Lenovo Global Technology
ThinkSystem ST550
(2.20 GHz, Intel Xeon Silver 4210)

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>SPECrate2017_int_base = 110</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECrate2017_int_peak = Not Run</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SPECrate2017_int_base</th>
<th>SPECrate2017_int_peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td>Not Run</td>
</tr>
</tbody>
</table>

### Hardware
- **CPU Name:** Intel Xeon Silver 4210
- **Max MHz.:** 3200
- **Nominal:** 2200
- **Enabled:** 20 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:** 13.75 MB I+D on chip per chip
- **Other:** None
- **Memory:** 384 GB (12 x 32 GB 2Rx4 PC4-2933Y-R, running at 2400)
- **Storage:** 1 x 480 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 19.0.1.144 of Intel C/C++ Compiler Build 20181018 for Linux;
  Fortran: Version 19.0.1.144 of Intel Fortran Compiler Build 20181018 for Linux
- **Parallel:** No
- **Firmware:** Lenovo BIOS Version OOE135M 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
## Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Base</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Peak</th>
<th>Seconds</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>500.perlbench_r</td>
<td>40</td>
<td>758</td>
<td>760.0</td>
<td>83.8</td>
<td>759</td>
<td>83.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>502.gcc_r</td>
<td>40</td>
<td>614</td>
<td>612.0</td>
<td>92.6</td>
<td>613</td>
<td>92.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>505.mcf_r</td>
<td>40</td>
<td>428</td>
<td>425.0</td>
<td>152</td>
<td>426</td>
<td>152</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>520.omnetpp_r</td>
<td>40</td>
<td>701</td>
<td>697.0</td>
<td>75.3</td>
<td>697</td>
<td>75.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>523.xalancbmk_r</td>
<td>40</td>
<td>324</td>
<td>324.0</td>
<td>130</td>
<td>324</td>
<td>130</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>525.x264_r</td>
<td>40</td>
<td>342</td>
<td>341.0</td>
<td>205</td>
<td>341</td>
<td>206</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>531.deepsjeng_r</td>
<td>40</td>
<td>503</td>
<td>503.0</td>
<td>91.1</td>
<td>503</td>
<td>91.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>541.leela_r</td>
<td>40</td>
<td>791</td>
<td>799.0</td>
<td>82.9</td>
<td>791</td>
<td>83.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>548.exchange2_r</td>
<td>40</td>
<td>545</td>
<td>546.0</td>
<td>192</td>
<td>546</td>
<td>192</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>557.xz_r</td>
<td>40</td>
<td>597</td>
<td>597.0</td>
<td>72.4</td>
<td>597</td>
<td>72.4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 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-ic19.0u1/lib/intel64"
```

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
```

runcpu command invoked through numactl i.e.:

```
umactl --interleave=all runcpu <etc>
```

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.
General Notes (Continued)

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
Choose Operating Mode set to Custom Mode
Patrol Scrub set to Disable
Sysinfo program /home/cpu2017-1.0.5-ic19.0u1/bin/sysinfo
Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9
running on linux-5h8d Tue Apr 23 20:34:42 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) Silver 4210 CPU @ 2.20GHz
  2 "physical id"s (chips)
  40 "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 : 10
siblings : 20
physical 0: cores 0 1 2 3 4 8 9 10 11 12
physical 1: cores 0 1 2 3 4 8 9 10 11 12

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 40
On–line CPU(s) list: 0–39
Thread(s) per core: 2
Core(s) per socket: 10
Socket(s): 2
NUMA node(s): 2
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Silver 4210 CPU @ 2.20GHz
Stepping: 6

(Continued on next page)
## Lenovo Global Technology

**ThinkSystem ST550**  
(2.20 GHz, Intel Xeon Silver 4210)

<table>
<thead>
<tr>
<th>SPECrate2017_int_base</th>
<th>110</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECrate2017_int_peak</td>
<td>Not Run</td>
</tr>
</tbody>
</table>

### 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

### Platform Notes (Continued)

```
CPU MHz:               2200.000  
CPU max MHz:           3200.0000  
CPU min MHz:           1000.0000  
BogoMIPS:              4400.00  
Virtualization:        VT-x  
L1d cache:             32K  
L1i cache:             32K  
L2 cache:              1024K  
L3 cache:              14080K  
NUMA node0 CPU(s):     0-9,20-29  
NUMA node1 CPU(s):     10-19,30-39  
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 ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm  
pccd dca ssse4_1 ssse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c  
rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb cat_13 cdp_13 invpcid_single ssbd  
mba ibrs ibpb stibp tpr_shadow vnmi flexpriority ept vpid fsgsbase tsc_adjust bm1  
hle avx2 smep bmi2 erms invpcid rtm cmp mpx rdt_a avx512f avx512dq rdseed adx smap  
cflushopt clwb intel_pt avx512cd avx512bw avx512vl xsaveopt xsaves xsavec xgetbv1 xsavees  
cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local dtherm ida arat pln pts pku ospke  
avx512_vnni flush_l1d arch_capabilities  
```

From `numactl --hardware`  
WARNING: a numactl 'node' might or might not correspond to a physical chip.

<table>
<thead>
<tr>
<th>available</th>
<th>2 nodes (0-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>node 0 cpus</td>
<td>0 1 2 3 4 5 6 7 8 9 20 21 22 23 24 25 26 27 28 29</td>
</tr>
</tbody>
</table>

| node 0 size | 193095 MB |
| node 0 free | 192299 MB |
| node 1 cpus | 10 11 12 13 14 15 16 17 18 19 30 31 32 33 34 35 36 37 38 39 |
| node 1 size | 193508 MB |
| node 1 free | 193091 MB |

From `/proc/meminfo`

MemTotal: 395882608 kB
HugePages_Total: 0
Hugepagesize: 2048 KB

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

SuSE-release:

(Continued on next page)
Lenovo Global Technology
ThinkSystem ST550
(2.20 GHz, Intel Xeon Silver 4210)

SPEC CPU2017 Integer Rate Result

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

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.

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 23 20:33

SPEC is set to: /home/cpu2017-1.0.5-ic19.0u1
  Filesystem Type Size Used Avail Use% Mounted on
  /dev/sda2 btrfs 446G 50G 396G 12% /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 -[00E135M-2.10]- 01/16/2019
Memory:
  12x Samsung M393A4K40CB2-CVF 32 GB 2 rank 2933, configured at 2400

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
CC  500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base) 525.x264_r(base)
  557.xz_r(base)
==============================================================================

(Continued on next page)
# SPEC CPU2017 Integer Rate Result

**Lenovo Global Technology**  
ThinkSystem ST550  
(2.20 GHz, Intel Xeon Silver 4210)

<table>
<thead>
<tr>
<th>CPU2017 License</th>
<th>Lenovo Global Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Sponsor</td>
<td>Lenovo Global Technology</td>
</tr>
<tr>
<td>Tested by</td>
<td>Lenovo Global Technology</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SPECrate2017_int_base</th>
<th>110</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECrate2017_int_peak</td>
<td>Not Run</td>
</tr>
</tbody>
</table>

**Test Sponsor:** Lenovo Global Technology  
**Hardware Availability:** Apr-2019  
**Software Availability:** Dec-2018  
**Test Date:** Apr-2019

## Compiler Version Notes (Continued)

---

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.

---

## Base Compiler Invocation

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

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

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

## Base Portability Flags

```  
500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64  
502.gcc_r: -DSPEC_LP64  
505.mcf_r: -DSPEC_LP64  
520.omnetpp_r: -DSPEC_LP64  
523.xalancbmk_r: -DSPEC_LP64 -DSPEC_LINUX  
525.x264_r: -DSPEC_LP64  
531.deepsjeng_r: -DSPEC_LP64
```

(Continued on next page)
<table>
<thead>
<tr>
<th>Base Portability Flags (Continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td>541.leela_r: -DSPEC_LP64</td>
</tr>
<tr>
<td>548.exchange2_r: -DSPEC_LP64</td>
</tr>
<tr>
<td>557.xz_r: -DSPEC_LP64</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Base Optimization Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C benchmarks:</strong></td>
</tr>
<tr>
<td>-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div</td>
</tr>
<tr>
<td>-qopt-mem-layout-trans=4</td>
</tr>
<tr>
<td>-L/usr/local/IntelCompiler19/compilers_andLibraries_2019.1.144/linux/compiler/lib/intel64</td>
</tr>
<tr>
<td>-lqkmalloc</td>
</tr>
</tbody>
</table>

| **C++ benchmarks:**       |
| -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div |
| -qopt-mem-layout-trans=4 |
| -L/usr/local/IntelCompiler19/compilers_andLibraries_2019.1.144/linux/compiler/lib/intel64 |
| -lqkmalloc                |

| **Fortran benchmarks:**   |
| -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div |
| -qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte |
| -L/usr/local/IntelCompiler19/compilers_andLibraries_2019.1.144/linux/compiler/lib/intel64 |
| -lqkmalloc                |

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-A.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-A.xml