



# SPEC CPU®2017 Floating Point Speed Result

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## Lenovo Global Technology

SPECspeed®2017\_fp\_base = 272

ThinkSystem SR650 V3  
(3.60 GHz, Intel Xeon Gold 6444Y)

SPECspeed®2017\_fp\_peak = Not Run

CPU2017 License: 9017

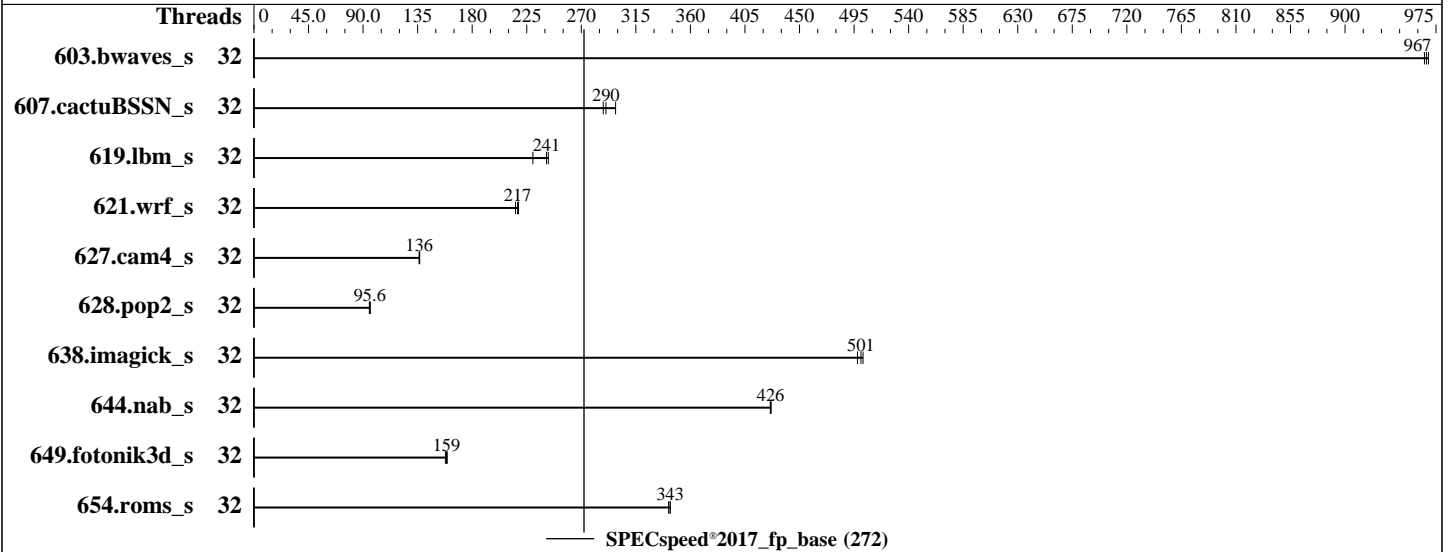
Test Date: Feb-2023

Test Sponsor: Lenovo Global Technology

Hardware Availability: Feb-2023

Tested by: Lenovo Global Technology

Software Availability: Dec-2022



### Hardware

CPU Name: Intel Xeon Gold 6444Y  
 Max MHz: 4000  
 Nominal: 3600  
 Enabled: 32 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: 45 MB I+D on chip per chip  
 Other: None  
 Memory: 512 GB (16 x 32 GB 2Rx8 PC5-4800B-R)  
 Storage: 1 x 480 GB SATA SSD  
 Other: None

### Software

OS: SUSE Linux Enterprise Server 15 SP4 (x86\_64)  
 Kernel 5.14.21-150400.22-default  
 Compiler: C/C++: Version 2023.0 of Intel oneAPI DPC++/C++ Compiler for Linux;  
 Fortran: Version 2023.0 of Intel Fortran Compiler Classic for Linux;  
 C/C++: Version 2023.0 of Intel C/C++ Compiler Classic for Linux  
 Parallel: Yes  
 Firmware: Lenovo BIOS Version ESE109L 1.10 released Jan-2023  
 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



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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	32	60.9	969	61.1	965	<b>61.0</b>	<b>967</b>							
607.cactuBSSN_s	32	57.9	288	<b>57.4</b>	<b>290</b>	55.9	298							
619.lbm_s	32	22.8	230	<b>21.7</b>	<b>241</b>	21.6	243							
621.wrf_s	32	60.6	218	61.3	216	<b>60.8</b>	<b>217</b>							
627.cam4_s	32	64.8	137	65.0	136	<b>65.0</b>	<b>136</b>							
628.pop2_s	32	125	95.2	124	96.0	<b>124</b>	<b>95.6</b>							
638.imagick_s	32	<b>28.8</b>	<b>501</b>	28.7	502	29.0	498							
644.nab_s	32	<b>41.0</b>	<b>426</b>	41.0	426	41.0	427							
649.fotonik3d_s	32	<b>57.4</b>	<b>159</b>	57.2	159	57.7	158							
654.roms_s	32	45.9	343	<b>45.9</b>	<b>343</b>	46.0	342							

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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-ic2023.0/lib/intel64:/home/cpu2017-1.1.9-ic2023.0/j  
e5.0.1-64"  
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.

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## General Notes (Continued)

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>

## Platform Notes

BIOS configuration:

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

Sysinfo program /home/cpu2017-1.1.9-ic2023.0/bin/sysinfo  
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197  
running on localhost Wed Feb 15 16:50:58 2023

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. sysctl
  16. /sys/kernel/mm/transparent\_hugepage
  17. /sys/kernel/mm/transparent\_hugepage/khugepaged
  18. OS release
  19. Disk information
  20. /sys/devices/virtual/dmi/id
  21. dmidecode
  22. BIOS
- -----

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### Platform Notes (Continued)

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`

```
16:50:58 up 2 min, 1 user, load average: 0.04, 0.03, 0.00
USER      TTY      FROM          LOGIN@   IDLE   JCPU   PCPU   WHAT
root      ttyl    -             16:49    10.00s 1.14s  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
file size               (blocks, -f) unlimited
pending signals         (-i) 2062693
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) 2062693
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
-bash
runcpu --nobuild --action validate --define default-platform-flags -c
ic2023.0-lin-sapphirerapids-speed-20221201.cfg --define cores=32 --tune base -o all --define drop_caches
fpspeed
runcpu --nobuild --action validate --define default-platform-flags --configfile
ic2023.0-lin-sapphirerapids-speed-20221201.cfg --define cores=32 --tune base --output_format all --define
drop_caches --nopower --runmode speed --tune base --size refspeed fpspeed --nopreenv --note-preenv
--logfile $SPEC/tmp/CPU2017.092/templogs/preenv.fpspeed.092.0.log --lognum 092.0 --from_runcpu 2
```

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### Platform Notes (Continued)

```
specperl $SPEC/bin/sysinfo
$SPEC = /home/cpu2017-1.1.9-ic2023.0
```

```
-----
6. /proc/cpuinfo
   model name      : Intel(R) Xeon(R) Gold 6444Y
   vendor_id       : GenuineIntel
   cpu family      : 6
   model           : 143
   stepping        : 8
   microcode       : 0x2b000161
   bugs            : spectre_v1 spectre_v2 spec_store_bypass swapgs
   cpu cores       : 16
   siblings        : 16
   2 physical ids (chips)
   32 processors (hardware threads)
   physical id 0: core ids 0-15
   physical id 1: core ids 0-15
   physical id 0: apicids 0,2,4,6,8,10,12,14,16,18,20,22,24,26,28,30
   physical id 1: apicids 128,130,132,134,136,138,140,142,144,146,148,150,152,154,156,158
```

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
Byte Order:            Little Endian
CPU(s):                32
On-line CPU(s) list:  0-31
Vendor ID:              GenuineIntel
Model name:            Intel(R) Xeon(R) Gold 6444Y
CPU family:            6
Model:                 143
Thread(s) per core:    1
Core(s) per socket:    16
Socket(s):             2
Stepping:              8
Frequency boost:       enabled
CPU max MHz:           3601.0000
CPU min MHz:           800.0000
BogoMIPS:              7200.00
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
```

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### Platform Notes (Continued)

```
lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology
nonstop_tsc cpuid aperfmpperf 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 intel_ppin 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 split_lock_detect 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: 1.5 MiB (32 instances)
L1i cache: 1 MiB (32 instances)
L2 cache: 64 MiB (32 instances)
L3 cache: 90 MiB (2 instances)
NUMA node(s): 2
NUMA node0 CPU(s): 0-15
NUMA node1 CPU(s): 16-31
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/swapgs 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	1.5M	12	Data	1	64	1	64
L1i	32K	1M	8	Instruction	1	64	1	64
L2	2M	64M	16	Unified	2	2048	1	64
L3	45M	90M	15	Unified	3	49152	1	64

8. numactl --hardware

NOTE: a numactl 'node' might or might not correspond to a physical chip.  
available: 2 nodes (0-1)  
node 0 cpus: 0-15  
node 0 size: 257673 MB  
node 0 free: 256743 MB

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### Platform Notes (Continued)

```
node 1 cpus: 16-31
node 1 size: 258023 MB
node 1 free: 257542 MB
node distances:
node 0 1
  0: 10 21
  1: 21 10
```

---

9. /proc/meminfo  
MemTotal: 528073980 kB

---

10. who -r  
run-level 3 Feb 15 16:48

---

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 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 chronyd console-getty cups cups-browsed debug-shell ebttables exchange-bmc-os-info firewalld gpm grub2-once haveged-switch-root ipmi ipmievd iscsi-init iscsid iscsiuiio issue-add-ssh-keys kexec-load lunmask man-db-create multipathd nfs nfs-blkmap nmb rdisc rpcbind rpmconfigcheck rsyncd serial-getty@ smartd_generate_opts smb snmpd snmptrapd systemd-boot-check-no-failures systemd-network-generator systemd-sysext systemd-time-wait-sync systemd-timesyncd udisks2
indirect	wickedd

---

13. Linux kernel boot-time arguments, from /proc/cmdline  
BOOT\_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default  
root=UUID=cf0c8526-2665-4565-b656-0513c168d1bb  
splash=silent  
mitigations=auto  
quiet  
security=apparmor

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### Platform Notes (Continued)

#### 14. cpupower frequency-info

analyzing CPU 0:

current policy: frequency should be within 800 MHz and 3.60 GHz.

The governor "ondemand" may decide which speed to use within this range.

boost state support:

Supported: yes

Active: yes

---

#### 15. 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

```

---

#### 16. /sys/kernel/mm/transparent\_hugepage

```

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

```

---

#### 17. /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

```

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## Platform Notes (Continued)

### 18. OS release

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

### 19. Disk information

```
SPEC is set to: /home/cpu2017-1.1.9-ic2023.0
Filesystem      Type  Size  Used Avail Use% Mounted on
/dev/sda3        xfs   446G   53G  393G  12% /
```

### 20. /sys/devices/virtual/dmi/id

```
Vendor:          Lenovo
Product:         ThinkSystem SR650 V3 MB,EGS,DDR5,SH,2U
Product Family: ThinkSystem
Serial:          1234567890
```

### 21. 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:
 9x Samsung M321R4GA3BB0-CQKEG 32 GB 2 rank 4800
 7x Samsung M321R4GA3BB0-CQKVG 32 GB 2 rank 4800
```

### 22. BIOS

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

```
BIOS Vendor:      Lenovo
BIOS Version:     ESE109L-1.10
BIOS Date:        01/07/2023
BIOS Revision:    1.10
Firmware Revision: 1.0
```

## 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 2023.0.0 Build 20221201
```

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## Compiler Version Notes (Continued)

Copyright (C) 1985-2022 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 2023.0.0 Build 20221201

Copyright (C) 1985-2022 Intel Corporation. All rights reserved.

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,  
Version 2023.0.0 Build 20221201

Copyright (C) 1985-2022 Intel Corporation. All rights reserved.

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version  
2023.0.0 Build 20221201

Copyright (C) 1985-2022 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  
2023.0.0 Build 20221201

Copyright (C) 1985-2022 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  
2023.0.0 Build 20221201

Copyright (C) 1985-2022 Intel Corporation. All rights reserved.

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,  
Version 2023.0.0 Build 20221201

Copyright (C) 1985-2022 Intel Corporation. All rights reserved.

## Base Compiler Invocation

C benchmarks:  
icx

Fortran benchmarks:  
ifx

Benchmarks using both Fortran and C:  
ifx icx

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## Base Compiler Invocation (Continued)

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:

```
-m64 -std=c11 -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:

```
-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:

```
-m64 -std=c11 -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
-nostandard-realloc-lhs -align array32byte -auto
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc
```

Benchmarks using Fortran, C, and C++:

```
-m64 -std=c++14 -std=c11 -Wl,-z,muldefs -xsaphirerapids -Ofast
```

(Continued on next page)



# SPEC CPU®2017 Floating Point Speed Result

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**Lenovo Global Technology**

SPECspeed®2017\_fp\_base = 272

ThinkSystem SR650 V3  
(3.60 GHz, Intel Xeon Gold 6444Y)

SPECspeed®2017\_fp\_peak = Not Run

**CPU2017 License:** 9017

**Test Date:** Feb-2023

**Test Sponsor:** Lenovo Global Technology

**Hardware Availability:** Feb-2023

**Tested by:** Lenovo Global Technology

**Software Availability:** Dec-2022

## Base Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++ (continued):

```
-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-O.html>

<http://www.spec.org/cpu2017/flags/Intel-ic2023-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-O.xml>

<http://www.spec.org/cpu2017/flags/Intel-ic2023-official-linux64.xml>

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For questions about this result, please contact the tester. For other inquiries, please contact [info@spec.org](mailto:info@spec.org).

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