



# SPEC CPU®2017 Floating Point Rate Result

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## Lenovo Global Technology

SPECrate®2017\_fp\_base = 193

ThinkSystem SR650  
(2.70 GHz, Intel Xeon Gold 5220S)

SPECrate®2017\_fp\_peak = Not Run

CPU2017 License: 9017

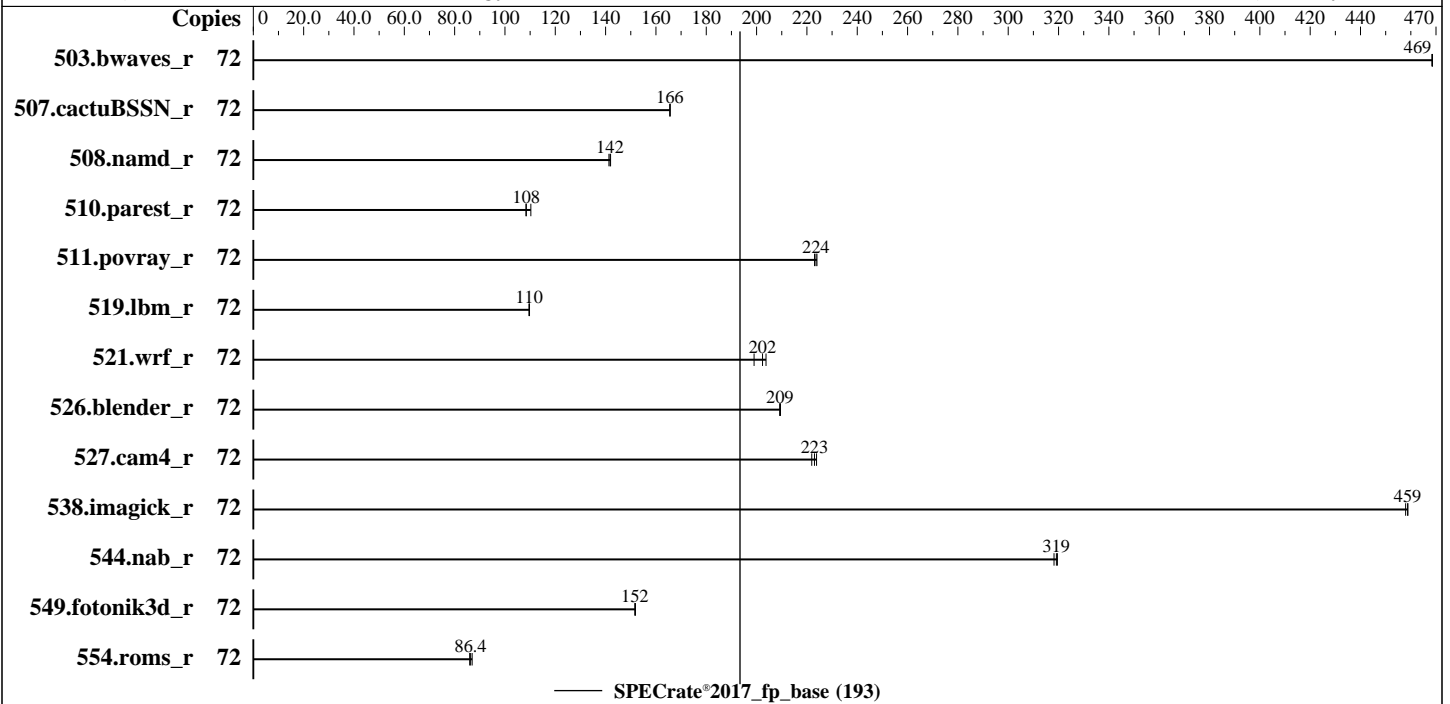
Test Date: Aug-2019

Test Sponsor: Lenovo Global Technology

Hardware Availability: Jul-2019

Tested by: Lenovo Global Technology

Software Availability: May-2019



### Hardware

CPU Name: Intel Xeon Gold 5220S  
 Max MHz: 3900  
 Nominal: 2700  
 Enabled: 36 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: 24.75 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 800 GB SATA SSD  
 Other: None

### Software

OS: Red Hat Enterprise Linux Server release 7.6 (Maipo)  
 Kernel 3.10.0-957.el7.x86\_64  
 Compiler: C/C++: Version 19.0.4.227 of Intel C/C++  
 Compiler for Linux;  
 Fortran: Version 19.0.4.227 of Intel Fortran  
 Compiler for Linux  
 Parallel: No  
 Firmware: Lenovo BIOS Version IVE142E 2.30 released Aug-2019 tested as IVE141E 2.30 Jul-2019  
 File System: xfs  
 System State: Run level 3 (multi-user)  
 Base Pointers: 64-bit  
 Peak Pointers: Not Applicable  
 Other: None  
 Power Management: --



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### Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
503.bwaves_r	72	1541	469	<u>1541</u>	<u>469</u>	1542	468							
507.cactuBSSN_r	72	<b>550</b>	<b>166</b>	550	166	551	166							
508.namd_r	72	482	142	<u>482</u>	<u>142</u>	484	141							
510.parest_r	72	1708	110	<u>1736</u>	<u>108</u>	1739	108							
511.povray_r	72	754	223	<u>752</u>	<u>224</u>	751	224							
519.lbm_r	72	692	110	<u>692</u>	<u>110</u>	691	110							
521.wrf_r	72	<b>797</b>	<b>202</b>	810	199	792	204							
526.blender_r	72	524	209	523	209	<b>524</b>	<b>209</b>							
527.cam4_r	72	<b>565</b>	<b>223</b>	563	224	567	222							
538.imagick_r	72	391	458	390	459	<b>390</b>	<b>459</b>							
544.nab_r	72	381	318	379	320	<b>380</b>	<b>319</b>							
549.fotonik3d_r	72	1850	152	<u>1850</u>	<u>152</u>	1848	152							
554.roms_r	72	<b>1325</b>	<b>86.4</b>	1316	87.0	1331	86.0							

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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/cpu2017-1.0.5-ic19.0u4/lib/intel64"

Binaries compiled on a system with 1x Intel Core i9-799X 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.:  
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.

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**Hardware Availability:** Jul-2019  
**Software Availability:** May-2019

### General Notes (Continued)

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

Choose Operating Mode set to Custom Mode

C-states set to Legacy

SNC set to Enable

DCU Streamer Prefetcher set to Disable

Trusted Execution Technology set to Enable

Stale AtoS set to Enable

LLC dead line alloc set to Disable

Patrol Scrub set to Disable

```
Sysinfo program /home/cpu2017-1.0.5-ic19.0u4/bin/sysinfo
Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9
running on localhost.localdomain Fri Aug 9 20:59:12 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) Gold 5220S CPU @ 2.70GHz
```

```
2 "physical id"s (chips)
```

```
72 "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 : 18
```

```
siblings : 36
```

```
physical 0: cores 0 1 2 3 4 8 9 10 11 16 17 18 19 20 24 25 26 27
```

```
physical 1: cores 0 1 2 3 4 8 9 10 11 16 17 18 19 20 24 25 26 27
```

From lscpu:

```
Architecture: x86_64
```

```
CPU op-mode(s): 32-bit, 64-bit
```

```
Byte Order: Little Endian
```

```
CPU(s): 72
```

```
On-line CPU(s) list: 0-71
```

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### Platform Notes (Continued)

```

Thread(s) per core:      2
Core(s) per socket:     18
Socket(s):               2
NUMA node(s):           4
Vendor ID:               GenuineIntel
CPU family:              6
Model:                   85
Model name:              Intel(R) Xeon(R) Gold 5220S CPU @ 2.70GHz
Stepping:                7
CPU MHz:                 2700.000
BogoMIPS:                5400.00
Virtualization:         VT-x
L1d cache:               32K
L1i cache:               32K
L2 cache:                1024K
L3 cache:                25344K
NUMA node0 CPU(s):      0-2,5,6,9,10,14,15,36-38,41,42,45,46,50,51
NUMA node1 CPU(s):      3,4,7,8,11-13,16,17,39,40,43,44,47-49,52,53
NUMA node2 CPU(s):      18-20,23,24,27,28,32,33,54-56,59,60,63,64,68,69
NUMA node3 CPU(s):      21,22,25,26,29-31,34,35,57,58,61,62,65-67,70,71
Flags:                   fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
pat pse36 clflush dts acpi mmx fxsr sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp
lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc
aperfmpperf eagerfpu pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg
fma cx16 xtpr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes
xsave avx f16c rdrand lahf_lm abm 3dnowprefetch epb cat_l3 cdp_l3 intel_ppin
intel_pt ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi flexpriority ept
vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm cqm mpx rdt_a
avx512f avx512dq rdseed adx smap clflushopt clwb avx512cd avx512bw avx512vl xsaveopt
xsavec xgetbv1 cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local dtherm ida arat pln
pts pku ospke avx512_vnni spec_ctrl intel_stibp flush_lld arch_capabilities

```

```

/proc/cpuinfo cache data
cache size : 25344 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 5 6 9 10 14 15 36 37 38 41 42 45 46 50 51
node 0 size: 196280 MB
node 0 free: 191708 MB
node 1 cpus: 3 4 7 8 11 12 13 16 17 39 40 43 44 47 48 49 52 53
node 1 size: 196608 MB
node 1 free: 191743 MB
node 2 cpus: 18 19 20 23 24 27 28 32 33 54 55 56 59 60 63 64 68 69
node 2 size: 196608 MB
node 2 free: 192170 MB

```

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### Platform Notes (Continued)

```

node 3 cpus: 21 22 25 26 29 30 31 34 35 57 58 61 62 65 66 67 70 71
node 3 size: 196608 MB
node 3 free: 192101 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: 792239648 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

From /etc/*release* /etc/*version*
os-release:
NAME="Red Hat Enterprise Linux Server"
VERSION="7.6 (Maipo)"
ID="rhel"
ID_LIKE="fedora"
VARIANT="Server"
VARIANT_ID="server"
VERSION_ID="7.6"
PRETTY_NAME="Red Hat Enterprise Linux Server 7.6 (Maipo)"
redhat-release: Red Hat Enterprise Linux Server release 7.6 (Maipo)
system-release: Red Hat Enterprise Linux Server release 7.6 (Maipo)
system-release-cpe: cpe:/o:redhat:enterprise_linux:7.6:ga:server

uname -a:
Linux localhost.localdomain 3.10.0-957.el7.x86_64 #1 SMP Thu Oct 4 20:48:51 UTC 2018
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: Load fences, __user pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS

run-level 3 Aug 9 20:55

SPEC is set to: /home/cpu2017-1.0.5-ic19.0u4
Filesystem Type Size Used Avail Use% Mounted on
/dev/sdb2 xfs 689G 36G 653G 6% /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

```

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### Platform Notes (Continued)

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 -[IVE141E-2.30]- 07/02/2019

Memory:

24x Samsung M393A4K40CB2-CVF 32 GB 2 rank 2933, configured at 2666

(End of data from sysinfo program)

### Compiler Version Notes

=====  
C | 519.lbm\_r(base) 538.imagick\_r(base) 544.nab\_r(base)

-----  
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,  
Version 19.0.4.227 Build 20190416  
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.  
-----

=====  
C++ | 508.namd\_r(base) 510.parest\_r(base)

-----  
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,  
Version 19.0.4.227 Build 20190416  
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.  
-----

=====  
C++, C | 511.povray\_r(base) 526.blender\_r(base)

-----  
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,  
Version 19.0.4.227 Build 20190416  
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.  
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,  
Version 19.0.4.227 Build 20190416  
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.  
-----

=====  
C++, C, Fortran | 507.cactuBSSN\_r(base)

-----  
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,  
Version 19.0.4.227 Build 20190416  
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.  
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,  
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### Compiler Version Notes (Continued)

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.4.227 Build 20190416  
Copyright (C) 1985-2019 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 for applications running on Intel(R) 64, Version 19.0.4.227 Build 20190416  
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

-----  
Fortran, C | 521.wrf\_r(base) 527.cam4\_r(base)

-----  
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.4.227 Build 20190416  
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.  
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.4.227 Build 20190416  
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

### Base Compiler Invocation

C benchmarks:  
icc -m64 -std=c11

C++ benchmarks:  
icpc -m64

Fortran benchmarks:  
ifort -m64

Benchmarks using both Fortran and C:  
ifort -m64 icc -m64 -std=c11

Benchmarks using both C and C++:  
icpc -m64 icc -m64 -std=c11

Benchmarks using Fortran, C, and C++:  
icpc -m64 icc -m64 -std=c11 ifort -m64



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## 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
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:

```

-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4

```

### C++ benchmarks:

```

-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4

```

### Fortran benchmarks:

```

-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
-align array32byte

```

### Benchmarks using both Fortran and C:

```

-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
-align array32byte

```

### Benchmarks using both C and C++:

```

-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4

```

### Benchmarks using Fortran, C, and C++:

```

-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
-align array32byte

```





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The flags files that were used to format this result can be browsed at

<http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.2019-04-02.html>

<http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-CLX-D.html>

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

<http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.2019-04-02.xml>

<http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-CLX-D.xml>

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