## SPEC CPU®2017 Floating Point Speed Result

**Lenovo Global Technology**  
ThinkSystem SR850 V2  
(2.80 GHz, Intel Xeon Gold 6328HL)

**SPECSpeed®2017_fp_base = 208**  
SPECSpeed®2017_fp_peak = Not Run

<table>
<thead>
<tr>
<th>Threads</th>
<th>Benchmark</th>
<th>Value</th>
<th>Spec Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>64</td>
<td>603.bwaves_s</td>
<td>64</td>
<td>204</td>
</tr>
<tr>
<td>64</td>
<td>607.cactuBSSN_s</td>
<td>64</td>
<td>199</td>
</tr>
<tr>
<td>64</td>
<td>619.lbm_s</td>
<td>64</td>
<td>137</td>
</tr>
<tr>
<td>64</td>
<td>621.wrf_s</td>
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<td>160</td>
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<td>64</td>
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<td>67.2</td>
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<tr>
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<tr>
<td>64</td>
<td>638.imagick_s</td>
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<tr>
<td>64</td>
<td>644.nab_s</td>
<td>64</td>
<td>309</td>
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<tr>
<td>64</td>
<td>649.fotonik3d_s</td>
<td>64</td>
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</tr>
<tr>
<td>64</td>
<td>654.roms_s</td>
<td>64</td>
<td>Not Applicable</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  
**L2:** 1 MB I+D on chip per core  
**L3:** 22 MB I+D on chip per chip  
**Memory:** 1536 GB (48 x 32 GB 2Rx8 PC4-3200AA-R, running at 2933)  
**Storage:** 1 x 960 GB SATA SSD  
**Other:** None

### Software

**OS:** Red Hat Enterprise Linux 8.2  
**Compiler:** C/C++: Version 19.0.5.281 of Intel  
**Parallel:** Yes  
**Firmware:** Lenovo BIOS Version M5E107I 1.01 released Nov-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
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<table>
<thead>
<tr>
<th>CPU2017 License: 9017</th>
<th>Test Date: Jan-2021</th>
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<tr>
<td>Test Sponsor: Lenovo Global Technology</td>
<td>Hardware Availability: Nov-2020</td>
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<td>Tested by: Lenovo Global Technology</td>
<td>Software Availability: Apr-2020</td>
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**Results Table**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
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<tr>
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<td><strong>47.9</strong></td>
<td><strong>329</strong></td>
<td>47.9</td>
<td>329</td>
</tr>
</tbody>
</table>

**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.
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 295195f888a3d7ed61e6e46a485a0011
running on localhost.localdomain Mon Jan  4 05:35:10 2021

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: 3270.452
CPU max MHz: 4300.0000
CPU min MHz: 1000.0000
BogoMIPS: 5600.00
Virtualization: VT-x

(Continued on next page)
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**CPU2017 License:** 9017

**Test Sponsor:** Lenovo Global Technology

**Test Date:** Jan-2021

**Tested by:** Lenovo Global Technology

**Hardware Availability:** Nov-2020

**Software Availability:** Apr-2020

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**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 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

aperfmpref pni pclmulqdq dtes64 monitor ds cpl vmx est tm2 ssse3 sdbg fma cx16

xtr2 pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave

avx f16c rdrand lahf_lm abml 3nowprefetch cpuid_fault epb cat_13 cdp_13

invpcid_single intel_pipp ssbd mba ibps ibbp ibrs_enhanced tpr_shadow vnmi

flexpriority op vpid fsogbase 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 xgetbv1 xsaves cqm_llc cqm_occ丝路l cqm_mbb_total

cqm_mmb_local avx512_bf16 dtherm ida arat pin pts kpu 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)

node 0 cpus: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

node 0 size: 386657 MB

node 0 free: 386180 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: 386756 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: 386833 MB

node 3 cpus: 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63

node 3 size: 387040 MB

node 3 free: 386797 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)
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</table>

**Platform Notes (Continued)**

MemTotal: 1584981380 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 (Melttdown)`: 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 sanitization
- `CVE-2017-5715 (Spectre variant 2)`: Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling
- `tsx_async_abort`: Not affected

```
run-level 3 Jan 4 05:33
```

### Filesystem

```
Filesystem  Type  Size  Used Avail Use% Mounted on
/dev/sda2    xfs  838G  41G  797G  5%  /home
```

From /sys/devices/virtual/dmi/id

```
    BIOS: Lenovo M5E107I-1.01 11/02/2020
    Vendor: Lenovo
    Product: ThinkSystem SR850 V2
    Product Family: ThinkSystem
```

(Continued on next page)
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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 M393A4G43AB3-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

C               | 619.lbm_s(base) 638.imagick_s(base) 644.nab_s(base)
------------------------------------------------------------------------------
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.
------------------------------------------------------------------------------

C++, C, Fortran | 607.cactuBSSN_s(base)
------------------------------------------------------------------------------
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.
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.
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.
------------------------------------------------------------------------------

Fortran         | 603.bwaves_s(base) 649.fotonik3d_s(base) 654.roms_s(base)
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Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64,
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------------------------------------------------------------------------------

Fortran, C      | 621.wrf_s(base) 627.cam4_s(base) 628.pop2_s(base)
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Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.5.281 Build 20190815
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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

Base Optimization Flags

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

(Continued on next page)
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

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