# SPEC CPU®2017 Floating Point Rate Result

## Lenovo Global Technology

ThinkSystem SD650 V3  
(2.10 GHz, Intel Xeon Platinum 8468)

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

<table>
<thead>
<tr>
<th>SPECrate®2017_fp_base =</th>
<th>874</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECrate®2017_fp_peak =</td>
<td>Not Run</td>
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<table>
<thead>
<tr>
<th>Copies</th>
<th>SPECrate®2017_fp_base (874)</th>
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<tbody>
<tr>
<td>503.bwaves_r</td>
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<tr>
<td>507.cactuBSSN_r</td>
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<td>508.namd_r</td>
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<td>510.parest_r</td>
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<td>521.wrf_r</td>
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<td>526.blender_r</td>
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<td>192</td>
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<tr>
<td>554.roms_r</td>
<td>192</td>
</tr>
</tbody>
</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; |
| Parallel: | No |
| Firmware: | Lenovo BIOS Version USE109N 1.12 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 |

### Hardware

| CPU Name: | Intel Xeon Platinum 8468 |
| Max MHz: | 3800 |
| Nominal: | 2100 |
| Enabled: | 96 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: | 105 MB I+D on chip per chip |
| Memory: | 512 GB (16 x 32 GB 2Rx8 PC5-4800B-R) |
| Storage: | 1 x 960 GB SATA SSD |
| Other: | None |
Results Table

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<th>Ratio</th>
<th>Base</th>
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</tr>
</tbody>
</table>

**SPECrate®2017_fp_base = 874**
**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-ic2023.0/lib/intel64;/home/cpu2017-1.1.9-ic2023.0/j
e5.0.1-64"
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

(Continued on next page)
General Notes (Continued)

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.
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.
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:
Choose Operating Mode set to Maximum Performance and then set it to Custom Mode
SNC set to SNC4
MONITOR/MWAIT set to Enabled
XPT Prefetcher set to Disabled
LLC Prefetch set to Disabled

Sysinfo program /home/cpu2017-1.1.9-ic2023.0/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost Thu Feb 9 07:03:14 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 systemd list-unit-files
13. Linux kernel boot-time arguments, from /proc/cmdline

(Continued on next page)
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---

### Platform Notes (Continued)

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

---

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`

```
07:03:14 up 1 min,  1 user,  load average: 2.55, 1.11, 0.41
USER     TTY      FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
root     tty1     -                07:03    9.00s  1.03s  0.01s -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) 2062421
 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) 2062421
 virtual memory         (kbytes, -v) unlimited
 file locks                 (-x) unlimited
```

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(Continued on next page)
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Platform Notes (Continued)

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=192 -c ic2023.0-lin-core-avx512-rate-20221201.cfg --define smt-on --define cores=96 --define physicalfirst --define invoke_with_interleave --define drop_caches --tune base -o all fprate
runcpu --nobuild --action validate --define default-platform-flags --define numcopies=192 --configfile ic2023.0-lin-core-avx512-rate-20221201.cfg --define smt-on --define cores=96 --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/CPU2017.007/tempslogs/preenv.fprate.007.0.log --lognum 007.0 --from_runcpu 2 specperl $SPEC/bin/sysinfo
$SPEC = /home/cpu2017-1.1.9-ic2023.0

-----------------------------------------------------------------------------
6. /proc/cpuinfo

model name : Intel(R) Xeon(R) Platinum 8468
vendor_id : GenuineIntel
cpu family : 6
model : 143
stepping : 8
microcode : 0x2b000161
bugs : spectre_v1 spectre_v2 spec_store_bypass swapgs
cpu cores : 48
siblings : 96
2 physical ids (chips)
192 processors (hardware threads)
physical id 0: core ids 0-47
physical id 1: core ids 0-47
physical id 0: apicids 0-95
physical id 1: apicids 128-223

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): 192
On-line CPU(s) list: 0-191

(Continued on next page)
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</tr>
</tbody>
</table>

**Vendor ID:** GenuineIntel  
**Model name:** Intel(R) Xeon(R) Platinum 8468  
**CPU Family:** 6  
**Model:** 143  
**Thread(s) per core:** 2  
**Core(s) per socket:** 48  
**Socket(s):** 2  
**Stepping:** 8  
**BogoMIPS:** 4200.00

**Platform Notes (Continued)**

Virtualization: VT-x  
L1d cache: 4.5 MiB (96 instances)  
L1i cache: 3 MiB (96 instances)  
L2 cache: 192 MiB (96 instances)  
L3 cache: 210 MiB (2 instances)

NUMA node(s): 8  
NUMA node0 CPU(s): 0-11,96-107  
NUMA node1 CPU(s): 12-23,108-119  
NUMA node2 CPU(s): 24-35,120-131  
NUMA node3 CPU(s): 36-47,132-143  
NUMA node4 CPU(s): 48-59,144-155  
NUMA node5 CPU(s): 60-71,156-167  
NUMA node6 CPU(s): 72-83,168-179  
NUMA node7 CPU(s): 84-95,180-191  
Vulnerability Itlb multihit: Not affected  
Vulnerability L1tf: Not affected  
Vulnerability Mds: Not affected  
Vulnerability Meltdown: Not affected  
Vulnerability 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, IBPB conditional, RSB filling

(Continued on next page)
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Platform Notes (Continued)

Vulnerability Srbds: Not affected
Vulnerability Tsx async abort: Not affected

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>PHYS-LINE</th>
<th>COHERENCY-SIZE</th>
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<td>48K</td>
<td>4.5M</td>
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<td>1</td>
<td>64</td>
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<td>32K</td>
<td>3M</td>
<td>8</td>
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<td>114688</td>
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<td>64</td>
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</tbody>
</table>

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

8. numactl --hardware
NOTE: a numactl 'node' might or might not correspond to a physical chip.
available: 8 nodes (0-7)
node 0 cpus: 0-11, 96-107
node 0 size: 64135 MB
node 0 free: 63459 MB
node 1 cpus: 12-23, 108-119
node 1 size: 64505 MB
node 1 free: 64119 MB
node 2 cpus: 24-35, 120-131
node 2 size: 64505 MB
node 2 free: 64158 MB
node 3 cpus: 36-47, 132-143
node 3 size: 64505 MB
node 3 free: 63870 MB
node 4 cpus: 48-59, 144-155
node 4 size: 64505 MB
node 4 free: 64268 MB
node 5 cpus: 60-71, 156-167
node 5 size: 64505 MB
node 5 free: 64268 MB
node 6 cpus: 72-83, 168-179
node 6 size: 64505 MB
node 6 free: 63778 MB
node 7 cpus: 84-95, 180-191
node 7 size: 64459 MB
node 7 free: 64220 MB
node distances:

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<th>5</th>
<th>6</th>
<th>7</th>
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<td>10</td>
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</tr>
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</table>

(Continued on next page)
Platform Notes (Continued)

7: 21 21 21 21 12 12 12 10

9. /proc/meminfo
   MemTotal: 528004536 kB

10. who -r
    run-level 3 Feb 9 07:02

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 display-manager getty@ haveged
                     irqbalance issue-generator kbdsettings klog lvmq-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 autoyast-initscripts blk-availability boot-sysctl ca-certificates chrony-wait
                     chronyd console-getty cups cups-browsed debug-shell ebtiontab exchange-bmc-os-info
                     firewalld gpm grub2-once haveged-switch-root ipmi ipmiemd issue-add-ssh-keys kexec-load
                     lumnask man-db-create multipathd nfs nfs-bkmap rdisc rpcbind rpmconfigcheck rsyncd
                     serial-getty@ smartd_generate_opts snmpd snmptrapd systemd-boot-check-no-failures
                     systemd-network-generator systemd-sysext systemd-time-time-sync systemd-timesyncd tuned
    indirect         wickedd

13. Linux kernel boot-time arguments, from /proc/cmdline
    BOOT_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default
    root=UUID=5f8bf2df-41d5-8917-33e974e2f5bd
    splash=silent
    mitigations=auto
    quiet
    security=apparmor

14. cpupower frequency-info
    analyzing CPU 0:
      Unable to determine current policy
    Supported: yes
    Active: yes

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Platform Notes (Continued)

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

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              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

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

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

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

From `/etc/*-release` /etc/*-version

os-release SUSE Linux Enterprise Server 15 SP4

```
20. Disk information
SPEC is set to: /home/cpu2017-1.1.9-ic2023.0
Filesystem  Type   Size  Used Avail Use% Mounted on
/dev/sda3   xfs     889G   46G  843G   6%  /
```

```
21. /sys/devices/virtual/dmi/id
Vendor: Lenovo
Product: ThinkSystem SD650 V3
Product Family: ThinkSystem
Serial: 9999999999
```

```
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: USE109N-1.12
BIOS Date: 01/09/2023
BIOS Revision: 1.12
Firmware Revision: 0.90
```

---

**Compiler Version Notes**

```
C | 519.lbm_r(base) 538.imagick_r(base) 544.nab_r(base)
```

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
Version 2023.0.0 Build 20221201
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(Continued on next page)
Lenovo Global Technology
ThinkSystem SD650 V3
(2.10 GHz, Intel Xeon Platinum 8468)

SPECrate®2017_fp_base = 874
SPECrate®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

Compiler Version Notes (Continued)

C++

| 508.namd_r(base) 510.parest_r(base)

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
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C++, C

| 511.povray_r(base) 526.blender_r(base)

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C++, C, Fortran

| 507.cactuBSSN_r(base)

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Fortran

| 503.bwaves_r(base) 549.fotonik3d_r(base) 554.roms_r(base)

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

| 521.wrf_r(base) 527.cam4_r(base)

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
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Compiler Version Notes (Continued)

Version 2023.0.0 Build 20221201
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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
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

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Base Optimization Flags

C benchmarks:
-w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-Wno-implicit-int -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib

C++ benchmarks:
-w -std=c++14 -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

Fortran benchmarks:
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -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 -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-Wno-implicit-int -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 -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -Wno-implicit-int
-ljemalloc -L/usr/local/jemalloc64-5.0.1/lib

Benchmarks using Fortran, C, and C++:
-w -std=c++14 -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -Wno-implicit-int
-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/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
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