## Lenovo Global Technology

**ThinkSystem SR650 V3**  
(2.10 GHz, Intel Xeon Gold 6538N)  

<table>
<thead>
<tr>
<th>SPECrate® 2017 int_base =</th>
<th>555</th>
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</thead>
<tbody>
<tr>
<td>SPECrate® 2017 int_peak =</td>
<td>Not Run</td>
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**CPU2017 License:** 9017  
**Test Sponsor:** Lenovo Global Technology  
**Tested by:** Lenovo Global Technology  
**Test Date:** Mar-2024  
**Hardware Availability:** Feb-2024  
**Software Availability:** Mar-2024  

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<td>502.gcc_r</td>
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<td>505.mcf_r</td>
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<tr>
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<tr>
<td>523.xalancbmk_r</td>
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<tr>
<td>525.x264_r</td>
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<td>531.deepsjeng_r</td>
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<td>548.exchange2_r</td>
<td>128</td>
</tr>
<tr>
<td>557.xz_r</td>
<td>128</td>
</tr>
</tbody>
</table>

### Hardware

- **CPU Name:** Intel Xeon Gold 6538N  
- **Max MHz:** 4100  
- **Nominal:** 2100  
- **Enabled:** 64 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:** 60 MB I+D on chip per chip  
- **Other:** None  
- **Memory:** 1 TB (16 x 64 GB 2Rx4 PC5-5600B-R, running at 5200)  
- **Storage:** 1 x 960 GB SATA SSD  
- **Other:** Cooling: DLC

### Software

- **OS:** Red Hat Enterprise Linux 9.2 (Plow)  
- **Kernel:** 5.14.0-284.11.1.el9_2.x86_64  
- **Compiler:** C/C++, Version 2024.0.2 of Intel oneAPI DPC++/C++ Compiler for Linux; Fortran: Version 2024.0.2 of Intel Fortran  
- **Firmware:** Lenovo BIOS Version ESE123B 3.11 released Jan-2024  
- **File System:** xfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** Not Applicable  
- **Power Management:** BIOS and OS set to prefer performance at the cost of additional power usage
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CPU2017 License: 9017
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Results Table

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<td>279</td>
<td>504</td>
<td>274</td>
<td>505</td>
<td>274</td>
</tr>
</tbody>
</table>

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-ic2024.0.2/lib/intel64:/home/cpu2017-1.1.9-ic2024.0.2/lib/ia32:/home/cpu2017-1.1.9-ic2024.0.2/lib/je5.0.1-32"
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.:
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.

(Continued on next page)
SPEC CPU®2017 Integer Rate Result
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Lenovo Global Technology
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SPECrate®2017_int_base = 555
SPECrate®2017_int_peak = Not Run

CPU2017 License: 9017
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Test Date: Mar-2024
Tested by: Lenovo Global Technology
Hardware Availability: Feb-2024
Software Availability: Mar-2024

General Notes (Continued)
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
UPI Link Disable set to Minimum Number of Links Enabled
SNC set to SNC2
LLC Prefetch set to Disabled
Sysinfo program /home/cpu2017-1.1.9-ic2024.0.2/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c52cc097bec197
running on localhost.localdomain Wed Mar 20 02:39:59 2024

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/cpudeck
7. lscpu
8. numactl --hardware
9. /proc/meminfo
10. who -r
11. Systemd service manager version: systemd 252 (252-13.el9_2)
12. Failed units, from systemctl list-units --state=failed
13. Services, from systemctl list-unit-files
14. Linux kernel boot-time arguments, from /proc/cmdline
15. cpupower frequency-info
16. tuned-adm active
17. sysct1
18. /sys/kernel/mm/transparent_hugepage
19. /sys/kernel/mm/transparent_hugepage/khugepaged
20. OS release
21. Disk information
22. /sys/devices/virtual/dmi/id
23. dmidecode
24. BIOS

------------------------------------------------------------

1. uname -a
Linux localhost.localdomain 5.14.0-284.11.1.e19_2.x86_64 #1 SMP PREEMPT_DYNAMIC Wed Apr 12 10:45:03 EDT 2023 x86_64 x86_64 x86_64 GNU/Linux

2. w
02:39:59 up 1:10, 1 user, load average: 0.09, 26.50, 75.05
USER TTY LOGIND@ IDLE JCPU PCPU WHAT
root tty1 01:30 55.00s 0.83s 0.01s -bash

(Continued on next page)
Platform Notes (Continued)

3. Username
   From environment variable $USER: root

--------------------

4. ulimit -a
   real-time non-blocking time (microseconds, -R) unlimited
   core file size (blocks, -c) 0
   data seg size (kbytes, -d) unlimited
   scheduling priority (-e) 0
   file size (blocks, -f) unlimited
   pending signals (-i) 4126962
   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) 4126962
   virtual memory (kbytes, -v) unlimited
   file locks (-x) unlimited
--------------------

5. sysinfo process ancestry
   /usr/lib/systemd/systemd rhgb --switched-root --system --deserialize 31
   login -- root
   -bash
   -bash
   runcpu --nobuild --action validate --define default-platform-flags --define numcopies=128 --corefile
   ic2024.0.2-lin-sapphirerapids-rate-20231213.cfg --define smt-on --define cores=64 --define physicalfirst
   --define invoke_with_interleave --define drop_caches --tune base -o all intrate
   runcpu --nobuild --action validate --define default-platform-flags --define numcopies=128 --configfile
   ic2024.0.2-lin-sapphirerapids-rate-20231213.cfg --define smt-on --define cores=64 --define physicalfirst
   --define invoke_with_interleave --define drop_caches --tune base --output_format all --nopower --runmode
   rate --tune base --size intrate --nopreenv --note-preenv --logfile
   $SPEC/tmp/CPU2017.030/templogs/preenv.intrate.030.0.log --lognum 030.0 --from_runcpu 2
   specperl $SPEC/bin/sysinfo
   $SPEC = /home/cpu2017-1.1.9-ic2024.0.2
--------------------

6. /proc/cpuinfo
   model name : INTEL(R) XEON(R) GOLD 6538N
   vendor_id : GenuineIntel
   cpu family : 6
   model : 207
   stepping : 2
   microcode : 0xe100000200
   bugs : spectre_v1 spectre_v2 spec_store_bypass swapgs eibrs_pbrsb
   cpu cores : 32
   siblings : 64
   2 physical ids (chips)
   128 processors (hardware threads)
   physical id 0: core ids 0-31
   physical id 1: core ids 0-31
   physical id 0: apicids 0-63
   physical id 1: apicids 128-191

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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SPECRate®2017_int_base = 555
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Test Date: Mar-2024
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Platform Notes (Continued)

7. Iscpu

From lscpu from util-linux 2.37.4:

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
BIOS Vendor ID: Intel(R) Corporation
Model name: INTEL(R) XEON(R) GOLD 6538N
CPU family: 6
Model: 207
Thread(s) per core: 2
Core(s) per socket: 32
Socket(s): 2
Stepping: 2
BogoMIPS: 4200.00

Flags:
fpu vme de pse tsc msr pae mca cmov pat pse36
clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp
lm constant_tsc art 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 ssse4
mmxex2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand
lahf_lm abm 3nowprefetch cpuid_fault epb cat_13 cat_12 cdp_13
ingenvid_cle cdp_12 ssbd mba ibrs ibpb ibrsEnhanced tpr_shadow
vmx flexpriority ht vpid ept_ad fsgsbase tsc_adjust bmi1 avx2 smep bmi2
erms invvpid cqm cqm_llc cqm_occup_llc cqm_mbb_total cqm_mbb_local avx_vni
avx_vpp16 behnoind dtherm ida arat pln pts hfi avx12vbmi umip pkp ospke
waitpkg avx512_vbmi1 qfni vaeas vpclmulqdq avx512_vni avx512_bitalg
avx512_vppcntdq las7 rdpid bus_lock_detect cldemote movdiri movdir64b
engcmd frm_md_clear serialize txsldptrm cnode_arch_lbr ibt amx_bf16
avx512_fp16 amx_tile amx_int8 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: 120 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 Lttf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Mmio stale data: Not affected
Vulnerability Retbleed: Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl
Vulnerability Spectre v1: Mitigation; usercopy/swapsgs barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Enhanced IBRS, IBPB conditional, RSB filling, PBRSB-eIBRS SW sequence
Vulnerability Srbds: Not affected
Vulnerability Tsx async abort: Not affected

(Continued on next page)
Platform Notes (Continued)

from lscpu --cache:

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<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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<td>3M</td>
<td>12</td>
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<td>64</td>
<td>1</td>
<td>64</td>
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<tr>
<td>L1i</td>
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<td>8</td>
<td>Instruction</td>
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<td>64</td>
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<td>L2</td>
<td>2M</td>
<td>128M</td>
<td>16</td>
<td>Unified</td>
<td>2</td>
<td>2048</td>
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<td>64</td>
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<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>
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</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: 0-15,64-79
node 0 size: 257704 MB
node 0 free: 256397 MB
node 1 cpus: 16-31,80-95
node 1 size: 258040 MB
node 1 free: 256758 MB
node 2 cpus: 32-47,96-111
node 2 size: 258040 MB
node 2 free: 256864 MB
node 3 cpus: 48-63,112-127
node 3 size: 257996 MB
node 3 free: 256816 MB
node distances:
node   0   1   2   3
0: 10 12 21 21
1: 12 10 21 21
2: 21 21 10 12
3: 21 21 12 10

9. /proc/meminfo
MemTotal: 1056545744 kB

10. who -r
run-level 3 Mar 20 01:30

11. Systemd service manager version: systemd 252 (252-13.el9_2)
Default Target Status
multi-user degraded

12. Failed units, from systemctl list-units --state=failed
UNIT LOAD ACTIVE SUB DESCRIPTION
* dnf-makecache.service loaded failed failed dnf makecache

13. Services, from systemctl list-unit-files
STATE UNIT FILES
enabled NetworkManager NetworkManager-dispatcher NetworkManager-wait-online atd auditd bluetooth chrony crond dbus-broker firewalld getty8 insights-client-boot iрогbalance iscsi iscsi-onboot kdump libstoragegmgt low-memory-monitor lvm2-monitor mcelog mmmonitor microcode multipathd nix-domainname nvmecc-boot-connections rshmcert rdssylog rtkit-daemon selinux-autorelabel-mark smartd sshd ssd systemd-boot-update systemd-network-generator tuned udisks2 upower

disabled-runtime systemd-remount-fs

disabled arp-ethers blk-availability canberra-system-bootup canberra-system-shutdown
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Platform Notes (Continued)

---

14. Linux kernel boot-time arguments, from /proc/cmdline
   BOOT_IMAGE=(hd3,gpt2)/vmlinuz-5.14.0-284.11.1.el9_2.x86_64
   root=/dev/mapper/rhel-root
   ro
   resume=/dev/mapper/rhel-swap
   rd.lvm.lv=rhel/root
   rd.lvm.lv=rhel/swap
   rhgb
   quiet

---

15. cpupower frequency-info
   analyzing CPU 0:
   Unable to determine current policy
   boost state support:
   Supported: yes
   Active: yes

---

16. tuned-adm active
   Current active profile: throughput-performance

---

17. 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                    40
   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                     10
   vm.watermark_boost_factor         15000
   vm.watermark_scale_factor        10
   vm.zone_reclaim_mode             0

---

18. /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)

19. /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

20. OS release
   From /etc/*-release /etc/*-version
   os-release: Red Hat Enterprise Linux 9.2 (Plow)
   redhat-release: Red Hat Enterprise Linux release 9.2 (Plow)
   system-release: Red Hat Enterprise Linux release 9.2 (Plow)

21. Disk information
   SPEC is set to: /home/cpu2017-1.1.9-ic2024.0.2
   Filesystem   Type  Size  Used Avail Use% Mounted on
   /dev/mapper/rhel-home xfs   819G   69G  750G   9% /home

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

23. dmidecode
   Additional information from dmidecode 3.3 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:
   5x Samsung M321R8GA0PB0-CWMKH 64 GB 2 rank 5600, configured at 5200
   11x Samsung M321R8GA0PB0-CWMKH 64 GB 2 rank 5600, configured at 5200

24. BIOS
   (This section combines info from /sys/devices and dmidecode.)
   BIOS Vendor: Lenovo
   BIOS Version: ESE123B-3.11
   BIOS Date: 01/25/2024
   BIOS Revision: 3.11
   Firmware Revision: 3.90

Compiler Version Notes

<table>
<thead>
<tr>
<th>C</th>
<th>500.perlbench_r(base)</th>
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2024.0.2 Build 20231213
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(Continued on next page)
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Compiler Version Notes (Continued)

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 2024.0.2 Build 20231213
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

Fortran | 548.exchange2_r(base)

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2024.0.2 Build 20231213
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Base Compiler Invocation

C benchmarks:
icx

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
-ffloat-math=sse -funroll-loops -qopt-mem-layout-trans=4
-L/opt/intel/oneapi/compiler/2024.0/lib -lqmalloc

(Continued on next page)
Lenovo Global Technology
ThinkSystem SR650 V3
(2.10 GHz, Intel Xeon Gold 6154N)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tr>
<td>Test Date:</td>
<td>Mar-2024</td>
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<td>Hardware Availability:</td>
<td>Feb-2024</td>
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<tr>
<td>Software Availability:</td>
<td>Mar-2024</td>
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</tbody>
</table>

Base Optimization Flags (Continued)

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/opt/intel/oneapi/compiler/2024.0/lib` `-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/opt/intel/oneapi/compiler/2024.0/lib` `-lqkmalloc`

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-AA.html  
http://www.spec.org/cpu2017/flags/Intel-ic2024-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-AA.xml  
http://www.spec.org/cpu2017/flags/Intel-ic2024-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 2024-03-20 02:39:59-0400.  
Originally published on 2024-04-09.