Lenovo Global Technology
ThinkSystem SN550 V2
(2.90 GHz, Intel Xeon Gold 6326)

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

SPECrater®2017_fp_base = 281
SPECrater®2017_fp_peak = Not Run

---

**Hardware**

- **CPU Name:** Intel Xeon Gold 6326
- **Max MHz:** 3500
- **Nominal:** 2900
- **Enabled:** 32 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:** 24 MB I+D on chip per chip
- **Other:** None
- **Memory:** 512 GB (16 x 32 GB 2Rx8 PC4-3200AA-R)
- **Storage:** 1 x 960 GB SATA SSD
- **Other:** None

**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;

- **Firmware:** No

- **File System:** xfs

- **System State:** Run level 3 (multi-user)

- **Base Pointers:** 64-bit

- **Peak Pointers:** Not Applicable

- **Other:** jemalloc memory allocator V5.0.1

- **Power Management:** BIOS and OS set to prefer performance at the cost of additional power usage

---

Copies

<table>
<thead>
<tr>
<th>Test Case</th>
<th>Copies</th>
<th>SPECrate 2017_fp_base</th>
<th>SPECrate 2017_fp_peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>503.bwaves_r</td>
<td>64</td>
<td>0</td>
<td>Not Run</td>
</tr>
<tr>
<td>507.cactuBSSN_r</td>
<td>64</td>
<td>197</td>
<td>Not Run</td>
</tr>
<tr>
<td>508.namd_r</td>
<td>64</td>
<td>153</td>
<td>Not Run</td>
</tr>
<tr>
<td>510.parest_r</td>
<td>64</td>
<td>291</td>
<td>Not Run</td>
</tr>
<tr>
<td>511.povray_r</td>
<td>64</td>
<td>226</td>
<td>Not Run</td>
</tr>
<tr>
<td>519.blp_r</td>
<td>64</td>
<td>274</td>
<td>Not Run</td>
</tr>
<tr>
<td>521.wrf_r</td>
<td>64</td>
<td>269</td>
<td>Not Run</td>
</tr>
<tr>
<td>526.blender_r</td>
<td>64</td>
<td>270</td>
<td>Not Run</td>
</tr>
<tr>
<td>527.cam4_r</td>
<td>64</td>
<td>270</td>
<td>Not Run</td>
</tr>
<tr>
<td>538.imagick_r</td>
<td>64</td>
<td>291</td>
<td>Not Run</td>
</tr>
<tr>
<td>544.nab_r</td>
<td>64</td>
<td>291</td>
<td>Not Run</td>
</tr>
<tr>
<td>549.fotonik3d_r</td>
<td>64</td>
<td>291</td>
<td>Not Run</td>
</tr>
<tr>
<td>554.roms_r</td>
<td>64</td>
<td>291</td>
<td>Not Run</td>
</tr>
</tbody>
</table>

---

503.bwaves_r 64
507.cactuBSSN_r 64
508.namd_r 64
510.parest_r 64
511.povray_r 64
519.blp_r 64
521.wrf_r 64
526.blender_r 64
527.cam4_r 64
538.imagick_r 64
544.nab_r 64
549.fotonik3d_r 64
554.roms_r 64
## Lenovo Global Technology

**ThinkSystem SN550 V2**  
(2.90 GHz, Intel Xeon Gold 6326)

**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

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Base Copies</th>
<th>Base Seconds</th>
<th>Base Ratio</th>
<th>Peak Copies</th>
<th>Peak Seconds</th>
<th>Peak Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>503.bwaves_r</td>
<td>64</td>
<td>1011</td>
<td>635</td>
<td>1011</td>
<td>635</td>
<td>1011</td>
</tr>
<tr>
<td>507.cactuBSSN_r</td>
<td>64</td>
<td>221</td>
<td>366</td>
<td>221</td>
<td>366</td>
<td>221</td>
</tr>
<tr>
<td>508.namd_r</td>
<td>64</td>
<td>308</td>
<td>197</td>
<td>309</td>
<td>197</td>
<td>309</td>
</tr>
<tr>
<td>510.parest_r</td>
<td>64</td>
<td>1097</td>
<td>153</td>
<td>1098</td>
<td>153</td>
<td>1098</td>
</tr>
<tr>
<td>511.povray_r</td>
<td>64</td>
<td>513</td>
<td>291</td>
<td>510</td>
<td>293</td>
<td>510</td>
</tr>
<tr>
<td>519.lbm_r</td>
<td>64</td>
<td>298</td>
<td>226</td>
<td>299</td>
<td>226</td>
<td>299</td>
</tr>
<tr>
<td>521.wrf_r</td>
<td>64</td>
<td>516</td>
<td>278</td>
<td>523</td>
<td>274</td>
<td>523</td>
</tr>
<tr>
<td>526.blender_r</td>
<td>64</td>
<td>362</td>
<td>269</td>
<td>362</td>
<td>269</td>
<td>362</td>
</tr>
<tr>
<td>527.cam4_r</td>
<td>64</td>
<td>415</td>
<td>270</td>
<td>415</td>
<td>271</td>
<td>413</td>
</tr>
<tr>
<td>538.imagick_r</td>
<td>64</td>
<td>232</td>
<td>685</td>
<td>234</td>
<td>681</td>
<td>236</td>
</tr>
<tr>
<td>544.nab_r</td>
<td>64</td>
<td>237</td>
<td>454</td>
<td>240</td>
<td>448</td>
<td>238</td>
</tr>
<tr>
<td>549.fotonik3d_r</td>
<td>64</td>
<td>1278</td>
<td>195</td>
<td>1278</td>
<td>195</td>
<td>1278</td>
</tr>
<tr>
<td>554.roms_r</td>
<td>64</td>
<td>824</td>
<td>123</td>
<td>822</td>
<td>124</td>
<td>821</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"

---

### 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 SN550 V2
(2.90 GHz, Intel Xeon Gold 6326)

**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
MONITOR/MWAIT set to Enabled
CPU P-state Control set to Legacy
Cl Enhanced Mode set to Enabled
Intel Virtualization Technology set to Disabled
SNC set to Enabled
XPT Prefetcher set to Disabled
UPI Prefetcher set to Disabled

Sysinfo program /home/cpu2017-1.1.8-ic2021.1-revB/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16aca6c56d
running on localhost.localdomain Sat Jul 3 04:59:11 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 6326 CPU @ 2.90GHz
  2 "physical id"'s (chips)
  64 "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 : 16
siblings : 32
physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

(Continued on next page)
Lenovo Global Technology
ThinkSystem SN550 V2
(2.90 GHz, Intel Xeon Gold 6326)

SPECrater®2017_fp_base = 281
SPECrater®2017_fp_peak = Not Run

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

Platform Notes (Continued)

From lscpu from util-linux 2.32.1:
Architectures: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 64
On-line CPU(s) list: 0-63
Thread(s) per core: 2
Core(s) per socket: 16
Socket(s): 2
NUMA node(s): 4
Vendor ID: GenuineIntel
CPU family: 6
Model: 106
Model name: Intel(R) Xeon(R) Gold 6326 CPU @ 2.90GHz
Stepping: 6
CPU MHz: 2023.613
CPU max MHz: 2901.0000
CPU min MHz: 800.0000
BogoMIPS: 5800.00
Virtualization: VT-x
L1d cache: 48K
L1i cache: 32K
L2 cache: 1280K
L3 cache: 24576K
NUMA node0 CPU(s): 0-7,32-39
NUMA node1 CPU(s): 8-15,40-47
NUMA node2 CPU(s): 16-23,48-55
NUMA node3 CPU(s): 24-31,56-63
Flags: fpu vme de pse tsc msr pae mce cmov pat pse36 clflush dts acpi mtrr pge mca cmov
pat pse36 clflush dts acpi mtrr pge mca cmov
From numactl --hardware
/WARNING: a numactl 'node' might or might not correspond to a physical chip.
Lenovo Global Technology

ThinkSystem SN550 V2
(2.90 GHz, Intel Xeon Gold 6326)

SPECrater®2017 fp_base = 281
SPECrater®2017 fp_peak = Not Run

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

available: 4 nodes (0-3)
node 0 cpus: 0 1 2 3 4 5 6 7 32 33 34 35 36 37 38 39
node 0 size: 126435 MB
node 0 free: 127891 MB
node 1 cpus: 8 9 10 11 12 13 14 15 40 41 42 43 44 45 46 47
node 1 size: 126848 MB
node 1 free: 128391 MB
node 2 cpus: 16 17 18 19 20 21 22 23 48 49 50 51 52 53 54 55
node 2 size: 127194 MB
node 2 free: 128534 MB
node 3 cpus: 24 25 26 27 28 29 30 31 56 57 58 59 60 61 62 63
node 3 size: 126961 MB
node 3 free: 128556 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:       527874276 kB
HugePages_Total:       0
Hugepagesize:       2048 kB

/sbin/tuned-adm active
Current active profile: throughput-performance

/sys/devices/system/cpu/cpu*/cpufreq/scaling_governor has performance

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

(Continued on next page)
Lenovo Global Technology
ThinkSystem SN550 V2
(2.90 GHz, Intel Xeon Gold 6326)

Platform Notes (Continued)

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
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 2 21:45

SPEC is set to: /home/cpu2017-1.1.8-ic2021.1-revB

From /sys/devices/virtual/dmi/id
Vendor: Lenovo
Product: ThinkSystem SN550 V2
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:
16x Samsung M393A4G43AB3-CWE 32 GB 2 rank 3200

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)
**SPEC CPU®2017 Floating Point Rate Result**

Lenovo Global Technology

ThinkSystem SN550 V2  
(2.90 GHz, Intel Xeon Gold 6326)

<table>
<thead>
<tr>
<th>SPECrate®2017_fp_base = 281</th>
<th>SPECrate®2017_fp_peak = Not Run</th>
</tr>
</thead>
</table>

**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

**Compiler Version Notes**

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

C++             | 508.namd_r(base) 510.parest_r(base)
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.

C++, C          | 511.povray_r(base) 526.blender_r(base)
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.

C++, C, Fortran | 507.cactuBSSN_r(base)
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.

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.

Fortran         | 503.bwaves_r(base) 549.fotonik3d_r(base) 554.roms_r(base)
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.
```

(Continued on next page)
Lenovo Global Technology
ThinkSystem SN550 V2
(2.90 GHz, Intel Xeon Gold 6326)

SPECraten 2017 fp_base = 281
SPECraten 2017 fp_peak = Not Run

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

Compiler Version Notes (Continued)

Fortran, C | 521.wrf_r(base) 527.cam4_r(base)

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.
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.lbm_r: -DSPEC_LP64  
521.wrf_r: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian  
526.blender_r: -DSPEC_LP64 -DSPEC_LINUX -funsigned-char

(Continued on next page)
Lenovo Global Technology
ThinkSystem SN550 V2
(2.90 GHz, Intel Xeon Gold 6326)

SPECrater®2017_fp_base = 281
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 Portability Flags (Continued)

527.cam4_r: -DSPEC_LP64 -DSPEC_CASE_FLAG
538.imagick_r: -DSPEC_LP64
544.nab_r: -DSPEC_LP64
549.fotonik3d_r: -DSPEC_LP64
554.roms_r: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
- 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 -nostandard-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

(Continued on next page)
**SPEC CPU®2017 Floating Point Rate Result**

Lenovo Global Technology

ThinkSystem SN550 V2
(2.90 GHz, Intel Xeon Gold 6326)

<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>

**Base Optimization Flags (Continued)**

- flto
- mfpmath=sse
- funroll-loops
- qopt-mem-layout-trans=4
- no-prec-div
- qopt-prefetch
- ffinite-math-only
- qopt-multiple-gather-scatter-by-shuffles
- 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


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


<table>
<thead>
<tr>
<th>SPECrate®2017_fp_base</th>
<th>281</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECrate®2017_fp_peak</td>
<td>Not Run</td>
</tr>
</tbody>
</table>

**Hardware Availability:** Jul-2021

**Software Availability:** Dec-2020

**Test Date:** Jul-2021

**Test Sponsor:** Lenovo Global Technology

**Tested by:** Lenovo Global Technology

**CPU2017 License:** 9017

**Test Date:** Jul-2021

**Hardware Availability:** Jul-2021

**Software Availability:** Dec-2020

---

SPEC CPU and SPECrate are registered trademarks of the Standard Performance Evaluation Corporation. All other brand and product names appearing in this result are trademarks or registered trademarks of their respective holders.

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

Tested with SPEC CPU®2017 v1.1.8 on 2021-07-02 16:59:11-0400.
Originally published on 2021-07-20.