



SPEC CPU®2017 Integer Rate Result

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Lenovo Global Technology

SPECrate®2017_int_base = 342

ThinkStation PX
(2.00 GHz, Intel Xeon Silver 4416+)

SPECrate®2017_int_peak = Not Run

CPU2017 License: 9017

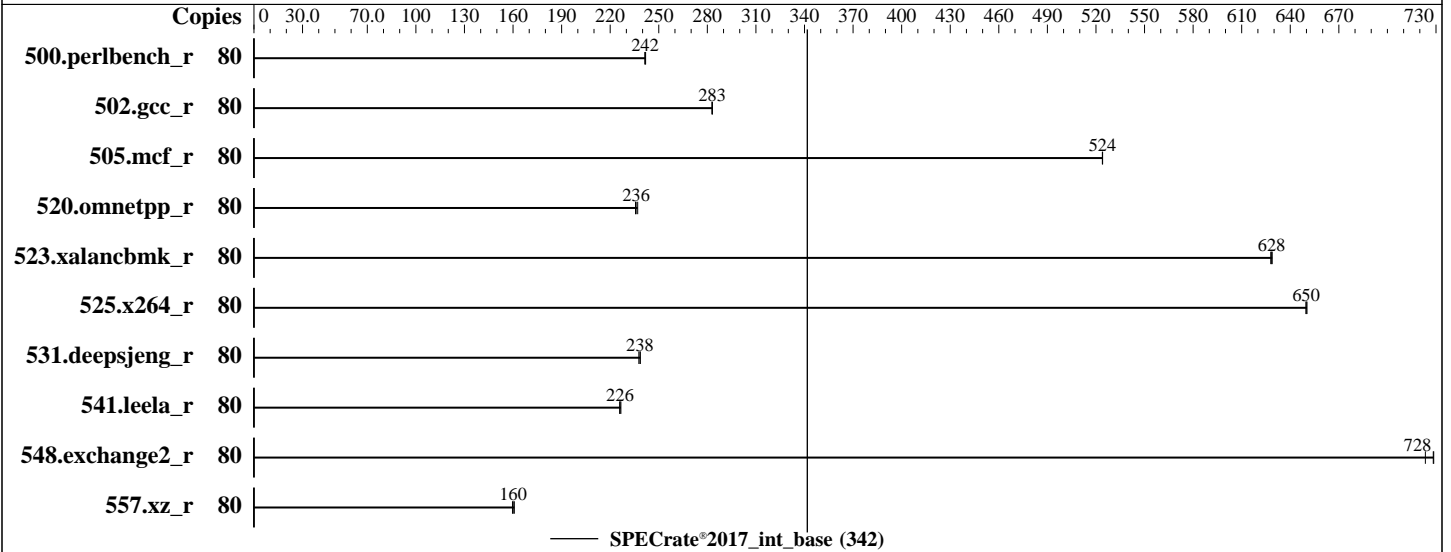
Test Date: May-2023

Test Sponsor: Lenovo Global Technology

Hardware Availability: May-2023

Tested by: Lenovo Global Technology

Software Availability: Dec-2022



Hardware

CPU Name: Intel Xeon Silver 4416+
 Max MHz: 3900
 Nominal: 2000
 Enabled: 40 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: 37.5 MB I+D on chip per chip
 Other: None
 Memory: 512 GB (16 x 32 GB 2Rx8 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	80	527	242	528	241	527	242							
502.gcc_r	80	400	283	400	283	400	283							
505.mcf_r	80	247	524	247	524	247	524							
520.omnetpp_r	80	445	236	443	237	445	236							
523.xalancbmk_r	80	135	628	134	629	134	628							
525.x264_r	80	216	650	215	650	216	650							
531.deepsjeng_r	80	385	238	384	239	386	238							
541.leela_r	80	587	226	586	226	585	227							
548.exchange2_r	80	288	728	288	729	290	723							
557.xz_r	80	537	161	541	160	540	160							

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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), 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 Thu May 18 13:06:27 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)

```
13:06:27 up 1 min, 1 user, load average: 0.50, 0.28, 0.10
USER      TTY      LOGIN@   IDLE   JCPU   PCPU   WHAT
px        tty2     13:05    1:37   0.02s  0.02s  /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) 2059733
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) 2059733
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=80 -c
ic2023.0-lin-sapphirerapids-rate-20221201.cfg --define smt-on --define cores=40 --define physicalfirst
--define invoke_with_interleave --define drop_caches --tune base -o all intrate
runcpu --nobuild --action validate --define default-platform-flags --define numcopies=80 --configfile
ic2023.0-lin-sapphirerapids-rate-20221201.cfg --define smt-on --define cores=40 --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/CPU2017.012/templogs/preenv.intrate.012.0.log --lognum 012.0 --from_runcpu 2
specperl \$SPEC/bin/sysinfo
\$SPEC = /home/cpu2017-1.1.9-ic2023.0

6. /proc/cpuinfo
model name : Intel(R) Xeon(R) Silver 4416+
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 : 20
siblings : 40

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Platform Notes (Continued)

2 physical ids (chips)
80 processors (hardware threads)
physical id 0: core ids 0-19
physical id 1: core ids 0-19
physical id 0: apicids 0-39
physical id 1: apicids 128-167

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):                80
On-line CPU(s) list:   0-79
Vendor ID:             GenuineIntel
BIOS Vendor ID:       Intel(R) Corporation
Model name:            Intel(R) Xeon(R) Silver 4416+
BIOS Model name:      Intel(R) Xeon(R) Silver 4416+
CPU family:            6
Model:                 143
Thread(s) per core:   2
Core(s) per socket:   20
Socket(s):             2
Stepping:              8
CPU max MHz:           3900.0000
CPU min MHz:           800.0000
BogoMIPS:              4000.00
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 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:             1.9 MiB (40 instances)
L1i cache:             1.3 MiB (40 instances)
L2 cache:              80 MiB (40 instances)
L3 cache:              75 MiB (2 instances)
NUMA node(s):         2
NUMA node0 CPU(s):    0-19,40-59
NUMA node1 CPU(s):    20-39,60-79
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf:   Not affected

```

(Continued on next page)



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Platform Notes (Continued)

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	1.9M	12	Data	1	64	1	64
L1i	32K	1.3M	8	Instruction	1	64	1	64
L2	2M	80M	16	Unified	2	2048	1	64
L3	37.5M	75M	15	Unified	3	40960	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: 0-19,40-59
node 0 size: 257009 MB
node 0 free: 255287 MB
node 1 cpus: 20-39,60-79
node 1 size: 257987 MB
node 1 free: 256644 MB
node distances:
node  0  1
  0:  10  21
  1:  21  10
```

9. /proc/meminfo

MemTotal: 527357696 kB

10. who -r

run-level 5 May 18 13:05

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 iprinit iprupdate ipsec iscsid iscsiuiob
```

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Platform Notes (Continued)

```

indirect
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
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 3.90 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+madvice [madvice] never
enabled        [always] madvice 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 390G 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 MTC20F2085S1RC48BA1 32 GB 2 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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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.

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