Lenovo Global Technology  
ThinkSystem SR650 V3  
(3.10 GHz, Intel Xeon Gold 6458Q)

CPU2017 License: 9017  
Test Sponsor: Lenovo Global Technology  
Tested by: Lenovo Global Technology  
Hardware Availability: Feb-2023  
Software Availability: Dec-2022

<table>
<thead>
<tr>
<th>Threads</th>
<th>SPECspeed®2017_fp_base</th>
<th>SPECspeed®2017_fp_peak</th>
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<td>607.cactuBSSN_s</td>
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<td>619.lbm_s</td>
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<td>628.pop2_s</td>
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<td>638.imagick_s</td>
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<td>644.nab_s</td>
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<td>462</td>
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<tr>
<td>654.roms_s</td>
<td>64</td>
<td></td>
</tr>
</tbody>
</table>

**Hardware**

- **CPU Name:** Intel Xeon Gold 6458Q  
- **Max MHz:** 4000  
- **Nominal:** 3100  
- **Enabled:** 64 cores, 2 chips  
- **Orderable:** 1.2 chips  
- **Cache L1:** 32 KB I + 48 KB D on chip per core  
- **L2:** 2 MB I+D on chip per core  
- **L3:** 60 MB I+D on chip per chip  
- **Other:** None  
- **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)  
  Kernel 5.14.21-150400.22-default  
- **Compiler:**  
  C/C++: Version 2023.0 of Intel oneAPI DPC++/C++ Compiler for Linux;  
  Fortran: Version 2023.0 of Intel Fortran Compiler Classic for Linux;  
  C/C++: Version 2023.0 of Intel C/C++ Compiler Classic for Linux  
- **Firmware:** Lenovo BIOS Version ESE109L 1.10 released Jan-2023  
- **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
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<th>Results Table</th>
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<td>Benchmark</td>
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<td>627.cam4_s</td>
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<tr>
<td>628.pop2_s</td>
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<tr>
<td>638.imagick_s</td>
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<tr>
<td>649.fotonik3d_s</td>
</tr>
<tr>
<td>654.roms_s</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/cpu2017-1.1.9-ic2023.0/lib/intel64:/home/cpu2017-1.1.9-ic2023.0/j e5.0.1-64"
- MALLOC_CONF = "retain:true"
- OMP_STACKSIZE = "192M"

### General Notes

Binaries compiled on a system with 2x Intel Xeon Platinum 8280M CPU + 384GB RAM memory using Redhat Enterprise Linux 8.0

Transparent Huge Pages enabled by default

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.

(Continued on next page)
General Notes (Continued)

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:
Operating Mode set to Custom Mode
CPU P-State Control set to Legacy
Hyper-Threading set to Disabled
DCU IP Prefetcher set to Disabled

Sysinfo program /home/cpu2017-1.1.9-ic2023.0/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost Wed Feb  8 23:44:55 2023

SUT (System Under Test) info as seen by some common utilities.

---------------------------------
Table of contents
---------------------------------
  1. uname -a
  2. w
  3. Username
  4. ulimit -a
  5. sysinfo process ancestry
  6. /proc/cpuinfo
  7. lscpu
  8. numactl --hardware
  9. /proc/meminfo
 10. who -r
 11. Systemd service manager version: systemd 249 (249.11+suse.124.g2bc0b2c447)
 12. Services, from systemctl list-unit-files
 13. Linux kernel boot-time arguments, from /proc/cmdline
 14. cpupower frequency-info
 15. tuned-adm active
 16. sysctl
 17. /sys/kernel/mm/transparent_hugepage
 18. /sys/kernel/mm/transparent_hugepage/khugepaged
 19. OS release
 20. Disk information
 21. /sys/devices/virtual/dmi/id
 22. dmidecode
 23. BIOS
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Lenovo Global Technology
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<tr>
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Platform Notes (Continued)

1. **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
   ```

2. **w**
   
   ```
   23:44:55 up 1 min,  1 user,  load average: 0.14, 0.05, 0.02
   USER     TTY      FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
   root     tty1     -                23:44    7.00s  1.12s  0.00s -bash
   ```

3. **Username**
   
   From environment variable $USER: root

4. **ulimit -a**
   
   ```
   core file size          (blocks, -c) unlimited
   data seg size           (kbytes, -d) unlimited
   scheduling priority     (-e) 0
   file size               (blocks, -f) unlimited
   pending signals         (-i) 2062622
   max locked memory       (kbytes, -l) 64
   max memory size         (kbytes, -m) unlimited
   open files              (-n) 1024
   pipe size               (512 bytes, -p) 8
   POSIX message queues    (bytes, -q) 819200
   real-time priority      (-r) 0
   stack size              (kbytes, -s) unlimited
   cpu time                (seconds, -t) unlimited
   max user processes      (-u) 2062622
   virtual memory          (kbytes, -v) unlimited
   file locks              (-x) unlimited
   ```

5. **sysinfo process ancestry**
   
   ```
   /usr/lib/systemd/systemd --switched-root --system --deserialize 30
   login -- root
   -bash
   -bash
   -bash
   runcpu --nobuild --action validate --define default-platform-flags -c
   ic2023.0-lin-sapphirerapids-speed-20221201.cfg --define cores=64 --tune base -o all --define drop_caches
   fpspeed
   runcpu --nobuild --action validate --define default-platform-flags --configfile
   ic2023.0-lin-sapphirerapids-speed-20221201.cfg --define cores=64 --tune base --output_format all --define
   drop_caches --nopower --runmode speed --tune base --size refspeed fpspeed --nopreenv --note-preenv
   ```

(Continued on next page)
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Platform Notes (Continued)

--logfile $SPEC/tmp/CPU2017.039/templogs/preenv.fpspeed.039.0.log --lognum 039.0 --from_runcpu 2
specperl $SPEC/bin/sysinfo
$SPEC = /home/cpu2017-1.1.9-ic2023.0

6. /proc/cpuinfo
   model name : Intel(R) Xeon(R) Gold 6458Q
   vendor_id : GenuineIntel
   cpu family : 6
   model : 143
   stepping : 8
   microcode : 0x2b000161
   bugs : spectre_v1 spectre_v2 spec_store_bypass swapgs
   cpu cores : 32
   siblings : 32
   2 physical ids (chips)
   64 processors (hardware threads)
   physical id 0: core ids 0–31
   physical id 1: core ids 0–31
   physical id 0: apicids
   0,2,4,6,8,10,12,14,16,18,20,22,24,26,28,30,32,34,36,38,40,42,44,46,48,50,52,54,56,58,60,62
   physical id 1: apicids
Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for virtualized systems. Use the above data carefully.

7. lscpu
From lscpu from util-linux 2.37.2:
    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): 64
    On-line CPU(s) list: 0-63
    Vendor ID: GenuineIntel
    Model name: Intel(R) Xeon(R) Gold 6458Q
    CPU family: 6
    Model: 143
    Thread(s) per core: 1
    Core(s) per socket: 32
    Socket(s): 2
    Stepping: 8
    Frequency boost: enabled
    CPU max MHz: 3101.0000

(Continued on next page)
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**CPU2017 License**: 9017
**Test Sponsor**: Lenovo Global Technology
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**CPU min MHz**: 800.0000
**BogoMIPS**: 6200.00

**Platform Notes (Continued)**

| L1d cache: | 3 MiB (64 instances) |
| L1i cache: | 2 MiB (64 instances) |
| L2 cache:  | 128 MiB (64 instances) |
| L3 cache:  | 120 MiB (64 instances) |

**Virtualization**: VT-x

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

From lscpu --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>
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</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>
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<tr>
<td>L2</td>
<td>2M</td>
<td>128M</td>
<td>16</td>
<td>Unified</td>
<td>2048</td>
<td>1</td>
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<td>64</td>
</tr>
<tr>
<td>L3</td>
<td>60M</td>
<td>120M</td>
<td>15</td>
<td>Unified</td>
<td>65536</td>
<td>1</td>
<td>64</td>
<td>64</td>
</tr>
</tbody>
</table>

8. numactl --hardware

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

(Continued on next page)
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SPECspeed®2017_fp_base = 354
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Platform Notes (Continued)

available: 2 nodes (0-1)
node 0 cpus: 0-31
node 0 size: 257668 MB
node 0 free: 256612 MB
node 1 cpus: 32-63
node 1 size: 258010 MB
node 1 free: 257164 MB
node distances:
  node 0 1
  0: 10 21
  1: 21 10

9. /proc/meminfo
MemTotal: 528055792 kB

10. who -r
run-level 3 Feb 8 23:44

11. Systemd service manager version: systemd 249 (249.11+suse.124.g2bc0b2c447)
Default Target Status
multi-user running

12. Services, from systemctl list-unit-files
STATE UNIT FILES
enabled YaST2-Firstboot YaST2-Second-Stage apparmor auditd cron getty@ haveged irqbalance
  issue-generator kbdsettings lvm2-monitor nsd postfix purge-kernels rollback rsyslog
  smartd sshd wicked wicked-auto4 wicked-dhcp4 wicked-dhcp6 wickedd-nanny
  systemctl-remount-fs
enabled-runtime systemd-remount-fs
disabled autosf autostart-initscripts blk-availability boot-sysctl ca-certificates chrony-wait
  chronyd console-getty cups cups-browsed debug-shell ebtables exchange-bmc-os-info
  firewall gpm grub2-once haveged-switch-root ipmi ipmienvd issue-add-ssh-keys keepcore load
  lvm2-monitor man-db-create multipathd nfs nfs-bkmap rdisc rpcbind rpmconfigcheck rsyncd
  sapconf serial-getty@ smartd_generate_opts snmpd smmtrpd sysstat
  systemd-boot-check-no-failures systemd-network-generator systemd-sysext
  systemd-timesysctl tuned
  systemctl-remount-fs
indirect uuidd wickedd

13. Linux kernel boot-time arguments, from /proc/cmdline
   BOOT_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default
   root=UUID=461ffbd6-8da0-4c20-adb7-d9d3143b6aa5
   splash=silent
   mitigations=auto

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

```plaintext
quiet
security=apparmor

14. cpupower frequency-info
   analyzing CPU 0:
   current policy: frequency should be within 800 MHz and 3.10 GHz.
   The governor "ondemand" may decide which speed to use
   within this range.
   
   boost state support:
   Supported: yes
   Active: yes

15. tuned-adm active
   It seems that tuned daemon is not running, preset profile is not activated.
   Preset profile: virtual-guest

16. sysctl
    kernel.numa_balancing               1
    kernel.randomize_va_space           2
    vm.compaction_proactiveness         20
    vm.dirty_background_bytes           0
    vm.dirty_background_ratio          10
    vm.dirty_bytes                      0
    vm.dirty_expire_centisecs          3000
    vm.dirty_ratio                     20
    vm.dirty_writeback_centisecs      500
    vm.dirtytime_expire_seconds     43200
    vm.extfrag_threshold              500
    vm.min_unmapped_ratio             20
    vm.nr_hugepages                   100
    vm.nr_hugepages_mempolicy       100
    vm.nr_overcommit_hugepages       100
    vm.swappiness                    60
    vm.watermark_boost_factor        15000
    vm.watermark_scale_factor         10
    vm.zone_reclaim_mode              0

17. /sys/kernel/mm/transparent_hugepage
    defrag always defer defer+madvise [madvise] never
    enabled [always] madvise never
    hpage_pmd_size 2097152
    shmem_enabled always within_size advise [never] deny force
```

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

18. `/sys/kernel/mm/transparent_hugepage/khugepaged`
   - `alloc_sleep_millisecs`: 60000
   - `defrag`: 1
   - `max_ptes_none`: 511
   - `max_ptes_shared`: 256
   - `max_ptes_swap`: 64
   - `pages_to_scan`: 4096
   - `scan_sleep_millisecs`: 10000

19. OS release
   - From `/etc/*-release` /etc/*-version
     - `os-release` SUSE Linux Enterprise Server 15 SP4

20. Disk information
   - Spec set to: `/home/cpu2017-1.1.9-ic2023.0`
   - Filesystem: Type Size Used Avail Use% Mounted on
     - `/dev/sda3` xfs 889G 78G 811G 9% /

21. `/sys/devices/virtual/dmi/id`
   - Vendor: Lenovo
   - Product: ThinkSystem SR650 V3 MB,EGS,DDR5,SH,2U
   - Product Family: ThinkSystem
   - Serial: 1234567890

22. `dmidecode`
   - 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 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 M321R4GA3BB0-CQKVG 32 GB 2 rank 4800

23. BIOS
   - (This section combines info from `/sys/devices` and `dmidecode`.)
     - BIOS Vendor: Lenovo
     - BIOS Version: ESE109L-1.10
     - BIOS Date: 01/07/2023
     - BIOS Revision: 1.10
     - Firmware Revision: 1.0
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Compiler Version Notes
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
  Version 2023.0.0 Build 20221201
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
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Base Compiler Invocation

C benchmarks:
icx

(Continued on next page)
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SPECSPEED®2017_fp_base = 354
SPECSPEED®2017_fp_peak = Not Run

Base Compiler Invocation (Continued)

Fortran benchmarks:
ifx

Benchmarks using both Fortran and C:
ifx icx

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

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 -Wl,-z,muldefs -xsapphirerapids -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -fopenmp
-DSPEC_OPENMP -Wno-implicit-int -mprefer-vector-width=512
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Fortran benchmarks:
-m64 -Wl,-z,muldefs -DSPEC_OPENMP -xsapphirerapids -Ofast
-ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -fopenmp -nostandard-realloc-lhs
-align array32byte -auto -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Benchmarks using both Fortran and C:
-m64 -std=c11 -Wl,-z,muldefs -xsapphirerapids -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -fopenmp
-DSPEC_OPENMP -Wno-implicit-int -mprefer-vector-width=512
-nostandard-realloc-lhs -align array32byte -auto

(Continued on next page)
## Lenovo Global Technology

ThinkSystem SR650 V3  
(3.10 GHz, Intel Xeon Gold 6458Q)  

<table>
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<tr>
<th>SPECspeed®2017_fp_base = 354</th>
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<tr>
<td>SPECspeed®2017_fp_peak = Not Run</td>
</tr>
</tbody>
</table>

### Test Details

- **CPU2017 License:** 9017  
- **Test Sponsor:** Lenovo Global Technology  
- **Tested by:** Lenovo Global Technology  
- **Test Date:** Feb-2023  
- **Hardware Availability:** Feb-2023  
- **Software Availability:** Dec-2022

### Base Optimization Flags (Continued)

Benchmarks using both Fortran and C (continued):

```
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc
```

Benchmarks using Fortran, C, and C++:

```
-m64 -std=c++14 -std=c11 -W1,-z,muldefs -xsapphirerapids -0fast  
-ffast-math -flto -mfpmath=sse -funroll-loops  
-qopt-mem-layout-trans=4 -fioopenmp -DSPEC_OPENMP -Wno-implicit-int  
-mprefer-vector-width=512 -nostandard-realloc-lhs -align array32byte  
-auto -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc
```

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

- [http://www.spec.org/cpu2017/flags/Intel-ic2023-official-linux64.html](http://www.spec.org/cpu2017/flags/Intel-ic2023-official-linux64.html)

You can also download the XML flags sources by saving the following links:

- [http://www.spec.org/cpu2017/flags/Intel-ic2023-official-linux64.xml](http://www.spec.org/cpu2017/flags/Intel-ic2023-official-linux64.xml)

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