Lenovo Global Technology
ThinkSystem SR650 V3
(3.70 GHz, Intel Xeon Gold 6434)

SPECrated®2017_fp_base = 282
SPECrated®2017_fp_peak = Not Run

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

Hardware
CPU Name: Intel Xeon Gold 6434
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
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 for Linux;
Parallel: No
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
Lenovo Global Technology
ThinkSystem SR650 V3
(3.70 GHz, Intel Xeon Gold 6434)

CPU2017 License: 9017
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Results Table

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SPECrate®2017_fp_base = 282
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"
MALLOCC_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)
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General Notes (Continued)

Prior to runcpu invocation
Filesystem page cache syncd 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.
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:
Operating Mode set to Maximum Performance and then set it to Custom Mode
MONITOR/MWAIT set to Enabled
SNC set to SNC2
LLC Prefetch set to Disabled
XPT 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 Mon Feb 27 01:13:08 2023

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

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17. /sys/kernel/mm/transparent_hugepage/khugepaged
18. OS release
19. Disk information
20. /sys/devices/virtual/dmi/id
21. dmidecode
22. 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
   01:13:08 up 9 min, 1 user, load average: 0.01, 0.02, 0.00
   USER    TTY     FROM           LOGIN@    IDLE    JCPU   PCPU WHAT
   root    tty1    -             01:09    12.00s   0.81s  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) 2062692
   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) 2062692
   virtual memory       (kbytes, -v) unlimited
   file locks           (-x) unlimited

5. sysinfo process ancestry

(Continued on next page)
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Test Date: Feb-2023
Hardware Availability: Feb-2023
Software Availability: Dec-2022

Platform Notes (Continued)

/usr/lib/systemd/systemd --switched-root --system --deserialize 30
login -- root
bash
bash
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 fprate
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 --runmode
rate --tune base --size refrate fprate --nopreenv --note-preenv --logfile
$SPEC/tmp/CPU2017.144/templogs/preenv.fprate.144.0.log --lognum 144.0 --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 6434
   vendor_id       : GenuineIntel
   cpu family      : 6
   model           : 143
   stepping        : 8
   microcode       : 0x2b000161
   bugs            : spectre_v1 spectre_v2 spec_store_bypass swapgs
   cpu cores       : 8
   siblings        : 16
   2 physical ids (chips)
   32 processors (hardware threads)
   physical id 0: core ids 0-7
   physical id 1: core ids 0-7
   physical id 0: apicids 0-15
   physical id 1: apicids 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

(Continued on next page)
Lenovo Global Technology

ThinkSystem SR650 V3
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<table>
<thead>
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**CPU2017 License:** 9017  
**Test Sponsor:** Lenovo Global Technology  
**Tested by:** Lenovo Global Technology

**Platform Notes (Continued)**

```markdown
Model name:                      Intel(R) Xeon(R) Gold 6434
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 mar pae mce cx8 apic sep mtrr pge 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 sse4_1
- sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand
- lahf_lm abm 3dnowprefetch cpuid_fault epb cat_13 cat_12 cdп_13
- invpcid_single intel_pinn cpd_12 ssbd mba ibrs ibpb stibp ibrs_enhanced
- tpr_shadow vmmi flexpriority ept vpid ept_ad fsgsbase tsc_adjust bml1
- hle avx2 smep bmi2 erms invpcid rtm cqm rdt_a avx512_pf16 amx_tile flush_l1d
- arch_capabilities

**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):** 4
**NUMA node0 CPU(s):** 0-3,16-19
**NUMA node1 CPU(s):** 4-7,20-23
**NUMA node2 CPU(s):** 8-11,24-27
**NUMA node3 CPU(s):** 12-15,28-31

**Vulnerability Itlb multihit:** Not affected
**Vulnerability L1tf:** 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/swaps barriers and __user pointer sanitization
**Vulnerability Spectre v2:** Mitigation; Enhanced IBRS, IBPB conditional, RSB filling
**Vulnerability Srbds:** Not affected
**Vulnerability Tsx async abort:** Not affected

---

From lscpu --cache:

```
NAME ONE-SIZE ALL-SIZE WAYS TYPE LEVEL SETS PHY-LINE COHERENCY-SIZE
```

(Continued on next page)
Lenovo Global Technology
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SPECraten2017_fp_base = 282
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Test Date: Feb-2023
Hardware Availability: Feb-2023
Software Availability: Dec-2022

Platform Notes (Continued)

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<td>22.5M</td>
<td>45M</td>
<td>15</td>
<td>Unified</td>
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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: 0-3,16-19
   node 0 size: 128685 MB
   node 0 free: 128107 MB
   node 1 cpus: 4-7,20-23
   node 1 size: 129021 MB
   node 1 free: 128711 MB
   node 2 cpus: 8-11,24-27
   node 2 size: 129021 MB
   node 2 free: 128741 MB
   node 3 cpus: 12-15,28-31
   node 3 size: 128967 MB
   node 3 free: 128703 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: 528073636 kB

---

10. who -r
   run-level 3 Feb 27 01:03

---

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 klog lvm2-monitor nsed postfix purge-kernels rollback rsyslog
   smartd sshd wicked wickedd-auto4 wickedd-dhcp4 wickedd-dhcp6 wickedd-nanny

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## Lenovo Global Technology

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### SPEC CPU®2017 Floating Point Rate Result

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## Platform Notes (Continued)

### enabled-runtime systemd-remount-fs

### disabled

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<td>boot-sysctl</td>
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<td>ca-certificates</td>
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<td></td>
<td>chrony-wait</td>
</tr>
</tbody>
</table>

---

13. Linux kernel boot-time arguments, from /proc/cmdline

```plaintext
BOOT_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default
root=UUID=cf0c8526-2665-4565-b656-0513c168d1bb
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.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
```

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### Lenovo Global Technology

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**SPEC CPU®2017 Floating Point Rate Result**

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#### Platform Notes (Continued)

```
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/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

---

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

---

19. Disk information
   - SPEC is set to: `/home/cpu2017-1.1.9-ic2023.0`
   - Files
     | Filesystem     | Type | Size  | Used | Avail | Use% | Mounted on |
     |----------------|------|-------|------|-------|------|------------|
     | /dev/sda3      | xfs  | 446G  | 54G  | 393G  | 12%  | /          |

---

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

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Hardware Availability: Feb-2023
Software Availability: Dec-2022

Platform Notes (Continued)

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

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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C++ |
- 508.namd_r(base) 510.parest_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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C++, C |
- 511.povray_r(base) 526.blender_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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C++, C, Fortran |
- 507.cactuBSSN_r(base)

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(Continued on next page)
**Lenovo Global Technology**

**ThinkSystem SR650 V3**

(3.70 GHz, Intel Xeon Gold 6434)

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<th>SPECrate(^\circ)2017 fp_base =</th>
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<tr>
<td>SPECrate(^\circ)2017 fp_peak =</td>
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**CPU2017 License:** 9017  
**Test Sponsor:** Lenovo Global Technology  
**Tested by:** Lenovo Global Technology

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**Compiler Version Notes (Continued)**

- **Version 2023.0.0 Build 20221201**  
  Copyright (C) 1985-2022 Intel Corporation. All rights reserved.

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| Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 23.0.0 Build 20221201  
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<th>Fortran, C</th>
<th>521.wrf_r(base) 527.cam4_r(base)</th>
</tr>
</thead>
</table>

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| Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 23.0.0 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

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**Test Date:** Feb-2023  
**Hardware Availability:** Feb-2023  
**Software Availability:** Dec-2022
Lenovo Global Technology
ThinkSystem SR650 V3
(3.70 GHz, Intel Xeon Gold 6434)

SPECrate®2017_fp_base = 282
SPECrate®2017_fp_peak = Not Run

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

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

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Lenovo Global Technology
ThinkSystem SR650 V3
(3.70 GHz, Intel Xeon Gold 6434)

SPECrate®2017_fp_base = 282
SPECrate®2017_fp_peak = Not Run

CPU2017 License: 9017
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Tested by: Lenovo Global Technology

Test Date: Feb-2023
Hardware Availability: Feb-2023
Software Availability: Dec-2022

Base Optimization Flags (Continued)

Benchmarks using both C and C++ (continued):
-lljemalloc -L/usr/local/jemalloc64-5.0.1/lib

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/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Eaglestream-O.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-O.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.

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