Lenovo Global Technology
ThinkSystem SR850 V3
(3.70 GHz, Intel Xeon Gold 6434H)

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

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

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</table>

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**SPECrate®2017_fp_base** = 579

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**Hardware**

CPU Name: Intel Xeon Gold 6434H
Max MHz: 4100
Nominal: 3700
Enabled: 32 cores, 4 chips, 2 threads/core
Orderable: 2,4 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: 2 TB (32 x 64 GB 2Rx4 PC5-4800B-R)
Storage: 1 x 960 GB M.2 NVME SSD
Other: None

**Software**

OS: Red Hat Enterprise Linux 9.1 (Plow) (x86_64)
Kernel 5.14.0-162.6.1.el9_1.x86_64
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 RSE105E 1.10 released May-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 SR850 V3
(3.70 GHz, Intel Xeon Gold 6434H)

Results Table

<table>
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<tr>
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</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-ic2023.0/lib/intel64/:/home/cpu2017-1.1.9-ic2023.0/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.:
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.
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(3.70 GHz, Intel Xeon Gold 6434H)

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Tested by: Lenovo Global Technology

SPECrates:
- SPECrater2017_fp_base = 579
- SPECrater2017_fp_peak = Not Run

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

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 and then set it to Custom Mode
C-States set to Legacy
DCU Streamer Prefetcher set to Disabled
LLC Prefetch set to Disabled
AMP Prefetch set to Enabled
SNC set to SNC2

Sysinfo program /home/cpu2017-1.1.9-ic2023.0/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c6ae2c92cc097bec197 running on localhost.localdomain Thu Aug 10 11:20:49 2023

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

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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. sysctl
17. /sys/kernel/mm/transparent_hugepage
18. /sys/kernel/mm/transparent_hugepage/never
19. OS release
20. Disk information
21. /sys/devices/virtual/dmi/id
22. dmidecode
23. BIOS

1. uname -a
 Linux localhost.localdomain 5.14.0-162.6.1.el9_1.x86_64 #1 SMP PREEMPT_DYNAMIC Fri Sep 30 07:36:03 EDT 2022
x86_64 x86_64 x86_64 GNU/Linux

(Continued on next page)
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Test Sponsor: Lenovo Global Technology
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SPECrater®2017_fp_base = 579
SPECrater®2017_fp_peak = Not Run

Test Date: Aug-2023
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Platform Notes (Continued)

11:20:49 up 4 min, 1 user, load average: 0.00, 0.05, 0.02
USER TTY LOGIN@ IDLE JCPU PCPU WHAT
root tty1 11:20 7.00s 0.79s 0.00s -bash

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) 8255754
 max locked memory (kbytes, -l) 64
 max memory size (kbytes, -m) unlimited
 open files (-n) 1024
 pipe size (512 bytes, -p) 8
 POSIX message queue (bytes, -q) 819200
 real-time priority (-r) 0
 stack size (kbytes, -s) unlimited
 cpu time (seconds, -t) unlimited
 max user processes (-u) 8255754
 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=64 -c
ic2023.0-lin-sapphirerapids-rate-20221201.cfg --define smt-on --define cores=32 --define physicalfirst
--define invoke_with_interleave --define drop_caches --tune base --o all fprate
runcpu --nobuild --action validate --define default-platform-flags --define numcopies=64 --configfile
ic2023.0-lin-sapphirerapids-rate-20221201.cfg --define smt-on --define cores=32 --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/CPU2017.066/templogs/preenv.fprate.066.0.log --lognum 066.0 --from_runcpu 2
specperl $SPEC/bin/sysinfo
$SPEC = /home/cpu2017-1.1.9-1c2023.0

6. /proc/cpuinfo
model name : Intel(R) Xeon(R) Gold 6434H
vendor_id : GenuineIntel
cpu family : 6
model : 143
stepping : 8
microcode : 0x2b0001b0
bugs : spectre_v1 spectre_v2 spec_store_bypass swapgs eibrs_pbrsb
cpu cores : 8
siblings : 16
4 physical ids (chips)
64 processors (hardware threads)
physical id 0: core ids 0-7
physical id 1: core ids 0-7

(Continued on next page)
Platform Notes (Continued)

physical id 2: core ids 0-7
physical id 3: core ids 0-7
physical id 0: apicids 0-15
physical id 1: apicids 128-143
physical id 2: apicids 256-271
physical id 3: apicids 384-399

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 2.37.4:
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): 64
On-line CPU(s) list: 0-63
Vendor ID: GenuineIntel
BIOS Vendor ID: Intel(R) Corporation
Model name: Intel(R) Xeon(R) Gold 6434H
BIOS 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): 4
Stepping: 8
Frequency boost: enabled
CPU max MHz: 3701.000
CPU min MHz: 800.0000
BogomIPS: 7400.00
Flags: fpu vme de pse tsc msr pae mca cmov pat pse36 vm xsave vsx crmmov 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 vm xgcm est tm2 ssse3 sdbg fma cx16 xtrm pdcm pcid dca sse4_1
sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsvav ax f16c rdrand lahf_lm abm 3nowprefetch cpuid_fault epb cat_l3 cat_12 cat_13 cdp_13
invpcid_single intel_p ​

Virtualization: VT-x
L1d cache: 1.5 MiB (32 instances)
L1i cache: 1 MiB (32 instances)
L2 cache: 64 MiB (32 instances)
L3 cache: 90 MiB (4 instances)
NUMA node(s): 8
NUMA node0 CPU(s): 0-3,32-35
NUMA node1 CPU(s): 4-7,36-39
NUMA node2 CPU(s): 8-11,40-43

(Continued on next page)
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SPECrater®2017_fp_base = 579
SPECrater®2017_fp_peak = Not Run

Platform Notes (Continued)

NUMA node3 CPU(s):
NUMA node4 CPU(s):
NUMA node5 CPU(s):
NUMA node6 CPU(s):
NUMA node7 CPU(s):
Vulnerability Itlb multihit: Not affected
Vulnerability Lltf: 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/swapgs 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

From lscpu --cache:

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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>Data</td>
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<td>32K</td>
<td>1M</td>
<td>8</td>
<td>Instruction</td>
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8. numactl --hardware
NOTE: a numactl 'node' might or might not correspond to a physical chip.

node distances:

node 0 1 2 3 4 5 6 7
0: 10 12 21 21 21 21 21 21
1: 12 10 21 21 21 21 21 21
2: 21 10 12 21 21 21 21 21
3: 21 21 12 10 21 21 21 21
4: 21 21 21 10 12 21 21 21

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SPEC CPU®2017 Floating Point Rate Result

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

SPECrate®2017_fp_base = 579
SPECrate®2017_fp_peak = Not Run

Platform Notes (Continued)

5: 21 21 21 21 12 10 21 21
6: 21 21 21 21 21 21 10 12
7: 21 21 21 21 21 21 12 10

9. /proc/meminfo
MemTotal: 2113513344 kB

10. who -r
run-level 3 Aug 10 11:16

11. Systemd service manager version: systemd 250 (250-12.el9_1)
Default Target Status
multi-user degraded

12. Failed units, from systemctl list-units --state=failed
UNIT LOAD ACTIVE SUB DESCRIPTION
* systemd-sysctl.service loaded failed failed Apply Kernel Variables

13. Services, from systemctl list-unit-files
STATE UNIT FILES
enabled NetworkManager NetworkManager-dispatcher NetworkManager-wait-online auditd crond
dbus-broker getty@ irqbalance kdump low-memory-monitor mmonitor microcode nis-domainname
rhcmeritd rsyslog rtkit-daemon selinux-autorelabel-mark sshd sssd
systemd-network-generator udisks2 upower
enabled-runtime systemd-remount-fs
disabled console-getty bootup canberra-system-shutdown canberra-system-shutdown-reboot
canberra-system-bootup canberra-system-shutdown canberra-system-shutdown-reboot
console-getty cpupower debug-shell firewall@ kvm_stat man-db-restart-cache-update nftables
systemd-boot-check-no-failures systemd-pstore systemd-sysext
indirect sssd-autofs sssd-kcm sssd-kmm sssd-keystore

14. Linux kernel boot-time arguments, from /proc/cmdline
BOOT_IMAGE=(hd0,gpt3)/boot/vmlinuz-5.14.0-162.6.1.el9_1.x86_64
root=UUID=43a7f1b1-66b0-4c6a-8c3f-451305a00281
ro
resume=UUID=58de1c40-542f-453b-bb6a-6bbd3510660a

15. cpupower frequency-info
analyzing CPU 0:
current policy: frequency should be within 800 MHz and 3.70 GHz.
The governor "performance" may decide which speed to use
within this range.
boost state support:
Supported: yes
Active: yes

16. sysctl
kernel.numa_balancing 1
kernel.randomize_va_space 2
vm.compaction_proactive 20
vm.dirty_background_bytes 0
vm.dirty_background_ratio 10

(Continued on next page)
Lenovo Global Technology

ThinkSystem SR850 V3
(3.70 GHz, Intel Xeon Gold 6434H)

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Software Availability: Dec-2022

SPECrate®2017_fp_base = 579
SPECrate®2017_fp_peak = Not Run

Platform Notes (Continued)

<table>
<thead>
<tr>
<th>Environment Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>vm.dirty_bytes</td>
<td>0</td>
</tr>
<tr>
<td>vm.dirty_expire_centisecs</td>
<td>3000</td>
</tr>
<tr>
<td>vm.dirty_ratio</td>
<td>20</td>
</tr>
<tr>
<td>vm.dirty_writeback_centisecs</td>
<td>500</td>
</tr>
<tr>
<td>vm.dirtytime_expire_seconds</td>
<td>43200</td>
</tr>
<tr>
<td>vm.extrfrag_threshold</td>
<td>500</td>
</tr>
<tr>
<td>vm.min_unmapped_ratio</td>
<td>1</td>
</tr>
<tr>
<td>vm.nr_hugepages</td>
<td>0</td>
</tr>
<tr>
<td>vm.nr_hugepages_mempolicy</td>
<td>0</td>
</tr>
<tr>
<td>vm.nr_overcommit_hugepages</td>
<td>0</td>
</tr>
<tr>
<td>vm.swappiness</td>
<td>60</td>
</tr>
<tr>
<td>vm.watermark_boost_factor</td>
<td>15000</td>
</tr>
<tr>
<td>vm.watermark_scale_factor</td>
<td>10</td>
</tr>
<tr>
<td>vm.zone_reclaim_mode</td>
<td>0</td>
</tr>
</tbody>
</table>

17. /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

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
---
From /etc/*-release /etc/*-version
os-release Red Hat Enterprise Linux 9.1 (Plow)
redhat-release Red Hat Enterprise Linux release 9.1 (Plow)
system-release Red Hat Enterprise Linux release 9.1 (Plow)

20. Disk information
SPEC is set to: /home/cpu2017-1.1.9-ic2023.0
<table>
<thead>
<tr>
<th>Filesystem</th>
<th>Type</th>
<th>Size</th>
<th>Used</th>
<th>Avail</th>
<th>Use%</th>
<th>Mounted on</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/nvme0n1p4</td>
<td>xfs</td>
<td>819G</td>
<td>16G</td>
<td>804G</td>
<td>2%</td>
<td>/home</td>
</tr>
</tbody>
</table>

21. /sys/devices/virtual/dmi/id
---
Vendor: Lenovo
Product: ThinkSystem SR850 V3
Product Family: ThinkSystem
Serial: None

22. 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:
21x SK Hynix HMCG94AE8RA102N 64 GB 2 rank 4800

(Continued on next page)
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Platform Notes (Continued)

4x SK Hynix HMC94AEBA109N 64 GB 2 rank 4800
7x SK Hynix HMC94AEBA123N 64 GB 2 rank 4800

23. BIOS
(This section combines info from /sys/devices and dmidecode.)
- BIOS Vendor: Lenovo
- BIOS Version: RSE105E-1.10
- BIOS Date: 05/12/2023
- BIOS Revision: 1.10
- Firmware Revision: 1.10

Compiler Version Notes

<table>
<thead>
<tr>
<th>C</th>
<th>519.lbm_r(base) 538.imagick_r(base) 544.nab_r(base)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201</td>
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<tr>
<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>
</tr>
</thead>
<tbody>
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<tr>
<th>C++, C, Fortran</th>
<th>507.cactuBSSN_r(base)</th>
</tr>
</thead>
<tbody>
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<table>
<thead>
<tr>
<th>Fortran</th>
<th>503.bwaves_r(base) 549.fotonik3d_r(base) 554.roms_r(base)</th>
</tr>
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<tbody>
<tr>
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<tr>
<th>Fortran, C</th>
<th>521.wrf_r(base) 527.camd_r(base)</th>
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Compiler Version Notes (Continued)

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

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

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---

### 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`

**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-ic2023-official-linux64.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/Intel-ic2023-official-linux64.xml](http://www.spec.org/cpu2017/flags/Intel-ic2023-official-linux64.xml)
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