Cisco Systems
Cisco UCS C240 M7 (Intel Xeon Gold 6416H, 2.20GHz)

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

SPECratre®2017_int_base = 333
SPECratre®2017_int_peak = 343

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

Hardware
CPU Name: Intel Xeon Gold 6416H
Max MHz: 4200
Nominal: 2200
Enabled: 36 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: 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 4.3.1a released Feb-2023
File System: xfs
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
## Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
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<tbody>
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<td>500.perlbench_r</td>
<td>72</td>
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<td>548.exchange2_r</td>
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</table>

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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.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This result is left in the SPEC results database for historical reference.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"
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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.
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:
Sub NUMA Clustering set to Enable SNC4
LLC Dead Line set to Disabled
ADDDC Sparing set to Disabled
Processor C6 Report set to Enabled
UPI Link Enablement 3
UPI Power Management Enabled

Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b?ed5c36ae2c92cc097bec197
running on srv04 Tue Mar 14 22:26:44 2023

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

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Platform Notes (Continued)

1. uname -a
   Linux srv04 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
   22:26:44 up 7 min, 1 user, load average: 0.14, 0.06, 0.02
   USER     TTY      FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
   root     tty1     -                22:20    4.00s  1.17s  0.15s -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) 4126941
   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) 4126941
   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
   runcpu --nobuild --action validate --define default-platform-flags --define numcopies=72 -c
   ic2023.0-lin-sapphirerapids-rate-20221201.cfg --reportable --iterations 3 --define smt-on --define cores=36 --define physicalfirst --define invoke_with_interleave --define drop_caches --tune all -- all intrate
   runcpu --nobuild --action validate --define default-platform-flags --define numcopies=72 --configfile
   ic2023.0-lin-sapphirerapids-rate-20221201.cfg --reportable --iterations 3 --define smt-on --define cores=36 --define physicalfirst --define invoke_with_interleave --define drop_caches --tune all --  output_format all --nopow --runmode rate --tune base:peak --size refrate intrate --nopreenv
   --note-preenv --logfile $SPEC/tmp/CPU2017.189/templogs/preenv.intrate.189.0.log --logfile $SPEC/tmp/CPUspec/189.0.log --lognum 189.0
   --from_runcpu 2
   specperl $SPEC/bin/sysinfo
   $SPEC = /home/cpu2017

6. /proc/cpuinfo
   model name      : Intel(R) Xeon(R) Gold 6416H
   vendor_id       : GenuineIntel
   cpu family      : 6

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https://www.spec.org
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Software Availability: Dec-2022

SPEC CPU®2017 Integer Rate Result
SPECrate®2017_int_base = 333
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Platform Notes (Continued)

model : 143
stepping : 8
microcode : 0x2b000161
bugs : spectre_v1 spectre_v2 spec_store_bypass swapgs
cpu cores : 18
siblings : 36
2 physical ids (chips)
72 processors (hardware threads)
physical id 0: core ids 0-17
physical id 1: core ids 0-17
physical id 0: apicids 0-35
physical id 1: apicids 128-163
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): 72
On-line CPU(s) list: 0-71
Vendor ID: GenuineIntel
Model name: Intel(R) Xeon(R) Gold 6416H
CPU family: 6
Model: 143
Thread(s) per core: 2
Core(s) per socket: 18
Socket(s): 2
Stepping: 8
CPU max MHz: 4200.000
CPU min MHz: 800.000
BogoMIPS: 4400.00

Flags:

Virtualization: VT-x
L1d cache: 1.7 MiB (36 instances)
L1i cache: 1.1 MiB (36 instances)
L2 cache: 72 MiB (36 instances)
L3 cache: 90 MiB (2 instances)
NUMA node(s): 4

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Cisco Systems
Cisco UCS C240 M7 (Intel Xeon Gold 6166H, 2.2GHz)

SPEC CPU®2017 Integer Rate Result
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SPECrate®2017_int_base = 333
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CPU2017 License: 9019
Test Sponsor: Cisco Systems
Tested by: Cisco Systems
Test Date: Mar-2023
Hardware Availability: Mar-2023
Software Availability: Dec-2022

Platform Notes (Continued)

NUMA node0 CPU(s):
0-8,36-44
NUMA node1 CPU(s):
9-17,45-53
NUMA node2 CPU(s):
18-26,54-62
NUMA node3 CPU(s):
27-35,63-71
Vulnerability Itlb multihit:
Not affected
Vulnerability Lttf:
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 Spectre v3:
Mitigation; Enhanced IBRS, IBPB conditional, RSB filling
Vulnerability Srbd:
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 1.7M 12 Data 1 64 1 64
L1i 32K 1.1M 8 Instruction 1 64 1 64
L2 2M 72M 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.
availabe: 4 nodes (0-3)
node 0 cpus: 0-8,36-44
node 0 size: 257692 MB
node 0 free: 256492 MB
node 1 cpus: 9-17,45-53
node 1 size: 258043 MB
node 1 free: 257273 MB
node 2 cpus: 18-26,54-62
node 2 size: 258008 MB
node 2 free: 257252 MB
node 3 cpus: 27-35,63-71
node 3 size: 258014 MB
node 3 free: 257336 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: 1056521708 kB

10. who -r
run-level 3 Mar 14 22:19

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

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Platform Notes (Continued)

enabled
YaST2-Firstboot YaST2-Second-Stage apparmor auditd cron getty@ havedeg irqbalance
issue-generator kbdsettings klog lvme2-monitor nscd postfix purge-kernels rollback rayslog
smartd sshd wicked wickeded-auto4 wickeded-dhcp4 wickeded-dhcp6 wickeded-nanny
systemd-remount-fs

enabled-runtime
autofs autoyast-initscripts blk-availability boot-sysctl ca-certificates chrony-wait
chronyd console-getty cups cups-browsed debug-shell ebtables exchange-bmc-os-info
firewalld gpm grub2-once havedeg-switch-root ipmi ipmiutils issue-add-ssh-keys kexec-load
lumask man-db-create multipathd nfs nfs-blkmap rdisc rlimits rmmconfcheck rsyncd
serial-getty@ smartd_generate_opts snmpd snmptrapd svserve systemd-boot-check-no-failures
systemd-network-generator systemd-sysext systemd-time-wait-sync systemd-timesyncd udisks2
wicked

disabled
autofs autoyast-initscripts blk-availability boot-sysctl ca-certificates chrony-wait
chronyd console-getty cups cups-browsed debug-shell ebtables exchange-bmc-os-info
firewalld gpm grub2-once havedeg-switch-root ipmi ipmiutils issue-add-ssh-keys kexec-load
lumask man-db-create multipathd nfs nfs-blkmap rdisc rlimits rmmconfcheck rsyncd
serial-getty@ smartd_generate_opts snmpd snmptrapd svserve systemd-boot-check-no-failures
systemd-network-generator systemd-sysext systemd-time-wait-sync systemd-timesyncd udisks2
wicked

indirect

13. Linux kernel boot-time arguments, from /proc/cmdline
   BOOT_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default
   root=UUID=e05292c4-0a31-46de-94f3-3ad8c6a360dd
   splash=silent
   mitigations=auto
   quiet
   security=

14. cpupower frequency-info
   analyzing CPU 0:
   current policy: frequency should be within 800 MHz and 4.20 GHz.
   The governor "performance" may decide which speed to use
   within this range.
   boost state support:
   Supported: yes
   Active: yes

15. sysctl
   kernel.numa_balancing                   0
   kernel.randomize_va_space               2
   vm.compaction_proactive_bytes           0
   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                  500
   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

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Platform Notes (Continued)

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 /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/sdb3 xfs 218G 11G 208G 5% /

20. /sys/devices/virtual/dmi/id
   Vendor: Cisco Systems Inc
   Product: UCSC-C240-M7SX
   Serial: WZP263592NZ

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

22. BIOS
   (This section combines info from /sys/devices and dmidecode.)
   BIOS Vendor: Cisco Systems, Inc.
   BIOS Version: C240M7.4.3.1a.0.0201231701
   BIOS Date: 02/01/2023
   BIOS Revision: 5.29

Compiler Version Notes

C      | 502.gcc_r(peak)

Intel(R) oneAPI DPC++/C++ Compiler for applications running on IA-32, Version 2023.0.0 Build 20221201
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.

C      | 500.perlbench_r(base, peak) 502.gcc_r(base) 505.mcf_r(base, peak) 525.x264_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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Compiler Version Notes (Continued)

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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
| Copyright (C) 1985-2022 Intel Corporation. All rights reserved. |
-----------------------------------------------------------------------------------
| 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 |
| Copyright (C) 1985-2022 Intel Corporation. All rights reserved. |
-----------------------------------------------------------------------------------
| C++ | 520.omnetpp_r(base, peak) 523.xalancbmk_r(base, peak) 531.deepsjeng_r(base, peak) 541.leela_r(base, peak) |
-----------------------------------------------------------------------------------
| 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, peak) |
-----------------------------------------------------------------------------------
| 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

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Software Availability: Dec-2022

Base Portability Flags (Continued)

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
-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
Cisco Systems
Cisco UCS C240 M7 (Intel Xeon Gold 6416H, 2.20GHz)

SPEC CPU®2017 Integer Rate Result
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SPECrate®2017_int_base = 333
SPECrate®2017_int_peak = 343

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
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

502.gcc_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

557.xz_r: basepeak = yes

C++ benchmarks:

(Continued on next page)
Cisco Systems
Cisco UCS C240 M7 (Intel Xeon Gold 6416H, 2.20GHz)

SPEC CPU®2017 Integer Rate Result
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SPECrate®2017_int_base = 333
SPECrate®2017_int_peak = 343

CPU2017 License: 9019
Test Sponsor: Cisco Systems
Tested by: Cisco Systems
Test Date: Mar-2023
Hardware Availability: Mar-2023
Software Availability: Dec-2022

Peak Optimization Flags (Continued)

520.omnetpp_r: basepeak = yes
523.xalancbmk_r: basepeak = yes
531.deepsjeng_r: basepeak = yes
541.leela_r: basepeak = yes

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

You can also download the XML flags sources by saving the following links:
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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