



# SPEC CPU®2017 Floating Point Speed Result

Copyright 2017-2024 Standard Performance Evaluation Corporation

## Lenovo Global Technology

ThinkSystem SR650 V3  
(2.20 GHz, Intel Xeon Gold 5520+)

SPECspeed®2017\_fp\_base = 294

SPECspeed®2017\_fp\_peak = Not Run

CPU2017 License: 9017

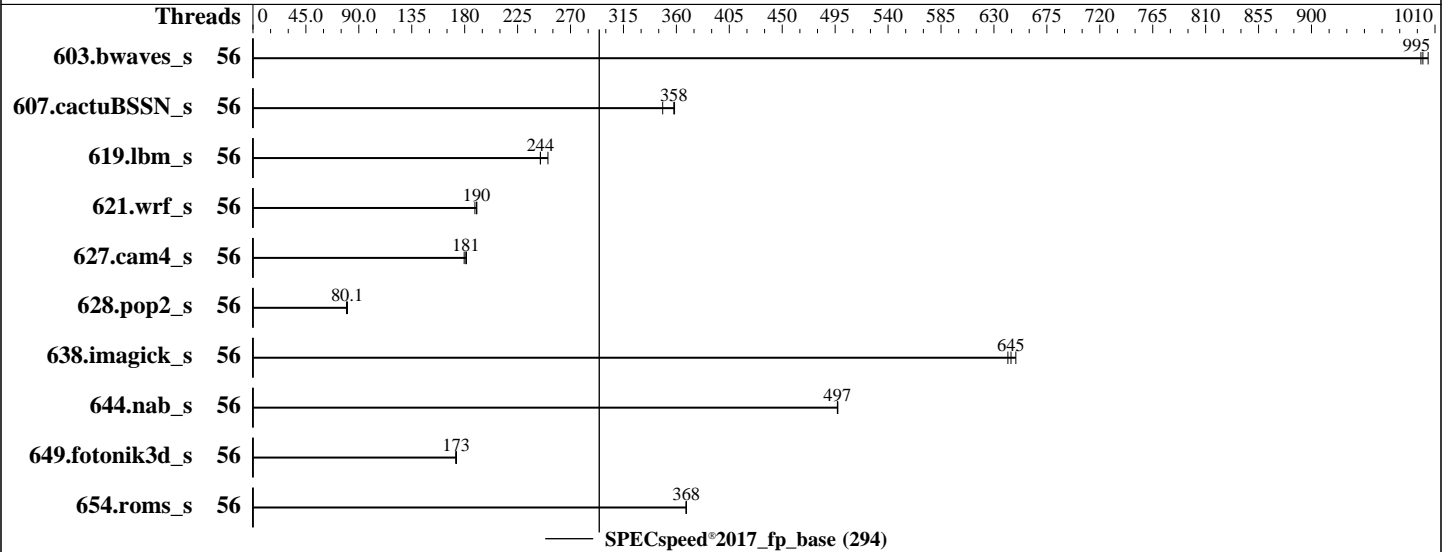
Test Sponsor: Lenovo Global Technology

Tested by: Lenovo Global Technology

Test Date: Mar-2024

Hardware Availability: Feb-2024

Software Availability: Mar-2024



### Hardware

CPU Name: Intel Xeon Gold 5520+  
 Max MHz: 4000  
 Nominal: 2200  
 Enabled: 56 cores, 2 chips  
 Orderable: 1,2 chips  
 Cache L1: 32 KB I + 48 KB D on chip per core  
 L2: 2 MB I+D on chip per core  
 L3: 52.5 MB I+D on chip per chip  
 Other: None  
 Memory: 1 TB (16 x 64 GB 2Rx4 PC5-5600B-R, running at 4800)  
 Storage: 1 x 960 GB SATA SSD  
 Other: CPU Cooling: Air

### Software

OS: SUSE Linux Enterprise Server 15 SP4  
 Kernel 5.14.21-150400.22-default  
 Compiler: C/C++: Version 2024.0.2 of Intel oneAPI DPC++/C++ Compiler for Linux;  
 Fortran: Version 2024.0.2 of Intel Fortran Compiler for Linux;  
 Parallel: Yes  
 Firmware: Lenovo BIOS Version ESE123B 3.11 released Jan-2024  
 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 set to prefer performance at the cost of additional power usage



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## Results Table

Benchmark	Base							Peak						
	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
603.bwaves_s	56	59.4	993	59.0	999	<u>59.3</u>	<u>995</u>							
607.cactuBSSN_s	56	47.9	348	46.5	358	<u>46.6</u>	<u>358</u>							
619.lbm_s	56	<u>21.4</u>	<u>244</u>	21.4	244	20.9	251							
621.wrf_s	56	69.5	190	70.1	189	<u>69.5</u>	<u>190</u>							
627.cam4_s	56	49.4	180	<u>49.0</u>	<u>181</u>	48.8	182							
628.pop2_s	56	149	79.5	<u>148</u>	<u>80.1</u>	148	80.3							
638.imagick_s	56	<u>22.4</u>	<u>645</u>	22.2	649	22.5	642							
644.nab_s	56	<u>35.2</u>	<u>497</u>	35.1	497	35.2	497							
649.fotonik3d_s	56	52.7	173	52.9	172	<u>52.7</u>	<u>173</u>							
654.roms_s	56	<u>42.7</u>	<u>368</u>	42.7	369	42.8	368							

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Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

## 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:  
KMP\_AFFINITY = "granularity=fine,compact"  
LD\_LIBRARY\_PATH = "/home/cpu2017-1.1.9-ic2024.0.2/lib/intel64:/home/cpu2017-1.1.9-ic2024.0.2/je5.0.1-64"  
MALLOCONF = "retain:true"  
OMP\_STACKSIZE = "192M"

## General Notes

Binaries compiled on a system with 2x Intel Xeon Platinum 8280M CPU + 384GB 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  
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  
sources available from jemalloc.net or <https://github.com/jemalloc/jemalloc/releases>



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## Platform Notes

BIOS configuration:

Choose Operating Mode set to Custom Mode  
Hyper-Threading set to Disabled  
CPU P-state Control set to Legacy  
DCU IP Prefetcher set to Disabled

Sysinfo program /home/cpu2017-1.1.9-ic2024.0.2/bin/sysinfo  
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197  
running on localhost Thu Mar 14 12:57:59 2024

SUT (System Under Test) info as seen by some common utilities.

-----  
Table of contents  
-----

1. uname -a
2. w
3. Username
4. ulimit -a
5. sysinfo process ancestry
6. /proc/cpuinfo
7. lscpu
8. numactl --hardware
9. /proc/meminfo
10. who -r
11. Systemd service manager version: systemd 249 (249.11+suse.124.g2bc0b2c447)
12. Services, from systemctl list-unit-files
13. Linux kernel boot-time arguments, from /proc/cmdline
14. cpupower frequency-info
15. tuned-adm active
16. sysctl
17. /sys/kernel/mm/transparent\_hugepage
18. /sys/kernel/mm/transparent\_hugepage/khugepaged
19. OS release
20. Disk information
21. /sys/devices/virtual/dmi/id
22. dmidecode
23. BIOS

-----  
1. uname -a  
Linux localhost 5.14.21-150400.22-default #1 SMP PREEMPT\_DYNAMIC Wed May 11 06:57:18 UTC 2022 (49db222)  
x86\_64 x86\_64 x86\_64 GNU/Linux  
-----

-----  
2. w  
12:57:59 up 1 min, 1 user, load average: 0.13, 0.06, 0.02  
USER TTY FROM LOGIN@ IDLE JCPU PCPU WHAT  
root tty1 - 12:57 7.00s 1.58s 0.01s -bash  
-----

-----  
3. Username  
From environment variable \$USER: root  
-----

-----  
4. ulimit -a  
core file size (blocks, -c) unlimited  
data seg size (kbytes, -d) unlimited  
scheduling priority (-e) 0  
-----

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### Platform Notes (Continued)

```

file size                (blocks, -f) unlimited
pending signals          (-i) 4127050
max locked memory        (kbytes, -l) 64
max memory size          (kbytes, -m) unlimited
open files                (-n) 1024
pipe size                 (512 bytes, -p) 8
POSIX message queues      (bytes, -q) 819200
real-time priority        (-r) 0
stack size                (kbytes, -s) unlimited
cpu time                  (seconds, -t) unlimited
max user processes        (-u) 4127050
virtual memory            (kbytes, -v) unlimited
file locks                (-x) unlimited

```

```

-----
5. sysinfo process ancestry
/usr/lib/systemd/systemd --switched-root --system --deserialize 30
login -- root
-bash
-bash
runcpu --nobuild --action validate --define default-platform-flags -c
  ic2024.0.2-lin-sapphirerapids-speed-20231213.cfg --define cores=56 --tune base -o all --define drop_caches
  fpspeed
runcpu --nobuild --action validate --define default-platform-flags --configfile
  ic2024.0.2-lin-sapphirerapids-speed-20231213.cfg --define cores=56 --tune base --output_format all
  --define drop_caches --nopower --runmode speed --tune base --size refspeed fpspeed --nopreenv
  --note-preenv --logfile $SPEC/tmp/CPU2017.015/templogs/preenv.fpspeed.015.0.log --lognum 015.0
  --from_runcpu 2
specperl $SPEC/bin/sysinfo
$SPEC = /home/cpu2017-1.1.9-ic2024.0.2

```

```

-----
6. /proc/cpuinfo
model name      : INTEL(R) XEON(R) GOLD 5520+
vendor_id      : GenuineIntel
cpu family     : 6
model          : 207
stepping       : 2
microcode      : 0x21000200
bugs           : spectre_v1 spectre_v2 spec_store_bypass swapgs
cpu cores      : 28
siblings       : 28
2 physical ids (chips)
56 processors (hardware threads)
physical id 0: core ids 0-27
physical id 1: core ids 0-27
physical id 0: apicids 0,2,4,6,8,10,12,14,16,18,20,22,24,26,28,30,32,34,36,38,40,42,44,46,48,50,52,54
physical id 1: apicids
128,130,132,134,136,138,140,142,144,146,148,150,152,154,156,158,160,162,164,166,168,170,172,174,176,178,1
80,182
Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for
virtualized systems. Use the above data carefully.

```

```

-----
7. lscpu

From lscpu from util-linux 2.37.2:
Architecture:          x86_64
CPU op-mode(s):        32-bit, 64-bit
Address sizes:          46 bits physical, 57 bits virtual

```

(Continued on next page)



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### Platform Notes (Continued)

```

Byte Order:                Little Endian
CPU(s):                    56
On-line CPU(s) list:      0-55
Vendor ID:                 GenuineIntel
Model name:               INTEL(R) XEON(R) GOLD 5520+
CPU family:               6
Model:                    207
Thread(s) per core:       1
Core(s) per socket:       28
Socket(s):                2
Stepping:                 2
Frequency boost:          enabled
CPU max MHz:              2201.0000
CPU min MHz:              800.0000
BogoMIPS:                 4400.00
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 cpuid aperfperf tsc_known_freq 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 cpuid_fault epb cat_l3 cat_l2 cdp_l3
                          invpcid_single cdp_l2 ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow
                          vnmi flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmi1 hle avx2 smep
                          bmi2 erms invpcid rtm cqm rdt_a avx512f avx512dq rdseed adx smap
                          avx512ifma clflushopt clwb intel_pt avx512cd sha_ni avx512bw avx512vl
                          xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbm_total
                          cqm_mbm_local avx_vnni avx512_bf16 wbnoinvd dtherm ida arat pln pts
                          avx512vbmi umip pku ospke waitpkg avx512_vbmi2 gfni vaes vpclmulqdq
                          avx512_vnni avx512_bitalg tme avx512_vpopcntdq la57 rdpid bus_lock_detect
                          cldemote movdiri movdir64b enqcmd fsrm md_clear serialize tsxldtrk pconfig
                          arch_lbr avx512_fp16 amx_tile flush_lld arch_capabilities

Virtualization:           VT-x
L1d cache:                2.6 MiB (56 instances)
L1i cache:                1.8 MiB (56 instances)
L2 cache:                 112 MiB (56 instances)
L3 cache:                 105 MiB (2 instances)
NUMA node(s):            2
NUMA node0 CPU(s):       0-27
NUMA node1 CPU(s):       28-55
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf:       Not affected
Vulnerability Mds:        Not affected
Vulnerability Meltdown:   Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
Vulnerability Spectre v1: Mitigation; usercopy/swaps barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Enhanced IBRS, IBPB conditional, RSB filling
Vulnerability Srbds:      Not affected
Vulnerability Tsx async abort: Not affected

```

From lscpu --cache:

NAME	ONE-SIZE	ALL-SIZE	WAYS	TYPE	LEVEL	SETS	PHY-LINE	COHERENCY-SIZE
L1d	48K	2.6M	12	Data	1	64	1	64
L1i	32K	1.8M	8	Instruction	1	64	1	64
L2	2M	112M	16	Unified	2	2048	1	64
L3	52.5M	105M	15	Unified	3	57344	1	64

8. numactl --hardware

NOTE: a numactl 'node' might or might not correspond to a physical chip.

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### Platform Notes (Continued)

```
available: 2 nodes (0-1)
node 0 cpus: 0-27
node 0 size: 515752 MB
node 0 free: 514265 MB
node 1 cpus: 28-55
node 1 size: 516034 MB
node 1 free: 515302 MB
node distances:
node 0 1
0: 10 21
1: 21 10
```

9. /proc/meminfo  
MemTotal: 1056549556 kB

10. who -r  
run-level 3 Mar 14 12:57

11. Systemd service manager version: systemd 249 (249.11+suse.124.g2bc0b2c447)  
Default Target Status  
multi-user running

12. Services, from systemctl list-unit-files

STATE	UNIT FILES
enabled	YaST2-Firstboot YaST2-Second-Stage apparmor auditd chronyd cron getty@ haveged irqbalance iscsi issue-generator kbdsettings klog lvm2-monitor nscd postfix purge-kernels rollback rsyslog smartd sshd wicked wickedd-auto4 wickedd-dhcp4 wickedd-dhcp6 wickedd-nanny
enabled-runtime	systemd-remount-fs
disabled	autofs autoyast-initscripts blk-availability boot-sysctl ca-certificates chrony-wait console-getty cups cups-browsed debug-shell ebttables exchange-bmc-os-info firewallld gpm grub2-once haveged-switch-root ipmi ipmievdev iscsi-init iscsid iscsiui issue-add-ssh-keys kexec-load ksm kvm_stat lunmask man-db-create multipathd nfs nfs-blkmap nmb ntp-wait ntpd rdisc rpcbind rpmconfigcheck rsyncd serial-getty@ smartd_generate_opts smb snmpd snmptrapd svnservice systemd-boot-check-no-failures systemd-network-generator systemd-sysext systemd-time-wait-sync systemd-timesyncd tuned udisks2
indirect	wickedd

13. Linux kernel boot-time arguments, from /proc/cmdline  
BOOT\_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default  
root=UUID=d68daf13-caf1-4614-b0e5-f766f243d7c8  
splash=silent  
mitigations=auto  
quiet  
security=apparmor

14. cpupower frequency-info  
analyzing CPU 0:  
current policy: frequency should be within 800 MHz and 2.20 GHz.  
The governor "ondemand" may decide which speed to use within this range.  
boost state support:  
Supported: yes  
Active: yes

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### Platform Notes (Continued)

-----  
15. tuned-adm active

It seems that tuned daemon is not running, preset profile is not activated.  
Preset profile: throughput-performance

-----  
16. sysctl

kernel.numa_balancing	1
kernel.randomize_va_space	2
vm.compaction_proactiveness	20
vm.dirty_background_bytes	0
vm.dirty_background_ratio	10
vm.dirty_bytes	0
vm.dirty_expire_centisecs	3000
vm.dirty_ratio	20
vm.dirty_writeback_centisecs	500
vm.dirtytime_expire_seconds	43200
vm.extfrag_threshold	500
vm.min_unmapped_ratio	1
vm.nr_hugepages	0
vm.nr_hugepages_mempolicy	0
vm.nr_overcommit_hugepages	0
vm.swappiness	60
vm.watermark_boost_factor	15000
vm.watermark_scale_factor	10
vm.zone_reclaim_mode	0

-----  
17. /sys/kernel/mm/transparent\_hugepage

defrag	always	defer	defer+madvise	[madvise]	never
enabled	[always]	madvise	never		
hpage_pmd_size	2097152				
shmem_enabled	always	within_size	advise	[never]	deny force

-----  
18. /sys/kernel/mm/transparent\_hugepage/khugepaged

alloc_sleep_millisecs	60000
defrag	1
max_ptes_none	511
max_ptes_shared	256
max_ptes_swap	64
pages_to_scan	4096
scan_sleep_millisecs	10000

-----  
19. OS release

From /etc/\*-release /etc/\*-version  
os-release SUSE Linux Enterprise Server 15 SP4

-----  
20. Disk information

SPEC is set to: /home/cpu2017-1.1.9-ic2024.0.2  
Filesystem Type Size Used Avail Use% Mounted on  
/dev/sda2 xfs 892G 118G 775G 14% /

-----  
21. /sys/devices/virtual/dmi/id

Vendor: Lenovo  
Product: ThinkSystem SR650 V3 MB,EGS,DDR5,SH,2U  
Product Family: ThinkSystem

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### Platform Notes (Continued)

Serial: 1234567890

#### 22. dmidecode

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:

8x Samsung M321R8GA0PB0-CWMKH 64 GB 2 rank 5600, configured at 4800  
8x Samsung M321R8GA0PB0-CWMXH 64 GB 2 rank 5600, configured at 4800

#### 23. BIOS

(This section combines info from /sys/devices and dmidecode.)

BIOS Vendor: Lenovo  
BIOS Version: ESE123B-3.11  
BIOS Date: 01/25/2024  
BIOS Revision: 3.11  
Firmware Revision: 3.90

### Compiler Version Notes

C | 619.lbm\_s(base) 638.imagick\_s(base) 644.nab\_s(base)

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2024.0.2 Build 20231213  
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

C++, C, Fortran | 607.cactuBSSN\_s(base)

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2024.0.2 Build 20231213  
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2024.0.2 Build 20231213  
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2024.0.2 Build 20231213  
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

Fortran | 603.bwaves\_s(base) 649.fotonik3d\_s(base) 654.roms\_s(base)

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2024.0.2 Build 20231213  
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

Fortran, C | 621.wrf\_s(base) 627.cam4\_s(base) 628.pop2\_s(base)

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2024.0.2 Build 20231213  
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2024.0.2 Build 20231213  
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## Base Compiler Invocation

C benchmarks:

icx

Fortran benchmarks:

ifx

Benchmarks using both Fortran and C:

ifx icx

Benchmarks using Fortran, C, and C++:

icpx icx ifx

## Base Portability Flags

```
603.bwaves_s: -DSPEC_LP64
607.cactuBSSN_s: -DSPEC_LP64
619.lbm_s: -DSPEC_LP64
621.wrf_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
627.cam4_s: -DSPEC_LP64 -DSPEC_CASE_FLAG
628.pop2_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
-assume byterecl
638.imagick_s: -DSPEC_LP64
644.nab_s: -DSPEC_LP64
649.fotonik3d_s: -DSPEC_LP64
654.roms_s: -DSPEC_LP64
```

## Base Optimization Flags

C benchmarks:

```
-w -std=c11 -m64 -Wl,-z,muldefs -xsaphirerapids -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -fiopenmp
-DSPEC_OPENMP -Wno-implicit-int -mprefer-vector-width=512
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc
```

Fortran benchmarks:

```
-w -m64 -Wl,-z,muldefs -DSPEC_OPENMP -xsaphirerapids -Ofast
-ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -fiopenmp -nostandard-realloc-lhs
-align array32byte -auto -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc
```

Benchmarks using both Fortran and C:

```
-w -m64 -std=c11 -Wl,-z,muldefs -xsaphirerapids -Ofast -ffast-math
```

(Continued on next page)



# SPEC CPU®2017 Floating Point Speed Result

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## Lenovo Global Technology

ThinkSystem SR650 V3  
(2.20 GHz, Intel Xeon Gold 5520+)

SPECspeed®2017\_fp\_base = 294

SPECspeed®2017\_fp\_peak = Not Run

CPU2017 License: 9017

Test Sponsor: Lenovo Global Technology

Tested by: Lenovo Global Technology

Test Date: Mar-2024

Hardware Availability: Feb-2024

Software Availability: Mar-2024

## Base Optimization Flags (Continued)

Benchmarks using both Fortran and C (continued):

```
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -fiopenmp
-DSPEC_OPENMP -Wno-implicit-int -mprefer-vector-width=512
-nostandard-realloc-lhs -align array32byte -auto
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc
```

Benchmarks using Fortran, C, and C++:

```
-w -std=c++14 -m64 -std=c11 -Wl,-z,muldefs -xsapphirerapids -Ofast
-ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -fiopenmp -DSPEC_OPENMP -Wno-implicit-int
-mprefer-vector-width=512 -nostandard-realloc-lhs -align array32byte
-auto -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc
```

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-Eaglestream-AA.html>

<http://www.spec.org/cpu2017/flags/Intel-ic2024-official-linux64.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-Eaglestream-AA.xml>

<http://www.spec.org/cpu2017/flags/Intel-ic2024-official-linux64.xml>

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