## Lenovo Global Technology

**ThinkSystem SD650 V2**

(2.40 GHz, Intel Xeon Platinum 8368)

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<tbody>
<tr>
<td>SPECrate®2017_fp_peak =</td>
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### CPU2017 License:

- Lenovo Global Technology

### Test Sponsor:
- Lenovo Global Technology

### Tested by:
- Lenovo Global Technology

### Test Date:
- May-2021

### Hardware Availability:
- Jul-2021

### Software Availability:
- Feb-2021

### Copies

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<td>549.fotonik3d_r</td>
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<tr>
<td>554.roms_r</td>
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</table>

### Hardware

**CPU Name:** Intel Xeon Platinum 8368

**Max MHz:** 3400

**Nominal:** 2400

**Enabled:** 76 cores, 2 chips

**Orderable:** 2 chips

**Cache L1:** 32 KB I + 48 KB D on chip per core

**L2:** 1.25 MB I+D on chip per core

**L3:** 57 MB I+D on chip per chip

**Memory:** 512 GB (16 x 32 GB 2Rx4 PC4-3200AA-R)

**Storage:** 1 x 480 GB SATA SSD

**Other:** None

### Software

**OS:** Red Hat Enterprise Linux 8.3

(Ootpa) Kernel 4.18.0-240.el8.x86_64

**Compiler:** 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;

**Parallel:** No

**Firmware:** Lenovo BIOS Version U8E109PT1 1.01 released Apr-2021

**File System:** xfs

**System State:** Run level 3 (multi-user)

**Base Pointers:** 64-bit

**Peak Pointers:** Not Applicable

**Other:** jemalloc memory allocator V5.0.1

**Power Management:** BIOS and OS set to prefer performance at the cost of additional power usage
## Lenovo Global Technology

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**SPECrate®2017_fp_base = 457**

**SPECrate®2017_fp_peak = Not Run**

### Hardware Availability: Jul-2021

### Software Availability: Feb-2021

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### Results Table

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</tr>
</tbody>
</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"

### 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.

jemalloc, a general purpose malloc implementation
built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5

---

**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 localhost.localdomain Mon May 10 17:55:29 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) Platinum 8368 CPU @ 2.40GHz
  2 "physical id"s (chips)
  76 "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 : 38
siblings : 38
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 28 29 30 31 32 33 34 35 36 37
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 28 29 30 31 32 33 34 35 36 37
```

(Continued on next page)
Platform Notes (Continued)

From lscpu:
- Architecture: x86_64
- CPU op-mode(s): 32-bit, 64-bit
- Byte Order: Little Endian
- CPU(s): 76
- On-line CPU(s) list: 0-75
- Thread(s) per core: 1
- Core(s) per socket: 38
- Socket(s): 2
- NUMA node(s): 2
- Vendor ID: GenuineIntel
- CPU family: 6
- Model: 106
- Model name: Intel(R) Xeon(R) Platinum 8368 CPU @ 2.40GHz
- Stepping: 6
- CPU MHz: 801.352
- BogoMIPS: 4800.00
- Virtualization: VT-x
- L1d cache: 48K
- L1i cache: 32K
- L2 cache: 1280K
- L3 cache: 58368K
- NUMA node0 CPU(s): 0-37
- NUMA node1 CPU(s): 38-75
- 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 pdemsg rdtscp
- lm constant_size tsc 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
- xtprior 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 vnmi flexpriority ept
- vpid ept_ad fsbgbase 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 xsave xsavec xsaveopt xsaves cqm_llc cqm_occup_llc cqm_mbb_total
- cqm_mbb_local split_lock_detect wbinvd dtherm ida arat pni pts avx512vbm avx512vp avx512vat
- avx512_vpopcntdq la57 rdrid md_clear pconfig flush_l1d arch_capabilities

/proc/cpuinfo cache data
- cache size: 58368 KB

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 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
- node 0 size: 242994 MB

(Continued on next page)
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<tr>
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</tbody>
</table>

- Test Sponsor: Lenovo Global Technology
- Tested by: Lenovo Global Technology
- Hardware Availability: Jul-2021
- Software Availability: Feb-2021

Platform Notes (Continued)

```
node 0 free: 256421 MB
node 1 cpus: 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62
63 64 65 66 67 68 69 70 71 72 73 74 75
node 1 size: 243006 MB
node 1 free: 257377 MB
node distances:
  node 0: 10 20
  node 1: 20 10

From /proc/meminfo
  MemTotal: 528004620 kB
  HugePages_Total: 0
  Hugepagesize: 2048 kB

/sbin/tuned-adm active
  No current active profile.

/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 localhost.localdomain 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

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): Not affected
- CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled via prctl and
```

(Continued on next page)
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CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
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Test Date: May-2021
Hardware Availability: Jul-2021
Software Availability: Feb-2021

Platform Notes (Continued)

CVE-2017-5753 (Spectre variant 1):
Mitigation: usercopy/swapgs barriers and __user pointer sanitization

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 10 17:53

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

Filesystem     Type  Size  Used Avail Use% Mounted on
/dev/sda4      xfs   372G  113G  259G  31% /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)

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.

(Continued on next page)
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SPECrater®2017_fp_base = 457
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Test Date: May-2021
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Hardware Availability: Jul-2021
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Compiler Version Notes (Continued)

==============================================================================
C++ | 508.namd_r(base) 510.parest_r(base)
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Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
==============================================================================

==============================================================================
C++, C | 511.povray_r(base) 526.blender_r(base)
==============================================================================
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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)
==============================================================================
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
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Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on
Intel(R) 64, Version 2021.1 Build 20201112_000000
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Fortran | 503.bwaves_r(base) 549.fotonik3d_r(base) 554.roms_r(base)
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Fortran, C | 521.wrf_r(base) 527.cam4_r(base)
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Compiler Version Notes (Continued)

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.

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.lbm\_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
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## SPEC CPU 2017 Floating Point Rate Result

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</table>

## 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
-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

Lenovo Global Technology
ThinkSystem SD650 V2
(2.40 GHz, Intel Xeon Platinum 8368)

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

SPECrate®2017_fp_base = 457
SPECrate®2017_fp_peak = Not Run

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

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

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