



# SPEC CPU®2017 Integer Rate Result

Copyright 2017-2024 Standard Performance Evaluation Corporation

## Lenovo Global Technology

ThinkStation PX  
(1.80 GHz, Intel Xeon Gold 5418N)

SPECrate®2017\_int\_base = 369

SPECrate®2017\_int\_peak = Not Run

CPU2017 License: 9017

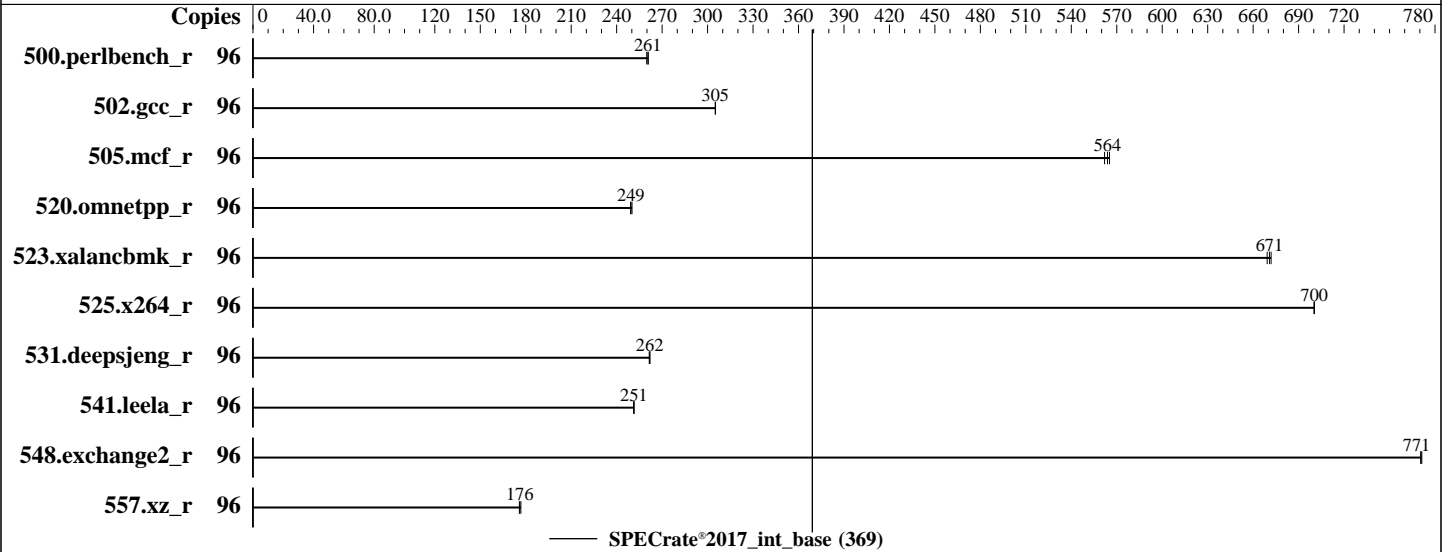
Test Sponsor: Lenovo Global Technology

Tested by: Lenovo Global Technology

Test Date: May-2023

Hardware Availability: May-2023

Software Availability: Dec-2022



### Hardware

CPU Name: Intel Xeon Gold 5418N  
 Max MHz: 3800  
 Nominal: 1800  
 Enabled: 48 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: 45 MB I+D on chip per chip  
 Other: None  
 Memory: 256 GB (16 x 16 GB 1Rx8 PC5-4800B-R, running at 4000)  
 Storage: 1 x 512 GB NVME SSD  
 Other: None

### Software

OS: Red Hat Enterprise Linux 9.1 (Plow)  
 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 S09KT07A released Mar-2023  
 File System: xfs  
 System State: Run level 5 (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



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## Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
500.perlbench_r	96	586	261	588	260	<b>586</b>	<b>261</b>							
502.gcc_r	96	446	305	<b>446</b>	<b>305</b>	445	305							
505.mcf_r	96	276	562	<b>275</b>	<b>564</b>	274	565							
520.omnetpp_r	96	506	249	<b>505</b>	<b>249</b>	504	250							
523.xalancbmk_r	96	<b>151</b>	<b>671</b>	151	669	151	672							
525.x264_r	96	240	700	240	700	<b>240</b>	<b>700</b>							
531.deepsjeng_r	96	420	262	421	262	<b>420</b>	<b>262</b>							
541.leela_r	96	<b>632</b>	<b>251</b>	632	251	633	251							
548.exchange2_r	96	326	771	<b>326</b>	<b>771</b>	326	771							
557.xz_r	96	586	177	<b>589</b>	<b>176</b>	590	176							

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Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

## 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/je5.0.1-32"
MALLOC_CONF = "retain:true"
```



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### 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.  
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

Sysinfo program /home/cpu2017-1.1.9-ic2023.0/bin/sysinfo  
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197  
running on localhost.localdomain Fri May 19 08:51:54 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 250 (250-12.e19\_1)
12. Services, from systemctl list-unit-files
13. Linux kernel boot-time arguments, from /proc/cmdline
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.localdomain 5.14.0-162.6.1.e19\_1.x86\_64 #1 SMP PREEMPT\_DYNAMIC Fri Sep 30 07:36:03 EDT 2022  
x86\_64 x86\_64 x86\_64 GNU/Linux  
-----

2. w

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### Platform Notes (Continued)

```
08:51:54 up 1 min, 1 user, load average: 0.81, 0.40, 0.15
USER      TTY      LOGIN@   IDLE   JCPU   PCPU   WHAT
px        tty2     08:51    1:52   0.03s  0.03s  /usr/libexec/gnome-session-binary
```

3. Username  
From environment variable \$USER: root  
From the command 'logname': px

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) 1027528  
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) 1027528  
virtual memory (kbytes, -v) unlimited  
file locks (-x) unlimited

5. sysinfo process ancestry  
/usr/lib/systemd/systemd rhgb --switched-root --system --deserialize 31  
/usr/lib/systemd/systemd --user  
/usr/libexec/gnome-terminal-server  
bash  
sudo ./speccpu2017.runtest.sh  
/bin/bash ./speccpu2017.runtest.sh  
/bin/bash ./speccpu2017.runtest.sh  
runcpu --nobuild --action validate --define default-platform-flags --define numcopies=96 -c  
ic2023.0-lin-sapphirerapids-rate-20221201.cfg --define smt-on --define cores=48 --define physicalfirst  
--define invoke\_with\_interleave --define drop\_caches --tune base -o all intrate  
runcpu --nobuild --action validate --define default-platform-flags --define numcopies=96 --configfile  
ic2023.0-lin-sapphirerapids-rate-20221201.cfg --define smt-on --define cores=48 --define physicalfirst  
--define invoke\_with\_interleave --define drop\_caches --tune base --output\_format all --nopower --runmode  
rate --tune base --size refrate intrate --nopreenv --note-preenv --logfile  
\$SPEC/tmp/CPU2017.014/templogs/preenv.intrate.014.0.log --lognum 014.0 --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 5418N  
vendor\_id : GenuineIntel  
cpu family : 6  
model : 143  
stepping : 8  
microcode : 0x2b000161  
bugs : spectre\_v1 spectre\_v2 spec\_store\_bypass swapgs eibrs\_pbrsb  
cpu cores : 24  
siblings : 48

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### Platform Notes (Continued)

2 physical ids (chips)  
96 processors (hardware threads)  
physical id 0: core ids 0-23  
physical id 1: core ids 0-23  
physical id 0: apicids 0-47  
physical id 1: apicids 128-175

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:          52 bits physical, 57 bits virtual
Byte Order:             Little Endian
CPU(s):                 96
On-line CPU(s) list:   0-95
Vendor ID:              GenuineIntel
BIOS Vendor ID:         Intel(R) Corporation
Model name:             Intel(R) Xeon(R) Gold 5418N
BIOS Model name:       Intel(R) Xeon(R) Gold 5418N
CPU family:             6
Model:                  143
Thread(s) per core:    2
Core(s) per socket:    24
Socket(s):              2
Stepping:               8
CPU max MHz:            3800.0000
CPU min MHz:            800.0000
BogoMIPS:               3600.00
Flags:                  fpu vme de pse tsc msr 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_l3 cat_l2 cdp_l3
                        invpcid_single intel_ppin cdp_l2 ssbd mba ibrs ibpb stibp ibrs_Enhanced
                        tpr_shadow vnmi flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmi1 avx2
                        smep bmi2 erms invpcid cqm rdt_a avx512f avx512dq rdseed adx smap
                        avx512ifma clflushopt clwb intel_pt avx512cd sha_ni avx512bw avx512vl
                        xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbm_total
                        cqm_mbm_local split_lock_detect avx_vnni avx512_bf16 wbnoinvd dtherm ida
                        arat pln pts hwp hwp_act_window hwp_epp hwp_pkg_req hfi avx512vbmi umip
                        pku ospke waitpkg avx512_vbmi2 gfni vaes vpclmulqdq avx512_vnni
                        avx512_bitalg tme avx512_vpopcntdq la57 rdpid bus_lock_detect cldemote
                        movdiri movdir64b enqcmd fsrm md_clear serialize tsxldtrk pconfig arch_lbr
                        amx_bf16 avx512_fp16 amx_tile amx_int8 flush_lld arch_capabilities

Virtualization:        VT-x
L1d cache:             2.3 MiB (48 instances)
L1i cache:             1.5 MiB (48 instances)
L2 cache:              96 MiB (48 instances)
L3 cache:              90 MiB (2 instances)
NUMA node(s):         2
NUMA node0 CPU(s):    0-23,48-71
NUMA node1 CPU(s):    24-47,72-95
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf:   Not affected

```

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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/swaps barriers and \_\_user pointer sanitization  
 Vulnerability Spectre v2: Mitigation; Enhanced IBRS, IBPB conditional, RSB filling, PBRSE-eIBRS SW sequence  
 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
L1d	48K	2.3M	12	Data	1	64	1	64
L1i	32K	1.5M	8	Instruction	1	64	1	64
L2	2M	96M	16	Unified	2	2048	1	64
L3	45M	90M	15	Unified	3	49152	1	64

8. numactl --hardware

NOTE: a numactl 'node' might or might not correspond to a physical chip.

```
available: 2 nodes (0-1)
node 0 cpus: 0-23,48-71
node 0 size: 127984 MB
node 0 free: 126106 MB
node 1 cpus: 24-47,72-95
node 1 size: 128962 MB
node 1 free: 127999 MB
node distances:
node  0  1
  0:  10  21
  1:  21  10
```

9. /proc/meminfo

MemTotal: 263113184 kB

10. who -r

run-level 5 May 19 08:50

11. Systemd service manager version: systemd 250 (250-12.e19\_1)

```
Default Target Status
graphical      running
```

12. Services, from systemctl list-unit-files

```
STATE UNIT FILES
enabled ModemManager NetworkManager NetworkManager-dispatcher NetworkManager-wait-online
accounts-daemon atd auditd avahi-daemon bluetooth chronyd crond cups dbus-broker firewalld
gdm getty@ insights-client-boot irqbalance iscsi iscsi-onboot kdump libstoragemgmt
low-memory-monitor lvm2-monitor mcelog mdmonitor microcode multipathd nis-domainname
nvme-fc-boot-connections ostree-remount power-profiles-daemon qemu-guest-agent rhsmcertd
rpcbind rsyslog rtkit-daemon selinux-autorelabel-mark smartd sshd sssd switcheroo-control
systemd-network-generator tuned udisks2 upower vgauthd vmtoolsd
enabled-runtime systemd-remount-fs
disabled arp-ethers blk-availability brltty canberra-system-bootup canberra-system-shutdown
canberra-system-shutdown-reboot chrony-wait console-getty cpupower cups-browsed
dbus-daemon debug-shell dnsmasq gssproxy iprump iprunit ipupdate ipsec iscsid iscsiui
```

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### Platform Notes (Continued)

```

kpatch kvm_stat ledmon man-db-restart-cache-update nfs-blkmap nfs-server nftables
nvmf-autoconnect pesign psacct rdisc rhcd rhsm rhsm-facts rpmdb-rebuild serial-getty@
speech-dispatcherd sshd-keygen@ systemd-boot-check-no-failures systemd-pstore
systemd-sysext thermald wpa_supplicant
indirect spice-vdagentd sssd-autofs sssd-kcm sssd-nss sssd-pac sssd-pam sssd-ssh sssd-sudo

```

```

-----
13. Linux kernel boot-time arguments, from /proc/cmdline
BOOT_IMAGE=(hd0,gpt2)/vmlinuz-5.14.0-162.6.1.el9_1.x86_64
root=/dev/mapper/rhel-root
ro
crashkernel=1G-4G:192M,4G-64G:256M,64G-:512M
resume=/dev/mapper/rhel-swap
rd.lvm.lv=rhel/root
rd.lvm.lv=rhel/swap
rhgb
quiet

```

```

-----
14. cpupower frequency-info
analyzing CPU 0:
  current policy: frequency should be within 800 MHz and 3.80 GHz.
                  The governor "powersave" may decide which speed to use
                  within this range.
boost state support:
  Supported: yes
  Active: yes

```

```

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

```

```

-----
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+madvise [madvise] never
enabled         [always] madvise never
hpage_pmd_size 2097152

```

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### Platform Notes (Continued)

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
Filesystem Type Size Used Avail Use% Mounted on
/dev/mapper/rhel-home xfs 402G 13G 389G 4% /home
-----
```

```
-----
21. /sys/devices/virtual/dmi/id
Vendor: LENOVO
Product: 30EUCT01WW
Product Family: Lenovo Product
Serial: MJ0D1234
-----
```

```
-----
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:
16x Micron MTC10F1084S1RC48BA1 16 GB 1 rank 4800, configured at 4000
-----
```

```
-----
23. BIOS
(This section combines info from /sys/devices and dmidecode.)
BIOS Vendor: LENOVO
BIOS Version: S09KT07A
BIOS Date: 03/16/2023
BIOS Revision: 1.7
Firmware Revision: 0.71
-----
```

### 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.
-----
```

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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 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

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

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ThinkStation PX  
(1.80 GHz, Intel Xeon Gold 5418N)

SPECrate®2017\_int\_peak = Not Run

**CPU2017 License:** 9017

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**Hardware Availability:** May-2023

**Tested by:** Lenovo Global Technology

**Software Availability:** Dec-2022

## Base Optimization Flags (Continued)

C benchmarks (continued):

```
-L/usr/local/intel/compiler/2023.0.0/linux/compiler/lib/intel64_lin  
-lqkmalloc
```

C++ benchmarks:

```
-w -std=c++14 -m64 -Wl,-z,muldefs -xsaphirerapids -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 -xsaphirerapids -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
```

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/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Eaglestream-P.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/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Eaglestream-P.xml>

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For questions about this result, please contact the tester. For other inquiries, please contact [info@spec.org](mailto:info@spec.org).

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