



# SPEC CPU®2017 Integer Rate Result

Copyright 2017-2024 Standard Performance Evaluation Corporation

## Fujitsu

PRIMERGY RX2540 M7, Intel Xeon Silver 4516Y+,  
2.20GHz

SPECrate®2017\_int\_base = 426

SPECrate®2017\_int\_peak = Not Run

CPU2017 License: 19

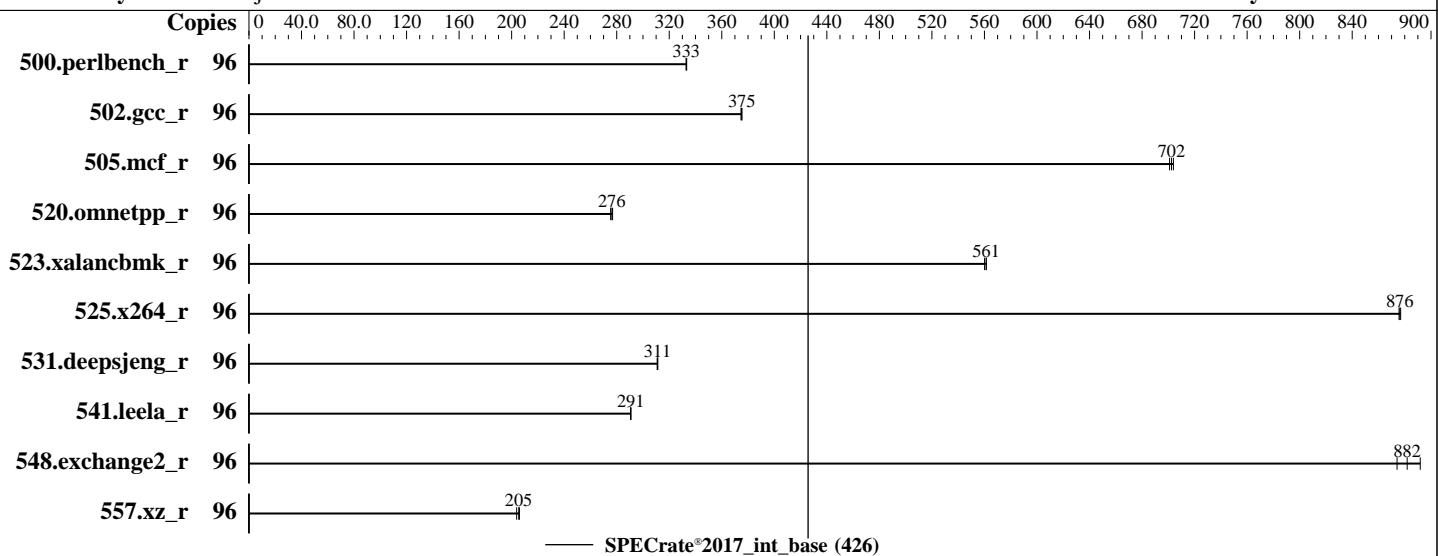
Test Sponsor: Fujitsu

Tested by: Fujitsu

Test Date: May-2024

Hardware Availability: Apr-2024

Software Availability: Dec-2023



### Hardware

CPU Name: Intel Xeon Silver 4516Y+  
Max MHz: 3700  
Nominal: 2200  
Enabled: 48 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, running at 4400)  
Storage: 1 x SATA M.2, 960GB  
Other: CPU Cooling: Air

### Software

OS: SUSE Linux Enterprise Server 15 SP5 5.14.21-150500.53-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: Fujitsu BIOS Version V1.0.0.0 R2.4.0 for D3983-A1x. Released Apr-2024 tested as V1.0.0.0 R2.1.2 for D3983-A1x Dec-2023  
File System: btrfs  
System State: Run level 3 (multi-user)  
Base Pointers: 64-bit  
Peak Pointers: Not Applicable  
Other: None  
Power Management: BIOS 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	Seconds	Ratio
500.perlbench_r	96	459	333	459	333	<b>459</b>	<b>333</b>									
502.gcc_r	96	362	375	363	375	<b>362</b>	<b>375</b>									
505.mcf_r	96	<b>221</b>	<b>702</b>	221	701	220	704									
520.omnetpp_r	96	455	277	<b>456</b>	<b>276</b>	457	275									
523.xalancbmk_r	96	<b>181</b>	<b>561</b>	181	560	181	561									
525.x264_r	96	192	876	192	877	<b>192</b>	<b>876</b>									
531.deepsjeng_r	96	354	311	353	311	<b>354</b>	<b>311</b>									
541.leela_r	96	547	291	<b>547</b>	<b>291</b>	547	291									
548.exchange2_r	96	282	892	288	874	<b>285</b>	<b>882</b>									
557.xz_r	96	509	204	503	206	<b>505</b>	<b>205</b>									

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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/benchmark/speccpu-23.2/lib/intel64:/home/benchmark/speccpu-23.2/lib/ia32:/home/benchmark/speccpu
    u-23.2/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.:

```
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.

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## General Notes (Continued)

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

BIOS configuration:

DCU Streamer Prefetcher = Disabled  
UPI Link Frequency Select = 14.4GT/s  
CPU Performance Boost = Aggressive  
SNC (Sub NUMA) = Enable SNC2  
Fan Control = Full  
HWPM Support = Disabled

```
Sysinfo program /home/benchmark/speccpu-23.2/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost Tue May 14 02:43:49 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. numactl --hardware  
9. /proc/meminfo  
10. who -r  
11. Systemd service manager version: systemd 249 (249.16+suse.171.gdad0071f15)  
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  
22. BIOS

-----  
1. uname -a  
Linux localhost 5.14.21-150500.53-default #1 SMP PREEMPT\_DYNAMIC Wed May 10 07:56:26 UTC 2023 (b630043)  
x86\_64 x86\_64 x86\_64 GNU/Linux

-----  
2. w  
02:43:49 up 1 min, 1 user, load average: 0.21, 0.08, 0.03  
USER TTY FROM LOGIN@ IDLE JCPU PCPU WHAT  
root tty1 - 02:43 13.00s 1.79s 0.15s -bash

-----  
3. Username

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## Platform Notes (Continued)

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) 4125037
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) 4125037
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 --nobuild --action validate --define default-platform-flags --define numcopies=96 -c
  ic2023.2.3-lin-sapphirerapids-rate-20231121.cfg --define smt-on --define cores=48 --define physicalfirst
  --define invoke_with_interleave --define drop_caches --tune base -o all intrate
runcpu --nobuild --action validate --define default-platform-flags --define numcopies=96 --configfile
  ic2023.2.3-lin-sapphirerapids-rate-20231121.cfg --define smt-on --define cores=48 --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/CPU2017.001/templogs/preenv.intrate.001.0.log --lognum 001.0 --from_runcpu 2
specperl $SPEC/bin/sysinfo
$SPEC = /home/benchmark/speccpu-23.2
```

```
6. /proc/cpuinfo
model name      : INTEL(R) XEON(R) SILVER 4516Y+
vendor_id       : GenuineIntel
cpu family      : 6
model          : 207
stepping        : 2
microcode       : 0x210001a0
bugs           : spectre_v1 spectre_v2 spec_store_bypass swapgs eibrp_brs
cpu cores       : 24
siblings        : 48
2 physical ids (chips)
96 processors (hardware threads)
physical id 0: core ids 0-23
physical id 1: core ids 0-23
physical id 0: apicids 0-47
physical id 1: apicids 128-175
Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for
virtualized systems. Use the above data carefully.
```

```
7. lscpu
```

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## Platform Notes (Continued)

From lscpu from util-linux 2.37.4:

```
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): 96
On-line CPU(s) list: 0-95
Vendor ID: GenuineIntel
Model name: INTEL(R) XEON(R) SILVER 4516Y+
CPU family: 6
Model: 207
Thread(s) per core: 2
Core(s) per socket: 24
Socket(s): 2
Stepping: 2
Frequency boost: enabled
CPU max MHz: 2201.0000
CPU min MHz: 800.0000
BogoMIPS: 4400.00
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 aperf mperf 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_13 cat_12 cdp_13
      invpcid_single cdp_12 ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow
      vnmi flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmi1 hle avx2 smep
      bmi2 erms invpcid rtm cqmq rdt_a avx512f avx512dq rdseed adx smap
      avx512ifma clflushopt clwb intel_pt avx512cd sha_ni avx512bw avx512vl
      xsaveopt xsavec xgetbv1 xsavec cqmq_llc cqmq_occup_llc cqmq_mbm_total
      cqmq_mbm_local avx_vnni avx512_bf16 wbnoinvd dtherm ida arat pln pts hfi
      avx512vbmi umip pkru ospke waitpkg avx512_vbmi2 gfni vaes vpclmulqdq
      avx512_vnni avx512_bitalg tme avx512_vpocntdq la57 rdpid bus_lock_detect
      cldemote movdiri movdir64b enqcmd fsrm md_clear serialize tsxldtrk pconfig
      arch_lbr avx512_fp16 amx_tile flush_lld arch_capabilities
Virtualization: VT-x
L1d cache: 2.3 MiB (48 instances)
L1i cache: 1.5 MiB (48 instances)
L2 cache: 96 MiB (48 instances)
L3 cache: 90 MiB (2 instances)
NUMA node(s): 4
NUMA node0 CPU(s): 0-11,48-59
NUMA node1 CPU(s): 12-23,60-71
NUMA node2 CPU(s): 24-35,72-83
NUMA node3 CPU(s): 36-47,84-95
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf: Not affected
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 and seccomp
Vulnerability Spectre v1: Mitigation; usercopy/swaps barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Enhanced IBRS, IBPB conditional, RSB filling, PBRSB-eIBRS SW sequence
Vulnerability Srbds: Not affected
Vulnerability Tsx async abort: Not affected
```

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## Platform Notes (Continued)

From lscpu --cache:

NAME	ONE-SIZE	ALL-SIZE	WAYS	TYPE	LEVEL	SETS	PHY-LINE	COHERENCY-SIZE
L1d	48K	2.3M	12	Data	1	64	1	64
L1i	32K	1.5M	8	Instruction	1	64	1	64
L2	2M	96M	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.

available: 4 nodes (0-3)

node 0 cpus: 0-11,48-59

node 0 size: 257620 MB

node 0 free: 256922 MB

node 1 cpus: 12-23,60-71

node 1 size: 258041 MB

node 1 free: 257458 MB

node 2 cpus: 24-35,72-83

node 2 size: 258007 MB

node 2 free: 257444 MB

node 3 cpus: 36-47,84-95

node 3 size: 257618 MB

node 3 free: 257049 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: 1056039900 kB

-----

10. who -r

run-level 3 May 14 02:42

-----

11. Systemd service manager version: systemd 249 (249.16+suse.171.gdad0071f15)

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 firewalld getty@ irqbalance issue-generator kbdsettings kdump kdump-early klog lvm2-monitor nsqd postfix purge-kernels rollback rsyslog sep5 smartd sshd systemd-pstore wickedd wickedd-auto4 wickedd-dhcp4 wickedd-dhcp6 wickedd-nanny
enabled-runtime	systemd-remount-fs
disabled	autofs autoast-initscripts blk-availability boot-sysctl ca-certificates chrony-wait chronyrd console-getty cups cups-browsed debug-shell ebttables exchange-bmc-os-info gpm grub2-once haveged haveged-switch-root ipmi ipmievrd issue-add-ssh-keys kexec-load lunmask man-db-create multipathd nfs nfs-blkmap rpcbind rpmconfigcheck rsyncd serial-getty@ smartd_generate_opts snmpd snmptrapd systemd-boot-check-no-failures systemd-network-generator systemd-sysext systemd-time-wait-sync systemd-timesyncd vncserver@ wickedd
indirect	

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## Platform Notes (Continued)

-----  
13. Linux kernel boot-time arguments, from /proc/cmdline  
BOOT\_IMAGE=/boot/vmlinuz-5.14.21-150500.53-default  
root=UUID=27cb8c0f-67b2-4941-ac3d-ea0cbaa02bdf  
splash=silent  
mitigations=auto  
quiet  
security=apparmor  
crashkernel=402M,high  
crashkernel=72M,low

-----  
14. cpupower frequency-info  
analyzing CPU 0:  
current policy: frequency should be within 800 MHz and 2.20 GHz.  
The governor "ondemand" 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.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

-----  
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

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## Platform Notes (Continued)

-----  
18. OS release  
From /etc/\*-release /etc/\*-version  
os-release SUSE Linux Enterprise Server 15 SP5

-----  
19. Disk information  
SPEC is set to: /home/benchmark/speccpu-23.2  
Filesystem Type Size Used Avail Use% Mounted on  
/dev/sdal btrfs 892G 111G 781G 13% /home

-----  
20. /sys/devices/virtual/dmi/id  
Vendor: FUJITSU  
Product: PRIMERGY RX2540 M7  
Product Family: SERVER  
Serial: EWCEXXXXXX

-----  
21. dmidecode  
Additional information from dmidecode 3.4 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:  
2x Samsung M321R8GA0BB0-CQKDG 64 GB 2 rank 4800, configured at 4400  
14x Samsung M321R8GA0BB0-CQKVG 64 GB 2 rank 4800, configured at 4400

-----  
22. BIOS  
(This section combines info from /sys/devices and dmidecode.)  
BIOS Vendor: FUJITSU  
BIOS Version: V1.0.0.0 R2.1.2 for D3983-A1x  
BIOS Date: 12/21/2023  
BIOS Revision: 2.1  
Firmware Revision: 2.38

## 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 2023.2.3 Build x  
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

=====

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 2023.2.3 Build x  
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

=====

Fortran | 548.exchange2\_r(base)

=====

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x  
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## Compiler Version Notes (Continued)

## 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  
-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

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## Base Optimization Flags (Continued)

Fortran benchmarks (continued):

```
-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
```

The flags files that were used to format this result can be browsed at

<http://www.spec.org/cpu2017/flags/Fujitsu-Platform-Settings-V1.0-EMR-RevD.html>

<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/Fujitsu-Platform-Settings-V1.0-EMR-RevD.xml>

<http://www.spec.org/cpu2017/flags/Intel-ic2023p2-official-linux64.xml>

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