# Lenovo Global Technology

ThinkSystem SR860 V2  
(2.80 GHz, Intel Xeon Gold 6328HL)

<table>
<thead>
<tr>
<th>Threads</th>
<th>SPECspeed®2017_fp_base = 207</th>
<th>SPECspeed®2017_fp_peak = Not Run</th>
</tr>
</thead>
<tbody>
<tr>
<td>603.bwaves_s 64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>607.cactuBSSN_s 64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>619.lbm_s 64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>621.wrf_s 64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>627.cam4_s 64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>628.pop2_s 64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>638.imagick_s 64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>644.nab_s 64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>649.fotonik3d_s 64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>654.roms_s 64</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Hardware

- **CPU Name:** Intel Xeon Gold 6328HL  
  - **Max MHz:** 4300  
  - **Nominal:** 2800  
  - **Enabled:** 64 cores, 4 chips  
  - **Orderable:** 2,4 chips  
  - **Cache L1:** 32 KB I + 32 KB D on chip per core  
  - **Cache L2:** 1 MB I+D on chip per core  
  - **Cache L3:** 22 MB I+D on chip per chip  
  - **Other:** None  
  - **Memory:** 1536 GB (48 x 32 GB 2Rx4 PC4-3200AA-R, running at 2933)  
  - **Storage:** 1 x 960 GB SATA SSD  
  - **Other:** None

## Software

- **OS:** Red Hat Enterprise Linux 8.2  
  (Ootpa)  
  - **Kernel:** 4.18.0-193.el8.x86_64  
  - **Compiler:** C/C++: Version 19.0.5.281 of Intel C/C++  
  - **Fortran:** Version 19.0.5.281 of Intel Fortran  
  - **Parallel:** Yes  
  - **Firmware:** Lenovo BIOS Version M5E107H 1.00 released Oct-2020  
  - **File System:** xfs  
  - **System State:** Run level 3 (multi-user)  
  - **Base Pointers:** 64-bit  
  - **Peak Pointers:** Not Applicable  
  - **Other:** None  
  - **Power Management:** BIOS set to prefer performance at the cost of additional power usage
### Lenovo Global Technology

ThinkSystem SR860 V2  
(2.80 GHz, Intel Xeon Gold 6328HL)

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

---

#### Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>603.bwaves_s</td>
<td>64</td>
<td>65.7</td>
<td>897</td>
<td>64.1</td>
<td>920</td>
<td>64.5</td>
<td>915</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>64</td>
<td>80.6</td>
<td>207</td>
<td>81.2</td>
<td>205</td>
<td>81.7</td>
<td>204</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>64</td>
<td>32.0</td>
<td>164</td>
<td>32.3</td>
<td>162</td>
<td>32.4</td>
<td>162</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>64</td>
<td>96.8</td>
<td>137</td>
<td>98.3</td>
<td>135</td>
<td>97.0</td>
<td>136</td>
</tr>
<tr>
<td>627.cam4_s</td>
<td>64</td>
<td>55.6</td>
<td>159</td>
<td>55.6</td>
<td>159</td>
<td>55.7</td>
<td>159</td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>64</td>
<td>178</td>
<td>66.5</td>
<td>175</td>
<td>67.9</td>
<td>176</td>
<td>67.4</td>
</tr>
<tr>
<td>638.imagick_s</td>
<td>64</td>
<td>70.6</td>
<td>204</td>
<td>70.5</td>
<td>205</td>
<td>70.0</td>
<td>206</td>
</tr>
<tr>
<td>644.nab_s</td>
<td>64</td>
<td>43.8</td>
<td>399</td>
<td>43.7</td>
<td>400</td>
<td>43.6</td>
<td>401</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>64</td>
<td>73.8</td>
<td>123</td>
<td>74.0</td>
<td>123</td>
<td>74.0</td>
<td>123</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>64</td>
<td>48.0</td>
<td>328</td>
<td>47.9</td>
<td>329</td>
<td>48.1</td>
<td>328</td>
</tr>
</tbody>
</table>

**SPECspeed®2017_fp_base =** 207  
**SPECspeed®2017_fp_peak =** Not Run

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/cpu2017-1.1.0-ic19.0u5-2/lib/intel64"`  
- `OMP_STACKSIZE = "192M"`

---

#### General Notes

Binaries compiled on a system with 1x Intel Core i9-9900K CPU + 64GB RAM memory using Redhat Enterprise Linux 8.0  
Transparent Huge Pages disabled by default  
echo never > /sys/kernel/mm/transparent_hugepage/enabled  
echo never > /sys/kernel/mm/transparent_hugepage/defrag  
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.
Lenovo Global Technology
ThinkSystem SR860 V2
(2.80 GHz, Intel Xeon Gold 6328HL)

SPECspeed®2017_fp_base = 207
SPECspeed®2017_fp_peak = Not Run

Platform Notes

BIOS configuration:
Choose Operating Mode set to Maximum Performance and then set it to Custom Mode
MONITOR/MWAIT set to Enabled
Hyper-Threading set to Disabled
Adjacent Cache Prefetch set to Disabled

Sysinfo program /home/cpu2017-1.1.0-ic19.0u5-2/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7eddb1e6e46a485a0011
running on localhost.localdomain Tue Dec 1 12:20:46 2020

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 6328HL CPU @ 2.80GHz
4 "physical id"s (chips)
64 "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 : 16
siblings : 16
physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
physical 2: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
physical 3: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 64
On-line CPU(s) list: 0-63
Thread(s) per core: 1
Core(s) per socket: 16
Socket(s): 4
NUMA node(s): 4
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Gold 6328HL CPU @ 2.80GHz
Stepping: 11
CPU MHz: 3563.265
CPU max MHz: 4300.0000
CPU min MHz: 1000.0000
BogoMIPS: 5600.00
Virtualization: VT-x

(Continued on next page)
### Lenovo Global Technology

ThinkSystem SR860 V2  
(2.80 GHz, Intel Xeon Gold 6328HL)

<table>
<thead>
<tr>
<th>SPECspeed®2017_fp_base</th>
<th>207</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECspeed®2017_fp_peak</td>
<td>Not Run</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th><strong>Test Date:</strong></th>
<th>Dec-2020</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hardware Availability:</strong></td>
<td>Nov-2020</td>
</tr>
<tr>
<td><strong>Software Availability:</strong></td>
<td>Apr-2020</td>
</tr>
</tbody>
</table>

---

**Platform Notes (Continued)**

```
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 22528K
NUMA node0 CPU(s): 0-15
NUMA node1 CPU(s): 16-31
NUMA node2 CPU(s): 32-47
NUMA node3 CPU(s): 48-63
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
aperfmperf 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 3nowprefetch cpuid_fault epb cat_l3 cdp_l3
invpclid_single intel_pmm ssbd mba ibrs ibpb ibrs_enhanced tpr_shadow vnumi
flexpriority ept vpid fsgsb base tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm
cqm mpx rdt_a avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd
avx512bw avx512vl xsaveopt xsavec xsavec xsaves cqm_llc cqm_occupa_llc cqm_mbm_total
cqm_mbm_local avx512_bf16 dtherm ida arat pin pts pku ospke avx512_vnni md_clear
flush_l1d arch_capabilities
```

/proc/cpuinfo cache data

```
cache size : 22528 KB
```

From numactl --hardware  
WARNING: a numactl 'node' might or might not correspond to a  
physical chip.

```
available: 4 nodes (0-3)
nod 0 cpus: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
node 0 size: 386629 MB
node 0 free: 386234 MB
node 1 cpus: 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
node 1 size: 387068 MB
node 1 free: 386836 MB
node 2 cpus: 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
node 2 size: 387068 MB
node 2 free: 386848 MB
node 3 cpus: 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63
node 3 size: 387067 MB
node 3 free: 386649 MB
node distances:
node 0 1 2 3
0: 10 20 20 20
1: 20 10 20 20
2: 20 20 10 20
3: 20 20 20 10
```

From /proc/meminfo

(Continued on next page)
Lenovo Global Technology
ThinkSystem SR860 V2
(2.80 GHz, Intel Xeon Gold 6328HL)

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

Platform Notes (Continued)

MemTotal: 1584981352 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

From /etc/*release* /etc/*version*
  os-release:
    NAME="Red Hat Enterprise Linux"
    VERSION=8.2 (Ootpa)
    ID="rhel"
    ID_LIKE="fedora"
    VERSION_ID="8.2"
    PLATFORM_ID="platform:el8"
    PRETTY_NAME="Red Hat Enterprise Linux 8.2 (Ootpa)"
    ANSI_COLOR="0;31"
  redhat-release: Red Hat Enterprise Linux release 8.2 (Ootpa)
  system-release: Red Hat Enterprise Linux release 8.2 (Ootpa)
  system-release-cpe: cpe:/o:redhat:enterprise_linux:8.2:ga

uname -a:
  Linux localhost.localdomain 4.18.0-193.el8.x86_64 #1 SMP Fri Mar 27 14:35:58 UTC 2020
  x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

itlb_multihit: Not affected
CVE-2018-3620 (L1 Terminal Fault): Not affected
Microarchitectural Data Sampling: Not affected
CVE-2017-5754 (Meltdown): Not affected
CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2017-5753 (Spectre variant 1): Mitigation: usercopy/swaps barriers and __user pointer sanitation
CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling
tsx_async_abort: Not affected

run-level 3 Dec 1 12:20

SPEC is set to: /home/cpu2017-1.1.0-ic19.0u5-2
  Filesystem Type Size Used Avail Use% Mounted on
  /dev/sda4 xfs 839G 23G 816G 3% /home

From /sys/devices/virtual/dmi/id
  BIOS: Lenovo M5E107H-1.00 10/18/2020
  Vendor: Lenovo
  Product: ThinkSystem SR860 V2
  Product Family: ThinkSystem

(Continued on next page)
Platform Notes (Continued)

Serial: none

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.

Memory:
48x Samsung M393A4K40DB3-CWE 32 GB 2 rank 3200

(End of data from sysinfo program)

Memory on this system run at 2933 MHz due to CPU limitation.

Compiler Version Notes

==============================================================================
<table>
<thead>
<tr>
<th>C</th>
<th>619.lbm_s(base) 638.imagick_s(base) 644.nab_s(base)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.5.281 Build 20190815</td>
<td></td>
</tr>
<tr>
<td>Copyright (C) 1985-2019 Intel Corporation. All rights reserved.</td>
<td></td>
</tr>
</tbody>
</table>

==============================================================================
<table>
<thead>
<tr>
<th>C++, C, Fortran</th>
<th>607.cactuBSSN_s(base)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.5.281 Build 20190815</td>
<td></td>
</tr>
<tr>
<td>Copyright (C) 1985-2019 Intel Corporation. All rights reserved.</td>
<td></td>
</tr>
<tr>
<td>Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.5.281 Build 20190815</td>
<td></td>
</tr>
<tr>
<td>Copyright (C) 1985-2019 Intel Corporation. All rights reserved.</td>
<td></td>
</tr>
<tr>
<td>Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.5.281 Build 20190815</td>
<td></td>
</tr>
<tr>
<td>Copyright (C) 1985-2019 Intel Corporation. All rights reserved.</td>
<td></td>
</tr>
</tbody>
</table>

==============================================================================
<table>
<thead>
<tr>
<th>Fortran</th>
<th>603.bwaves_s(base) 649.fotonik3d_s(base) 654.roms_s(base)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.5.281 Build 20190815</td>
<td></td>
</tr>
<tr>
<td>Copyright (C) 1985-2019 Intel Corporation. All rights reserved.</td>
<td></td>
</tr>
</tbody>
</table>

==============================================================================
<table>
<thead>
<tr>
<th>Fortran, C</th>
<th>621.wrf_s(base) 627.cam4_s(base) 628.pop2_s(base)</th>
</tr>
</thead>
</table>

(Continued on next page)
Lenovo Global Technology
ThinkSystem SR860 V2
(2.80 GHz, Intel Xeon Gold 6328HL)

Copyright 2017-2020 Standard Performance Evaluation Corporation

Lenovo Global Technology
Lenovo Global Technology
Lenovo Global Technology
Lenovo Global Technology

Compiler Version Notes (Continued)

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.0.5.281 Build 20190815
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.5.281 Build 20190815
Copyright (C) 1985-2019 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

-DSPEC_LP64
-DSPEC_CASE_FLAG
-convert big_endian
-assume byterecl

Base Optimization Flags

-m64 -std=c11 -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch

(Continued on next page)
Lenovo Global Technology
ThinkSystem SR860 V2
(2.80 GHz, Intel Xeon Gold 6328HL)

SPECspeed®2017_fp_base = 207
SPECspeed®2017_fp_peak = Not Run

CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Test Date: Dec-2020
Tested by: Lenovo Global Technology
Hardware Availability: Nov-2020
Software Availability: Apr-2020

Base Optimization Flags (Continued)

C benchmarks (continued):
-ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP

Fortran benchmarks:
-m64 -DSPEC_OPENMP -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp
-nostandard-realloc-lhs

Benchmarks using both Fortran and C:
-m64 -std=c11 -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP
-nostandard-realloc-lhs

Benchmarks using Fortran, C, and C++:
-m64 -std=c11 -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP
-nostandard-realloc-lhs

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

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-Cooperlake-A.xml

SPEC CPU and SPECspeed are registered trademarks of the Standard Performance Evaluation Corporation. All other brand and product names appearing in this result are trademarks or registered trademarks of their respective holders.

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

Tested with SPEC CPU®2017 v1.1.0 on 2020-12-01 12:20:46-0500.
Report generated on 2020-12-28 09:45:07 by CPU2017 PDF formatter v6255.
Originally published on 2020-12-22.