## Lenovo Global Technology

ThinkSystem SD650 V2
(2.60 GHz, Intel Xeon Gold 6348)

**CPU2017 License:** 9017  
**Test Sponsor:** Lenovo Global Technology  
**Tested by:** Lenovo Global Technology  
**Test Date:** May-2021  
**Hardware Availability:** Jul-2021  
**Software Availability:** Feb-2021

### SPECrate®2017_fp_base

![SPECrate®2017_fp_base](image)

### SPECrate®2017_fp_peak

Not Run

### Hardware

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CPU Name</strong></td>
<td>Intel Xeon Gold 6348</td>
</tr>
<tr>
<td><strong>Max MHz</strong></td>
<td>3500</td>
</tr>
<tr>
<td><strong>Nominal</strong></td>
<td>2600</td>
</tr>
<tr>
<td><strong>Enabled</strong></td>
<td>56 cores, 2 chips</td>
</tr>
<tr>
<td><strong>Orderable</strong></td>
<td>2 chips</td>
</tr>
<tr>
<td><strong>Cache L1</strong></td>
<td>32 KB I + 48 KB D on chip per core</td>
</tr>
<tr>
<td><strong>L2</strong></td>
<td>1.25 MB I+D on chip per core</td>
</tr>
<tr>
<td><strong>L3</strong></td>
<td>42 MB I+D on chip per chip</td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td>512 GB (16 x 32 GB 2Rx4 PC4-3200AA-R)</td>
</tr>
<tr>
<td><strong>Storage</strong></td>
<td>1 x 480 GB SATA SSD</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>None</td>
</tr>
</tbody>
</table>

### Software

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OS</strong></td>
<td>Red Hat Enterprise Linux 8.3</td>
</tr>
<tr>
<td><strong>Kernel</strong></td>
<td>4.18.0-240.el8.x86_64</td>
</tr>
<tr>
<td><strong>Compiler</strong></td>
<td>C/C++: Version 2021.1 of Intel oneAPI DPC++/C++ Compiler Build 20201113 for Linux; Fortran: Version 2021.1 of Intel Fortran Compiler Classic Build 20201112 for Linux; C/C++: Version 2021.1 of Intel C/C++ Compiler Classic Build 20201112 for Linux</td>
</tr>
<tr>
<td><strong>Parallel</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Firmware</strong></td>
<td>Lenovo BIOS Version U8E109PT1 1.01 released Apr-2021</td>
</tr>
<tr>
<td><strong>File System</strong></td>
<td>xfs</td>
</tr>
<tr>
<td><strong>System State</strong></td>
<td>Run level 3 (multi-user)</td>
</tr>
<tr>
<td><strong>Base Pointers</strong></td>
<td>64-bit</td>
</tr>
<tr>
<td><strong>Peak Pointers</strong></td>
<td>Not Applicable</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>jemalloc memory allocator V5.0.1</td>
</tr>
<tr>
<td><strong>Power Management</strong></td>
<td>BIOS and OS set to prefer performance at the cost of additional power usage</td>
</tr>
</tbody>
</table>
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ThinkSystem SD650 V2  
(2.60 GHz, Intel Xeon Gold 6348)  

Test Sponsor: Lenovo Global Technology  
Tested by: Lenovo Global Technology  

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
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<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
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<tbody>
<tr>
<td>503.bwaves_r</td>
<td>56</td>
<td>771</td>
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<td>507.cactuBSSN_r</td>
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<td>56</td>
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<td>319</td>
<td>163</td>
<td>327</td>
<td>166</td>
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<td>511.povray_r</td>
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<td>131</td>
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<td>544.nab_r</td>
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<td>150</td>
<td>628</td>
<td>183</td>
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<td>549.fotonik3d_r</td>
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<tr>
<td>554.roms_r</td>
<td>56</td>
<td>472</td>
<td>189</td>
<td>471</td>
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<td>471</td>
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</tr>
</tbody>
</table>

Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

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"

Environment Variables Notes

Environment variables set by runcpu before the start of the run:

```
LD_LIBRARY_PATH = 
  "\home/cpu2017-1.1.5-ic2021.1-revB/lib/intel64:\home/cpu2017-1.1.5-ic202
  1.1-revB/je5.0.1-64"

MALLOCC_CONF = "retain:true"
```

General Notes

Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM memory using Red Hat Enterprise Linux 8.1

Transparent Huge Pages enabled by default

(Continued on next page)
General Notes (Continued)

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>

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 
 C-States set to Legacy 
 Hyper-Threading set to Disabled 
 CPU Frequency Limits set to Restrict maximum frequency 
 Patrol Scrub set to Disabled 
 SNC set to Enabled 

 Sysinfo program /home/cpu2017-1.1.5-ic2021.1-revB/bin/sysinfo 
 Rev: r6538 of 2020-09-24 e8664e66d2d7080afeaa89d4b38e2f1c 
 running on ip10-245-59-38.labs.lenovo.com Wed May 19 16:10:10 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 6348 CPU @ 2.60GHz
        2 "physical id"'s (chips)
        56 "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 : 28
        siblings : 28
        physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
        physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

(Continued on next page)
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SPECrate®2017_fp_base = 400
SPECrate®2017_fp_peak = Not Run

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 56
On-line CPU(s) list: 0-55
Thread(s) per core: 1
Core(s) per socket: 28
Socket(s): 2
NUMA node(s): 4
Vendor ID: GenuineIntel
CPU family: 6
Model: 106
Model name: Intel(R) Xeon(R) Gold 6348 CPU @ 2.60GHz
Stepping: 6
CPU MHz: 1742.631
BogoMIPS: 5200.00
Virtualization: VT-x
L1d cache: 48K
L1i cache: 32K
L2 cache: 1280K
L3 cache: 43008K
NUMA node0 CPU(s): 0-13
NUMA node1 CPU(s): 14-27
NUMA node2 CPU(s): 28-41
NUMA node3 CPU(s): 42-55
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
xtrn 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 invpcid_single
intel_pinn ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vmi fpxprec ept vpid
ept_ad fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid cqm rdt_a
avx512f avx512dq rdseed adx smap avx512ifma clflushopt clwb intel_pt avx512cd sha ni
avx512bw avx512vl xsaveopt xsaveopt xsave xaxset bxsetbv1 xsaves cqm cqm_occ_dir cqm
cqm_mm_mmb cm_mmb_local split_lock_detect wbinvd dtherm ida arat phts avx512vbmi umip puck
ospe avx512_vbmi2 gini vaes vpcmflushdq avx512_umi avx512_bitalg tme
avx512_vpopcntdq la57 rdpid md_clear pconfic flush_l1d arch_capabilities

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

(Continued on next page)
**Platform Notes (Continued)**

```
node 0 size: 126700 MB
node 0 free: 128194 MB
node 1 cpus: 14 15 16 17 18 19 20 21 22 23 24 25 26 27
node 1 size: 127025 MB
node 1 free: 128255 MB
node 2 cpus: 28 29 30 31 32 33 34 35 36 37 38 39 40 41
node 2 size: 127114 MB
node 2 free: 128672 MB
node 3 cpus: 42 43 44 45 46 47 48 49 50 51 52 53 54 55
node 3 size: 127470 MB
node 3 free: 128708 MB
node distances:
node   0   1   2   3
0:  10  11  20  20
1:  11  10  20  20
2:  20  20  10  11
3:  20  20  11  10
```

From `/proc/meminfo`
- MemTotal: 528007640 kB
- HugePages_Total: 0
- Hugepagesize: 2048 kB

/sbin/tuned-adm active
- Current active profile: throughput-performance

/usr/bin/lsb_release -d
- Red Hat Enterprise Linux release 8.3 (Ootpa)

From `/etc/*release* /etc/*version*`
- os-release:
  - NAME="Red Hat Enterprise Linux"
  - VERSION="8.3 (Ootpa)"
  - ID="rhel"
  - ID_LIKE="fedora"
  - VERSION_ID="8.3"
  - PLATFORM_ID="platform:el8"
  - PRETTY_NAME="Red Hat Enterprise Linux 8.3 (Ootpa)"
  - ANSI_COLOR="0;31"

  redhat-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
  system-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
  system-release-cpe: cpe:/o:redhat:enterprise_linux:8.3:ga

uname -a:
- Linux ip10-245-59-38.labs.lenovo.com 4.18.0-240.el8.x86_64 #1 SMP Wed Sep 23 05:13:10 EDT 2020 x86_64 x86_64 x86_64 GNU/Linux

(Continued on next page)
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SPECrate®2017_fp_peak = Not Run

CPU2017 License: 9017
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Tested by: Lenovo Global Technology

Test Date: May-2021
Hardware Availability: Jul-2021
Software Availability: Feb-2021

Platform Notes (Continued)

Kernel self-reported vulnerability status:

CVE-2018-12207 (iTLB Multihit): Not affected
CVE-2018-3620 (L1 Terminal Fault): Not affected
Microarchitectural Data Sampling: Not affected
CVE-2017-5754 (Meltdown): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2018-3639 (Speculative Store Bypass): Mitigation: usercopy/swapgs barriers and __user pointer sanitation
CVE-2017-5753 (Spectre variant 1):
CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort): Not affected

run-level 3 May 19 16:08

SPEC is set to: /home/cpu2017-1.1.5-ic2021.1-revB

Filesystem     Type  Size  Used Avail Use% Mounted on
/dev/sda4      xfs   372G   21G  351G   6% /home

From /sys/devices/virtual/dmi/id
Vendor: Lenovo
Product: ThinkSystem SD650 V2
Product Family: ThinkSystem
Serial: 1234567890

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:
16x Samsung M393A4K40DB3-CWE 32 GB 2 rank 3200

BIOS:
  BIOS Vendor: Lenovo
  BIOS Version: U8E109PT1-1.01
  BIOS Date: 04/28/2021
  BIOS Revision: 1.1
  Firmware Revision: 1.40

(End of data from sysinfo program)
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Compiler Version Notes
==============================================================================
C               | 519.lbm_r(base) 538.imagick_r(base) 544.nab_r(base)
------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
              Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------

C++             | 508.namd_r(base) 510.parest_r(base)
------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
              Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------

C++, C          | 511.povray_r(base) 526.blender_r(base)
------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
              Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
              Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------

C++, C, Fortran | 507.cactuBSSN_r(base)
------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
              Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
              Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on
              Intel(R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------

Fortran         | 503.bwaves_r(base) 549.fotonik3d_r(base) 554.roms_r(base)
------------------------------------------------------------------------------
Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on
              Intel(R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
==============================================================================
(Continued on next page)
Lenovo Global Technology
ThinkSystem SD650 V2
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Compiler Version Notes (Continued)

Fortran, C | 521.wrf_r(base) 527.cam4_r(base)

Base Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:
ifort

Benchmarks using both Fortran and C:
ifort icx

Benchmarks using both C and C++:
icpx icx

Benchmarks using Fortran, C, and C++:
icpx icx 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

(Continued on next page)
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Base Portability Flags (Continued)
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:
-w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

C++ benchmarks:
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

Fortran benchmarks:
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ipo -no-prec-div
-qopt-prefetch -ffinite-math-only
-qopt-multiple-gather-scatter-by-shuffles -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte -auto
-mbranches-within-32B-boundaries -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

Benchmarks using both Fortran and C:
-w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -O3 -ipo
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-multiple-gather-scatter-by-shuffles
-mbranches-within-32B-boundaries -nostandard-realloc-lhs
-align array32byte -auto -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib

Benchmarks using both C and C++:
-w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

Benchmarks using Fortran, C, and C++:
-w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math

(Continued on next page)
## Lenovo Global Technology

### ThinkSystem SD650 V2

(2.60 GHz, Intel Xeon Gold 6348)

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

### Base Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++ (continued):
- `-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -O3`
- `-no-prec-div -qopt-prefetch -ffinite-math-only`
- `-qopt-multiple-gather-scatter-by-shuffles`
- `-mbranches-within-32B-boundaries -nostandard-realloc-lhs`
- `-align array32byte -auto -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib`

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-ICElake-D.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-ICElake-D.xml

http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64_revA.xml

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