SPEC CPU®2017 Integer Rate Result

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xFusion

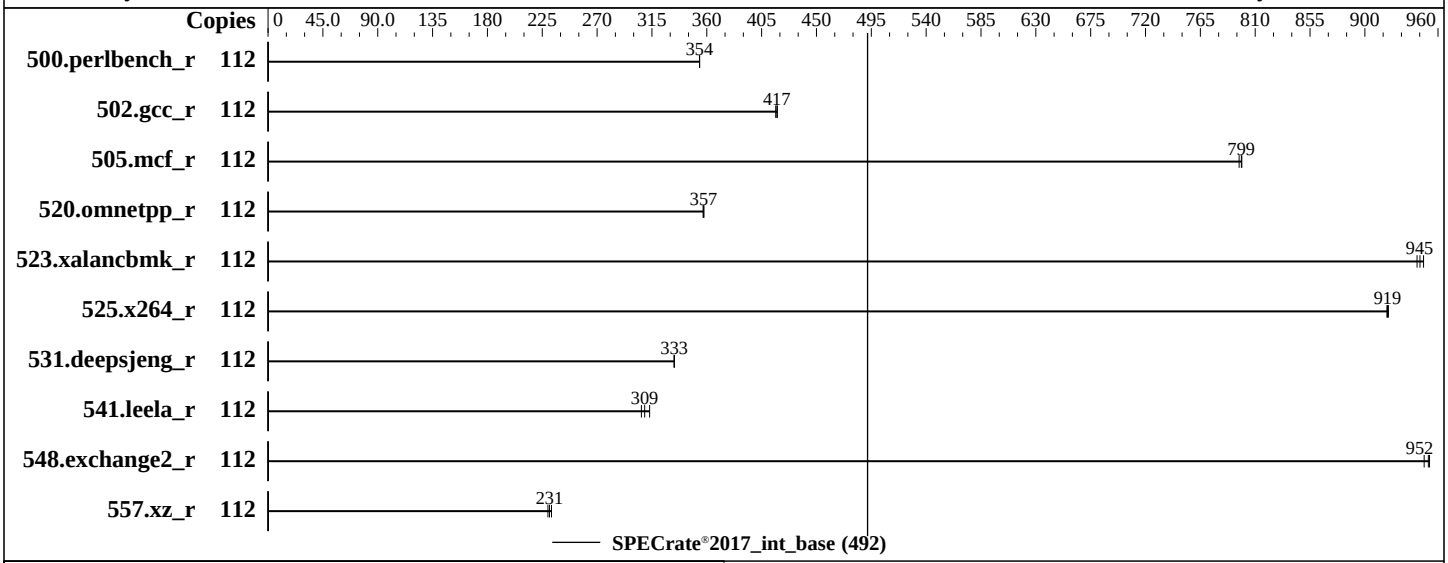
FusionServer 2288H V7 (Intel Xeon Gold 5420+)

SPECrate®2017_int_base = 492

SPECrate®2017_int_peak = Not Run

CPU2017 License: 6488
Test Sponsor: xFusion
Tested by: xFusion

Test Date: Jun-2023
Hardware Availability: Jan-2023
Software Availability: Dec-2022



Hardware

CPU Name:	Intel Xeon Gold 5420+
Max MHz:	4100
Nominal:	2000
Enabled:	56 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:	52.5 MB I+D on chip per chip
Other:	None
Memory:	512 GB (16 x 32 GB 2Rx8 PC5-4800B-R, running at 4400)
Storage:	1 x 1920 GB SATA SSD
Other:	None

Software

OS:	Red Hat Enterprise Linux release 9.0 (Plow) 5.14.0-70.13.1.el9_0.x86_64
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 2.00.55 Released Mar-2023
File System:	xfs
System State:	Run level 5 (multi-user)
Base Pointers:	64-bit
Peak Pointers:	Not Applicable
Other:	None
Power Management:	BIOS and OS 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
500.perlbench_r	112	504	354	504	354	**504**	**354**							
502.gcc_r	112	**380**	**417**	381	417	379	418							
505.mcf_r	112	227	797	**227**	**799**	227	799							
520.omnetpp_r	112	411	358	412	357	**411**	**357**							
523.xalancbmk_r	112	125	943	125	948	**125**	**945**							
525.x264_r	112	**214**	**919**	214	918	213	919							
531.deepsjeng_r	112	**385**	**333**	385	333	385	333							
541.leela_r	112	592	313	**600**	**309**	605	306							
548.exchange2_r	112	**308**	**952**	309	949	308	953							
557.xz_r	112	520	233	**524**	**231**	527	230							

SPECrate®2017_int_base = 492

SPECrate®2017_int_peak = Not Run

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.xalancbmk_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 =
     "/spec2017-icc2023.0/lib/intel64:/spec2017-icc2023.0/lib/ia32:/spec2017-icc2023.0/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.
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:
Performance Profile Set to Performance
SNC Set to Enable SNC2 (2-clusters)

Sysinfo program /spec2017-icc2023.0/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost.localdomain Tue Jun 13 06:36:04 2023

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 250 (250-6.el9_0)
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.localdomain 5.14.0-70.13.1.el9_0.x86_64 #1 SMP PREEMPT Thu Apr 14 12:42:38 EDT 2022 x86_64
  x86_64 x86_64 GNU/Linux
```

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Platform Notes (Continued)

```
------------------------------------------------------------
2. w
   06:36:04 up 13:44,  3 users,  load average: 0.39, 0.28, 0.11
  USER     TTY        LOGIN@   IDLE   JCPU   PCPU WHAT
  root     tty1      Mon16   12.00s  1.34s  0.06s -bash
  root     pts/0     06:30    1:24   0.02s  0.02s -bash

------------------------------------------------------------
3. Username
  From environment variable $USER:  root

------------------------------------------------------------
4. ulimit -a
  real-time non-blocking time  (microseconds, -R) unlimited
  core file size              (blocks, -c) 0
  data seg size               (kbytes, -d) unlimited
  scheduling priority                 (-e) 0
  file size                   (blocks, -f) unlimited
  pending signals                     (-i) 2060116
  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) 2060116
  virtual memory              (kbytes, -v) unlimited
  file locks                          (-x) unlimited

------------------------------------------------------------
5. sysinfo process ancestry
 /usr/lib/systemd/systemd rhgb --switched-root --system --deserialize 31
 login -- root
 -bash
 -bash
 runcpu --define default-platform-flags --copies 112 -c ic2023.0-lin-sapphirerapids-rate-20221201.cfg
   --define smt-on --define cores=56 --define physicalfirst --define invoke_with_interleave --define
   drop_caches --tune base --iterations 3 -o all intrate
 runcpu --define default-platform-flags --copies 112 --configfile
   ic2023.0-lin-sapphirerapids-rate-20221201.cfg --define smt-on --define cores=56 --define physicalfirst
   --define invoke_with_interleave --define drop_caches --tune base --iterations 3 --output_format all
   --nopower --runmode rate --tune base --size refrate intrate --nopreenv --note-preenv --logfile
   $SPEC/tmp/CPU2017.004/templogs/preenv.intrate.004.0.log --lognum 004.0 --from_runcpu 2
 specperl $SPEC/bin/sysinfo
$SPEC = /spec2017-icc2023.0

------------------------------------------------------------
6. /proc/cpuinfo
    model name      : Intel(R) Xeon(R) Gold 5420+
    vendor_id       : GenuineIntel
    cpu family      : 6
    model           : 143
    stepping        : 7
    microcode       : 0x2b000111
    bugs            : spectre_v1 spectre_v2 spec_store_bypass swapgs
    cpu cores       : 28
    siblings        : 56
    2 physical ids (chips)
```

(Continued on next page)

Platform Notes (Continued)

```
     112 processors (hardware threads)
     physical id 0: core ids 0-27
     physical id 1: core ids 0-27
     physical id 0: apicids 0-55
     physical id 1: apicids 128-183
   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 2.37.4:
   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):                          112
   On-line CPU(s) list:             0-111
   Vendor ID:                       GenuineIntel
   BIOS Vendor ID:                  Intel(R) Corporation
   Model name:                      Intel(R) Xeon(R) Gold 5420+
   BIOS Model name:                 Intel(R) Xeon(R) Gold 5420+
   CPU family:                      6
   Model:                           143
   Thread(s) per core:              2
   Core(s) per socket:              28
   Socket(s):                       2
   Stepping:                        7
   BogoMIPS:                        4000.00
   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 aperfmperf tsc_known_freq pni pclmulqdq dtes64 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_l3 cat_l2 cdp_l3 invpcid_single
                                    intel_ppin cdp_l2 ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi
                                    flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmi1 avx2 smep bmi2 erms
                                    invpcid cqm rdt_a avx512f avx512dq rdseed adx smap avx512ifma clflushopt
                                    clwb intel_pt avx512cd sha_ni avx512bw avx512vl xsaveopt xsavec xgetbv1
                                    xsaves cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local split_lock_detect
                                    avx_vnni avx512_bf16 wbnoinvd dtherm ida arat pln pts avx512vbmi umip pku
                                    ospke waitpkg avx512_vbmi2 gfni vaes vpclmulqdq avx512_vnni avx512_bitalg
                                    tme avx512_vpopcntdq la57 rdpid bus_lock_detect cldemote movdiri movdir64b
                                    enqcmd fsrm md_clear serialize tsxldtrk pconfig arch_lbr avx512_fp16
                                    amx_tile flush_l1d arch_capabilities
   Virtualization:                  VT-x
   L1d cache:                       2.6 MiB (56 instances)
   L1i cache:                       1.8 MiB (56 instances)
   L2 cache:                        112 MiB (56 instances)
   L3 cache:                        105 MiB (2 instances)
   NUMA node(s):                    4
   NUMA node0 CPU(s):               0-13,56-69
   NUMA node1 CPU(s):               14-27,70-83
   NUMA node2 CPU(s):               28-41,84-97
   NUMA node3 CPU(s):               42-55,98-111
   Vulnerability Itlb multihit:     Not affected
   Vulnerability L1tf:              Not affected
   Vulnerability Mds:               Not affected
   Vulnerability Meltdown:          Not affected
```

(Continued on next page)

Platform Notes (Continued)

```
  Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl
  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:
     NAME ONE-SIZE ALL-SIZE WAYS TYPE        LEVEL  SETS PHY-LINE COHERENCY-SIZE
     L1d       48K     2.6M   12 Data            1    64        1             64
     L1i       32K     1.8M    8 Instruction     1    64        1             64
     L2         2M     112M   16 Unified         2  2048        1             64
     L3      52.5M     105M   15 Unified         3 57344        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: 0-13,56-69
  node 0 size: 128043 MB
  node 0 free: 125984 MB
  node 1 cpus: 14-27,70-83
  node 1 size: 129017 MB
  node 1 free: 127635 MB
  node 2 cpus: 28-41,84-97
  node 2 size: 129017 MB
  node 2 free: 127579 MB
  node 3 cpus: 42-55,98-111
  node 3 size: 129007 MB
  node 3 free: 127572 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:       527448656 kB

------------------------------------------------------------
10. who -r
  run-level 3 Jun 12 16:53 last=5

------------------------------------------------------------
11. Systemd service manager version: systemd 250 (250-6.el9_0)
  Default Target  Status
  graphical       running

------------------------------------------------------------
12. Services, from systemctl list-unit-files
  STATE            UNIT FILES
  enabled          ModemManager NetworkManager NetworkManager-dispatcher NetworkManager-wait-online
                   accounts-daemon atd auditd avahi-daemon bluetooth chronyd crond cups dbus-broker gdm
                   getty@ insights-client-boot irqbalance iscsi iscsi-onboot kdump libstoragemgmt
                   low-memory-monitor lvm2-monitor mcelog mdmonitor microcode multipathd nis-domainname
                   nvmefc-boot-connections ostree-remount power-profiles-daemon qemu-guest-agent rhsmcertd
                   rsyslog rtkit-daemon selinux-autorelabel-mark smartd sshd sssd switcheroo-control sysstat
                   systemd-network-generator udisks2 upower vgauthd vmtoolsd
  enabled-runtime  systemd-remount-fs
```

(Continued on next page)

Platform Notes (Continued)

```
  disabled         arp-ethers blk-availability brltty canberra-system-bootup canberra-system-shutdown
                   canberra-system-shutdown-reboot chrony-wait cni-dhcp console-getty cpupower cups-browsed
                   dbus-daemon debug-shell dnsmasq firewalld iprdump iprinit iprupdate iscsid iscsiuio kpatch
                   kvm_stat ledmon man-db-restart-cache-update nftables nvmf-autoconnect podman
                   podman-auto-update podman-restart psacct ras-mc-ctl rasdaemon rdisc rhcd rhsm rhsm-facts
                   rpmdb-rebuild serial-getty@ speech-dispatcherd sshd-keygen@ systemd-boot-check-no-failures
                   systemd-pstore systemd-sysext wpa_supplicant
  indirect         spice-vdagentd sssd-autofs sssd-kcm sssd-nss sssd-pac sssd-pam sssd-ssh sssd-sudo

------------------------------------------------------------
13. Linux kernel boot-time arguments, from /proc/cmdline
  BOOT_IMAGE=(hd0,gpt3)/boot/vmlinuz-5.14.0-70.13.1.el9_0.x86_64
  root=UUID=cc4bab05-907e-44ef-b818-2b2874390234
  ro
  crashkernel=1G-4G:192M,4G-64G:256M,64G-:512M
  resume=UUID=5ba347ca-8beb-4f6e-9c11-de63dc4ddf5f
  rhgb
  quiet

------------------------------------------------------------
14. cpupower frequency-info
  analyzing CPU 0:
    Unable to determine current policy
    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
```

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Platform Notes (Continued)

```
   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     Red Hat Enterprise Linux 9.0 (Plow)
   redhat-release Red Hat Enterprise Linux release 9.0 (Plow)
   system-release Red Hat Enterprise Linux release 9.0 (Plow)

 ------------------------------------------------------------
 19. Disk information
 SPEC is set to: /spec2017-icc2023.0
   Filesystem     Type  Size  Used Avail Use% Mounted on
   /dev/sda3      xfs   420G   17G  404G   4% /

 ------------------------------------------------------------
 20. /sys/devices/virtual/dmi/id
     Vendor:         XFUSION
     Product:        2288H V7
     Product Family: Eagle Stream
     Serial:         2106181991X3N5000001

 ------------------------------------------------------------
 21. dmidecode
   Additional information from dmidecode 3.3 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 Samsung M321R4GA3BB6-CQKDG 32 GB 2 rank 4800, configured at 4400


 ------------------------------------------------------------
 22. BIOS
 (This section combines info from /sys/devices and dmidecode.)
    BIOS Vendor:       XFUSION
    BIOS Version:      2.00.55
    BIOS Date:         03/07/2023
    BIOS Revision:     0.55
```

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 2023.0.0 Build 20221201
Copyright (C) 1985-2022 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 2023.0.0 Build 20221201
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
--------------------------------------------------------------------------------------------------------------
```

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Compiler Version Notes (Continued)

```
==============================================================================================================
Fortran | 548.exchange2_r(base)
--------------------------------------------------------------------------------------------------------------
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
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

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Base Optimization Flags (Continued)

C++ benchmarks (continued):
-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

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/xFusion-Platform-Settings-SPR-V1.1-revC.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/xFusion-Platform-Settings-SPR-V1.1-revC.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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