Lenovo Global Technology

ThinkSystem SN550 (2.20 GHz, Intel Xeon Gold 5220R)

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

CPU Name: Intel Xeon Gold 5220R
Max MHz: 4000
Nominal: 2200
Enabled: 48 cores, 2 chips, 2 threads/core
Orderable: 1.2 cores/chip
Cache L1: 32 KB I + 32 KB D on chip per core
L2: 1 MB I+D on chip per core
L3: 35.75 MB I+D on chip per chip
Other: None
Memory: 768 GB (24 x 32 GB 2Rx4 PC4-2933Y-R, running at 2666)
Storage: 1 x 960 GB SATA SSD
Other: None

OS: Red Hat Enterprise Linux 8.1 (Ootpa)
Compiler: C/C++: Version 19.0.5.281 of Intel C/C++
Compiler for Linux:
Fortran: Version 19.0.5.281 of Intel Fortran
Compiler for Linux:
Parallel: No
Firmware: Lenovo BIOS Version IVE152L 2.51 released Feb-2020 tested as IVE151L 2.51 Jan-2020
File System: xfs
System State: Run level 3 (multi-user)
Base Pointers: 64-bit
Peak Pointers: Not Applicable
Other: None
Power Management: BIOS set to prefer performance at the cost of additional power usage

SPEC CPU®2017 Integer Rate Result
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SPECrate®2017_int_base = 265
SPECrate®2017_int_peak = Not Run

Test Date: Mar-2020
Hardware Availability: Mar-2020
Software Availability: Nov-2019

Hardware

<table>
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<tr>
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<th>SPECrate®2017_int_base (265)</th>
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<tr>
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<td>505.mcf_r</td>
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<td>525.x264_r</td>
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<tr>
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<tr>
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<tr>
<td>548.exchange2_r</td>
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<td>557.xz_r</td>
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</table>

Software

OS: Red Hat Enterprise Linux 8.1
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Results Table

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<th>Copies</th>
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<td>616</td>
<td>168</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"

Environment Variables Notes
Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = 
"/home/cpu2017-1.1.0-ic19.0u5/lib/intel64:/home/cpu2017-1.1.0-ic19.0u5/lib/ia32:/home/cpu2017-1.1.0-ic19.0u5/je5.0.1-32"

General Notes
Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM memory using Redhat Enterprise Linux 8.0
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.:

(Continued on next page)
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SPECrate®2017_int_base = 265 
SPECrate®2017_int_peak = Not Run 

General Notes (Continued) 

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. 
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 
Stale AtoS set to Enable 

Sysinfo program /home/cpu2017-1.1.0-ic19.0u5/bin/sysinfo 
Rev: r6365 of 2019-08-21 295195f888a3d7eddb1e6a46a485a0011 running on localhost.localdomain Thu Mar 12 22:36:52 2020 

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 5220R CPU @ 2.20GHz 
  2 "physical id"s (chips) 
  96 "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 : 24 
  siblings : 48 
  physical 0: cores 0 1 2 3 4 5 6 9 10 11 12 13 16 17 18 19 20 21 24 25 26 27 28 29 
  physical 1: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 16 17 18 19 20 21 24 25 26 27 28 29 

From lscpu: 
Architecture: x86_64 
CPU op-mode(s): 32-bit, 64-bit 
Byte Order: Little Endian 
CPU(s): 96 
On-line CPU(s) list: 0-95 
Thread(s) per core: 2 

(Continued on next page)
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Platform Notes (Continued)

Core(s) per socket: 24
Socket(s): 2
NUMA node(s): 4
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Gold 5220R CPU @ 2.20GHz
Stepping: 7
CPU MHz: 2903.904
CPU max MHz: 4000.0000
CPU min MHz: 1000.0000
BogoMIPS: 4400.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 36608K
NUMA node0 CPU(s): 0-3,7,8,12-14,18-20,48-51,55,56,60-62,66-68
NUMA node1 CPU(s): 4-6,9-11,15-17,21-23,52-54,57-59,63-65,69-71
NUMA node2 CPU(s): 24-27,31-33,37-39,43,44,72-75,79-81,85-87,91,92
NUMA node3 CPU(s): 28-30,34-36,40-42,45-47,76-78,82-84,88-90,93-95

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 rdxtsc
lm constant_tsc art_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid
aperfmpref fpi pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16
xtr pdc mcpc 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 _ ppin ssbd mba ibrs ibpb stibp ibrs _ enhanced tpr _ shadow vmni
flexpriority ep vpid fsbgbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtmi
cmq mxp rdt _ a avx512f avx512dq rdseed adx smap clflushopt clwb intel _ pt avx512cd
avx512bw avx512vl xsaveopt xsaves cmq _ llc cmq _ total cmq _ mbm _ local dtherm ida arat pln pts pk u ospe akavx512_vnni md _ clear flush _ lld
arch _ capabilities

/proc/cpuinfo cache data
cache size: 36608 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 3 7 8 12 13 14 18 19 20 48 49 50 51 55 56 60 61 62 66 67 68
node 0 size: 193150 MB
node 0 free: 191817 MB
node 1 cpus: 4 5 6 9 10 11 15 16 17 21 22 23 52 53 54 57 58 59 63 64 65 69 70 71
node 1 size: 193531 MB
node 1 free: 193258 MB
node 2 cpus: 24 25 26 27 31 32 33 37 38 39 43 44 72 73 74 75 79 80 81 85 86 87 91 92

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

node 2 size: 193505 MB  
node 2 free: 193165 MB  
node 3 cpus: 28 29 30 34 35 40 41 42 45 46 47 76 77 78 82 83 84 88 89 90 93 94 95  
node 3 size: 193530 MB  
node 3 free: 193248 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:       792286704 kB  
HugePages_Total:       0  
Hugepagesize:       2048 kB  

From /etc/*release* /etc/*version*  
os-release:  
  NAME="Red Hat Enterprise Linux"  
  VERSION="8.1 (Ootpa)"  
  ID="rhel"  
  ID_LIKE="fedora"  
  VERSION_ID="8.1"  
  PLATFORM_ID="platform:el8"  
  PRETTY_NAME="Red Hat Enterprise Linux 8.1 (Ootpa)"  
  ANSI_COLOR="0;31"  
  redhat-release: Red Hat Enterprise Linux release 8.1 (Ootpa)  
  system-release: Red Hat Enterprise Linux release 8.1 (Ootpa)  
  system-release-cpe: cpe:/o:redhat:enterprise_linux:8.1:ga  

uname -a:  
  Linux localhost.localdomain 4.18.0-147.el8.x86_64 #1 SMP Thu Sep 26 15:52:44 UTC 2019  
  x86_64 x86_64 x86_64 GNU/Linux  

Kernel self-reported vulnerability status:  

- **CVE-2018-3620 (L1 Terminal Fault):** Not affected  
- **Microarchitectural Data Sampling:** Not affected  
- **CVE-2017-5754 (Meltdown):** Not affected  
- **CVE-2018-3639 (Speculative Store Bypass):** Mitigation: Speculative Store Bypass disabled via prctl and seccomp  
- **CVE-2017-5753 (Spectre variant 1):** Mitigation: usercopy/swapgs barriers and __user pointer sanitization  
- **CVE-2017-5715 (Spectre variant 2):** Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling

(Continued on next page)
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Tested by: Lenovo Global Technology

Test Date: Mar-2020
Hardware Availability: Mar-2020
Software Availability: Nov-2019

### Platform Notes (Continued)

run-level 3 Mar 12 22:35

SPEC is set to: /home/cpu2017-1.1.0-ic19.0u5

<table>
<thead>
<tr>
<th>Filesystem</th>
<th>Type</th>
<th>Size</th>
<th>Used</th>
<th>Avail</th>
<th>Use%</th>
<th>Mounted on</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/sdb4</td>
<td>xfs</td>
<td>840G</td>
<td>38G</td>
<td>803G</td>
<td>5%</td>
<td>/home</td>
</tr>
</tbody>
</table>

From /sys/devices/virtual/dmi/id
BIOS: Lenovo -[IVE151L-2.51]- 01/14/2020
Vendor: Lenovo
Product: ThinkSystem SN550 -[7X16CT00WW]-
Product Family: ThinkSystem
Serial: 1234567890

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.

Memory:
24x Samsung M393A4K40CB2-CVF 32 GB 2 rank 2933

(End of data from sysinfo program)

### Compiler Version Notes

```
C      | 500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base)
| 525.x264_r(base) 557.xz_r(base)

Intel(R) C Compiler for applications running on Intel(R) 64, Version 19.0.5
NextGen Technology Build 20190729
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.
```

```
C++    | 520.omnetpp_r(base) 523.xalancbmk_r(base) 531.deepsjeng_r(base)
| 541.leela_r(base)

Intel(R) C++ Compiler for applications running on Intel(R) 64, Version 19.0.5
NextGen Technology Build 20190729
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.
```

```
Fortran | 548.exchange2_r(base)

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
```

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### Compiler Version Notes (Continued)

64, Version 19.0.5.281 Build 20190815
Copyright (C) 1985-2019 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

### Base Optimization Flags

- **C benchmarks:**
  - -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -flto
  - -mfpmath=sse -funroll-loops -qnextgen -fuse-ld=gold
  - -qopt-mem-layout-trans=4
  - -L/usr/local/IntelCompiler19/compilers_and_libraries_2019.5.281/linux/compiler/lib/intel64_lin
  - -lqkmalloc

- **C++ benchmarks:**
  - -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -flto -mfpmath=sse
  - -funroll-loops -qnextgen -fuse-ld=gold -qopt-mem-layout-trans=4
  - -L/usr/local/IntelCompiler19/compilers_and_libraries_2019.5.281/linux/compiler/lib/intel64_lin

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**Lenovo Global Technology**

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</table>

### Base Optimization Flags (Continued)

**C++ benchmarks (continued):**
- -lqkmalloc

**Fortran benchmarks:**
- -m64  
  -W1,-z,muldefs -xCORE-AVX512 -O3 -ipo -no-prec-div  
  -qopt-mem-layout-trans=4 -nostandard-realloc-lhs  
  -L/usr/local/IntelCompiler19/compilers_and_libraries_2019.5.281/linux/compiler/lib/intel64_lin  
  -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-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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For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.