Cisco Systems
Cisco UCS X210c M7 (Intel Xeon Gold 6448H, 2.40GHz)

<table>
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<th>SPECrate®2017_int_peak = 639</th>
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**Hardware**

- **CPU Name:** Intel Xeon Gold 6448H
- **Max MHz:** 4100
- **Nominal:** 2400
- **Enabled:** 64 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:** 60 MB I+D on chip per core
- **Other:** None
- **Memory:** 1 TB (16 x 64 GB 2Rx4 PC5-4800B-R)
- **Storage:** 1 x 960 GB M.2 SSD SATA
- **Other:** None

**Software**

- **OS:** SUSE Linux Enterprise Server 15 SP4 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:** Version 5.1.1b released Mar-2023
- **File System:** btrfs
- **System State:** Run level 3 (multi-user)
- **Base Pointers:** 64-bit
- **Peak Pointers:** 32/64-bit
- **Other:** jemalloc memory allocator V5.0.1
- **Power Management:** BIOS set to prefer performance at the cost of additional power usage
Cisco Systems
Cisco UCS X210c M7 (Intel Xeon Gold 6448H, 2.40GHz)

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CPU2017 License: 9019
Test Sponsor: Cisco Systems
Tested by: Cisco Systems

Test Date: May-2023
Hardware Availability: Mar-2023
Software Availability: Dec-2022

Results Table

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</table>

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.xalanchmk_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This result is left in the SPEC results database for historical reference.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/lib/intel64:/home/cpu2017/lib/ia32:/home/cpu2017/je5.0.1-32"
MALLOC_CONF = "retain:true"
Cisco Systems
Cisco UCS X210c M7 (Intel Xeon Gold 6448H, 2.40GHz)

SPEC CPU®2017 Integer Rate Result
Copyright 2017-2024 Standard Performance Evaluation Corporation

SPECRate®2017_int_base = 620
SPECRate®2017_int_peak = 639

CPU2017 License: 9019
Test Sponsor: Cisco Systems
Tested by: Cisco Systems

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
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.
jemalloc, a general purpose malloc implementation
built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5

Platform Notes

BIOS Settings:
Adjacent Cache Line Prefetcher set to Disabled
DCU streamer Prefetch set to Disabled
Enhanced CPU Performance set to Auto
LLC Dead Line set to Disabled
ADDDC Sparing set to Disabled
Processor C6 Report set to Enabled

Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c6ae2c92cc097bec197
running on localhost Wed May 24 00:34:29 2023

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

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7. Iscpu
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9. /proc/meminfo
10. who -r
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12. Services, from systemctl list-unit-files
13. Linux kernel boot-time arguments, from /proc/cmdline
14. cpupower frequency-info
15. sysctl
16. /sys/kernel/mm/transparent_hugepage
17. /sys/kernel/mm/transparent_hugepage/khugepaged
18. OS release
19. Disk information
20. /sys/devices/virtual/dmi/id
21. dmidecode
Platform Notes (Continued)

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
   00:34:29 up 3 min, 1 user, load average: 1.47, 3.09, 1.48
   USER   TTY      FROM            LOGIN@     IDLE    JCPU    PCPU WHAT
   root   tty1     -                00:31       13.00s  1.11s  0.19s  -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 (-l) 4126816
   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) 4126816
   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 --action=build --action validate --define default-platform-flags --define numcopies=128 -c
   ic2023.0-lin-sapphirerapids-rate-20221201.cfg --reportable --iterations 3 --define smt-on --define
   cores=64 --define physicalfirst --define invoke_with_interleave --define drop_caches --tune all --o all
   intrate
   runcpu --action build --action validate --define default-platform-flags --define numcopies=128 --configfile
   ic2023.0-lin-sapphirerapids-rate-20221201.cfg --reportable --iterations 3 --define smt-on --define
   cores=64 --define physicalfirst --define invoke_with_interleave --define drop_caches --tune all
   --output_format all --nopower --runmode rate --tune base:peak --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
   -----------------------------

6. /proc/cpuinfo
   model name : Intel(R) Xeon(R) Gold 6448H
   vendor_id : GenuineIntel

(Continued on next page)
Cisco Systems
Cisco UCS X210c M7 (Intel Xeon Gold 6448H, 2.40GHz)

SPECratio®2017_int_base = 620
SPECratio®2017_int_peak = 639

CPU2017 License: 9019
Test Sponsor: Cisco Systems
Tested by: Cisco Systems

Test Date: May-2023
Hardware Availability: Mar-2023
Software Availability: Dec-2022

Platform Notes (Continued)

cpu family : 6
cpu cores : 32
siblings : 64
2 physical ids (chips)
128 processors (hardware threads)
physical id 0: core ids 0-31
physical id 1: core ids 0-31
physical id 0: apicids 0-63
physical id 1: apicids 128-191

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): 128
On-line CPU(s) list: 0-127
Vendor ID: GenuineIntel
Model name: Intel(R) Xeon(R) Gold 6448H
CPU family: 6
Model: 143
Thread(s) per core: 2
Core(s) per socket: 32
Socket(s): 2
Stepping: 8
CPU max MHz: 4100.0000
CPU min MHz: 800.0000
BogoMIPS: 4800.00

Flags:

Virtualization: VT-x
L1d cache: 3 MiB (64 instances)
L1i cache: 2 MiB (64 instances)
L2 cache: 128 MiB (64 instances)
L3 cache: 120 MiB (2 instances)

(Continued on next page)
Cisco Systems
Cisco UCS X210c M7 (Intel Xeon Gold 6448H, 2.40GHz)

CPU2017 License: 9019
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Platform Notes (Continued)

NUMA node(s): 2
NUMA node0 CPU(s): 0-31,64-95
NUMA node1 CPU(s): 32-63,96-127

Vulnerability Itlb multihit: Not affected
Vulnerability L1t: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Spectre v1: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
Vulnerability Spectre v2: Mitigation; usercopy/swapgs barriers and __user pointer sanitization
Vulnerability Srbds: Not affected
Vulnerability Tax async abort: Not affected

From lscpu --cache:

NAME ONE-SIZE ALL-SIZE WAYS TYPE LEVEL SETS PHY-LINE COHERENCY-SIZE
L1d 48K 3M 12 Data 1 64 1 64
L1i 32K 2M 8 Instruction 1 64 1 64
L2 2M 128M 16 Unified 2 2048 1 64
L3 60M 120M 15 Unified 3 65536 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: 0-31,64-95
node 0 size: 515729 MB
node 0 free: 513895 MB
node 1 cpus: 32-63,96-127
node 1 size: 515998 MB
node 1 free: 514936 MB

9. /proc/meminfo
MemTotal: 1056489200 kB

10. who -r
run-level 3 May 24 00:31

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

enabled-runtime systemd-remount-fs

disabled autosfs autostart-initscripts blk-availability boot-sysctl ca-certificates chrony-wait
chronyd console-getty cups cups-browsed debug-shell etabtables exchange-bmc-os-info
firewalld gpm grub2-once haveged-switch-root ipmi ipmiyevd issue-add-ssh-keys kexec-load
lunmask man-db-create multipathd nfs nfs-bkmap rdisc rpcbind rpmconfigcheck rsyncd

(Continued on next page)
SPEC CPU®2017 Integer Rate Result
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Platform Notes (Continued)

13. Linux kernel boot-time arguments, from /proc/cmdline
BOOT_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default
root=UUID=355b818f-3256-41eb-9dee-8dad9fff7170
splash=silent
mitigations=auto
quiet
security=apparmor

14. cpupower frequency-info
 analyzing CPU 0:
 current policy: frequency should be within 800 MHz and 4.10 GHz.
    The governor "performance" may decide which speed to use
    within this range.
    boost state support:
        Supported: yes
        Active: yes

15. sysct1
 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  1
 vm.watermark_boost_factor  15000
 vm.watermark_scale_factor  10
 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

(Continued on next page)
Cisco Systems
Cisco UCS X210c M7 (Intel Xeon Gold 6448H, 2.40GHz)

SPEC CPU®2017 Integer Rate Result

**Platform Notes (Continued)**

scan_sleep_millisecs 10000

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

19. Disk information
   SPEC is set to: /home/cpu2017
   Filesystem    Type   Size  Used Avail Use% Mounted on
   /dev/sda2      btrfs  892G  9.2G  882G   2% /home

20. `/sys/devices/virtual/dmi/id`
   Vendor:         Cisco Systems Inc
   Product:        UCSX-210C-M7
   Serial:         FCH270978F4

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:
   16x 0xAD00 HMCG94MEBRA109N 64 GB 2 rank 4800

---

**Compiler Version Notes**

C | 502.gcc_r(peak)
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on IA-32, Version 2023.0.0 Build 20221201
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C | 500.perlbench_r(base, peak) 502.gcc_r(base) 505.mcf_r(base, peak) 525.x264_r(base, peak) 557.xz_r(base, peak)
---

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

C | 502.gcc_r(peak)
---

Intel(R) oneAPI DPC++/C++ Compiler for applications running on IA-32, Version 2023.0.0 Build 20221201
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(Continued on next page)
**Cisco Systems**
Cisco UCS X210c M7 (Intel Xeon Gold 6448H, 2.40GHz)

**SPEC CPU®2017 Integer Rate Result**

<table>
<thead>
<tr>
<th>Test Sponsor:</th>
<th>Cisco Systems</th>
</tr>
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<tbody>
<tr>
<td>Tested by:</td>
<td>Cisco Systems</td>
</tr>
<tr>
<td>CPU2017 License:</td>
<td>9019</td>
</tr>
<tr>
<td>Test Date:</td>
<td>May-2023</td>
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**Compiler Version Notes (Continued)**

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C

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

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<tr>
<th>520.omnetpp_r(base, peak)</th>
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
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Fortran

<table>
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<tr>
<th>548.exchange2_r(base, peak)</th>
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</table>

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

**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
### Cisco Systems
Cisco UCS X210c M7 (Intel Xeon Gold 6448H, 2.40GHz)  

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<th>SPECrate®2017_int_base = 620</th>
<th>SPECrate®2017_int_peak = 639</th>
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**CPU2017 License:** 9019  
**Test Sponsor:** Cisco Systems  
**Tested by:** Cisco Systems  
**Test Date:** May-2023  
**Hardware Availability:** Mar-2023  
**Software Availability:** Dec-2022

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

C++ benchmarks:
- `-w -std=c++14 -m64 -Wl,-z,muldefs -xsapphirerapids -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 -xsapphirerapids -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`

### Peak Compiler Invocation
C benchmarks:
- `icx`

C++ benchmarks:
- `icpx`

Fortran benchmarks:
- `ifx`

### Peak Portability Flags
- `500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64`
- `502.gcc_r: -D_FILE_OFFSET_BITS=64`
- `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`

(Continued on next page)
Cisco Systems
Cisco UCS X210c M7 (Intel Xeon Gold 6448H, 2.40GHz)

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**Peak Portability Flags (Continued)**

- 557.xz_r: -DSPEC_LP64

**Peak Optimization Flags**

**C benchmarks:**

- 500.perlbench_r: -w -std=c11 -m64 -Wl,-z,muldefs
  -fprofile-generate(pass 1)
  -fprofile-use=default.profdata(pass 2) -xCORE-AVX2(pass 1)
  -flto -Ofast -xCORE-AVX512 -ffast-math -mfpmath=sse
  -funroll-loops -qopt-mem-layout-trans=4
  -fno-strict-overflow
  -L/usr/local/intel/compiler/2023.0.0/linux/compiler/lib/intel64_lin
  -lqkmalloc

- 502gcc_r: -m32
  -L/usr/local/intel/compiler/2023.0.0/linux/compiler/lib/ia32_lin
  -std=gnu89 -Wl,-z,muldefs -fprofile-generate(pass 1)
  -fprofile-use=default.profdata(pass 2) -xCORE-AVX2(pass 1)
  -flto -Ofast -xCORE-AVX512 -ffast-math -mfpmath=sse
  -funroll-loops -qopt-mem-layout-trans=4
  -L/usr/local/jemalloc32-5.0.1/lib -ljemalloc

- 505.mcf_r: basepeak = yes

- 525.x264_r: -w -std=c11 -m64 -Wl,-z,muldefs -xsapphirerapids -Ofast
  -ffast-math -flto -mfpmath=sse -funroll-loops
  -qopt-mem-layout-trans=4 -fno-alias
  -L/usr/local/intel/compiler/2023.0.0/linux/compiler/lib/intel64_lin
  -lqkmalloc

**C++ benchmarks:**

- 520.omnetpp_r: basepeak = yes

- 523.xalancbmk_r: basepeak = yes

- 531.deepsjeng_r: basepeak = yes

- 541.leela_r: basepeak = yes

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## Cisco Systems

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### Peak Optimization Flags (Continued)

For the Fortran benchmarks:

548.exchange2_r: basepeak = yes

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)