### Lenovo Global Technology

**Test System:**
- **Name:** ThinkSystem SR590
- **CPU:** Intel Xeon Gold 6128
- **Clock Speed:** 3.40 GHz

**SPECspeed2017_fp_base:** 70.9
**SPECspeed2017_fp_peak:** 71.9

### Hardware

**CPU Name:** Intel Xeon Gold 6128  
**Max MHz.:** 3700  
**Nominal:** 3400  
**Enabled:** 12 cores, 2 chips  
**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:** 19.25 MB I+D on chip per core  
**Other:** None  
**Memory:** 384 GB (12 x 32 GB 2Rx4 PC4-2666V-R)  
**Storage:** 1 x 800 GB SAS SSD  
**Other:** None

### Software

**OS:** SUSE Linux Enterprise Server 12 SP3 (x86_64)  
**Kernel:** 4.4.114-94.11-default  
**Compiler:** C/C++: Version 18.0.0.128 of Intel C/C++  
**Compiler for Linux:**  
**Compiler for Fortran:** Version 18.0.0.128 of Intel Fortran  
**Compilers for Linux:**  
**Parallel:** Yes  
**Firmware:** Lenovo BIOS Version TEE119R 1.22 released Feb-2018  
**File System:** btrfs  
**System State:** Run level 3 (multi-user)  
**Base Pointers:** 64-bit  
**Peak Pointers:** 64-bit  
**Other:** None

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| Benchmark | Threads | 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 | 330.0 | 345.0 | 360.0 | 375.0 | 390.0 |
|-----------|---------|---|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 603.bwaves_s | 12 |   |      |      |      |      |      |      |       |       |       |       |       | 75.5  |       |       |       |       |       |       |       | 89.7  |       |       |       |       |       |       | 364   |
| 607.cactuBSSN_s | 12 |   |      |      |      |      |      |      |       |       |       |       |       | 76.3  |       |       |       |       |       |       |       |       |       |       |       |       |       |       | 364   |
| 619.lbm_s | 12 |   |      |      |      |      |      |      |       |       |       |       |       | 35.6  | 35.9  |       |       |       |       |       |       |       |       |       |       |       |       | 364   |
| 621.wrf_s | 12 |   |      |      |      |      |      |      |       |       |       |       |       | 66.3  | 69.2  |       |       |       |       |       |       |       |       |       |       |       |       | 364   |
| 627.cam4_s | 12 |   |      |      |      |      |      |      |       |       |       |       |       | 38.9  | 38.9  |       |       |       |       |       |       |       |       |       |       |       |       | 364   |
| 628.pop2_s | 12 |   |      |      |      |      |      |      |       |       |       |       |       | 57.1  | 38.4  |       |       |       |       |       |       |       |       |       |       |       |       | 364   |
| 638.imagick_s | 12 |   |      |      |      |      |      |      |       |       |       |       |       | 49.1  | 49.1  |       |       |       |       |       |       |       |       |       |       |       |       | 364   |
| 644.nab_s | 12 |   |      |      |      |      |      |      |       |       |       |       |       | 64.9  | 89.7  |       |       |       |       |       |       |       |       |       |       |       |       | 364   |
| 649.fotonik3d_s | 12 |   |      |      |      |      |      |      |       |       |       |       |       | 65.5  | 77.4  |       |       |       |       |       |       |       |       |       |       |       |       | 364   |
| 654.roms_s | 12 |   |      |      |      |      |      |      |       |       |       |       |       | 77.4  | 81.4  |       |       |       |       |       |       |       |       |       |       |       |       | 364   |
Lenovo Global Technology
ThinkSystem SR590
(3.40 GHz, Intel Xeon Gold 6128)

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

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"
OMP_STACKSIZE = "192M"

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
Yes: 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.

Platform Notes
BIOS configuration:
Choose Operating Mode set to Maximum Performance
Hyper-Threading set to Disable

(Continued on next page)
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<table>
<thead>
<tr>
<th>CPU2017 License:</th>
<th>9017</th>
<th>Test Date:</th>
<th>Mar-2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Sponsor:</td>
<td>Lenovo Global Technology</td>
<td>Hardware Availability:</td>
<td>Nov-2017</td>
</tr>
<tr>
<td>Tested by:</td>
<td>Lenovo Global Technology</td>
<td>Software Availability:</td>
<td>Feb-2018</td>
</tr>
</tbody>
</table>

**Platform Notes (Continued)**

Adjacent Cache Prefetch set to Disable
DCA set to Enable
Uncore Frequency Scaling set to Disable
MONITORMWAIT set to Enable
Per Core P-state set to Disable
LLC dead line alloc set to Disable
Patrol Scrub set to Disable
SNC set to Enable

Sysinfo program /home/cpu2017.1.0.2.ic18.0/bin/sysinfo
Rev: r5797 of 2017-06-14 96c45e4568ad54c135fd618bcc091c0f
running on SR590-1 Mon Mar 26 13:53:15 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) Gold 6128 CPU @ 3.40GHz
- 2 "physical id"s (chips)
- 12 "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 : 6
    - siblings : 6
    - physical 0: cores 1 4 8 10 11 12
    - physical 1: cores 0 6 9 10 11 13

From lscpu:
- Architecture: x86_64
- CPU op-mode(s): 32-bit, 64-bit
- Byte Order: Little Endian
- CPU(s): 12
- On-line CPU(s) list: 0-11
- Thread(s) per core: 1
- Core(s) per socket: 6
- Socket(s): 2
- NUMA node(s): 4
- Vendor ID: GenuineIntel
- CPU family: 6
- Model: 85
- Model name: Intel(R) Xeon(R) Gold 6128 CPU @ 3.40GHz
- Stepping: 4
- CPU MHz: 3392.054
- BogoMIPS: 6784.10
- Virtualization: VT-x
- L1d cache: 32K
- L1i cache: 32K

(Continued on next page)
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SPECspeed2017_fp_peak = 71.9

CPU2017 License: 9017
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Test Date: Mar-2018
Hardware Availability: Nov-2017
Software Availability: Feb-2018

Platform Notes (Continued)

L2 cache: 1024K
L3 cache: 19712K
NUMA node0 CPU(s): 0,2,3
NUMA node1 CPU(s): 1,4,5
NUMA node2 CPU(s): 6,8,9
NUMA node3 CPU(s): 7,10,11
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 nop1 xtopology nonstop_tsc
aperfmpref eagerfpu pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg
fma cx16 xtrm pclmulqdq dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes
xsave avxf16c rdrand lahf_lm abm 3dnowprefetch ida arat epb invpcid_single pln pts
dtherm intel_pt rsb_ctxtsw spec_ctrl retpoline kaiser tpr_shadow vnmi flexpriority
ept vpid fsgsb tsc_adjust bmi hle avx2 smep bmi2 erms invpcid rtm cqm mpx
avx512f avx512dq rdseed adx smap clflushopt clwb avx512cd avx512bw avx512vl xsaveopt
xsaveopt xgetbv1 cqm_llc cqm_occup_llc pku ospke

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 2 3
  node 0 size: 96364 MB
  node 0 free: 95267 MB
  node 1 cpus: 1 4 5
  node 1 size: 96760 MB
  node 1 free: 95848 MB
  node 2 cpus: 6 8 9
  node 2 size: 96760 MB
  node 2 free: 96525 MB
  node 3 cpus: 7 10 11
  node 3 size: 96757 MB
  node 3 free: 96445 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: 395921572 kB
  HugePages_Total: 0
  Hugepagesize: 2048 kB

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Platform Notes (Continued)

From /etc/*release*/etc/*version*
SuSE-release:
  SUSE Linux Enterprise Server 12 (x86_64)
  VERSION = 12
  PATCHLEVEL = 3
  # 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-SP3"
  VERSION_ID="12.3"
  PRETTY_NAME="SUSE Linux Enterprise Server 12 SP3"
  ID="sles"
  ANSI_COLOR="0;32"
  CPE_NAME="cpe:/o:suse:sles:12:sp3"

uname -a:
  Linux SR590-1 4.4.114-94.11-default #1 SMP Thu Feb 1 19:28:26 UTC 2018 (4309ff9)
  x86_64 x86_64 x86_64 GNU/Linux

run-level 3 Mar 26 10:23

SPEC is set to: /home/cpu2017.1.0.2.ic18.0

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 -[TEE119R-1.22]- 02/06/2018
Memory:
  12x Hynix HMA84GR7AFR4N-VK 32 GB 2 rank 2666
  4x NO DIMM NO DIMM

(End of data from sysinfo program)

Compiler Version Notes

==========================================
CC  619.lbm_s(base) 638.imagick_s(base, peak) 644.nab_s(base, peak)
------------------------------------------
icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

(Continued on next page)
## Compiler Version Notes (Continued)

### CC 619.lbm_s (peak)
---

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

### FC 607.cactuBSSN_s (base)
---

```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.
```

### FC 607.cactuBSSN_s (peak)
---

```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.
```

### FC 603.bwaves_s (base) 649.fotonik3d_s (base) 654.roms_s (base)
---

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

### FC 603.bwaves_s (peak) 649.fotonik3d_s (peak) 654.roms_s (peak)
---

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

### CC 621.wrf_s (base) 627.cam4_s (base, peak) 628.pop2_s (base)
---

```plaintext
ifort (IFORT) 18.0.0 20170811
```
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Compiler Version Notes (Continued)

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

Base Compiler Invocation

C benchmarks:
icc

Fortran benchmarks:
ifort

Benchmarks using both Fortran and C:
ifort icc

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

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

Base Optimization Flags

C benchmarks:
-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=3 -qopenmp -DSPEC_OPENMP

Fortran benchmarks:
-DSPEC_OPENMP -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=3 -qopenmp
-nostandard-realloc-lhs -align array32byte

Benchmarks using both Fortran and C:
-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=3 -qopenmp -DSPEC_OPENMP
-nostandard-realloc-lhs -align array32byte

Benchmarks using Fortran, C, and C++:
-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=3 -qopenmp -DSPEC_OPENMP
-nostandard-realloc-lhs -align array32byte

Base Other Flags

C benchmarks:
-m64 -std=c11

Fortran benchmarks:
-m64

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

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

Peak Compiler Invocation

C benchmarks:
icc

Fortran benchmarks:
ifort

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Peak Compiler Invocation (Continued)

Benchmarks using both Fortran and C:
ifort icc

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

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

619.lbm_s: -prof-gen(pass 1) -prof-use(pass 2) -O2 -xCORE-AVX512
-qopt-prefetch -ipo -O3 -ffinite-math-only -no-prec-div
-qopt-mem-layout-trans=3 -DSPEC_SUPPRESS_OPENMP -qopenmp
-DSPEC_OPENMP

638.imagick_s: -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=3 -qopenmp
-DSPEC_OPENMP

644.nab_s: Same as 638.imagick_s

Fortran benchmarks:

 PROF-gen(pass 1) -prof-use(pass 2) -DSPEC_SUPPRESS_OPENMP
-DSPEC_OPENMP -O2 -xCORE-AVX512 -qopt-prefetch -ipo -O3
-ffinite-math-only -no-prec-div -qopt-mem-layout-trans=3 -qopenmp
-nostandard-realloc-lhs -align array32byte

Benchmarks using both Fortran and C:

621.wrf_s: -prof-gen(pass 1) -prof-use(pass 2) -O2 -xCORE-AVX512
-qopt-prefetch -ipo -O3 -ffinite-math-only -no-prec-div
-qopt-mem-layout-trans=3 -DSPEC_SUPPRESS_OPENMP -qopenmp
-DSPEC_OPENMP -nostandard-realloc-lhs -align array32byte

627.cam4_s: -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=3 -qopenmp
-DSPEC_OPENMP -nostandard-realloc-lhs -align array32byte

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Software Availability: Feb-2018

Peak Optimization Flags (Continued)

628.pop2_s: Same as 621.wrf_s

Benchmarks using Fortran, C, and C++:
-prof-gen(pass 1) -prof-use(pass 2) -O2 -xCORE-AVX512 -qopt-prefetch
-ipo -O3 -ffinite-math-only -no-prec-div -qopt-mem-layout-trans=3
-DSPEC_SUPPRESS_OPENMP -qopenmp -DSPEC_OPENMP -nostandard-realloc-lhs
-align array32byte

Peak Other Flags

C benchmarks:
-m64 -std=c11

Fortran benchmarks:
-m64

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

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

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/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/Lenovo-Platform-SPECcpu2017-Flags-V1.2-SKL-C.xml

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

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