## Lenovo Global Technology

**ThinkSystem ST650 V3 (3.70 GHz, Intel Xeon Gold 6434H)**

<table>
<thead>
<tr>
<th>Software</th>
<th>Hardware</th>
</tr>
</thead>
</table>

### 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 for Linux;
- **Firmware:** Lenovo BIOS Version USE113Y 2.10 released Mar-2023
- **File System:** xfs
- **System State:** Run level 3 (multi-user)
- **Base Pointers:** 64-bit
- **Peak Pointers:** Not Applicable
- **Other:** None
- **Power Management:** BIOS and OS set to prefer performance at the cost of additional power usage

### Hardware

- **CPU Name:** Intel Xeon Gold 6434H
- **Max MHz:** 4100
- **Nominal:** 3700
- **Enabled:** 16 cores, 2 chips, 2 threads/core
- **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:** 22.5 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

### Test Information

<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>
<tr>
<td>Test Date:</td>
<td>Jun-2023</td>
</tr>
<tr>
<td>Hardware Availability:</td>
<td>May-2023</td>
</tr>
<tr>
<td>Software Availability:</td>
<td>Dec-2022</td>
</tr>
</tbody>
</table>

### SPECrate®2017_int_base

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>500.perlbench_r</td>
<td>141</td>
</tr>
<tr>
<td>502.gcc_r</td>
<td>165</td>
</tr>
<tr>
<td>505.mcf_r</td>
<td>32</td>
</tr>
<tr>
<td>520.omnetpp_r</td>
<td>179</td>
</tr>
<tr>
<td>523.xalancbmk_r</td>
<td>32</td>
</tr>
<tr>
<td>525.x264_r</td>
<td>32</td>
</tr>
<tr>
<td>531.deepsjeng_r</td>
<td>140</td>
</tr>
<tr>
<td>541.leela_r</td>
<td>133</td>
</tr>
<tr>
<td>548.exchange2_r</td>
<td>413</td>
</tr>
<tr>
<td>557.xz_r</td>
<td>86.2</td>
</tr>
</tbody>
</table>

**SPECrate®2017_int_base = 199**
**SPEC CPU®2017 Integer Rate Result**

Copyright 2017-2024 Standard Performance Evaluation Corporation

**Lenovo Global Technology**

ThinkSystem ST650 V3
(3.70 GHz, Intel Xeon Gold 6434H)

**SPECrate®2017_int_base = 199**

**SPECrate®2017_int_peak = Not Run**

---

**Results Table**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>500.perlbench_r</td>
<td>32</td>
<td>362</td>
<td>141</td>
<td>362</td>
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<td>274</td>
<td>165</td>
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<td>165</td>
<td>274</td>
<td>165</td>
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<tr>
<td>505.mcf_r</td>
<td>32</td>
<td>161</td>
<td>202</td>
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<td>202</td>
</tr>
<tr>
<td>520.omnetpp_r</td>
<td>32</td>
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<td>129</td>
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<td>393</td>
<td>86.4</td>
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<tr>
<td>525.x264_r</td>
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<td>147</td>
<td>382</td>
<td>146</td>
<td>383</td>
<td>146</td>
<td>383</td>
</tr>
<tr>
<td>531.deepsjeng_r</td>
<td>32</td>
<td>262</td>
<td>140</td>
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<td>140</td>
<td>262</td>
<td>140</td>
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<tr>
<td>541.leela_r</td>
<td>32</td>
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</tr>
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<td>548.exchange2_r</td>
<td>32</td>
<td>203</td>
<td>413</td>
<td>204</td>
<td>412</td>
<td>202</td>
<td>415</td>
</tr>
<tr>
<td>557.xz_r</td>
<td>32</td>
<td>401</td>
<td>86.2</td>
<td>399</td>
<td>86.5</td>
<td>402</td>
<td>85.9</td>
</tr>
</tbody>
</table>

**Compiler Notes**

SPEC has ruled that the compiler used for this result was performing a compilation that specifically improves the performance of the 523.xalancbmk_r / 623.xalancbmk_s benchmarks using a priori knowledge of the SPEC code and dataset to perform a transformation that has narrow applicability.

In order to encourage optimizations that have wide applicability (see rule 1.4 [https://www.spec.org/cpu2017/Docs/runrules.html#rule_1.4](https://www.spec.org/cpu2017/Docs/runrules.html#rule_1.4)), SPEC will no longer publish results using this optimization.

This result is left in the SPEC results database for historical reference.

---

**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-ic2023.0/lib/intel64:/home/cpu2017-1.1.9-ic2023.0/lib/ia32:/home/cpu2017-1.1.9-ic2023.0/jed5.0.1-32"
MALLOC_CONF = "retain:true"
```
Lenovo Global Technology
ThinkSystem ST650 V3
(3.70 GHz, Intel Xeon Gold 6434H)

SPECraten®2017_int_peak = Not Run
SPECraten®2017_int_base = 199

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

Test Date: Jun-2023
Hardware Availability: May-2023
Software Availability: Dec-2022

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:
```bash
sync; echo 3>/proc/sys/vm/drop_caches
```
runcpu command invoked through numactl i.e.:
runcpu --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.

Platform Notes

BIOS configuration:
Choose Operating Mode set to Maximum Performance and then set it to Custom Mode
C-States set to Legacy
SNC set to SNC2
LLC Prefetch set to Disabled
UPI Link Disable set to Disabled 1 Link
Sysinfo program /home/cpu2017-1.1.9-ic2023.0/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost Sat Jun 24 14:16:51 2023

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

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7. lscpu
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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
14. cpupower frequency-info
15. sysctl
16. /sys/kernel/mm/transparent_hugepage
17. /sys/kernel/mm/transparent_hugepage/khugepaged
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19. Disk information
20. /sys/devices/virtual/dmi/id
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Lenovo Global Technology
ThinkSystem ST650 V3
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CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Tested by: Lenovo Global Technology

Platform Notes (Continued)

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
14:16:51 up 3:35,  2 users,  load average: 0.00, 0.00, 0.00
USER   TTY     FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
root   tty1    -                10:41    7.00s  0.83s  0.01s -bash
root   pts/0   172.30.81.13     14:15    1:07   0.02s  0.01s vim CPU2017.082.intrate.refrate.txt

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) 2062701
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) 2062701
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
runcpu --nobuild --action validate --define default-platform-flags --define numcopies=32 --c
ic2023.0-lin-sapphirerapids-rate-20221201.cfg --define smt-on --define cores=16 --define physicalfirst
--define invoke_with_interleave --define drop_caches --tune base -o all intrate
runcpu --nobuild --action validate --define default-platform-flags --define numcopies=32 --configfile
ic2023.0-lin-sapphirerapids-rate-20221201.cfg --define smt-on --define cores=16 --define physicalfirst
--define invoke_with_interleave --define drop_caches --tune base --output_format all --nopower --runcpu
rate --tune base --size intrate --nopreenv --note-preenv --logfile
$SPEC/tmp/CPU2017.083/tempplogs/preenv.intrate.083.0.log --lognum 083.0 --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 6434H
vendor_id : GenuineIntel
cpu family : 6
model : 143
stepping : 8
microcode : 0x2b000190
bugs : spectre_v1 spectre_v2 spec_store_bypass swaps

(Continued on next page)
Platform Notes (Continued)

siblings          : 16  
2 physical ids (chips)  
32 processors (hardware threads)  
physical id 0: core ids 0-7  
physical id 0: core ids 0-7  
physical id 1: core ids 0-15  
physical id 1: core ids 128-143
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): 32  
On-line CPU(s) list: 0-31  
Vendor ID: GenuineIntel  
Model name: Intel(R) Xeon(R) Gold 6434H  
CPU family: 6  
Model: 143  
Thread(s) per core: 2  
Core(s) per socket: 8  
Socket(s): 2  
Stepping: 8  
BogoMIPS: 7400.00  
Flags: fpu vme de pse tsc msr pae mce cs c7  
cache clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtps  
lm constant-tsc art arch_perfmon pebs rep_good nopl xtopology  
nonstop-tsc cpuid aperfmperf tsc_known_freq pni pclmulqdq dtes64 ds_cpl  
vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pclid ca sse4_1 mce cx8 apic  
sep mtrr pae mce cx8 apic sep mtrr pge mca cmov pat pse36  
ciflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtsdp  
lm constant-tsc art arch_perfmon pebs rep_good nopl xtopology

Virtualization: VT-x  
L1d cache: 768 KiB (16 instances)  
L1i cache: 512 KiB (16 instances)  
L2 cache: 32 MiB (16 instances)  
L3 cache: 45 MiB (2 instances)  
NUMA node(s): 2  
NUMA node0 CPU(s): 0-7,16-23  
NUMA node1 CPU(s): 8-15,24-31  
Vulnerability Itlb multihit: Not affected  
Vulnerability L1f: Not affected  
Vulnerability Mds: Not affected  
Vulnerability Meltdown: Not affected  
Vulnerability Spec store bypass: Mitigation; Spectacular Store Bypass disabled via prctl and seccomp  
Vulnerability Spectre v1: Mitigation; usercopy/swapsgs barriers and __user pointer sanitization

(Continued on next page)
Platform Notes (Continued)

Vulnerability Spectre v2: Mitigation; Enhanced IBRS, IBPB conditional, RSB filling
Vulnerability SrbdS: 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>
</tr>
</thead>
<tbody>
<tr>
<td>L1d</td>
<td>48K</td>
<td>768K</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>512K</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>32M</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>22.5M</td>
<td>45M</td>
<td>15</td>
<td>Unified</td>
<td>3</td>
<td>24576</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: 0-7,16-23
node 0 size: 257675 MB
node 0 free: 256528 MB
node 1 cpus: 8-15,24-31
node 1 size: 258023 MB
node 1 free: 257186 MB
node distances:
node 0   1
0:  10  21
1:  21  10

9. /proc/meminfo
MemTotal: 528075996 kB

10. who -r
run-level 3 Jun 24 10:41

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 auditt cron getty@ havedeg irsbalance
issue-generator kbdsettings lvm2-monitor nscd postfix purge-kernels rollback rsyslog
smartd sshd wicked wickedd-auto4 wickedd-dhcp4 wickedd-dhcp6 wickedd-nanny
enabled-runtime systemd-remount-fs
disabled autosfs autostart-initscripts blk-availability boot-sysctl ca-certificates chrony-wait
chronyD console-getty cups cups-browsed debug-shell eolvables exchange-bmc-os-info
firewallD gpm grub2-once havedeg-switch-root ipmi ipmielvd issue-add-ssh-keys kexec-load
lvm2-monitor man-db-create multipathd nfs nfs-blkmap rdisc rpcbind rpmconfigcheck rsysncd
serial-getty@ smartd_generate_opts snmpd snmptrapd systemd-boot-check-no-failures
systemd-network-generator systemd-sysxeth systemd-time-wait-sync systemd-timesyncd
indirect wicked

13. Linux kernel boot-time arguments, from /proc/cmdline
BOOT_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default
root=UUID=17904382-c2c1-4de4-88b3-dda5a45ba9e5
splash=silent
mitigations=auto

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Lenovo Global Technology
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(3.70 GHz, Intel Xeon Gold 6434H)

SPECrate®2017_int_base = 199
SPECrate®2017_int_peak = Not Run

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

Platform Notes (Continued)

```
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.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 1
    max_ptes_none 511
    max_ptes_shared 256
    max_ptes_swap 64
    pages_to_scan 4096
    scan_sleep_millisecs 10000

17. /sys/kernel/mm/transparent_hugepage/khugepaged
    alloc_sleep_millisecs 60000

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/sda2 xfs 894G 82G 813G 10% /

(Continued on next page)```
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CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
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Platform Notes (Continued)

20. /sys/devices/virtual/dmi/id
   Vendor: Lenovo
   Product: ThinkSystem ST650 V3 MAIN BOARD
   Product Family: ThinkSystem
   Serial: MDSN00110D

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:
   14x Samsung M321R4GA3BB0-CQKEG 32 GB 2 rank 4800
   2x Samsung M321R4GA3BB0-CQKVG 32 GB 2 rank 4800

22. BIOS
   (This section combines info from /sys/devices and dmidecode.)
   BIOS Vendor: Lenovo
   BIOS Version: USE113Y-2.10
   BIOS Date: 03/26/2023
   BIOS Revision: 2.10
   Firmware Revision: 2.10

Compiler Version Notes

C       | 500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base) 525.x264_r(base) 557.xz_r(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.

C++     | 520.omnetpp_r(base) 523.xalancbmk_r(base) 531.deepsjeng_r(base) 541.leela_r(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.

Fortran | 548.exchange2_r(base)
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.

Base Compiler Invocation

C benchmarks:
icx

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Lenovo Global Technology
ThinkSystem ST650 V3
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Base Compiler Invocation (Continued)

C++ benchmarks:
icpx

Fortran benchmarks:
ifx

Base Portability Flags

500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
502.gcc_r: -DSPEC_LP64
505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
523.xalancbmk_r: -DSPEC_LP64 -DSPEC_LINUX
525.x264_r: -DSPEC_LP64
531.deepsjeng_r: -DSPEC_LP64
541.leela_r: -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-w -std=c11 -m64 -Wl,-z,muldefs -xsapphirerapids -O3 -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-L/usr/local/intel/compiler/2023.0.0/linux/compiler/lib/intel64_lin
-lqkmalloc

C++ benchmarks:
-w -std=c++14 -m64 -Wl,-z,muldefs -xsapphirerapids -O3 -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-L/usr/local/intel/compiler/2023.0.0/linux/compiler/lib/intel64_lin
-lqkmalloc

Fortran benchmarks:
-w -m64 -Wl,-z,muldefs -xsapphirerapids -O3 -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte -auto
-L/usr/local/intel/compiler/2023.0.0/linux/compiler/lib/intel64_lin
-lqkmalloc
# SPEC CPU®2017 Integer Rate Result

## Lenovo Global Technology

ThinkSystem ST650 V3  
(3.70 GHz, Intel Xeon Gold 6434H)

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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-U.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-U.xml

http://www.spec.org/cpu2017/flags/Intel-ic2023-official-linux64.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 v1.1.9 on 2023-06-24 02:16:50-0400.
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