## Lenovo Global Technology

**ThinkSystem ST650 V2**  
*(2.20 GHz, Intel Xeon Gold 5320)*

**CPU2017 License:** 9017  
**Test Sponsor:** Lenovo Global Technology  
**Tested by:** Lenovo Global Technology  
**Test Date:** Jul-2021  
**Hardware Availability:** Jul-2021  
**Software Availability:** Dec-2020

### SPECrate\textsuperscript{®}2017 fp_base = 349

### SPECrate\textsuperscript{®}2017 fp_peak = Not Run

### Hardware

| Copies | 0  | 40.0 | 80.0 | 120 | 160 | 200 | 240 | 280 | 320 | 360 | 400 | 440 | 480 | 520 | 560 | 600 | 640 | 680 | 720 | 760 | 800 | 840 | 880 | 920 | 960 | 1000 |
|--------|----|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 503.bwaves_r | 104 |      |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 507.cactuBSSN_r | 104 |      |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 508.namd_r | 104 |      |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 510.parest_r | 104 |      |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 511.povray_r | 104 |      |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 519.lbm_r | 104 |      |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 521.wrf_r | 104 |      |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 526.blender_r | 104 |      |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 527.cam4_r | 104 |      |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 538.imagick_r | 104 |      |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 544.nab_r | 104 |      |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 549.fotonik3d_r | 104 |      |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 554.roms_r | 104 |      |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |

### Software

- **OS:** Red Hat Enterprise Linux 8.3 (Ootpa)  
  - Kernel 4.18.0-240.el8.x86_64
- **Compiler:**  
  - C/C++: Version 2021.1 of Intel oneAPI DPC++/C++ Compiler Build 20201113 for Linux;  
  - Fortran: Version 2021.1 of Intel Fortran Compiler Classic Build 20201112 for Linux
- **Parallel:** No
- **Firmware:** Lenovo BIOS Version USE111A 1.02 released May-2021
- **File System:** xfs
- **System State:** Run level 3 (multi-user)
- **Base Pointers:** 64-bit
- **Peak Pointers:** Not Applicable
- **Power Management:** BIOS and OS set to prefer performance at the cost of additional power usage

### Hardware

- **CPU Name:** Intel Xeon Gold 5320  
  - Max MHz: 3400  
  - Nominal: 2200  
  - Enabled: 52 cores, 2 chips, 2 threads/core  
  - Orderable: 1,2 chips  
  - Cache L1: 32 KB I + 48 KB D on chip per core  
  - L2: 1.25 MB I+D on chip per core  
  - L3: 39 MB I+D on chip per chip  
  - Other: None  
- **Memory:** 1 TB (32 x 32 GB 2Rx8 PC4-3200AA-R, running at 2933)  
- **Storage:** 1 x 960 GB SATA SSD  
- **Other:** None  

### Software

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Page 1  
Standard Performance Evaluation Corporation (info@spec.org)  
https://www.spec.org/
Lenovo Global Technology

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(2.20 GHz, Intel Xeon Gold 5320)

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

Test Date: Jul-2021
Hardware Availability: Jul-2021
Software Availability: Dec-2020

Results Table

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</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"

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH =
"/home/cpu2017-1.1.8-ic2021.1-revB/lib/intel64:/home/cpu2017-1.1.8-ic202
1.1-revB/je5.0.1-64"
MALLOC_CONF = "retain:true"

General Notes

Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM
memory using Red Hat Enterprise Linux 8.1
Transparent Huge Pages enabled by default

(Continued on next page)
Lenovo Global Technology
ThinkSystem ST650 V2
(2.20 GHz, Intel Xeon Gold 5320)

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

<table>
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<tr>
<th>SPECrate®2017_fp_base = 349</th>
<th>Test Date: Jul-2021</th>
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<tr>
<td>SPECrate®2017_fp_peak = Not Run</td>
<td>Hardware Availability: Jul-2021</td>
</tr>
<tr>
<td></td>
<td>Software Availability: Dec-2020</td>
</tr>
</tbody>
</table>

General Notes (Continued)

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.:
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.

jemalloc, a general purpose malloc implementation
built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5

Platform Notes

BIOS configuration:
Choose Operating Mode set to Maximum Performance and then set it to Custom Mode
SNC set to Enabled

Sysinfo program /home/cpu2017-1.1.8-ic2021.1-revB/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acaf64d
running on localhost.localdomain Tue Jul 27 17:33:57 2021

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 5320 CPU @ 2.20GHz
    2 "physical id"s (chips)
    104 "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 : 26
siblings : 52
physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

From lscpu from util-linux 2.32.1:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian

(Continued on next page)
Platform Notes (Continued)

CPU(s): 104
On-line CPU(s) list: 0-103
Thread(s) per core: 2
Core(s) per socket: 26
Socket(s): 2
NUMA node(s): 4
Vendor ID: GenuineIntel
CPU family: 6
Model: 106
Model name: Intel(R) Xeon(R) Gold 5320 CPU @ 2.20GHz
Stepping: 6
CPU MHz: 2800.000
BogoMIPS: 4400.00
Virtualization: VT-x
L1d cache: 48K
L1i cache: 32K
L2 cache: 1280K
L3 cache: 39936K
NUMA node0 CPU(s): 0-12,52-64
NUMA node1 CPU(s): 13-25,65-77
NUMA node2 CPU(s): 26-38,78-90
NUMA node3 CPU(s): 39-51,91-103
Flags: fpu vme de pse tsc msr pae mce cmov pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp lm constant_tsc arch_perfmon pebs bts rep_good ntopology nonstop_tsc cpuid aperfmperf pni pclmulqdq dtes64 ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid dca ssd4_1 sse4_1 mce xsave xaes xsaveopt xsaves l 共享内存的内存节点 (0-3)
node 0 cpus: 0 1 2 3 4 5 6 7 8 9 10 11 12 52 53 54 55 56 57 58 59 60 61 62 63 64
node 0 size: 252358 MB
node 0 free: 257236 MB
node 1 cpus: 13 14 15 16 17 18 19 20 21 22 23 24 25 65 66 67 68 69 70 71 72 73 74 75 76 77

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 4 5 6 7 8 9 10 11 12 52 53 54 55 56 57 58 59 60 61 62 63 64
node 0 size: 252358 MB
node 0 free: 257236 MB
node 1 cpus: 13 14 15 16 17 18 19 20 21 22 23 24 25 65 66 67 68 69 70 71 72 73 74 75 76 77

(Continued on next page)
Lenovo Global Technology

ThinkSystem ST650 V2
(2.20 GHz, Intel Xeon Gold 5320)

SPECratenet_2017_fp_base = 349
SPECratenet_2017_fp_peak = Not Run

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

Test Date: Jul-2021
Hardware Availability: Jul-2021
Software Availability: Dec-2020

Platform Notes (Continued)

node 1 size: 252821 MB
node 1 free: 257708 MB
node 2 cpus: 26 27 28 29 30 31 32 33 34 35 36 37 38 78 79 80 81 82 83 84 85 86 87 88 89 90
node 2 size: 252301 MB
node 2 free: 257796 MB
node 3 cpus: 39 40 41 42 43 44 45 46 47 48 49 50 51 91 92 93 94 95 96 97 98 99 100 101 102 103
node 3 size: 252165 MB
node 3 free: 257453 MB
node distances:
node 0  1  2  3
0: 10 11 20 20
1: 11 10 20 20
2: 20 20 10 11
3: 20 20 11 10

From /proc/meminfo
MemTotal: 1056479420 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

/sbin/tuned-adm active
Current active profile: balanced

From /etc/*release*/etc/*version*
os-release:
NAME="Red Hat Enterprise Linux"
VERSION="8.3 (Ootpa)"
ID="rhel"
ID_LIKE="fedora"
VERSION_ID="8.3"
PLATFORM_ID="platform:el8"
PRETTY_NAME="Red Hat Enterprise Linux 8.3 (Ootpa)"
ANSI_COLOR="0;31"
redhat-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
system-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
system-release-cpe: cpe:/o:redhat:enterprise_linux:8.3:ga

uname -a:
Linux localhost.localdomain 4.18.0-240.el8.x86_64 #1 SMP Wed Sep 23 05:13:10 EDT 2020
x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:
CVE-2018-12207 (iTLB Multihit): Not affected
CVE-2018-3620 (L1 Terminal Fault): Not affected

(Continued on next page)
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### CPU2017 License: 9017  
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### SPEC CPU 2017 Floating Point Rate Result

**SPECrade®2017_fp_base = 349**  
**SPECrade®2017_fp_peak = Not Run**

| Test Date: | Jul-2021  
| Hardware Availability: | Jul-2021  
| Software Availability: | Dec-2020

### Platform Notes (Continued)

- **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
- **CVE-2020-0543 (Special Register Buffer Data Sampling):** Not affected
- **CVE-2019-11135 (TSX Asynchronous Abort):** Not affected

- **run-level 3 Jul 27 17:33**
- **SPEC is set to: /home/cpu2017-1.1.8-ic2021.1-revB**
- **Filesystem Type Size Used Avail Use% Mounted on**
  - /dev/sda4 xfs 818G 108G 710G 14% /home

- **From /sys/devices/virtual/dmi/id**
  - **Vendor:** Lenovo
  - **Product:** ThinkSystem ST650V2
  - **Product Family:** ThinkSystem
  - **Serial:** 1234567890

- **Additional information from dmidecode 3.2 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:**
  - 32x Samsung M393A4G43AB3-CWE 32 GB 2 rank 3200, configured at 2933

- **BIOS:**
  - **BIOS Vendor:** Lenovo
  - **BIOS Version:** U8E111A-1.02
  - **BIOS Date:** 05/07/2021
  - **BIOS Revision:** 1.2
  - **Firmware Revision:** 1.40

(End of data from sysinfo program)

### Compiler Version Notes

```
==============================================================================
C               | 519.lbm_r(base) 538.imagick_r(base) 544.nab_r(base)
==============================================================================
```

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## Lenovo Global Technology

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### Compiler Version Notes (Continued)

Intel (R) oneAPI DPC++/C++ Compiler for applications running on Intel (R) 64, Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

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Intel (R) Fortran Intel(R) 64 Compiler Classic for applications running on Intel (R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

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(Continued on next page)
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SPECratever 2017 fp_base = 349
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Compiler Version Notes (Continued)

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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

Base Compiler Invocation

C benchmarks:
icx
C++ benchmarks:
icpx
Fortran benchmarks:
ifort
Benchmarks using both Fortran and C:
ifort icx
Benchmarks using both C and C++:
icpx icx
Benchmarks using Fortran, C, and C++:
icpx icx ifort

Base Portability Flags

503.bwaves_r: -DSPEC_LP64
507.cactuBSSN_r: -DSPEC_LP64
508.namd_r: -DSPEC_LP64
510.parest_r: -DSPEC_LP64
511.povray_r: -DSPEC_LP64
519.ibm_r: -DSPEC_LP64
521.wrf_r: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
526.blender_r: -DSPEC_LP64 -DSPEC_LINUX -funsigned-char
527.cam4_r: -DSPEC_LP64 -DSPEC_CASE_FLAG
538.imagick_r: -DSPEC_LP64
544.nab_r: -DSPEC_LP64

(Continued on next page)
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Table: Base Optimization Flags

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| -w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math |
| -flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 |
| -mbranches-within-32B-boundaries -ljemalloc |
| -L/usr/local/jemalloc64-5.0.1/lib         |
| C++ benchmarks:
| -w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math -flto |
| -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 |
| -mbranches-within-32B-boundaries -ljemalloc |
| -L/usr/local/jemalloc64-5.0.1/lib         |
| Fortran benchmarks:
| -w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ipo -no-prec-div |
| -qopt-prefetch -ffinite-math-only         |
| -qopt-multiple-gather-scatter-by-shuffles -qopt-mem-layout-trans=4 |
| -nstandard-realloc-lhs -align array32byte -auto |
| -mbranches-within-32B-boundaries -ljemalloc |
| -L/usr/local/jemalloc64-5.0.1/lib         |
| Benchmarks using both Fortran and C:
| -w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math |
| -flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -O3 -ipo |
| -no-prec-div -qopt-prefetch -ffinite-math-only |
| -qopt-multiple-gather-scatter-by-shuffles |
| -mbranches-within-32B-boundaries -nstandard-realloc-lhs |
| -align array32byte -auto -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib |
| Benchmarks using both C and C++:
| -w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math |
| -flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 |
| -mbranches-within-32B-boundaries -ljemalloc |
| -L/usr/local/jemalloc64-5.0.1/lib         |
| Benchmarks using Fortran, C, and C++:
| -w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math |
| -flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -O3 |
| -no-prec-div -qopt-prefetch -ffinite-math-only |
| -qopt-multiple-gather-scatter-by-shuffles |

(Continued on next page)
Lenovo Global Technology
ThinkSystem ST650 V2
(2.20 GHz, Intel Xeon Gold 5320)

SPECrater®2017_fp_base = 349
SPECrater®2017_fp_peak = Not Run

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

Test Date: Jul-2021
Hardware Availability: Jul-2021
Software Availability: Dec-2020

Base Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++ (continued):
-mbranches-within-32B-boundaries -nostandard-realloc-lhs
-align array32byte -auto -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib

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-ICElake-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-ICElake-F.xml
http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64_revA.xml

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For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

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