Lenovo Global Technology
ThinkSystem SN550 (2.00 GHz, Intel Xeon Silver 4109T)

| Copies | 0  | 15.0 | 30.0 | 45.0 | 60.0 | 75.0 | 90.0 | 105.0 | 120.0 | 135.0 | 150.0 | 165.0 | 180.0 | 195.0 | 210.0 | 225.0 | 240.0 | 255.0 | 270.0 | 285.0 | 300.0 | 315.0 | 320.0 |
|---------|----|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 503.bwaves_r | 32 |   |     |     |     |     |     |   | 315 |   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 507.cactuBSSN_r | 32 |   |     |     |     |     |     |   | 315 |   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 508.namd_r | 32 |   |     |     |     |     |     |   |     |   | 315 |   |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 510.parest_r | 32 |   |     |     |     |     |     |   |     |   |     |   | 315 |   |     |     |     |     |     |     |     |     |     |     |     |
| 511.povray_r | 32 |   |     |     |     |     |     |   |     |   |     |   |     |   | 315 |   |     |     |     |     |     |     |     |     |     |
| 519.lbm_r | 32 |   |     |     |     |     |     |   |     |   |     |   |     |   |     |   | 315 |   |     |     |     |     |     |     |     |
| 521.wrf_r | 32 |   |     |     |     |     |     |   |     |   |     |   |     |   |     |   |     |   | 315 |   |     |     |     |     |     |     |
| 526.blender_r | 32 |   |     |     |     |     |     |   |     |   |     |   |     |   |     |   |     |   |     |   | 315 |   |     |     |     |     |
| 527.cam4_r | 32 |   |     |     |     |     |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |   | 315 |   |     |     |
| 538.imagick_r | 32 |   |     |     |     |     |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |   | 315 |   |
| 544.nab_r | 32 |   |     |     |     |     |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     | 315 |
| 549.fotonik3d_r | 32 |   |     |     |     |     |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |     |
| 554.roms_r | 32 |   |     |     |     |     |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |   |     |     |

**SPECrate2017_fp_base** = 81.8
**SPECrate2017_fp_peak** = 84.1

**CPU Name:** Intel Xeon Silver 4109T
**Max MHz.:** 3000
**Nominal:** 2000
**Enabled:** 16 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:** 11 MB I+D on chip per chip
**Other:** None
**Memory:** 768 GB (24 x 32 GB 2Rx4 PC4-2666V-R, running at 2400)
**Storage:** 1 x 800 GB SAS SSD
**Other:** None

**OS:** SUSE Linux Enterprise Server 12 SP2 (x86_64)
**Kernel:** 4.4.114-92.64-default
**Compiler:** C/C++: Version 18.0.0.128 of Intel C/C++ Compiler for Linux;
Fortran: Version 18.0.0.128 of Intel Fortran Compiler for Linux
**Parallel:** No
**Firmware:** Lenovo BIOS Version IVE113W 1.12 released Feb-2018
**File System:** xfs
**System State:** Run level 3 (multi-user)
**Base Pointers:** 64-bit
**Peak Pointers:** 64-bit
**Other:** None

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**Hardware**

**Software**

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## Lenovo Global Technology

**ThinkSystem SN550**

(2.00 GHz, Intel Xeon Silver 4109T)

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### Results Table

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### 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/cpu2017.1.0.2.ic18.0/lib/ia32:/home/cpu2017.1.0.2.ic18.0/lib/intel64"
LD_LIBRARY_PATH = "$LD_LIBRARY_PATH:/home/cpu2017.1.0.2.ic18.0/je5.0.1-32:/home/cpu2017.1.0.2.ic18.0/je5.0.1-64"
```

Binaries compiled on a system with 1x Intel Core i7-4790 CPU + 32GB RAM

Memory using Redhat Enterprise Linux 7.4

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>`

Yes: The test sponsor attests, as of date of publication, that CVE-2017-5754 (Meltdown) is mitigated in the system as tested and documented.
**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.

**Platform Notes**

BIOS configuration:
Choose Operating Mode set to Maximum Performance
DCU Streamer Prefetcher set to Disable
SNC set to Disable
MONITOR/MWAIT set to Enable
LLC dead line alloc set to Disable
Sysinfo program /home/cpu2017.1.0.2.ic18.0/bin/sysinfo
Rev: r5797 of 2017-06-14 96c45e4568ad54c135fd618b0c91c0f
running on SN550 Tue Jun 12 10:13:11 2018

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) Silver 4109T CPU @ 2.00GHz
  2 "physical id"s (chips)
  32 "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 : 8
siblings : 16
  physical 0: cores 0 1 2 3 4 5 6 7
  physical 1: cores 0 1 2 3 4 5 6 7
```

From lscpu:

```
Architecture:      x86_64
CPU op-mode(s):    32-bit, 64-bit
Byte Order:        Little Endian
CPU(s):            32
On-line CPU(s) list: 0-31
Thread(s) per core: 2
Core(s) per socket: 8
Socket(s):         2
NUMA node(s):      2
Vendor ID:         GenuineIntel
CPU family:        6
Model:             85
Model name:        Intel(R) Xeon(R) Silver 4109T CPU @ 2.00GHz
```

(Continued on next page)
## Lenovo Global Technology
### ThinkSystem SN550
(2.00 GHz, Intel Xeon Silver 4109T)

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### CPU2017 License:
9017

### Test Sponsor:
Lenovo Global Technology

### Tested by:
Lenovo Global Technology

### Test Date:
Jun-2018

### Hardware Availability:
Aug-2017

### Software Availability:
Feb-2018

---

### Platform Notes (Continued)

- Stepping: 4
- CPU MHz: 1995.317
- BogoMIPS: 3990.63
- Virtualization: VT-x
- L1d cache: 32K
- L1i cache: 32K
- L2 cache: 1024K
- L3 cache: 11264K
- NUMA node0 CPU(s): 0-7,16-23
- NUMA node1 CPU(s): 8-15,24-31
- Flags: fpu vme de pse tsc msr pae 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 aperfmperf 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 ida arat epb invpcid_single pln pts dtherm intel_pt rsb_ctesw spec_ctrl retpoline kaiser tpr_shadow vnmi flexpriority ept vpid fsgsbase tsc_adjust bni hle avx2 smep bmi2 ibrms invpcid rtm cqm mpx avx512f avx512dq rdseed adx smap clflushopt clwb avx512cd avx512bw avx512vl xsaveopt xsavec xgetbv1 cqm_llc cqm_occup_llc

From `numactl --hardware`

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

- available: 2 nodes (0-1)
- node 0 cpus: 0 1 2 3 4 5 6 7 16 17 18 19 20 21 22 23
- node 0 size: 386646 MB
- node 0 free: 386068 MB
- node 1 cpus: 8 9 10 11 12 13 14 15 24 25 26 27 28 29 30 31
- node 1 size: 387040 MB
- node 1 free: 386583 MB
- node distances:
  - node 0 1
  - 0: 10 21
  - 1: 21 10

From `/proc/meminfo`

- MemTotal: 792255352 kB
- HugePages_Total: 0
- Hugepagesize: 2048 kB

From `/etc/*release* `/etc/*version*`

- SuSE-release:
  - SUSE Linux Enterprise Server 12 (x86_64)
  - VERSION = 12

(Continued on next page)
SPEC CPU2017 Floating Point Rate Result

Lenovo Global Technology
ThinkSystem SN550
(2.00 GHz, Intel Xeon Silver 4109T)

SPECrate2017_fp_base = 81.8
SPECrate2017_fp_peak = 84.1

CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Tested by: Lenovo Global Technology
Test Date: Jun-2018
Hardware Availability: Aug-2017
Software Availability: Feb-2018

Platform Notes (Continued)

PATCHLEVEL = 2
# This file is deprecated and will be removed in a future service pack or release.
# Please check /etc/os-release for details about this release.

os-release:
NAME="SLES"
VERSION="12-SP2"
VERSION_ID="12.2"
PRETTY_NAME="SUSE Linux Enterprise Server 12 SP2"
ID="sles"
ANSI_COLOR="0;32"
CPE_NAME="cpe:/o:suse:sles:12:sp2"

uname -a:
Linux SN550 4.4.114-92.64-default #1 SMP Thu Feb 1 19:18:19 UTC 2018 (c6ce5db) x86_64
x86_64 x86_64 GNU/Linux

run-level 3 Jun 12 10:09
SPEC is set to: /home/cpu2017.1.0.2.ic18.0

Filesystem  Type Size  Used Avail Use% Mounted on
/dev/sda4     xfs   687G  170G  518G  25% /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 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 -[IVE113W-1.12]- 02/06/2018
Memory:
  24x Samsung M393A4K40BB2-CTD 32 GB 2 rank 2666, configured at 2400

(End of data from sysinfo program)

Compiler Version Notes

==================================================================================
CC  519.lbm_r(base) 538.imagick_r(base, peak) 544.nab_r(base)
==================================================================================
icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
==================================================================================
CC  519.lbm_r(peak) 544.nab_r(peak)
==================================================================================
icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
(Continued on next page)
Lenovo Global Technology  
ThinkSystem SN550  
(2.00 GHz, Intel Xeon Silver 4109T)  

**SPEC CPU2017 Floating Point Rate Result**

**Lenovo Global Technology**

**ThinkSystem SN550**  
(2.00 GHz, Intel Xeon Silver 4109T)

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**Specrate2017_fp_base** = 81.8

**Specrate2017_fp_peak** = 84.1

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**Compiler Version Notes (Continued)**

------------------------------------------------------------------------------
CXXC 508.namd_r(base) 510.parest_r(base)
icpc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

------------------------------------------------------------------------------
CXXC 508.namd_r(peak) 510.parest_r(peak)
icpc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

------------------------------------------------------------------------------
CC 511.povray_r(base) 526.blender_r(base)
icpc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

------------------------------------------------------------------------------
CC 511.povray_r(peak) 526.blender_r(peak)
icpc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

------------------------------------------------------------------------------
FC 507.cactuBSSN_r(base)
icpc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
ifort (IFORT) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

------------------------------------------------------------------------------
FC 507.cactuBSSN_r(peak)

(Continued on next page)
Lenovo Global Technology
ThinkSystem SN550 (2.00 GHz, Intel Xeon Silver 4109T)

SPECrate2017_fp_base = 81.8
SPECrate2017_fp_peak = 84.1

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### Compiler Version Notes (Continued)

```plaintext
icpc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

ifort (IFORT) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
```

---

```plaintext
FC 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak) 554.roms_r(base)
```

---

```plaintext
ifort (IFORT) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
```

---

```plaintext
FC 554.roms_r(peak)
```

---

```plaintext
ifort (IFORT) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
```

---

```plaintext
CC 521.wrf_r(base) 527.cam4_r(base)
```

---

```plaintext
ifort (IFORT) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
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```plaintext
CC 521.wrf_r(peak) 527.cam4_r(peak)
```

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```plaintext
ifort (IFORT) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
```

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### Base Compiler Invocation

C benchmarks:

icc

(Continued on next page)
Lenovo Global Technology
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(2.00 GHz, Intel Xeon Silver 4109T)

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Test Sponsor: Lenovo Global Technology
Test Date: Jun-2018
Tested by: Lenovo Global Technology
Hardware Availability: Aug-2017
Software Availability: Feb-2018

Base Compiler Invocation (Continued)

C++ benchmarks:
icpc

Fortran benchmarks:
ifort

Benchmarks using both Fortran and C:
ifort icc

Benchmarks using both C and C++:
icpc icc

Benchmarks using Fortran, C, and C++:
icpc icc 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.libm_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=3

C++ benchmarks:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=3

(Continued on next page)
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### Base Optimization Flags (Continued)

#### Fortran benchmarks:

- `xCORE-AVX2`  
- `-ipo`  
- `-O3`  
- `-no-prec-div`  
- `-qopt-prefetch`  
- `-ffinite-math-only`  
- `-qopt-mem-layout-trans=3`  
- `-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=3`  
- `-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=3`

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

- `xCORE-AVX2`  
- `-ipo`  
- `-O3`  
- `-no-prec-div`  
- `-qopt-prefetch`  
- `-ffinite-math-only`  
- `-qopt-mem-layout-trans=3`  
- `-nostandard-realloc-lhs`  
- `-align array32byte`

### Base Other Flags

#### C benchmarks:

- `-m64`  
- `-std=c11`

#### C++ benchmarks:

- `-m64`

#### Fortran benchmarks:

- `-m64`

#### Benchmarks using both Fortran and C:

- `-m64`  
- `-std=c11`

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

- `-m64`  
- `-std=c11`

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

- `-m64`  
- `-std=c11`

### Peak Compiler Invocation

#### C benchmarks:

- `icc`

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Lenovo Global Technology
ThinkSystem SN550
(2.00 GHz, Intel Xeon Silver 4109T)

SPECraten2017_fp_base = 81.8
SPECraten2017_fp_peak = 84.1

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### Peak Compiler Invocation (Continued)

**C++ benchmarks:**
- icpc

**Fortran benchmarks:**
- ifort

**Benchmarks using both Fortran and C:**
- ifort icc

**Benchmarks using both C and C++:**
- icpc icc

**Benchmarks using Fortran, C, and C++:**
- icpc icc ifort

---

### Peak Portability Flags

Same as Base Portability Flags

---

### Peak Optimization Flags

**C benchmarks:**

519.lbm_r:  
- prof-gen(pass 1)  
- prof-use(pass 2)  
- i po  
- xCORE-AVX2 -O3  
- no-prec-div  
- qopt-prefetch  
- ff inite-math-only  
- qopt-mem-layout-trans=3  

538.imagick_r:  
- xCORE-AVX2  
- i po -O3  
- no-prec-div  
- qopt-prefetch  
- ff inite-math-only  
- qopt-mem-layout-trans=3  

544.nab_r: Same as 519.lbm_r

**C++ benchmarks:**

- prof-gen(pass 1)  
- prof-use(pass 2)  
- i po -xCORE-AVX2 -O3  
- no-prec-div  
- qopt-prefetch  
- ff inite-math-only  
- qopt-mem-layout-trans=3  

**Fortran benchmarks:**

503.bwaves_r:  
- xCORE-AVX2  
- i po -O3  
- no-prec-div  
- qopt-prefetch  
- ff inite-math-only  
- qopt-mem-layout-trans=3  

(Continued on next page)
Lenovo Global Technology
ThinkSystem SN550
(2.00 GHz, Intel Xeon Silver 4109T)

SPECrate2017_fp_base = 81.8
SPECrate2017_fp_peak = 84.1

Peak Optimization Flags (Continued)

549.fotonik3d_r: Same as 503.bwaves_r

554.roms_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=3 -nstandard-realloc-lhs
-align array32byte

Benchmarks using both Fortran and C:
- prof-gen(pass 1) - prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=3 -nstandard-realloc-lhs -align array32byte

Benchmarks using both C and C++:
- prof-gen(pass 1) - prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=3

Benchmarks using Fortran, C, and C++:
- prof-gen(pass 1) - prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=3 -nstandard-realloc-lhs -align array32byte

Peak Other Flags

C benchmarks:
- m64 -std=c11

C++ benchmarks:
- m64

Fortran benchmarks:
- m64

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

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

Benchmarks using Fortran, C, and C++:
- m64 -std=c11
### Lenovo Global Technology

**ThinkSystem SN550**  
(2.00 GHz, Intel Xeon Silver 4109T)

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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.html](http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.html)
- [http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-SKL-C.html](http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-SKL-C.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.xml](http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.xml)
- [http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-SKL-C.xml](http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-SKL-C.xml)

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