Lenovo Global Technology
ThinkSystem SD650 V3
(3.10 GHz, Intel Xeon Gold 6458Q)

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

Test Date: Jan-2023
Hardware Availability: Feb-2023
Software Availability: Jun-2022

SPECrate®2017_fp_base = 785
SPECrate®2017_fp_peak = Not Run

### Copies

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
</tr>
</thead>
<tbody>
<tr>
<td>503.bwaves_r</td>
<td>128</td>
</tr>
<tr>
<td>507.cactuBSSN_r</td>
<td>128</td>
</tr>
<tr>
<td>508.namd_r</td>
<td>128</td>
</tr>
<tr>
<td>510.parest_r</td>
<td>128</td>
</tr>
<tr>
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<td>128</td>
</tr>
<tr>
<td>519.lbm_r</td>
<td>128</td>
</tr>
<tr>
<td>521.wrf_r</td>
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</tr>
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<td>526.blender_r</td>
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<tr>
<td>527.cam4_r</td>
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</tr>
<tr>
<td>538.imagick_r</td>
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</tr>
<tr>
<td>544.nab_r</td>
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<tr>
<td>549.fotonik3d_r</td>
<td>128</td>
</tr>
<tr>
<td>554.roms_r</td>
<td>128</td>
</tr>
</tbody>
</table>

### Hardware

- **CPU Name:** Intel Xeon Gold 6458Q
- **Max MHz:** 4000
- **Nominal:** 3100
- **Enabled:** 64 cores, 2 chips, 2 threads/core
- **Orderable:** 1,2 chips
- **Cache L1:** 32 KB I + 48 KB D on chip per core
- **Cache L2:** 2 MB I+D on chip per core
- **Cache L3:** 60 MB I+D on chip per core
- **Memory:** 512 GB (16 x 32 GB 2Rx8 PC5-4800B-R)
- **Storage:** 1 x 960 GB SATA SSD
- **Other:** None

### Software

- **OS:** SUSE Linux Enterprise Server 15 SP4 (x86_64)
- **Compiler:** C/C++: Version 2022.1 of Intel oneAPI DPC++/C++ Compiler for Linux;
  Fortran: Version 2022.1 of Intel Fortran Compiler for Linux;
- **Parallel:** No
- **Firmware:** Lenovo BIOS Version USE109M 1.12 released Dec-2022
- **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

## ThinkSystem SD650 V3

(3.10 GHz, Intel Xeon Gold 6458Q)

### SPEC CPU®2017 Floating Point Rate Result

<table>
<thead>
<tr>
<th>CPU2017 License:</th>
<th>9017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Sponsor:</td>
<td>Lenovo Global Technology</td>
</tr>
<tr>
<td>Tested by:</td>
<td>Lenovo Global Technology</td>
</tr>
</tbody>
</table>

### Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
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<td>503.bwaves_r</td>
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<td>866</td>
<td>342</td>
<td>875</td>
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<td>367</td>
<td>367</td>
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<tr>
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<td>128</td>
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<td>558</td>
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<td>557</td>
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<td>790</td>
<td>246</td>
<td>792</td>
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<td>837</td>
<td>266</td>
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<td>544.nab_r</td>
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<tr>
<td>549.fotonik3d_r</td>
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<td>526</td>
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<td>525</td>
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<td>730</td>
<td>279</td>
</tr>
</tbody>
</table>

### SPECrate®2017_fp_base = 785

### SPECrate®2017_fp_peak = Not Run

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/cpu2017-1.1.8-ic2022.1/lib/intel64:/home/cpu2017-1.1.8-ic2022.1/j
e5.0.1-64"
MALLOC_CONF = "retain:true"
```

---

### General Notes

Binaries compiled on a system with 2x Intel Xeon Platinum 8280M CPU + 384GB RAM memory using Red Hat Enterprise Linux 8.4

Transparent Huge Pages enabled by default

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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
SNC set to SNC2
MONITOR/MWAIT set to Enabled
XPT Prefetcher set to Disabled
LLC Prefetch set to Disabled

Sysinfo program /home/cpu2017-1.1.8-ic2022.1/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acaf64d
running on localhost Mon Jan 30 11:55:03 2023

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 6458Q
    2 "physical id"s (chips)
    128 "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 : 32
    siblings : 64
    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
    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
From lscpu from util-linux 2.37.2:

(Continued on next page)
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SPEC CPU®2017 Floating Point Rate Result

SPECrade®2017_fp_base = 785
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CPU2017 License: 9017
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Platform Notes (Continued)

Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Address sizes: 46 bits physical, 57 bits virtual
Byte Order: Little Endian
CPU(s): 128
On-line CPU(s) list: 0-127
Vendor ID: GenuineIntel
Model name: Intel(R) Xeon(R) Gold 6458Q
CPU family: 6
Model: 143
Thread(s) per core: 2
Core(s) per socket: 32
Socket(s): 2
Stepping: 8
BogoMIPS: 6200.00
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
        pdemtng rdtscp lm constant_tsc arch_perfmon pebs bts rep_good nopl xtopology
        nonstop_tsc cpuid aperfmperf tsc_known_freq pni pclmulqdq dtes64 monitor ds_cpl vmx
        smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid dca sse4_1_1 ept vpid
        cmltssarch perfctldr reitrdlab lahf_lm abm 3dnowprefetch codfault epb
        cat_l1c cat_l2 cdp_l3 invpcid_single intel_puin cdp_l2 ssbd mba ibrs ibpb stibp
        ibrs_enhanced tpr_shadow vmmi flexpriority ept vpid ept_ad fsqsbse tsc_adjust bni
        hle avx2 smep bmi2 emms invpcid rtm cqm rdt_a avx512f avx512dq rdseed adx smap
        avx512fma clflushopt clwb intel_pt avx512cd sha ni avx512bw avx512vl xsx6e
        xgetbv1 xsaves cqm_llc cqm_occuc_llc cqm_mbb_total cqm_mbb_local
        split_lock_detect avx_vnni avx512bf16 wbnoinvd dtherm ida arat pln pts avx512vBMI
        umip pku ospke waitpkg avx512_vmbi gfn vaes vpcmldqgx avx512_vnmi avx512_bitalg
        tme avx512_vpopcntdq la57 rdpid bus_lock_detect cldemote movdiri movdir64b enqcmd
        fshr md_clear serialize tsxldtrk pconfig arch_lbr avx512_fp16 amx_tilr flush_lld
        arch_capabilities

Virtualization: VT-x
L1d cache: 3 MiB (64 instances)
L1i cache: 2 MiB (64 instances)
L2 cache: 128 MiB (64 instances)
L3 cache: 128 MiB (2 instances)
NUMA node(s): 4
NUMA node0 CPU(s): 0-15, 64-79
NUMA node1 CPU(s): 16-31, 80-95
NUMA node2 CPU(s): 32-47, 96-111
NUMA node3 CPU(s): 48-63, 112-127
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via
        prctl and seccomp

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Platform Notes (Continued)

Vulnerability Spectre v1: Mitigation; usercopy/swapgs barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Enhanced IBRS, IBPB conditional, RSB filling
Vulnerability Srbd: Not affected
Vulnerability Tsx async abort: Not affected

From lsct --cache:

<table>
<thead>
<tr>
<th>NAME</th>
<th>ONE-SIZE</th>
<th>ALL-SIZE</th>
<th>WAYS</th>
<th>TYPE</th>
<th>LEVEL</th>
<th>SETS</th>
<th>PHY-LINE</th>
<th>COHERENCY-SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1d</td>
<td>48K</td>
<td>3M</td>
<td>12</td>
<td>Data</td>
<td>1</td>
<td>64</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L1i</td>
<td>32K</td>
<td>2M</td>
<td>8</td>
<td>Instruction</td>
<td>1</td>
<td>64</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L2</td>
<td>2M</td>
<td>128M</td>
<td>16</td>
<td>Unified</td>
<td>2</td>
<td>2048</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L3</td>
<td>60M</td>
<td>120M</td>
<td>15</td>
<td>Unified</td>
<td>3</td>
<td>65536</td>
<td>1</td>
<td>64</td>
</tr>
</tbody>
</table>

From numactl --hardware

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

From /proc/cpuinfo cache data

MemTotal:       528022024 kB
HugePages_Total:       0
Hugepagesize:       2048 kB

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SPECraten017 fp_base = 785
SPECraten017 fp_peak = Not Run

Platform Notes (Continued)

From /etc/*release* /etc/*version*
  os-release:
    NAME="SLES"
    VERSION="15-SP4"
    VERSION_ID="15.4"
    PRETTY_NAME="SUSE Linux Enterprise Server 15 SP4"
    ID="sles"
    ID_LIKE="suse"
    ANSI_COLOR="0;32"
    CPE_NAME="cpe:/o:suse:sles:15:sp4"

  uname -a:
    Linux localhost 5.14.21-150400.22-default #1 SMP PREEMPT_DYNAMIC Wed May 11 06:57:18
    UTC 2022 (49db222) 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): Mitigation: Speculative Store
CVE-2018-3639 (Speculative Store Bypass):
Bypass disabled via prctl and
seccomp
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 Jan 30 11:54

SPEC is set to: /home/cpu2017-1.1.8-ic2022.1
  Filesystem     Type  Size  Used Avail Use% Mounted on
  /dev/sda3      xfs   890G   67G  824G   8% /

From /sys/devices/virtual/dmi/id
  Vendor: Lenovo
  Product: ThinkSystem SD650 V3
  Product Family: ThinkSystem
  Serial: 9999999999

Additional information from dmidecode 3.2 follows. WARNING: Use caution when you
interpret this section. The 'dmidecode' program reads system data which is "intended to
Platform Notes (Continued)

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:
4x Hynix HMCG88AE8RA115N 32 GB 2 rank 4800
12x Hynix HMCG88AE8RA173N 32 GB 2 rank 4800

BIOS:
BIOS Vendor: Lenovo
BIOS Version: USE109M-1.12
BIOS Date: 12/29/2022
BIOS Revision: 1.12
Firmware Revision: 0.90

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 2022.1.0 Build 20220316
Copyright (C) 1985-2022 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 2022.1.0 Build 20220316
Copyright (C) 1985-2022 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 2022.1.0 Build 20220316
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
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Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
-----------------------------------------------

C++, C, Fortran | 507.cactuBSSN_r(base)

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Compiler Version Notes (Continued)

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Copyright (C) 1985-2022 Intel Corporation. All rights reserved.

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version
2022.1.0 Build 20220316
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.

Fortran         | 503.bwaves_r(base) 549.fotonik3d_r(base) 554.roms_r(base)
------------------------------------------------------------------------
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version
2022.1.0 Build 20220316
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
------------------------------------------------------------------------

Fortran, C      | 521.wrf_r(base) 527.cam4_r(base)
------------------------------------------------------------------------
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version
2022.1.0 Build 20220316
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.

Base Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:
ifx

Benchmarks using both Fortran and C:
ifx icx
## Base Compiler Invocation (Continued)

Benchmarks using both C and C++:

```plaintext
icpx icx
```

Benchmarks using Fortran, C, and C++:

```plaintext
icpx icx ifx
```

## Base Portability Flags

```plaintext
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
554.roms_r: -DSPEC_LP64
```

## Base Optimization Flags

### C benchmarks:

```plaintext
-w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib
```

### C++ benchmarks:

```plaintext
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib
```

### Fortran benchmarks:

```plaintext
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte -auto -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib
```

### Benchmarks using both Fortran and C:

```plaintext
-w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
```
Lenovo Global Technology
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Standard Performance Evaluation Corporation

Base Optimization Flags (Continued)

Benchmarks using both Fortran and C (continued):
- flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
- 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 -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
- 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-Eaglestream-N.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-Eaglestream-N.xml

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

Tested with SPEC CPU®2017 v1.1.8 on 2023-01-29 22:55:02-0500.
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