SPEC CPU®2017 Integer Rate Result

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xFusion
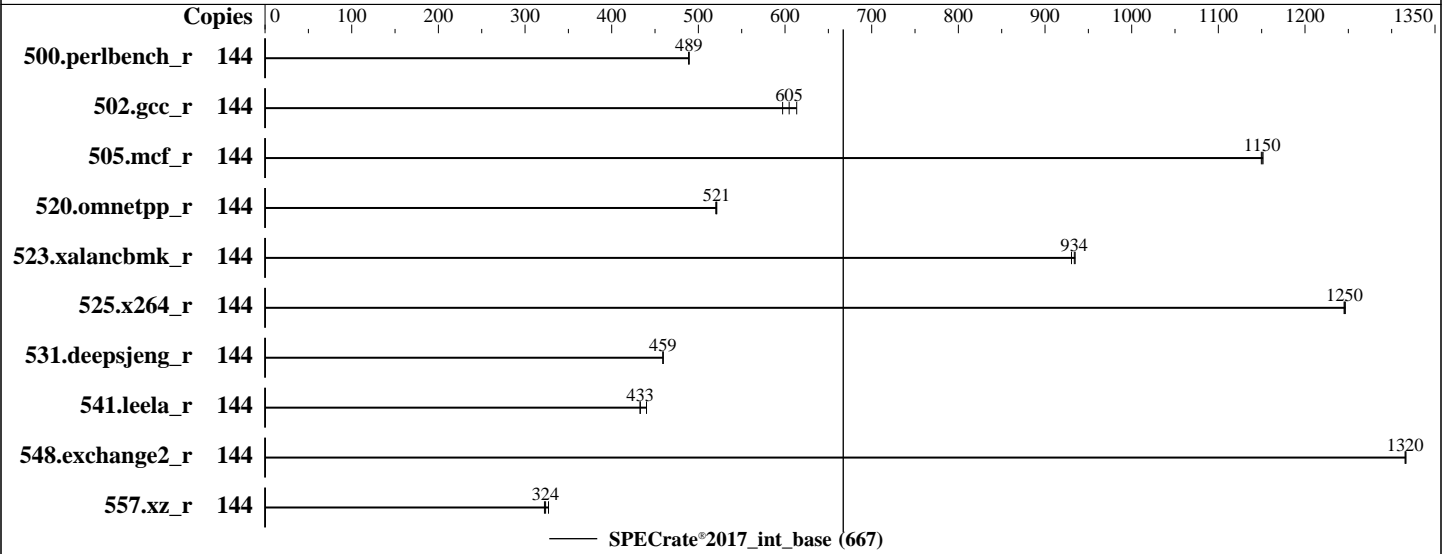
FusionServer 2488H V7 (Intel Xeon Gold 6416H)

$SPECrate^{®}2017\_int\_base = 667$

$SPECrate^{®}2017_int_peak = $ Not Run

CPU2017 License: 6488

Test Sponsor: xFusion

Tested by: xFusion

Test Date: Apr-2024

Hardware Availability: Jul-2023

Software Availability: Dec-2023

Benchmark	Copies	Result
500.perlbench_r	144	489
502.gcc_r	144	605
505.mcf_r	144	1150
520.omnetpp_r	144	521
523.xalancbmk_r	144	934
525.x264_r	144	1250
531.deepsjeng_r	144	459
541.leela_r	144	433
548.exchange2_r	144	1320
557.xz_r	144	324

SPECrate®2017_int_base (667)

Hardware

CPU Name: Intel Xeon Gold 6416H

 Max MHz: 4200

 Nominal: 2200

Enabled: 72 cores, 4 chips, 2 threads/core

Orderable: 1,2,4 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: 2 TB (32 x 64 GB 2Rx4 PC5-4800B-R)

Storage: 1 x 960 GB SATA SSD

Other: CPU Cooling: Air

Software

OS: Red Hat Enterprise Linux 9.0 (Plow)
5.14.0-70.13.1.el9_0.x86_64

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 01.02.01.04 Released Jan-2024

File System: xfs

System State: Run level 3 (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

Standard Performance Evaluation Corporation (info@spec.org)

https://www.spec.org/

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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	144	**469**	**489**	469	489	469	489							
502.gcc_r	144	341	597	332	613	**337**	**605**							
505.mcf_r	144	202	1150	**202**	**1150**	202	1150							
520.omnetpp_r	144	363	521	**363**	**521**	363	520							
523.xalancbmk_r	144	163	935	163	931	**163**	**934**							
525.x264_r	144	**202**	**1250**	203	1250	202	1250							
531.deepsjeng_r	144	**359**	**459**	359	459	359	459							
541.leela_r	144	551	433	**551**	**433**	542	440							
548.exchange2_r	144	287	1320	**287**	**1320**	287	1320							
557.xz_r	144	475	327	**480**	**324**	482	322							

SPECrate®2017_int_base = **667**

SPECrate®2017_int_peak = **Not Run**

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/Uniautos/cpu2017/lib/intel64:/home/Uniautos/cpu2017/lib/ia32:/home/Uniautos/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.:
 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)
```

(Continued on next page)

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Test Date: Apr-2024
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General Notes (Continued)

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 /home/Uniautos/cpu2017/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost.localdomain Thu Apr 18 21:53:17 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 250 (250-6.el9_0)
12. Failed units, from systemctl list-units --state=failed
13. Services, from systemctl list-unit-files
14. Linux kernel boot-time arguments, from /proc/cmdline
15. cpupower frequency-info
16. tuned-adm active
17. sysctl
18. /sys/kernel/mm/transparent_hugepage
19. /sys/kernel/mm/transparent_hugepage/khugepaged
20. OS release
21. Disk information
22. /sys/devices/virtual/dmi/id
23. dmidecode
24. 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


------------------------------------------------------------
2. w
   21:53:17 up 55 min,  2 users,  load average: 1.87, 59.50, 98.08
  USER     TTY          LOGIN@   IDLE   JCPU   PCPU WHAT
  root     pts/0     21:08   29:56   0.04s  0.04s -bash
  root     pts/1     21:44   25.00s  1.23s  0.16s -bash


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

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Platform Notes (Continued)

```
-------------------------------------------------------------
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) 8253962
  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) 8253962
  virtual memory              (kbytes, -v) unlimited
  file locks                       (-x) unlimited


-------------------------------------------------------------
5. sysinfo process ancestry
 /usr/lib/systemd/systemd --switched-root --system --deserialize 30
 sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups
 sshd: root [priv]
 sshd: root@pts/1
 -bash
 /bin/sh ./test-rate-cpu2017.sh
 runcpu --define default-platform-flags --copies 144 -c ic2023.2.3-lin-sapphirerapids-rate-20231121.cfg
   --define smt-on --define cores=72 --define physicalfirst --define invoke_with_interleave --define
   drop_caches --tune base -o all intrate
 runcpu --define default-platform-flags --copies 144 --configfile
   ic2023.2.3-lin-sapphirerapids-rate-20231121.cfg --define smt-on --define cores=72 --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/CPU2017.116/templogs/preenv.intrate.116.0.log --lognum 116.0 --from_runcpu 2
 specperl $SPEC/bin/sysinfo
 $SPEC = /home/Uniautos/cpu2017


-------------------------------------------------------------
6. /proc/cpuinfo
    model name      : Intel(R) Xeon(R) Gold 6416H
    vendor_id       : GenuineIntel
    cpu family      : 6
    model           : 143
    stepping        : 8
    microcode       : 0x2b0004d0
    bugs            : spectre_v1 spectre_v2 spec_store_bypass swapgs
    cpu cores       : 18
    siblings        : 36
    4 physical ids (chips)
    144 processors (hardware threads)
    physical id 0: core ids 0-17
    physical id 1: core ids 0-17
    physical id 2: core ids 0-17
    physical id 3: core ids 0-17
    physical id 0: apicids 0-35
    physical id 1: apicids 128-163
    physical id 2: apicids 256-291
    physical id 3: apicids 384-419
```

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Platform Notes (Continued)

```
   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):                      144
     On-line CPU(s) list:         0-143
     Vendor ID:                   GenuineIntel
     BIOS Vendor ID:              Intel(R) Corporation
     Model name:                  Intel(R) Xeon(R) Gold 6416H
     BIOS 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):                   4
     Stepping:                    8
     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 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:                   3.4 MiB (72 instances)
     L1i cache:                   2.3 MiB (72 instances)
     L2 cache:                    144 MiB (72 instances)
     L3 cache:                    180 MiB (4 instances)
     NUMA node(s):                8
     NUMA node0 CPU(s):           0-8,72-80
     NUMA node1 CPU(s):           9-17,81-89
     NUMA node2 CPU(s):           18-26,90-98
     NUMA node3 CPU(s):           27-35,99-107
     NUMA node4 CPU(s):           36-44,108-116
     NUMA node5 CPU(s):           45-53,117-125
     NUMA node6 CPU(s):           54-62,126-134
     NUMA node7 CPU(s):           63-71,135-143
     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
```

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Platform Notes (Continued)

```
  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     3.4M  12 Data              1    64        1             64
     L1i       32K     2.3M   8 Instruction       1    64        1             64
     L2         2M     144M  16 Unified           2  2048        1             64
     L3        45M     180M  15 Unified           3 49152        1             64

 ------------------------------------------------------------
 8. numactl --hardware
 NOTE: a numactl 'node' might or might not correspond to a physical chip.
   available: 8 nodes (0-7)
   node 0 cpus: 0-8,72-80
   node 0 size: 257239 MB
   node 0 free: 251436 MB
   node 1 cpus: 9-17,81-89
   node 1 size: 258043 MB
   node 1 free: 253813 MB
   node 2 cpus: 18-26,90-98
   node 2 size: 258043 MB
   node 2 free: 253921 MB
   node 3 cpus: 27-35,99-107
   node 3 size: 258043 MB
   node 3 free: 253890 MB
   node 4 cpus: 36-44,108-116
   node 4 size: 258043 MB
   node 4 free: 253910 MB
   node 5 cpus: 45-53,117-125
   node 5 size: 258043 MB
   node 5 free: 253947 MB
   node 6 cpus: 54-62,126-134
   node 6 size: 258043 MB
   node 6 free: 253722 MB
   node 7 cpus: 63-71,135-143
   node 7 size: 258024 MB
   node 7 free: 253891 MB
   node distances:
   node   0   1   2   3   4   5   6   7
     0:  10  12  21  21  21  21  21  21
     1:  12  10  21  21  21  21  21  21
     2:  21  21  10  12  21  21  21  21
     3:  21  21  12  10  21  21  21  21
     4:  21  21  21  21  10  12  21  21
     5:  21  21  21  21  12  10  21  21
     6:  21  21  21  21  21  21  10  12
     7:  21  21  21  21  21  21  12  10

 ------------------------------------------------------------
 9. /proc/meminfo
    MemTotal:       2113052388 kB

 ------------------------------------------------------------
 10. who -r
   run-level 3 Apr 18 20:58

 ------------------------------------------------------------
```

(Continued on next page)

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Platform Notes (Continued)

```
11. Systemd service manager version: systemd 250 (250-6.el9_0)
  Default Target  Status
  multi-user      degraded


   -----------------------------------------------------------
12. Failed units, from systemctl list-units --state=failed
    UNIT          LOAD   ACTIVE SUB    DESCRIPTION
  * sep5.service loaded failed failed systemd script to load sep5 driver at boot time


   -----------------------------------------------------------
13. Services, from systemctl list-unit-files
  STATE               UNIT FILES
  enabled             NetworkManager NetworkManager-dispatcher NetworkManager-wait-online auditd crond
                      dbus-broker firewalld getty@ irqbalance kdump mdmonitor microcode nis-domainname rhsmcertd
                      rsyslog selinux-autorelabel-mark sep5 sshd sssd systemd-network-generator tuned udisks2
  enabled-runtime     systemd-remount-fs
  disabled            console-getty cpupower debug-shell kvm_stat man-db-restart-cache-update nftables rdisc
                      rhsm rhsm-facts rpmdb-rebuild serial-getty@ sshd-keygen@ systemd-boot-check-no-failures
                      systemd-pstore systemd-sysext
  indirect            sssd-autofs sssd-kcm sssd-nss sssd-pac sssd-pam sssd-ssh sssd-sudo


   -----------------------------------------------------------
14. Linux kernel boot-time arguments, from /proc/cmdline
  BOOT_IMAGE=(hd2,gpt2)/vmlinuz-5.14.0-70.13.1.el9_0.x86_64
  root=UUID=fc5aaa98-7763-4e7f-8371-1b1810d17883
  ro
  crashkernel=1G-4G:192M,4G-64G:256M,64G-:512M
  resume=UUID=62bda881-0d36-43ce-826e-76cb2ea35911
  nohz_full=1-143


   -----------------------------------------------------------
15. cpupower frequency-info
  analyzing CPU 0:
    Unable to determine current policy
    boost state support:
      Supported: yes
      Active: yes


   -----------------------------------------------------------
16. tuned-adm active
  Current active profile: throughput-performance


   -----------------------------------------------------------
17. 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                  40
  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                   10
```

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Platform Notes (Continued)

```
  vm.watermark_boost_factor        15000
  vm.watermark_scale_factor           10
  vm.zone_reclaim_mode                 0


  ----------------------------------------------------------------
18. /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


  ----------------------------------------------------------------
19. /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


  ----------------------------------------------------------------
20. 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)


  ----------------------------------------------------------------
21. Disk information
SPEC is set to: /home/Uniautos/cpu2017
  Filesystem      Type  Size  Used Avail Use% Mounted on
  /dev/sdc3       xfs   272G   60G  212G  22% /home


  ----------------------------------------------------------------
22. /sys/devices/virtual/dmi/id
    Vendor:         XFUSION
    Product:        2488H V7
    Product Family: EagleStream


  ----------------------------------------------------------------
23. 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:
    1x Hynix HMCG94AEBRA102N 64 GB 2 rank 4800
    22x Hynix HMCG94AEBRA108N 64 GB 2 rank 4800
    8x Hynix HMCG94AEBRA109N 64 GB 2 rank 4800
    1x Hynix HMCG94AEBRA123N 64 GB 2 rank 4800



  ----------------------------------------------------------------
24. BIOS
(This section combines info from /sys/devices and dmidecode.)
  BIOS Vendor:    XFUSION
  BIOS Version:   01.02.01.04
  BIOS Date:      01/15/2024
```

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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
Copyright (C) 1985-2023 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`

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SPECrate®2017_int_base = 667

SPECrate®2017_int_peak = Not Run

CPU2017 License: 6488		**Test Date:**	Apr-2024
Test Sponsor: xFusion		**Hardware Availability:**	Jul-2023
Tested by: xFusion		**Software Availability:**	Dec-2023

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
```

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
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-ic2023p2-official-linux64.xml
http://www.spec.org/cpu2017/flags/xFusion-Platform-Settings-SPR-V1.1-revC.xml
```

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

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