# SPEC CPU®2017 Integer Rate Result

**Cisco Systems**

Cisco UCS C220 M7 (Intel Xeon Silver 4416+, 2.00GHz)

<table>
<thead>
<tr>
<th><strong>SPECrate®2017_int_base</strong></th>
<th><strong>SPECrate®2017_int_peak</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>353</td>
<td>364</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>SPECrate®2017_int_base</th>
<th>SPECrate®2017_int_peak</th>
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</thead>
<tbody>
<tr>
<td>perlbench_r</td>
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<tr>
<td>gcc_r</td>
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<td>omnetpp_r</td>
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<td>xalancbmk_r</td>
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<tr>
<td>x264_r</td>
<td>80</td>
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<td>deepsjeng_r</td>
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</tr>
<tr>
<td>xz_r</td>
<td>80</td>
<td>165</td>
<td></td>
</tr>
</tbody>
</table>

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## 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:** 1 TB (16 x 64 GB 2Rx4 PC5-4800B-R, running at 4000)  
- **Storage:** 1 x 960 GB M.2 SSD SATA  
- **Other:** None

## Software

- **OS:** SUSE Linux Enterprise Server 15 SP4  
- **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 4.3.1b released Mar-2023  
- **File System:** btrfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 32/64-bit  
- **Power Management:** BIOS set to prefer performance at the cost of additional power usage
Cisco Systems
Cisco UCS C220 M7 (Intel Xeon Silver 4416+, 2.00GHz)

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
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</tr>
</tbody>
</table>

**SPECrate®2017_int_base = 353**
**SPECrate®2017_int_peak = 364**

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 C220 M7 (Intel Xeon Silver 4146+, 2.00GHz)

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

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

SPECrate®2017_int_base = 353
SPECrate®2017_int_peak = 364

Test Date: Aug-2023
Hardware Availability: Feb-2023
Software Availability: Dec-2022

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 numaclt 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.
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 Enabled
DCU streamer Prefetch set to Enabled
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 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost Sat Aug 19 22:15:42 2023

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

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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
   22:15:42 up 9 min, 1 user, load average: 0.00, 0.34, 0.39
   USER TTY FROM LOGIN@ IDLE JCPU PCPU WHAT
   root tty1 - 22:15 14.00s 1.13s 0.17s -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) 4126927
   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) 4126927
   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=80 -c
     ic2023.0-lin-saphirerapids-rate-20221201.cfg --reportable --iterations 3 --define smt-on --define
     cores=40 --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=80 --configfile
     ic2023.0-lin-saphirerapids-rate-20221201.cfg --reportable --iterations 3 --define smt-on --define
     cores=40 --define physicalfirst --define invoke_with_interleave --define drop_caches --tune all
     --output_format all --nopower --runmode rate --tune base:peak --size refrain intrate --nospeenv
     --note-preenv --logfile $SPEC/tmp/CPUS2017.045/templogs/preenv.intrate.045.0.log --lognum 045.0
     --from_runcpu 2
   specperl $SPEC/bin/sysinfo
   $SPEC = /home/cpu2017

6. /proc/cpuinfo
   model name : Intel(R) Xeon(R) Silver 4416+
   vendor_id : GenuineIntel

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SPECrate®2017_int_base = 353
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Platform Notes (Continued)

cpu family : 6
model : 143
stepping : 8
microcode : 0x2b000190
bugs : spectre_v1 spectre_v2 spec_store_bypass swapgs
cpu cores : 20
siblings : 40
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 2.37.2:

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): 80
On-line CPU(s) list: 0-79
Vendor ID: GenuineIntel
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: 3900.000
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 sse sse2 ss ht tm pse syscall nx pdpe1gb rdtscp lm constant_tsc arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid aperfmperf tsc_known_freq pni pclmulqdq dtes64 kɐt monitore
nonstop_tsc cpuid aperfmperf tsc_known_freq pni pclmulqdq dtes64 kɐt monitor
des cpl vmx smx est tm2 ss syscall nx tsc ad x86core ppin
flags_hle avx2 ampe bml2 erms invpcid rtm cqm rdql a avx512f avx512dq rdseed adx smap
avx512fma clflushopt clwb intel_pt avx512cd avx512bw avx512v1
Cache sizes:
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)

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Platform Notes (Continued)

NUMA node(s): 4  
NUMA node0 CPU(s): 0-9,40-49  
NUMA node1 CPU(s): 10-19,50-59  
NUMA node2 CPU(s): 20-29,60-69  
NUMA node3 CPU(s): 30-39,70-79  
Vulnerability Itlb multihit: 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/swapgs barriers and __user pointer sanitization  
Vulnerability Spectre v2: Mitigation; Enhanced IBRS, IBPB conditional, RSB filling  
Vulnerability Srbds: Not affected  
Vulnerability Tsx async abort: Not affected

From lscpu --cache:

<table>
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<tr>
<th>NAME</th>
<th>ONE-SIZE</th>
<th>ALL-SIZE</th>
<th>WAYS</th>
<th>TYPE</th>
<th>LEVEL</th>
<th>SETS</th>
<th>PHY-LINE</th>
<th>COHERENCY-SIZE</th>
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<td>1.9M</td>
<td>12</td>
<td>Data</td>
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<td>64</td>
<td>1</td>
<td>64</td>
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<td>32K</td>
<td>1.3M</td>
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<td>2</td>
<td>2048</td>
<td>1</td>
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<td>L3</td>
<td>37.5M</td>
<td>75M</td>
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<td>Unified</td>
<td>3</td>
<td>40960</td>
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<td>64</td>
</tr>
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</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: 0-9,40-49
node 0 size: 257690 MB
node 0 free: 253556 MB
node 1 cpus: 10-19,50-59
node 1 size: 258008 MB
node 1 free: 254435 MB
node 2 cpus: 20-29,60-69
node 2 size: 258042 MB
node 2 free: 257603 MB
node 3 cpus: 30-39,70-79
node 3 size: 258013 MB
node 3 free: 257566 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: 1056517964 kB

10. who -r
run-level 3 Aug 19 22:06

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

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Platform Notes (Continued)

STATE UNIT FILES
--- -----------
enabled YaST2-Firstboot YaST2-Second-Stage apparmor auditd cron getty@ havedeg irqbalance
issue-generator kbdsettings klog lvm2-monitor nscd postfix purge-kernels rollback rsyslog
smartd sshd wicked wickedd-auto4 wickedd-dhcp wickedd-dhcp6 wickedd-nanny
enabled-runtime systemd-remount-fs
disabled autosysay autoyast-initscripts blk-availability boot-sysctl ca-certificates chrony-wait
debguel console-getty cups cups-browsed debug-shel ektables exchange-bmc os-in
firewaidl gpm grub2- once havedeg-switch-root ipmi ipmiethyl issue-add-ssh-keys keyexec-load
kvm kvm_stat lunmask man-db-create multipathd nfs nfs-blkmap rdisc rpcbind rpmconfigcheck
rsyncd serial-getty@ smartd_generate_opts snmpd snmptrapd svnservice
systemd-boot-check-no-failures systemd-network-generator systemd-sys	
systemd-time-wait-sync systemd-timesyncd udisks2
 organz
indirect wickedd

13. Linux kernel boot-time arguments, from /proc/cmdline
BOOT_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default
root=UUID=77a2740b-b14c-4767-8283-c21dd85e97d
splash=quiet
mitigations=auto
security=apparmor

14. cpupower frequency-info
analyzing CPU 0:
current policy: frequency should be within 800 MHz and 3.90 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_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.extrah_thread 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

(Continued on next page)
Cisco Systems
Cisco UCS C220 M7 (Intel Xeon Silver 4416+, 2.00GHz)

SPEC CPU®2017 Integer Rate Result

Copyright 2017-2024 Standard Performance Evaluation Corporation

SPECrate®2017_int_base = 353
SPECrate®2017_int_peak = 364

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

Test Date: Aug-2023
Hardware Availability: Feb-2023
Software Availability: Dec-2022

Platform Notes (Continued)

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

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

20. /sys/devices/virtual/dmi/id
Vendor: Cisco Systems Inc
Product: UCSC-C220-M7S
Serial: WZP27020928

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 4000

22. BIOS
(This section combines info from /sys/devices and dmidecode.)

Compiler Version Notes

(Continued on next page)
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Compiler Version Notes (Continued)

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
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<table>
<thead>
<tr>
<th>C</th>
<th>502.gcc_r(peak)</th>
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<tbody>
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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.

<table>
<thead>
<tr>
<th>C</th>
<th>500.perlbench_r(base, peak) 502.gcc_r(base) 505.mcf_r(base, peak) 525.x264_r(base, peak) 557.xz_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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<table>
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<tr>
<th>C++</th>
<th>520.omnetpp_r(base, peak) 523.xalancbmk_r(base, peak) 531.deepsjeng_r(base, peak) 541.leela_r(base, peak)</th>
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<table>
<thead>
<tr>
<th>Fortran</th>
<th>548.exchange2_r(base, peak)</th>
</tr>
</thead>
</table>

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

(Continued on next page)
## Cisco Systems

Cisco UCS C220 M7 (Intel Xeon Silver 4161+, 2.00GHz)

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### CPU2017 License:
9019

### Test Sponsor:
Cisco Systems

### Tested by:
Cisco Systems

### Test Date:
Aug-2023

### Hardware Availability:
Feb-2023

### Software Availability:
Dec-2022

## Base Portability Flags (Continued)

- 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`
- `-fno-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`
- `-fno-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
# SPEC CPU®2017 Integer Rate Result

## Cisco Systems

Cisco UCS C220 M7 (Intel Xeon Silver 4416+, 2.00GHz)

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## 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)
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CPU2017 License: 9019
Test Sponsor: Cisco Systems
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**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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