## SPEC CPU®2017 Floating Point Speed Result

**Lenovo Global Technology**  
ThinkSystem SR650 V3  
(2.00 GHz, Intel Xeon Platinum 8450H)

<table>
<thead>
<tr>
<th>SPECspeed®2017_fp_base =</th>
<th>258</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECspeed®2017_fp_peak =</td>
<td>Not Run</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Threads</th>
<th>SPECspeed®2017_fp_base (258)</th>
</tr>
</thead>
<tbody>
<tr>
<td>603.bwaves_s</td>
<td>56</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>56</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>56</td>
</tr>
<tr>
<td>621.wrf_s</td>
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</tr>
<tr>
<td>644.nab_s</td>
<td>56</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>56</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>56</td>
</tr>
</tbody>
</table>

### Hardware

- **CPU Name:** Intel Xeon Platinum 8450H  
- **Max MHz:** 3500  
- **Nominal:** 2000  
- **Enabled:** 56 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:** 75 MB I+D on chip per chip  
- **Memory:** 512 GB (16 x 32 GB 2Rx8 PC5-4800B-R)  
- **Storage:** 1 x 480 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  
- **Parallel:** Yes  
- **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
### Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
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<tr>
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<td>60.8</td>
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<td>962</td>
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<td>295</td>
<td>57.4</td>
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<tr>
<td>619.lbm_s</td>
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<td>252</td>
<td>20.2</td>
<td>259</td>
<td>20.2</td>
<td>259</td>
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<td>621.wrf_s</td>
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<td>158</td>
<td>83.8</td>
<td>158</td>
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<tr>
<td>627.cam4_s</td>
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<td>65.2</td>
<td>136</td>
<td>65.7</td>
<td>135</td>
<td>65.1</td>
<td>136</td>
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<tr>
<td>628.pop2_s</td>
<td>56</td>
<td>194</td>
<td>61.2</td>
<td>195</td>
<td>60.8</td>
<td>194</td>
<td>61.3</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.
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 Tue Feb 7 17:57:05 2023

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

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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
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17. /sys/kernel/mm/transparent_hugepage/khugepaged
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20. /sys/devices/virtual/dmi/id
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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`
   
   17:57:05 up  1:14,  1 user,  load average: 15.08, 40.75, 47.38
   
   USER     TTY      FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
   
   root     tty1     -                16:42    1:12m  0.97s  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) 2062669
   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) 2062669
   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
   -bash
   runcpu --nobuild --action validate --define default-platform-flags -c
   ic2023.0-lin-sapphirerapids-speed-20221201.cfg --define cores=56 --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=56 --tune base --output_format all --define
   drop_caches --nopower --runmode speed --tune base --size refspeed fpspeed --nopreenv --note-preenv
   --logfile $SPEC/tmp/CPU2017.025/templogs/preenv.fpspeed.025.0.log --lognum 025.0 --from_runcpu 2

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Test Sponsor: Lenovo Global Technology
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Platform Notes (Continued)

specperl $SPEC/bin/sysinfo
$SPEC = /home/cpu2017-1.1.9-ic2023.0

6. /proc/cpuinfo
   model name      : Intel(R) Xeon(R) Platinum 8450H
   vendor_id       : GenuineIntel
   cpu family      : 6
   model           : 143
   stepping        : 8
   microcode       : 0x2b000161
   bugs            : spectre_v1 spectre_v2 spec_store_bypass swapgs
   cpu cores       : 28
   siblings        : 28
   2 physical ids (chips)
   56 processors (hardware threads)
   physical id 0: core ids 0-27
   physical id 1: core ids 0-27
   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
   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):                 56
   On–line CPU(s) list:    0-55
   Vendor ID:              GenuineIntel
   Model name:             Intel(R) Xeon(R) Platinum 8450H
   CPU family:             6
   Model:                  143
   Thread(s) per core:     1
   Core(s) per socket:     28
   Socket(s):              2
   Stepping:               8
   Frequency boost:        enabled
   CPU max MHz:            2001.0000
   CPU min MHz:            800.0000
   BogoMIPS:               4000.00

(Continued on next page)
Lenovo Global Technology
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SPECspeed®2017_fp_base = 258
SPECspeed®2017_fp_peak = Not Run

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

Platform Notes (Continued)

Flags:

Virtualization: VT-x
L1d cache: 2.6 MiB (56 instances)
L1i cache: 1.8 MiB (56 instances)
L2 cache: 112 MiB (56 instances)
L3 cache: 150 MiB (2 instances)
NUMA node(s): 2
NUMA node0 CPU(s): 0-27
NUMA node1 CPU(s): 28-55

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, IBFB conditional, RSB filling
Vulnerability Srbds: Not affected
Vulnerability Txs 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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<tr>
<td>L1d</td>
<td>48K</td>
<td>2.6M</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>1.8M</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>112M</td>
<td>16</td>
<td>Unified</td>
<td>2</td>
<td>2048</td>
<td>1</td>
<td>64</td>
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<tr>
<td>L3</td>
<td>75M</td>
<td>150M</td>
<td>15</td>
<td></td>
<td>3</td>
<td>81920</td>
<td>1</td>
<td>64</td>
</tr>
</tbody>
</table>

8. numactl --hardware
NOTE: a numactl 'node' might or might not correspond to a physical chip.
available: 2 nodes (0-1)
node 0 cpus: 0-27

(Continued on next page)
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Platform Notes (Continued)

node 0 size: 257704 MB
node 0 free: 256822 MB
node 1 cpus: 28-55
node 1 size: 257986 MB
node 1 free: 255927 MB
node distances:
node 0 1
  0: 10 21
  1: 21 10

9. /proc/meminfo
   MemTotal: 528067920 kB

10. who -r
    run-level 3 Feb 7 16:42

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 iscsi
    issue-generator kbdsettings lkm v2-monitor nscd postfix purge-kernels rollback rsyslog
    smartd sshd wicked wickedd-auto4 wickedd-dhcp4 wickedd-dhcp6 wickedd-nanny
    enabled-runtime systemd-remount-fs
    disabled autofs autost-initscripts blk-availability boot-sysctl ca-certificates chrony-wait
    chronyd console-getty cups cups-browsed debug-shell ebtables exchange-bmc-os-info
    firewalld gpm grub2-once haveged-switch-root ipmi ipmiedv iscsi-init iscsid iscsiui0
    issue-add-ssh-keys kexec-load lunmask man-db-create multipathd nfs nfs-bkmap nmb rdisc
    rpcbind rpmconfigcheck rsysd serial-getty@ smartd_generate_opts smb snmpd smntrpd
    systemd-boot-check-no-fails systemd-network-generator systemd-sysext
    indirect wicked

13. Linux kernel boot-time arguments, from /proc/cmdline
    BOOT_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default
    root=UUID=cf0c8526-2665-4565-b656-0513c168d1bb
    splash=silent
    mitigations=auto
    quiet
    security=apparmor
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14. cpupower frequency-info
   analyzing CPU 0:
   current policy: frequency should be within 800 MHz and 2.00 GHz.
   The governor "performance" may decide which speed to use
   within this range.
   
   boost state support:
   Supported: yes
   Active: yes

15. 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              1
   vm.nr_hugepages                    0
   vm.nr_hugepages_mempolicy          0
   vm.nr_overcommit_hugepages         0
   vm.swappiness                      60
   vm.watermark_boost_factor          15000
   vm.watermark_scale_factor          10
   vm.zone_reclaim_mode               0

---

16. /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

---

17. /sys/kernel/mm/transparent_hugepage/慎hugepaged
   alloc_sleep_millisecs   60000
   defrag                    1
   max_ptes_none             511
   max_ptes_shared           256
   max_ptes_swap             64

---

(Continued on next page)
Platform Notes (Continued)

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

19. Disk information
   SPEC is set to: /home/cpu2017-1.1.9-ic2023.0
   Filesystem     Type  Size  Used Avail Use% Mounted on
   /dev/sda3      xfs   446G   80G  366G  18% /

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

21. 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:
   9x Samsung M321R4GA3BB0-CQKEG 32 GB 2 rank 4800
   7x Samsung M321R4GA3BB0-CQKVG 32 GB 2 rank 4800

22. 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

Compiler Version Notes

<table>
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<tr>
<th>C</th>
<th>619.lbm_s(base)</th>
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**Compiler Version Notes (Continued)**

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.

---

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

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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Fortran | 603.bwaves_s(base) 649.fotonik3d_s(base) 654.roms_s(base)
---

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
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---

Fortran, C | 621.wrf_s(base) 627.cam4_s(base) 628.pop2_s(base)
---

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
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---

Base Compiler Invocation

**C benchmarks:**

icx

**Fortran benchmarks:**

ifx
Base Compiler Invocation (Continued)

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
-ffast-math -flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -fiopenmp
-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 -fiopenmp -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
-ffast-math -flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -fiopenmp
-DSPEC_OPENMP -Wno-implicit-int -mprefer-vector-width=512
-nostandard-realloc-lhs -align array32byte -auto
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

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Base Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++:
- m64 -std=c++14 -std=c11 -Wl,-z,muldefs -xsapphirerapids -Ofast
- ffast-math -flto -mfpmath=sse -funroll-loops
- qopt-mem-layout-trans=4 -fiopenmp -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/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Eaglestream-N.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/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Eaglestream-N.xml
http://www.spec.org/cpu2017/flags/Intel-ic2023-official-linux64.xml