: `/home/cpu2017-1.0.5-ic19/bin/sysinfo`
  - Rev: r5974 of 2018-05-19 9bcde8f2999c3361f64985e45859ea9
  - Running on `linux-o16r Sun Apr 14 16:11:17 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 5220 CPU @ 2.20GHz`
  - 2 "physical id"s (chips)
  - 36 "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: 18
    - 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): 36
  - On-line CPU(s) list: 0-35
  - Thread(s) per core: 1
  - 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 5220 CPU @ 2.20GHz
  - Stepping: 6
  - CPU MHz: 2200.000
  - BogoMIPS: 4400.00
  - Virtualization: VT-x
  - L1d cache: 32K
  - L1i cache: 32K
  - L2 cache: 1024K

(Continued on next page)
**Platform Notes (Continued)**

<table>
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<th>Spec CPU2017 Floating Point Speed Result</th>
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<td>ThinkSystem SR590 (2.20 GHz, Intel Xeon Gold 5220)</td>
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| Lenovo Global Technology                |
| Lenovo Global Technology                |

| CPU2017 License: 9017                     |
| Test Sponsor: Lenovo Global Technology   |
| Tested by: Lenovo Global Technology      |
| Test Date: Apr-2019                      |
| Hardware Availability: Apr-2019          |
| Software Availability: Dec-2018          |

- **L3 cache:** 25344K
- **NUMA node0 CPU(s):** 0-17
- **NUMA node1 CPU(s):** 18-35
- **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
  - aperfmpref pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16
  - xtrr pdcm pclid 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 ssbd mba ibrs ibpb stibp tpr_shadow vnmi flexpriority ept vpid
  - fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erts invpcid rtm cqm mpx rdt_a avx512f
  - avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd avx512bw avx512vl
  - xsaveopt xsaves xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local
  - dtherm ida arat pln pts hwp_epp pku ospke avx512_vnni flush_l1d arch_capabilities

/proc/cpuinfo cache data

```
cache size : 25344 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 8 9 10 11 12 13 14 15 16 17
node 0 size: 96030 MB
node 0 free: 94948 MB
node 1 cpus: 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
node 1 size: 96741 MB
node 1 free: 95651 MB
node distances:
  node 0 1
  0: 10 21
  1: 21 10
```

From /proc/meminfo

<table>
<thead>
<tr>
<th>MemTotal: 197397916 kB</th>
</tr>
</thead>
<tbody>
<tr>
<td>HugePages_Total: 0</td>
</tr>
<tr>
<td>Hugepagesize: 2048 kB</td>
</tr>
</tbody>
</table>

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

| SuSE-release: SUSE Linux Enterprise Server 12 (x86_64) |
| VERSION = 12 |
| PATCHLEVEL = 4 |
| # 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-SP4" |

(Continued on next page)
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SPECspeed2017_fp_base = 121
SPECspeed2017_fp_peak = Not Run

Platform Notes (Continued)

VERSION_ID="12.4"
PRETTY_NAME="SUSE Linux Enterprise Server 12 SP4"
ID="sles"
ANSI_COLOR="0;32"
CPE_NAME="cpe:/o:suse:sles:12:sp4"

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 Apr 14 12:58

SPEC is set to: /home/cpu2017-1.0.5-ic19
    Filesystem Type Size Used Avail Use% Mounted on
    /dev/sda3 btrfs 740G 33G 707G 5% /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 -[TEE135L-2.10]- 01/10/2019
    Memory:
        4x NO DIMM NO DIMM
        12x SK Hynix HMA82GR7CJR8N-WM 16 GB 2 rank 2933, configured at 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 19.0.0.117 Build 20180804
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
==============================================================================
FC 607.cactuBSSN_s(base)

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Compiler Version Notes (Continued)

Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.0.117 Build 20180804
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.0.117 Build 20180804
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Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.0.0.117 Build 20180804
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

Compiler Version Notes (Continued)

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.0.0.117 Build 20180804
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Compiler Version Notes (Continued)

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.0.0.117 Build 20180804
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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**

- bwaves_s: -DSPEC_LP64
- cactuBSSN_s: -DSPEC_LP64
- lbm_s: -DSPEC_LP64
- wrf_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
- cam4_s: -DSPEC_LP64 -DSPEC_CASE_FLAG
- pop2_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian -assume byterecl
- imagick_s: -DSPEC_LP64
- nab_s: -DSPEC_LP64
- fotonik3d_s: -DSPEC_LP64
- roms_s: -DSPEC_LP64

**Base Optimization Flags**

**C benchmarks:**
- xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
- ffinitie-math-only -qopt-mem-layout-trans=3 -qopenmp -DSPEC_OPENMP

**Fortran benchmarks:**
- DSPEC_OPENMP -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
- ffinitie-math-only -qopt-mem-layout-trans=3 -qopenmp
- nostandard-realloc-lhs -align array32byte

**Benchmarks using both Fortran and C:**
- xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
- ffinitie-math-only -qopt-mem-layout-trans=3 -qopenmp -DSPEC_OPENMP
- nostandard-realloc-lhs -align array32byte

**Benchmarks using Fortran, C, and C++:**
- xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
- ffinitie-math-only -qopt-mem-layout-trans=3 -qopenmp -DSPEC_OPENMP
- nostandard-realloc-lhs -align array32byte

The flags files that were used to format this result can be browsed at:


You can also download the XML flags sources by saving the following links:

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