



SPEC CPU®2017 Integer Rate Result

Copyright 2017-2024 Standard Performance Evaluation Corporation

ZTE Corporation

ZTE R8500G5 Server System
(2.10 GHz, Intel Xeon Gold 6418H)

SPECrate®2017_int_base = 865

SPECrate®2017_int_peak = Not Run

CPU2017 License: 9061

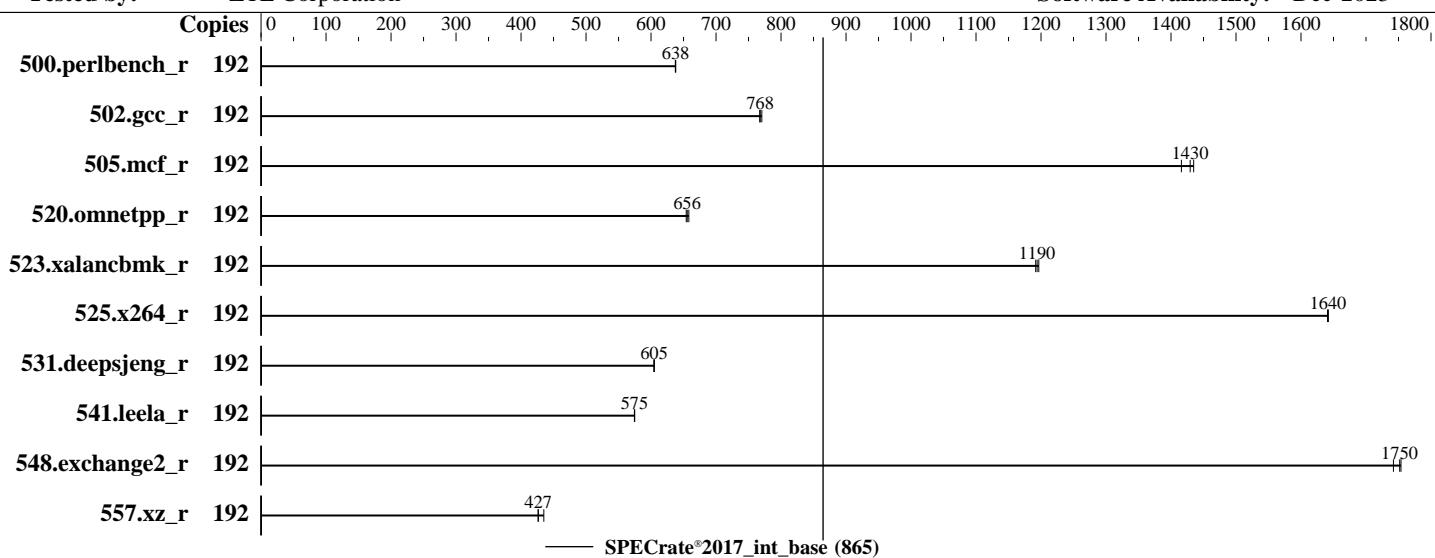
Test Sponsor: ZTE Corporation

Tested by: ZTE Corporation

Test Date: May-2024

Hardware Availability: Apr-2023

Software Availability: Dec-2023



Hardware

CPU Name: Intel Xeon Gold 6418H
Max MHz: 4000
Nominal: 2100
Enabled: 96 cores, 4 chips, 2 threads/core
Orderable: 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: 60 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 2024.0.2 of Intel oneAPI DPC++/C++ Compiler for Linux;
Fortran: Version 2024.0.2 of Intel Fortran Compiler for Linux;
Parallel: No
Firmware: Version 04.24.01.10 released Mar-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.



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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 | 192 | 479 | 638 | 479 | 638 | 480 | 637 | | | | | | | | | |
| 502.gcc_r | 192 | 354 | 767 | 354 | 768 | 353 | 770 | | | | | | | | | |
| 505.mcf_r | 192 | 216 | 1430 | 217 | 1430 | 219 | 1420 | | | | | | | | | |
| 520.omnetpp_r | 192 | 385 | 654 | 384 | 656 | 383 | 658 | | | | | | | | | |
| 523.xalancbmk_r | 192 | 170 | 1190 | 170 | 1190 | 169 | 1200 | | | | | | | | | |
| 525.x264_r | 192 | 205 | 1640 | 205 | 1640 | 205 | 1640 | | | | | | | | | |
| 531.deepsjeng_r | 192 | 364 | 605 | 364 | 605 | 364 | 605 | | | | | | | | | |
| 541.leela_r | 192 | 554 | 574 | 553 | 575 | 553 | 575 | | | | | | | | | |
| 548.exchange2_r | 192 | 289 | 1740 | 287 | 1750 | 287 | 1750 | | | | | | | | | |
| 557.xz_r | 192 | 477 | 435 | 486 | 427 | 487 | 426 | | | | | | | | | |

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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"
OS set to performance mode via cpupower frequency-set -g performance

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.:

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.

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General Notes (Continued)

is mitigated in the system as tested and documented.

Platform Notes

BIOS Configuration:

ENERGY_PERF_BIAS_CFG mode = performance
LLC dead line alloc = Disabled
Patrol Scrub = Disabled
Intel VT for Directed I/O (VT-d) = Disabled
SR-IOV Support = Disabled
Sub NUMA(SNC) = Enable SNC4

Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost.localdomain Wed May 1 17:16:11 2024

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

Table of contents

1. uname -a
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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

2. w
17:16:11 up 42 min, 1 user, load average: 0.00, 0.00, 0.00
USER TTY LOGIN@ IDLE JCPU PCPU WHAT
root pts/0 17:14 11.00s 0.82s 0.00s /bin/sh
. /reportable-ic2024.0.2-lin-sapphirerapids-rate-smt-on-20231213.sh

3. Username

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Platform Notes (Continued)

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) 8253266
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) 8253266
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/0
-bash
/bin/sh ./reportable-ic2024.0.2-lin-sapphirerapids-rate-smt-on-20231213.sh
runcpu --nobuild --action validate --define default-platform-flags --define numcopies=192 -c
  ic2024.0.2-lin-sapphirerapids-rate-20231213.cfg --define smt-on --define cores=96 --define physicalfirst
  --define invoke_with_interleave --define drop_caches --tune base -o all intrate
runcpu --nobuild --action validate --define default-platform-flags --define numcopies=192 --configfile
  ic2024.0.2-lin-sapphirerapids-rate-20231213.cfg --define smt-on --define cores=96 --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/CPU2017.004/templogs/preenv.intrate.004.0.log --lognum 004.0 --from_runcpu 2
specperl $SPEC/bin/sysinfo
$SPEC = /home/cpu2017
```

```
6. /proc/cpuinfo
model name      : Intel(R) Xeon(R) Gold 6418H
vendor_id       : GenuineIntel
cpu family     : 6
model          : 143
stepping        : 8
microcode       : 0x2b000571
bugs            : spectre_v1 spectre_v2 spec_store_bypass swapgs
cpu cores      : 24
siblings        : 48
4 physical ids (chips)
192 processors (hardware threads)
physical id 0: core ids 0-23
physical id 1: core ids 0-23
physical id 2: core ids 0-23
physical id 3: core ids 0-23
physical id 0: apicids 0-47
physical id 1: apicids 128-175
```

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Platform Notes (Continued)

physical id 2: apicids 256-303
physical id 3: apicids 384-431

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): | 192 |
| On-line CPU(s) list: | 0-191 |
| Vendor ID: | GenuineIntel |
| BIOS Vendor ID: | Intel(R) Corporation |
| Model name: | Intel(R) Xeon(R) Gold 6418H |
| BIOS Model name: | Intel(R) Xeon(R) Gold 6418H |
| CPU family: | 6 |
| Model: | 143 |
| Thread(s) per core: | 2 |
| Core(s) per socket: | 24 |
| Socket(s): | 4 |
| Stepping: | 8 |
| CPU max MHz: | 4000.0000 |
| CPU min MHz: | 800.0000 |
| BogoMIPS: | 4200.00 |
| 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 aperfimperf tsc_known_freq pn1 pclmulqdq dtes64 monitor ds_cpl 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 intel_ppin cdp_12 ssbd mba ibrs ibpb stibp ibrs_enhanced fsgsbase tsc_adjust bmil avx2 smpf bmi2 erms invpcid cqmq rdt_a avx512f avx512dq rdseed adx smap avx512ifma clflushopt clwb intel_pt avx512cd sha_ni avx512bw avx512vl xsaveopt xgetbv1 xsaves cqmq_llc cqmq_occup_llc cqmq_mbm_total cqmq_mbm_local split_lock_detect avx_vnni avx512_bf16 wbnoinvd dtherm ida arat pln pts hwp hwp_act_window hwp_epp hwp_pkg_req 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_l1d arch_capabilities |
| L1d cache: | 4.5 MiB (96 instances) |
| L1i cache: | 3 MiB (96 instances) |
| L2 cache: | 192 MiB (96 instances) |
| L3 cache: | 240 MiB (4 instances) |
| NUMA node(s): | 8 |
| NUMA node0 CPU(s): | 0-11,96-107 |
| NUMA node1 CPU(s): | 12-23,108-119 |
| NUMA node2 CPU(s): | 24-35,120-131 |
| NUMA node3 CPU(s): | 36-47,132-143 |
| NUMA node4 CPU(s): | 48-59,144-155 |
| NUMA node5 CPU(s): | 60-71,156-167 |
| NUMA node6 CPU(s): | 72-83,168-179 |
| NUMA node7 CPU(s): | 84-95,180-191 |
| Vulnerability Itlb multihit: | Not affected |
| Vulnerability L1tf: | Not affected |

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Platform Notes (Continued)

Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl
Vulnerability Spectre v1: Mitigation; usercopy/swaps 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 | 4.5M | 12 | Data | 1 | 64 | 1 | 64 |
| L1i | 32K | 3M | 8 | Instruction | 1 | 64 | 1 | 64 |
| L2 | 2M | 192M | 16 | Unified | 2 | 2048 | 1 | 64 |
| L3 | 60M | 240M | 15 | Unified | 3 | 65536 | 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: 0-11,96-107

node 0 size: 257114 MB

node 0 free: 256523 MB

node 1 cpus: 12-23,108-119

node 1 size: 258006 MB

node 1 free: 257467 MB

node 2 cpus: 24-35,120-131

node 2 size: 258042 MB

node 2 free: 257672 MB

node 3 cpus: 36-47,132-143

node 3 size: 258042 MB

node 3 free: 257751 MB

node 4 cpus: 48-59,144-155

node 4 size: 258042 MB

node 4 free: 257242 MB

node 5 cpus: 60-71,156-167

node 5 size: 258042 MB

node 5 free: 257581 MB

node 6 cpus: 72-83,168-179

node 6 size: 258042 MB

node 6 free: 257159 MB

node 7 cpus: 84-95,180-191

node 7 size: 258022 MB

node 7 free: 257239 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: 2112877400 kB

10. who -r

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Platform Notes (Continued)

run-level 3 May 1 16:33

11. Systemd service manager version: systemd 250 (250-6.e19_0)
Default Target Status
multi-user running

12. Services, from systemctl list-unit-files
STATE UNIT FILES
enabled NetworkManager NetworkManager-dispatcher NetworkManager-wait-online audited chronyd crond
dbus-broker firewalld getty@ irqbalance kdump lvm2-monitor mdmonitor microcode
nis-domainname rhsmcertd rsyslog selinux-autorelabel-mark sshd sssd
systemd-network-generator udisks2
enabled-runtime systemd-remount-fs
disabled arp-ethers blk-availability chrony-wait console-getty cpupower debug-shell kvm_stat
man-db-restart-cache-update nftables rdisc rhsm rhsm-facts rpmbuild rebuild serial-getty@
sshd-keygen@ systemd-boot-check-no-failures systemd-pstore systemd-sysext target
targetclid
indirect 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,gpt2)/vmlinuz-5.14.0-70.13.1.e19_0.x86_64
root=/dev/mapper/rhel-root
ro
crashkernel=1G-4G:192M,4G-64G:256M,64G-:512M
resume=/dev/mapper/rhel-swap
rd.lvm.lv=rhel/root
rd.lvm.lv=rhel/swap

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_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

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Platform Notes (Continued)

```
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
```

```
-----  
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: /home/cpu2017  
Filesystem      Type  Size  Used  Avail Use% Mounted on  
/dev/mapper/rhel-home xfs   819G   66G   753G   9%  /home
```

```
-----  
20. /sys/devices/virtual/dmi/id  
    Vendor:      ZTE  
    Product:     R8500 G5  
    Product Family: Server  
    Serial:      219413636851
```

```
-----  
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:  
32x Samsung M321R8GA0BB0-CQKMG 64 GB 2 rank 4800
```

```
-----  
22. BIOS  
(This section combines info from /sys/devices and dmidecode.)  
BIOS Vendor:      American Megatrends Inc.  
BIOS Version:    04.24.01.10  
BIOS Date:       03/13/2024  
BIOS Revision:   4.24
```



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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 2024.0.2 Build 20231213
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 2024.0.2 Build 20231213
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 2024.0.2 Build 20231213
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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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/opt/intel/oneapi/compiler/2024.0/lib -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/opt/intel/oneapi/compiler/2024.0/lib -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/opt/intel/oneapi/compiler/2024.0/lib -lqkmalloc
```

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

<http://www.spec.org/cpu2017/flags/Intel-ic2024-official-linux64.2024-05-21.html>
<http://www.spec.org/cpu2017/flags/ZTE-Platform-Settings-SPR-V1.10.html>

You can also download the XML flags sources by saving the following links:

<http://www.spec.org/cpu2017/flags/Intel-ic2024-official-linux64.2024-05-21.xml>
<http://www.spec.org/cpu2017/flags/ZTE-Platform-Settings-SPR-V1.10.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 2024-05-01 17:16:10-0400.

Report generated on 2024-05-21 19:24:04 by CPU2017 PDF formatter v6716.

Originally published on 2024-05-21.