## Lenovo Global Technology

### ThinkSystem SR550

(2.00 GHz, Intel Xeon Silver 4109T)

<table>
<thead>
<tr>
<th>Test Sponsor</th>
<th>Lenovo Global Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware Availability</td>
<td>Aug-2017</td>
</tr>
<tr>
<td>Software Availability</td>
<td>Sep-2017</td>
</tr>
</tbody>
</table>

### CPU2017 License

9017

### Test Date

Nov-2017

### Hardware

**CPU Name:** Intel Xeon Silver 4109T  
**Max MHz.:** 3000  
**Nominal:** 2000  
**Enabled:** 16 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:** 11 MB I+D on chip per chip  
**Memory:** 384 GB (12 x 32 GB 2Rx4 PC4-2666V-R, running at 2400)  
**Storage:** 1 x 800 GB SAS SSD  
**Other:** None

### Software

**OS:** SUSE Linux Enterprise Server 12 SP2 (x86_64)  
**Kernel:** 4.4.21-69-default  
**Compiler:** C/C++: Version 18.0.0.128 of Intel C/C++  
**Compiler for Linux:** Fortran: Version 18.0.0.128 of Intel Fortran  
**Firmware:** Lenovo BIOS Version TEE119J 1.20 released Sep-2017  
**File System:** btrfs  
**System State:** Run level 3 (multi-user)  
**Base Pointers:** 64-bit  
**Peak Pointers:** 32/64-bit  
**Other:** jemalloc: jemalloc memory allocator library V5.0.1; jemalloc: configured and built at default for 32bit (i686) and 64bit (x86_64) targets; jemalloc: built with the RedHat Enterprise 7.4, and the system compiler gcc 4.8.5; jemalloc: sources available from jemalloc.net or releases

### SPEC® CPU2017 Integer Rate Result

**SPECrate2017_int_base = 70.3**  
**SPECrate2017_int_peak = 74.9**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>SPECrate2017_int_base</th>
<th>SPECrate2017_int_peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>perlbench_r</td>
<td>32</td>
<td>74.9</td>
<td></td>
</tr>
<tr>
<td>gcc_r</td>
<td>32</td>
<td>70.3</td>
<td></td>
</tr>
<tr>
<td>mcf_r</td>
<td>32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>omnetpp_r</td>
<td>32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xalancbmk_r</td>
<td>32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>x264_r</td>
<td>32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>deepsjeng_r</td>
<td>32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>leela_r</td>
<td>32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>exchange2_r</td>
<td>32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xz_r</td>
<td>32</td>
<td></td>
<td></td>
</tr>
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</table>
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Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Base</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Peak</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>500.perlbench_r</td>
<td>32</td>
<td>973</td>
<td>52.4</td>
<td>974</td>
<td>52.3</td>
<td>975</td>
<td>52.2</td>
<td>783</td>
<td>65.1</td>
<td>783</td>
<td>65.1</td>
</tr>
<tr>
<td>502.gcc_r</td>
<td>32</td>
<td>726</td>
<td>62.4</td>
<td>724</td>
<td>62.6</td>
<td>716</td>
<td>63.3</td>
<td>611</td>
<td>74.1</td>
<td>613</td>
<td>73.9</td>
</tr>
<tr>
<td>505.mcf_r</td>
<td>32</td>
<td>569</td>
<td>91.0</td>
<td>591</td>
<td>87.6</td>
<td>583</td>
<td>88.7</td>
<td>581</td>
<td>89.0</td>
<td>587</td>
<td>88.0</td>
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<tr>
<td>520.omnetpp_r</td>
<td>32</td>
<td>901</td>
<td>46.6</td>
<td>903</td>
<td>46.5</td>
<td>903</td>
<td>46.5</td>
<td>890</td>
<td>47.2</td>
<td>893</td>
<td>47.0</td>
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<tr>
<td>523.xalancbmk_r</td>
<td>32</td>
<td>458</td>
<td>73.8</td>
<td>467</td>
<td>72.3</td>
<td>467</td>
<td>72.4</td>
<td>380</td>
<td>89.0</td>
<td>379</td>
<td>89.0</td>
</tr>
<tr>
<td>525.x264_r</td>
<td>32</td>
<td>421</td>
<td>133</td>
<td>421</td>
<td>133</td>
<td>426</td>
<td>132</td>
<td>408</td>
<td>137</td>
<td>406</td>
<td>138</td>
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<tr>
<td>531.deepsjeng_r</td>
<td>32</td>
<td>611</td>
<td>60.0</td>
<td>611</td>
<td>60.0</td>
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<td>60.1</td>
<td>610</td>
<td>60.1</td>
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<tr>
<td>541.leela_r</td>
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<td>955</td>
<td>55.5</td>
<td>956</td>
<td>55.4</td>
<td>952</td>
<td>55.7</td>
<td>956</td>
<td>55.5</td>
<td>950</td>
<td>55.8</td>
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<tr>
<td>548.exchange2_r</td>
<td>32</td>
<td>664</td>
<td>130</td>
<td>664</td>
<td>130</td>
<td>646</td>
<td>130</td>
<td>645</td>
<td>130</td>
<td>646</td>
<td>130</td>
</tr>
<tr>
<td>557.xz_r</td>
<td>32</td>
<td>664</td>
<td>52.0</td>
<td>659</td>
<td>52.4</td>
<td>659</td>
<td>52.5</td>
<td>660</td>
<td>52.3</td>
<td>664</td>
<td>52.0</td>
</tr>
</tbody>
</table>

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/cpu2017.1.0.2.ic18.0/lib/ia32:/home/cpu2017.1.0.2.ic18.0/lib/intel64"
LD_LIBRARY_PATH = "$LD_LIBRARY_PATH:/home/cpu2017.1.0.2.ic18.0/je5.0.1-32:/home/cpu2017.1.0.2.ic18.0/je5.0.1-64"
Binaries compiled on a system with 1x Intel Core i7-4790 CPU + 32GB RAM
memory using Redhat Enterprise Linux 7.4
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>

Platform Notes

BIOS configuration:
Choose Operating Mode set to Maximum Performance

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

**Lenovo Global Technology**
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<table>
<thead>
<tr>
<th>CPU2017 License:</th>
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<th>Test Date:</th>
<th>Nov-2017</th>
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<tr>
<td>Test Sponsor:</td>
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<td>Hardware Availability:</td>
<td>Aug-2017</td>
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<td>Tested by:</td>
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**SPECrate2017_int_base = 70.3**  
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**Platform Notes (Continued)**

- DCU Streamer Prefetcher set to Enable
- MONITORMWAIT set to Enable
- SNC set to Enable
- LLC dead line alloc set to Disable
- XPT Prefetcher set to Enable
- Sysinfo program /home/cpu2017.1.0.2.ic18.0/bin/sysinfo
- Rev: r5797 of 2017-06-14 96c45e4568ad54c135fd618b909c0f
- running on linux-g50d Tue Nov 7 08:21:04 2017

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 4109T CPU @ 2.00GHz
- 2 "physical id"s (chips)
- 32 "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 : 8
  - siblings : 16
  - physical 0: cores 0 1 2 3 4 5 6 7
  - physical 1: cores 0 1 2 3 4 5 6 7

From lscpu:
- Architecture: x86_64
- CPU op-mode(s): 32-bit, 64-bit
- Byte Order: Little Endian
- CPU(s): 32
- On-line CPU(s) list: 0-31
- Thread(s) per core: 2
- Core(s) per socket: 8
- Socket(s): 2
- NUMA node(s): 2
- Vendor ID: GenuineIntel
- CPU family: 6
- Model: 85
- Model name: Intel(R) Xeon(R) Silver 4109T CPU @ 2.00GHz
- Stepping: 4
- CPU MHz: 1995.319
- BogoMIPS: 3990.63
- Virtualization: VT-x
- L1d cache: 32K
- L1i cache: 32K
- L2 cache: 1024K
- L3 cache: 11264K
- NUMA node0 CPU(s): 0-7,16-23

(Continued on next page)
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</tr>
</tbody>
</table>

**Platform Notes (Continued)**

NUMA node1 CPU(s): 8-15, 24-31

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
aperfmon perfmonitor cpuid dts dtes64 monitor ds cpl vmx smx est tm2 ssse3 sdbg
fma cx16 xtr阅 pdcsc pdcd dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes
xsave avx f16c rdrand lahf_lm abm 3dnowprefetch ida arat epb pln pts dtherm intel_pt
tpr_shadow vmm flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2
emms invpcid rdram cmp cqm mxav512f avx512dq rdseed adx smap clflushopt clwb avx512cd
avx512bw avx512vl xsaveopt xsavec xgetbv1 cqm_llc cqm_occup_llc

From /proc/cpuinfo cache data

| cache size | 11264 KB |

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</td>
<td>cpus: 0 1 2 3 4 5 6 7 16 17 18 19 20 21 22 23</td>
</tr>
<tr>
<td>node 0</td>
<td>size: 193111 MB</td>
</tr>
<tr>
<td>node 0</td>
<td>free: 192366 MB</td>
</tr>
<tr>
<td>node 1</td>
<td>cpus: 8 9 10 11 12 13 14 15 24 25 26 27 28 29 30 31</td>
</tr>
<tr>
<td>node 1</td>
<td>size: 193504 MB</td>
</tr>
<tr>
<td>node 1</td>
<td>free: 192810 MB</td>
</tr>
<tr>
<td>node distances:</td>
<td></td>
</tr>
<tr>
<td>node 0</td>
<td>0 1</td>
</tr>
<tr>
<td>0: 10 21</td>
<td></td>
</tr>
<tr>
<td>1: 21 10</td>
<td></td>
</tr>
</tbody>
</table>

From /proc/meminfo

<table>
<thead>
<tr>
<th>MemTotal:</th>
<th>395894288 kB</th>
</tr>
</thead>
<tbody>
<tr>
<td>HugePages_Total:</td>
<td>0</td>
</tr>
<tr>
<td>Hugepagesize:</td>
<td>2048 kB</td>
</tr>
</tbody>
</table>

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

SuSE-release:

- SUSE Linux Enterprise Server 12 (x86_64)
- VERSION = 12
- PATCHLEVEL = 2

# 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-SP2"
- VERSION_ID="12.2"
- PRETTY_NAME="SUSE Linux Enterprise Server 12 SP2"
- ID="sles"
- ANSI_COLOR="0;32"

(Continued on next page)
Platform Notes (Continued)

uname -a:
Linux linux-g50d 4.4.21-69-default #1 SMP Tue Oct 25 10:58:20 UTC 2016 (9464f67)
x86_64 x86_64 x86_64 GNU/Linux

run-level 3 Nov 7 08:19

SPEC is set to: /home/cpu2017.1.0.2.ic18.0

Filesystem Type Size Used Avail Use% Mounted on
/dev/sda2 btrfs 744G 151G 592G 21% /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 -[TEE119J-1.20]- 09/06/2017
Memory:
12x Hynix HMA84GR7AFR4N-VK 32 GB 2 rank 2666, configured at 2400

(End of data from sysinfo program)
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Compiler Version Notes (Continued)

CXXC 520.omnetpp_r(peak) 523.xalancbmk_r(peak) 531.deepsjeng_r(peak)
541.leela_r(peak)

icpc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

FC 548.exchange2_r(base, peak)

ifort (IFORT) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

---

Base Compiler Invocation

C benchmarks:
icc
C++ benchmarks:
icpc
Fortran benchmarks:
ifort

---

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
541.leela_r: -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64
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Base Optimization Flags

C benchmarks:
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=3 -L/usr/local/je5.0.1-64/lib -ljemalloc

C++ benchmarks:
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=3 -L/usr/local/je5.0.1-64/lib -ljemalloc

Fortran benchmarks:
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=3 -nostandard-realloc-lhs -align array32byte
-L/usr/local/je5.0.1-64/lib -ljemalloc

Base Other Flags

C benchmarks:
-m64 -std=c11

C++ benchmarks:
-m64

Fortran benchmarks:
-m64

Peak Compiler Invocation

C benchmarks:
icc

C++ benchmarks:
icpc

Fortran benchmarks:
ifort

Peak Portability Flags

500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
502.gcc_r: -D_FILE_OFFSET_BITS=64

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

505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
523.xalancbnmk_r: -D_FILE_OFFSET_BITS=64 -DSPEC_LINUX
525.x264_r: -DSPEC_LP64
531.deepsjeng_r: -DSPEC_LP64
541.leela_r: -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64

Peak Optimization Flags

C benchmarks:

500.perlbench_r: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
-xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=3 -fno-strict-overflow -L/usr/local/je5.0.1-64/lib
-ljemalloc

502.gcc_r: -L/opt/intel/compilers_and_libraries_2018/linux/lib/ia32
-Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
-xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=3 -L/usr/local/je5.0.1-32/lib -ljemalloc

505.mcf_r: -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=3 -L/usr/local/je5.0.1-64/lib
-ljemalloc

525.x264_r: -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=3 -fno-alias -L/usr/local/je5.0.1-64/lib -ljemalloc

557.xz_r: Same as 505.mcf_r

C++ benchmarks:

520.omnetpp_r: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
-xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=3 -L/usr/local/je5.0.1-64/lib -ljemalloc

523.xalancbnmk_r: -L/opt/intel/compilers_and_libraries_2018/linux/lib/ia32
-Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
-xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=3 -L/usr/local/je5.0.1-32/lib -ljemalloc

(Continued on next page)
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Peak Optimization Flags (Continued)

531.deepsjeng_r: Same as 520.omnetpp_r
541.leela_r: Same as 520.omnetpp_r

Fortran benchmarks:
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=3 -nostandard-realloc-lhs -align array32byte
-L/usr/local/je5.0.1-64/lib -ljemalloc

Peak Other Flags

C benchmarks (except as noted below):
-m64 -std=c11
502.gcc_r: -m32 -std=c11

C++ benchmarks (except as noted below):
-m64
523.xalancbmk_r: -m32

Fortran benchmarks:
-m64

The flags files that were used to format this result can be browsed at:
http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.html
http://www.spec.org/cpu2017/flags/Lenovo-Platform-Flags-V1.2-SKL-F.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.xml
http://www.spec.org/cpu2017/flags/Lenovo-Platform-Flags-V1.2-SKL-F.xml

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