Cisco Systems
Cisco UCS C220 M7 (Intel Xeon Gold 5416S, 2.00GHz)

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

SPECrater©2017_int_base = 276
SPECrater©2017_int_peak = 285

Test Date: Mar-2024
Hardware Availability: Feb-2023
Software Availability: Dec-2023

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>SPECrate©2017_int_base</th>
<th>SPECrate©2017_int_peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>500.perlbench_r</td>
<td>64</td>
<td>223</td>
<td>285</td>
</tr>
<tr>
<td>502.gcc_r</td>
<td>64</td>
<td>239</td>
<td>467</td>
</tr>
<tr>
<td>505.mcf_r</td>
<td>64</td>
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<td>382</td>
</tr>
<tr>
<td>520.omnetpp_r</td>
<td>64</td>
<td>202</td>
<td>529</td>
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<tr>
<td>523.xalancbmk_r</td>
<td>64</td>
<td>196</td>
<td>564</td>
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<tr>
<td>525.x264_r</td>
<td>64</td>
<td>186</td>
<td>569</td>
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<tr>
<td>531.deepsjeng_r</td>
<td>64</td>
<td>131</td>
<td>590</td>
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<tr>
<td>541.leela_r</td>
<td>64</td>
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</tr>
<tr>
<td>548.exchange2_r</td>
<td>64</td>
<td>131</td>
<td>590</td>
</tr>
<tr>
<td>557.xz_r</td>
<td>64</td>
<td>131</td>
<td>590</td>
</tr>
</tbody>
</table>

Hardware
CPU Name: Intel Xeon Gold 5416S
Max MHz: 4000
Nominal: 2000
Enabled: 32 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: 30 MB I+D on chip per chip
Other: None
Memory: 1 TB (16 x 64 GB 2Rx4 PC5-4800B-R, running at 4400)
Storage: 1 x 960 GB M.2 SSD SATA
Other: Cooling: Air

Software
OS: SUSE Linux Enterprise Server 15 SP4
5.14.21-150400.22-default
Compiler: C/C++: Version 2023.2.3 of Intel oneAPI DPC++/C++
Compiler for Linux:
Fortran: Version 2023.2.3 of Intel Fortran
Compiler for Linux:
Parallel: No
Firmware: Version 4.3.2d released Nov-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
SPEC CPU®2017 Integer Rate Result

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SPECrater®2017_int_base = 276
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Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
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<th>Seconds</th>
<th>Ratio</th>
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Specrate®2017_int_base = 276
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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/lib/intel64:/home/cpu2017/lib/ia32:/home/cpu2017/je5.0.1-32"
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.:
umactl --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.

(Continued on next page)
General Notes (Continued)

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
Adjacent cache line prefetcher set to Enabled
DCU streamer prefetch set to Disabled
Enhanced CPU performance set to Auto
LLC Dead Line set to Disabled
Processor C6 Report set to Enabled
ADDDC Sparing set to Disabled

Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7e5c6ae2c92cc097bec197
running on localhost Mon Mar 4 23:59:52 2024

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. numacl --hardware
9. /proc/meminfo
10. who -r
11. Systemd service manager version: systemd 249 (249.11+suse.124.g2bc0b2c447)
12. Services, from systemctl list-unit-files
13. Linux kernel boot-time arguments, from /proc/cmdline
14. cpupower frequency-info
15. systcl
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
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
23:59:52 up 4 min, 1 user, load average: 0.20, 0.56, 0.29
USER   TTY     FROM       LOGIN@  IDLE   JCPU   PCPU WHAT
root    tty1    -          23:58  8.00s  1.13s  0.15s -bash
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Platform Notes (Continued)

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) 4126938
   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) 4126938
   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=64 --define default-platform-flags --define numcopies=64 --define default-platform-flags --define numcopies=64 --define default-platform-flags --define numcopies=64 --define default-platform-flags --define numcopies=64
   ic2023.2.3-lin-sapphirerapids-rate-20231121.cfg --reportable --iterations 3 --define smt-on --define cores=32 --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=64 --configfile ic2023.2.3-lin-sapphirerapids-rate-20231121.cfg --reportable --iterations 3 --define smt-on --define cores=32 --define physicalfirst --define invoke_with_interleave --define drop_caches --tune all --output_format all --nopower --runmode rate --base:peak --size refrate intra rate --nopreenv --note-preenv --logfile $SPEC/tmp/CPU2017.052/tempglogs/preenv.intrate.052.0.log --lognum 052.0 --from_runcpu 2
   specperl $SPEC/bin/sysinfo
   $SPEC = /home/cpu2017

6. /proc/cpuinfo
   model name: Intel(R) Xeon(R) Gold 5416S
   vendor_id: GenuineIntel
   cpu family: 6
   model: 143
   stepping: 8
   microcode: 0x2b0004b1
   bugs: spectre_v1 spectre_v2 spec_store_bypass swaps
   cpu cores: 16
   siblings: 32
   2 physical ids (chips)
   64 processors (hardware threads)
   physical id 0: core ids 0-15
   physical id 1: core ids 0-15
   physical id 0: apicids 0-31
   physical id 1: apicids 128-159

Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for

(Continued on next page)
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Platform Notes (Continued)

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): 64
On-line CPU(s) list: 0-63
Vendor ID: GenuineIntel
Model name: Intel(R) Xeon(R) Gold 5416S
CPU family: 6
Model: 143
Thread(s) per core: 2
Core(s) per socket: 16
Stepping: 8
CPU max MHz: 4000.000
CPU min MHz: 800.000
BogoMIPS: 4000.00

Flags:
fpu vme de pse tsc msr pae mca cmov pat pse36 clflush dts acpi mmx fxsr mda cmovomore sn ax pes mce pxr dtscpx constant_tsc arch_perfmon pebs bts rep_good nopl x87logged rdtscp lm constant_tsc art arch_perfmon pebs bts rep_good noplapx tstop tsc tsc_adjust tscdelminfo
tr_bits arm statearch ea xsave avx f16c rdrand
lahf_lm abm 3nowprefetch cpuid_fault epb cat_l3 cat_l2 cdp_l3
time invec rdtscl npxd dtm ip slf ret pmc lppe mbmi lmu

Virtualization: VT-x
L1d cache: 1.5 MiB (32 instances)
L1i cache: 1 MiB (32 instances)
L2 cache: 64 MiB (32 instances)
L3 cache: 60 MiB (2 instances)
NUMA node(s): 4
NUMA node0 CPU(s): 0-7, 32-39
NUMA node1 CPU(s): 8-15, 40-47
NUMA node2 CPU(s): 16-23, 48-55
NUMA node3 CPU(s): 24-31, 56-63

Vulnerability Intel multith: Not affected
Vulnerability L1tf: Not affected
Vulnerability Mds: Not affected
Vulnerability MeltDown: Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
Vulnerability Spectre v1: Mitigation; usercopy/swaps barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Enhanced IBRS, IBPB conditional, RSB filling
Vulnerability Srbd: Not affected
Vulnerability Txs async abort: Not affected

(Continued on next page)
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---

**Platform Notes (Continued)**

From `lscpu --cache:

<table>
<thead>
<tr>
<th>NAME ONE-SIZE ALL-SIZE WAYS TYPE</th>
<th>LEVEL</th>
<th>SETS</th>
<th>PHY-LINE</th>
<th>COHERENCY-SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1d 48K 1.5M 12 Data</td>
<td>1</td>
<td>64</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L1i 32K 1M 8 Instruction</td>
<td>1</td>
<td>64</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L2 2M 64M 16 Unified</td>
<td>2</td>
<td>2048</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L3 30M 60M 15 Unified</td>
<td>3</td>
<td>32768</td>
<td>1</td>
<td>64</td>
</tr>
</tbody>
</table>

8. numactl --hardware

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

available: 4 nodes (0-3)

node 0 cpus: 0-7,32-39
node 0 size: 257656 MB
node 0 free: 256343 MB
node 1 cpus: 8-15,40-47
node 1 size: 258043 MB
node 1 free: 257452 MB
node 2 cpus: 16-23,48-55
node 2 size: 258043 MB
node 2 free: 257611 MB
node 3 cpus: 24-31,56-63
node 3 size: 258014 MB
node 3 free: 257571 MB

node distances:

<table>
<thead>
<tr>
<th>node</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:</td>
<td>10</td>
<td>12</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>1:</td>
<td>12</td>
<td>10</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>2:</td>
<td>21</td>
<td>21</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>3:</td>
<td>21</td>
<td>21</td>
<td>12</td>
<td>10</td>
</tr>
</tbody>
</table>

9. /proc/meminfo

MemTotal: 1056520804 kB

10. who -r

run-level 3 Mar 4 23:56

11. Systemd service manager version: systemd 249 (249.11+suse.124.q2bca2c447)

Default Target Status

multi-user running

12. Services, from systemctl list-unit-files

<table>
<thead>
<tr>
<th>STATE</th>
<th>UNIT FILES</th>
</tr>
</thead>
<tbody>
<tr>
<td>enabled</td>
<td>YaST2-Firstboot YaST2-Second-Stage apparmor auditd crond getty@ haveged irqbalance iscsi issue-generator kbdsettings klog libvirt lvm2-monitor nscd postfix purge-kernels rollback rsyslog smartd sshd wicked wickedd-auto4 wickedd-dhcpc4 wickeddd-dhcp6 wickedd-nanny</td>
</tr>
<tr>
<td>enabled-runtime</td>
<td>systemd-remount-fs</td>
</tr>
</tbody>
</table>

(Continued on next page)
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Platform Notes (Continued)

indirect     pcsd virtlockd virtlogd wickedd

13. Linux kernel boot-time arguments, from /proc/cmdline
    BOOT_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default
    root=UUID=2e0ad397-074a-46f8-9f0a-5231b03b9d87
    splash=silent
    mitigations=auto
    quiet
    security=apparmor

14. cpupower frequency-info
    analyzing CPU 0:
    current policy: frequency should be within 800 MHz and 4.00 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               1
    kernel.randomize_va_space           2
    vm.compaction_proactive              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.extrfrag_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
    scan_sleep_millisecs 10000

(Continued on next page)
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---
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/sdb2 btrfs 445G 15G 430G 4% /home
---
20. /sys/devices/virtual/dmi/id
Vendor: Cisco Systems Inc
Product: UCS-C220-M7S
Serial: WZP2702091W
---
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 0xCE00 M321R8GA0BB0-CQKDG 64 GB 2 rank 4800, configured at 4400
---
22. BIOS
(This section combines info from /sys/devices and dmidecode.)
BIOS Vendor: Cisco Systems, Inc.
BIOS Version: C220M7.4.3.2d.0.1101232037
BIOS Date: 11/01/2023
BIOS Revision: 5.31
---

Compiler Version Notes

---
C | 502.gcc_r(peak)
---
Intel(R) oneAPI DPC++/C++ Compiler for applications running on IA-32, Version 2023.2.3 Build x
Copyright (C) 1985-2023 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 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.
---
C | 502.gcc_r(peak)
---
Intel(R) oneAPI DPC++/C++ Compiler for applications running on IA-32, Version 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.
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(Continued on next page)
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<th>523.xalancbmk_r(base, peak)</th>
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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 C220 M7 (Intel Xeon Gold 5416S, 2.00GHz)

SPECrate®2017_int_base = 276
SPECrate®2017_int_peak = 285

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

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/home/specdev/new_compilers/ic2023.2.3/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/home/specdev/new_compilers/ic2023.2.3/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/home/specdev/new_compilers/ic2023.2.3/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)
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SPEC CPU®2017 Integer Rate Result
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SPECrate®2017_int_base = 276
SPECrate®2017_int_peak = 285

CPU2017 License: 9019
Test Sponsor: Cisco Systems
Test Date: Mar-2024
Tested by: Cisco Systems
Hardware Availability: Feb-2023
Software Availability: Dec-2023

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/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin
-1qkmalloc

502.gcc_r: -m32
-L/home/specdev/new_compilers/ic2023.2.3/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/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin
-1qkmalloc

557.xz_r: basepeak = yes

C++ benchmarks:

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

(Continued on next page)
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Peak Optimization Flags (Continued)

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-ic2023p2-official-linux64.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/Intel-ic2023p2-official-linux64.xml
http://www.spec.org/cpu2017/flags/Cisco-Platform-Settings-V1.0-SPR-revM.xml

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For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

Tested with SPEC CPU®2017 v1.1.9 on 2024-03-04 23:59:51-0500.
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