# Lenovo Global Technology

ThinkSystem SD650 V3
(2.20 GHz, Intel Xeon Platinum 8593Q)

<table>
<thead>
<tr>
<th>Copies</th>
<th>Hardware</th>
<th>Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>503.bwaves_r</td>
<td>256</td>
<td>CPU Name: Intel Xeon Platinum 8593Q</td>
</tr>
<tr>
<td>507.cactuBSSN_r</td>
<td>256</td>
<td>Max MHz: 3900</td>
</tr>
<tr>
<td>508.namd_r</td>
<td>256</td>
<td>Nominal: 2200</td>
</tr>
<tr>
<td>510.parest_r</td>
<td>256</td>
<td>Enabled: 128 cores, 2 chips, 2 threads/core</td>
</tr>
<tr>
<td>511.povray_r</td>
<td>256</td>
<td>Orderable: 2 chips</td>
</tr>
<tr>
<td>519.lbm_r</td>
<td>256</td>
<td>Cache L1: 32 KB I + 48 KB D on chip per core</td>
</tr>
<tr>
<td>521.wrf_r</td>
<td>256</td>
<td>L2: 2 MB I+D on chip per core</td>
</tr>
<tr>
<td>526.blender_r</td>
<td>256</td>
<td>L3: 320 MB I+D on chip per chip</td>
</tr>
<tr>
<td>527.cam4_r</td>
<td>256</td>
<td>Other: None</td>
</tr>
<tr>
<td>538.imagick_r</td>
<td>256</td>
<td>Memory: 1 TB (16 x 64 GB 2Rx4 PC5-5600B-R)</td>
</tr>
<tr>
<td>544.nab_r</td>
<td>256</td>
<td>Storage: 1 x 1.92 TB SATA SSD</td>
</tr>
<tr>
<td>549.fotonik3d_r</td>
<td>256</td>
<td>Other: None</td>
</tr>
<tr>
<td>554.roms_r</td>
<td>256</td>
<td>Power Management: BIOS and OS set to prefer performance at the cost of additional power usage</td>
</tr>
</tbody>
</table>

**SPECratenet**

| Test Date: | Nov-2023 |
| Software Availability: | Jun-2023 |

- **SPECratenet**
  - **SPECratenet**
    - **SPECrate®2017_fp_base** = 1140
    - **SPECrate®2017_fp_peak** = Not Run
Lenovo Global Technology
ThinkSystem SD650 V3
(2.20 GHz, Intel Xeon Platinum 8593Q)

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

Results Table

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<tr>
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<th>Seconds</th>
<th>Ratio</th>
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<td>326</td>
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<td>554.roms_r</td>
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</tr>
</tbody>
</table>

SPECrate®2017_fp_base = 1140
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/cpu2017-1.1.9-ic2023.2/lib/intel64:/home/cpu2017-1.1.9-ic2023.2/je5.0.1-64"
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
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.:
umactl --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.

(Continued on next page)
## Lenovo Global Technology

**ThinkSystem SD650 V3 (2.20 GHz, Intel Xeon Platinum 8593Q)**

**General Notes (Continued)**

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

SNC set to SNC2

Sysinfo program /home/cpu2017-1.1.9-ic2023.2/bin/sysinfo

Rev: r6732 of 2022-11-07 fe91c89b7ed5c6ae2c92c097bec197 running on localhost Tue Nov 14 01:03:34 2023

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

---

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12. Services, from systemctl list-unit-files
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16. `/sys/kernel/mm/transparent_hugepage`
17. `/sys/kernel/mm/transparent_hugepage/abi/hugepaged`
18. OS release
19. Disk information
20. `/sys/devices/virtual/dmi/id`
21. `dmidecode`
22. BIOS

---

1. `uname -a`

    Linux localhost 5.14.21-150500.53-default #1 SMP PREEMPT_DYNAMIC Wed May 10 07:56:26 UTC 2023 (b630043)

    x86_64 x86_64 x86_64 GNU/Linux

2. `w`

    01:03:34 up 1 min, 1 user, load average: 0.26, 0.12, 0.04

    USER  TTY     FROM   LOGIN@   IDLE   JCPU   PCPU WHAT
    root  tty1     -     01:02  22.00s  1.08s  0.01s  -bash

(Continued on next page)
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SPECrater® 2017 fp_base = 1140
SPECrater® 2017 fp_peak = Not Run

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

Platform Notes (Continued)

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    (-l) 4126607
   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
   max user processes  (-u) 4126607
   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 --define numcopies=256 --c
   ic2023.2-lin-sapphirerapids-rate-20230622.cfg --define smt-on --define cores=128 --define physicalfirst
   --define invoke_with_interleave --define drop_caches --tune base --o all fprate
   runcpu --nobuild --action validate --define default-platform-flags --define numcopies=256 --configfile
   ic2023.2-lin-sapphirerapids-rate-20230622.cfg --define smt-on --define cores=128 --define physicalfirst
   --define invoke_with_interleave --define drop_caches --tune base --output_format all --nopower --runmode
   rate --tune base --size refrate fprate --nopreenv --note-preenv --logfile
   $SPEC/tmp/CPU2017.005/templogs/preenv.fprate.005.0.log --lognum 005.0 --from_runcpu 2
   specperl1 $SPEC/bin/sysinfo
   $SPEC = /home/cpu2017-1.1.9-ic2023.2

6. /proc/cpuinfo
   model name : INTEL(R) XEON(R) PLATINUM 8593Q
   vendor_id : GenuineIntel
   cpu family : 6
   model : 207
   stepping : 2
   microcode : 0x21000190
   bugs : spectre_v1 spectre_v2 spec_store_bypass swapgs eibrs_pbrsb
   cpu cores : 64
   siblings : 128
   2 physical ids (chips)
   256 processors (hardware threads)
   physical id 0: core ids 0-63
   physical id 1: core ids 0-63
   physical id 0: apicids 0-127
   physical id 1: apicids 128-255
   Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for virtualized systems. Use the above data carefully.

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## Platform Notes (Continued)

### 7. lscpu

From `lscpu` from `util-linux 2.37.4`:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture:</td>
<td>x86_64</td>
</tr>
<tr>
<td>CPU op-mode(s):</td>
<td>32-bit, 64-bit</td>
</tr>
<tr>
<td>Address sizes:</td>
<td>46 bits physical, 57 bits virtual</td>
</tr>
<tr>
<td>Byte Order:</td>
<td>Little Endian</td>
</tr>
<tr>
<td>CPU(s):</td>
<td>256</td>
</tr>
<tr>
<td>On-line CPU(s) list:</td>
<td>0-255</td>
</tr>
<tr>
<td>Vendor ID:</td>
<td>GenuineIntel</td>
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<tr>
<td>Model name:</td>
<td>INTEL(R) XEON(R) PLATINUM 8593Q</td>
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<td>CPU family:</td>
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<td>Model:</td>
<td>207</td>
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<td>Thread(s) per core:</td>
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<tr>
<td>Core(s) per socket:</td>
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<td>Socket(s):</td>
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<tr>
<td>Stepping:</td>
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<td>BogoMIPS:</td>
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<tr>
<td>Flags:</td>
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<tr>
<td>Virtualization:</td>
<td>VT-x</td>
</tr>
<tr>
<td>L1d cache:</td>
<td>6 MiB (128 instances)</td>
</tr>
<tr>
<td>L1i cache:</td>
<td>4 MiB (128 instances)</td>
</tr>
<tr>
<td>L2 cache:</td>
<td>256 MiB (128 instances)</td>
</tr>
<tr>
<td>L3 cache:</td>
<td>640 MiB (2 instances)</td>
</tr>
<tr>
<td>NUMA node(s):</td>
<td>4</td>
</tr>
<tr>
<td>NUMA node0 CPU(s):</td>
<td>0-31, 128-159</td>
</tr>
<tr>
<td>NUMA node1 CPU(s):</td>
<td>32-63, 160-191</td>
</tr>
<tr>
<td>NUMA node2 CPU(s):</td>
<td>64-95, 192-223</td>
</tr>
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<td>NUMA node3 CPU(s):</td>
<td>96-127, 224-255</td>
</tr>
<tr>
<td>Vulnerability Itlb multihit:</td>
<td>Not affected</td>
</tr>
<tr>
<td>Vulnerability Lttf:</td>
<td>Not affected</td>
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<tr>
<td>Vulnerability MiDs:</td>
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<tr>
<td>Vulnerability Meltdown:</td>
<td>Not affected</td>
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<tr>
<td>Vulnerability MmIo stale data:</td>
<td>Not affected</td>
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<tr>
<td>Vulnerability Retbleed:</td>
<td>Not affected</td>
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<tr>
<td>Vulnerability Spec store bypass:</td>
<td>Mitigation; Speculative Store Bypass disabled via prctl and seccomp</td>
</tr>
<tr>
<td>Vulnerability Spectre v1:</td>
<td>Mitigation; usercopy/swaps barriers and __user pointer sanitization</td>
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<tr>
<td>Vulnerability Spectre v2:</td>
<td>Mitigation; Enhanced IBRS, IBFB conditional, RSB filling, PBRSB-eIBRS SW sequence</td>
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<tr>
<td>Vulnerability Srbd:</td>
<td>Not affected</td>
</tr>
<tr>
<td>Vulnerability Tsx async abort:</td>
<td>Not affected</td>
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From `lscpu --cache`

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CPU2017 License: 9017
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Hardware Availability: Feb-2024
Software Availability: Jun-2023

Platform Notes (Continued)

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<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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<td>48K</td>
<td>6M</td>
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<td>Data</td>
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<td>64</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L1i</td>
<td>32K</td>
<td>4M</td>
<td>8</td>
<td>Instruction</td>
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<td>1</td>
<td>64</td>
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<td>2M</td>
<td>256M</td>
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<td>Unified</td>
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<td>262144</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: 4 nodes (0-3)
node 0 cpus: 0-31,128-159
node 0 size: 257695 MB
node 0 free: 256788 MB
node 1 cpus: 32-63,160-191
node 1 size: 258031 MB
node 1 free: 257367 MB
node 2 cpus: 64-95,192-223
node 2 size: 257997 MB
node 2 free: 256927 MB
node 3 cpus: 96-127,224-255
node 3 size: 257957 MB
node 3 free: 257237 MB
node distances:
node 0: 10 12 21 21
node 1: 12 10 21 21
node 2: 21 21 10 12
node 3: 21 21 12 10

9. /proc/meminfo
MemTotal: 1056442392 kB

10. who -r
run-level 3 Nov 14 01:02

11. Systemd service manager version: systemd 249 (249.16+suse.171.gd0071f15)
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@ irqbalance issue-generator
               kbdsettings lvm-monitor nsd postfix purge-kernels rollback rsyslog systemd sshd
               systemd-pstore wicked wickedd-auto4 wickedd-dhcp4 wickedd-dhcp6 wickedd-nanny
enabled-runtime systemd-remount-fs
disabled       autofs 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-haveged-switch-root ipmi ipmiwd issue-add-ssh-keys
               kexec-load lnumask man-db-create multipathd nfs nfs-bkmap rpclbind rpmconfigcheck ryncd
               serial-getty@ smartd_generate_opts snmpd snmptrapd systemd-boot-check-no-failures
               systemd-network-generator systemd-sysxext systemd-time-wait-sync systemd-timesyncd
               indirect wicked

13. Linux kernel boot-time arguments, from /proc/cmdline
BOOT_IMAGE=/boot/vmlinuz-5.14.21-150500.53-default

(Continued on next page)
Platform Notes (Continued)

root=UUID=d7791671-9fd7-462e-99cf-2cc433d1f618
splash=silent
mitigations=auto
quiet
security=apparmor

14. cpupower frequency-info
   analyzing CPU 0:
     Unable to determine current policy
     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.extrfrag_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/hugepaged
   alloc_sleep_millisecs     6000
   defrag                   1
   max_ptes_none            511
   max_ptes_shared          256
   max_ptes_swap            64
   pages_to_scan            4096
   scan_sleep_millisecs    10000

18. OS release
   From /etc/*-release /etc/*-version
   os-release SUSE Linux Enterprise Server 15 SP5

19. Disk information

(Continued on next page)
Lenovo Global Technology

ThinkSystem SD650 V3
(2.20 GHz, Intel Xeon Platinum 8593Q)

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

SPECraten®2017 fp_base = 1140
SPECraten®2017 fp_peak = Not Run

Platform Notes (Continued)

SPEC is set to: /home/cpu2017-1.1.9-ic2023.2
Filesystem     Type  Size  Used Avail Use% Mounted on
/dev/sda3      xfs   1.8T   28G  1.8T   2% /

20. /sys/devices/virtual/dmi/id
Vendor: Lenovo
Product: ThinkSystem SD650 V3
Product Family: ThinkSystem
Serial: 123456789

21. dmidecode
Additional information from dmidecode 3.4 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:
15x Samsung M321R8GA0PB0-CWMKH 64 GB 2 rank 5600
1x Samsung M321R8GA0PB0-CWMXH 64 GB 2 rank 5600

22. BIOS
(BThis section combines info from /sys/devices and dmidecode.)
BIOS Vendor: Lenovo
BIOS Version: USE125B-4.10
BIOS Date: 11/02/2023
BIOS Revision: 4.10
Firmware Revision: 0.30

Compiler Version Notes

<table>
<thead>
<tr>
<th>C</th>
<th>519.lbm_r(base) 538.imagick_r(base) 544.nab_r(base)</th>
</tr>
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<tbody>
<tr>
<td>Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.2.0 Build 20230622</td>
<td></td>
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<tr>
<td>Copyright (C) 1985-2023 Intel Corporation. All rights reserved.</td>
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<th>C++</th>
<th>508.namd_r(base) 510.parest_r(base)</th>
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<tr>
<th>C++, C</th>
<th>511.povray_r(base) 526.blender_r(base)</th>
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<tr>
<th>C++, C, Fortran</th>
<th>507.cactuBSSN_r(base)</th>
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Lenovo Global Technology
ThinkSystem SD650 V3
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SPECr®2017_fp_base = 1140
SPECr®2017_fp_peak = Not Run

Compiler Version Notes (Continued)

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.2.0 Build 20230622
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.2.0 Build 20230622
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

Fortran, C
-----------------------------------------------
Fortran         | 503.bwaves_r(base) 549.fotonik3d_r(base) 554.roms_r(base)
-----------------------------------------------

Base Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:
ifx

Benchmarks using both Fortran and C:
ifx icx

Benchmarks using both C and C++:
icpx icx

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

Base Portability Flags

503.bwaves_r: -DSPEC_LP64
507.cactuBSSN_r: -DSPEC_LP64

(Continued on next page)
Lenovo Global Technology
ThinkSystem SD650 V3
(2.20 GHz, Intel Xeon Platinum 8593Q)

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<th>CPU2017 License: 9017</th>
<th>Test Date: Nov-2023</th>
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<td>Test Sponsor: Lenovo Global Technology</td>
<td>Hardware Availability: Feb-2024</td>
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<tr>
<td>Tested by: Lenovo Global Technology</td>
<td>Software Availability: Jun-2023</td>
</tr>
</tbody>
</table>

**Base Portability Flags (Continued)**

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:
-w -std=c11 -m64 -Wl,-z,muldefs -xsapphirerapids -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-Wno-implicit-int -mprefer-vector-width=512 -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

C++ benchmarks:
-w -std=c++14 -m64 -Wl,-z,muldefs -xsapphirerapids -Ofast
-ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -mprefer-vector-width=512 -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

Fortran benchmarks:
-w -m64 -Wl,-z,muldefs -xsapphirerapids -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:
-w -m64 -std=c11 -Wl,-z,muldefs -xsapphirerapids -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-Wno-implicit-int -mprefer-vector-width=512 -nostandard-realloc-lhs
-align array32byte -auto -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib

Benchmarks using both C and C++:
-w -std=c++14 -m64 -std=c11 -Wl,-z,muldefs -xsapphirerapids -Ofast
-ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -Wno-implicit-int -mprefer-vector-width=512
-ljemalloc -L/usr/local/jemalloc64-5.0.1/lib

(Continued on next page)
Lenovo Global Technology
ThinkSystem SD650 V3
(2.20 GHz, Intel Xeon Platinum 8593Q)

SPECraté®2017_fp_base = 1140
SPECraté®2017_fp_peak = Not Run

Base Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++:
-w -m64 -std=c++14 -std=c11 -Wl,-z,muldefs -xsapphirerapids -Ofast
-ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -Wno-implicit-int -mprefer-vector-width=512
-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/Intel-ic2023p2-official-linux64.html
http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Eaglestream-AA.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/Intel-ic2023p2-official-linux64.xml
http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Eaglestream-AA.xml