



SPEC CPU®2017 Integer Rate Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL560 Gen11

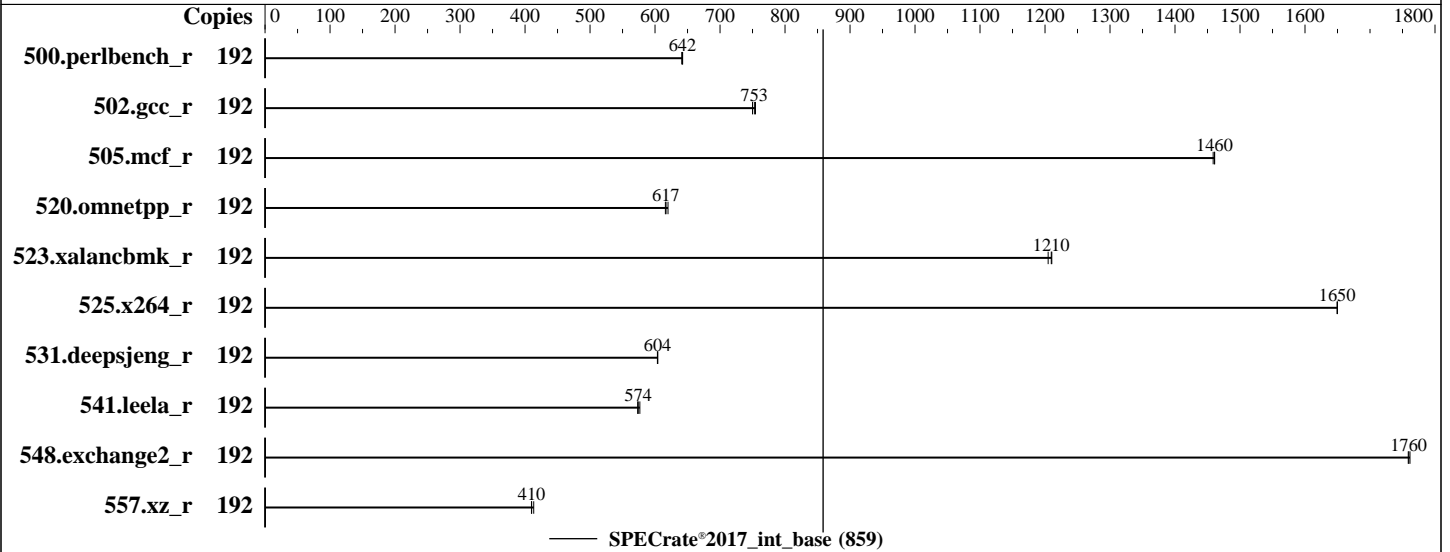
(2.10 GHz, Intel Xeon Gold 6418H)

SPECrate®2017_int_base = 859

SPECrate®2017_int_peak = Not Run

CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Test Date: Apr-2024
Hardware Availability: Dec-2023
Software Availability: Apr-2024



Hardware

CPU Name: Intel Xeon Gold 6418H
 Max MHz: 4000
 Nominal: 2100
 Enabled: 96 cores, 4 chips, 2 threads/core
 Orderable: 1, 2, 4 chip(s)
 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: 1 TB (32 x 32 GB 2Rx8 PC5-4800B-R)
 Storage: 1 x 480 GB SATA SSD
 Other: CPU Cooling: Air

Software

OS: Ubuntu 22.04.1 LTS
 Kernel 5.15.0-105-generic
 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: HPE BIOS Version v2.12 12/13/2023 released Dec-2023
 File System: ext4
 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	192	476	642	476	642	477	641							
502.gcc_r	192	360	755	363	750	361	753							
505.mcf_r	192	213	1460	212	1460	212	1460							
520.omnetpp_r	192	409	616	406	620	408	617							
523.xalancbmk_r	192	168	1210	168	1210	168	1200							
525.x264_r	192	204	1650	204	1650	204	1650							
531.deepsjeng_r	192	364	604	364	604	365	604							
541.leela_r	192	554	574	551	577	555	573							
548.exchange2_r	192	286	1760	286	1760	286	1760							
557.xz_r	192	502	413	506	410	505	410							

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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"
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>
IRQ balance service was stopped using "systemctl stop irqbalance.service"
tuned-adm profile was set to accelerator-performance using "tuned-adm profile accelerator-performance"
perf-bias for all the CPUs is set using "cpupower set -b 0"

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"
MALLOCONF = "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
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)

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General Notes (Continued)

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

Workload Profile set to General Throughput Compute

Memory Patrol Scrubbing set to Disabled

Last Level Cache (LLC) Dead Line Allocation set to Disabled

Enhanced Processor Performance Profile set to Aggressive

Stale A to S set to Enabled

Thermal Configuration set to Maximum Cooling

Workload Profile set to Custom

Intel UPI Link Power Management set to Enabled

Minimum Processor Idle Power Package C-State set to Package C6 (non-retention) State

Sysinfo program /home/cpu2017/bin/sysinfo

Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197

running on admin1 Tue Apr 23 00:42:02 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 (249.11-0ubuntu3.7)
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 admin1 5.15.0-105-generic #115-Ubuntu SMP Mon Apr 15 09:52:04 UTC 2024 x86_64 x86_64 x86_64 GNU/Linux

2. w
 00:42:02 up 17 min, 3 users, load average: 0.07, 0.77, 1.89

```

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## Platform Notes (Continued)

| USER   | TTY   | FROM        | LOGIN@ | IDLE   | JCPU  | PCPU  | WHAT                |
|--------|-------|-------------|--------|--------|-------|-------|---------------------|
| admin1 | tty1  | -           | 00:39  | 2:16   | 0.03s | 0.01s | -bash               |
| admin1 | pts/0 | 172.17.1.13 | 00:40  | 1:54   | 0.01s | 0.00s | sshd: admin1 [priv] |
| admin1 | pts/1 | 172.17.1.13 | 00:40  | 10.00s | 1.09s | 0.00s | sudo -i             |

### 3. Username

From environment variable \$USER: root  
From the command 'logname': admin1

### 4. ulimit -a

```
time(seconds) unlimited
file(blocks) unlimited
data(kbytes) unlimited
stack(kbytes) unlimited
coredump(blocks) 0
memory(kbytes) unlimited
locked memory(kbytes) 132052084
process 4126175
nofiles 1024
vmemory(kbytes) unlimited
locks unlimited
rtprio 0
```

### 5. sysinfo process ancestry

```
/sbin/init
sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups
sshd: admin1 [priv]
sshd: admin1@pts/0
-bash
sudo -i
sudo -i
-bash
-bash
runccpu --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
runccpu --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/CPU2017.029/templogs/preenv.intrate.029.0.log --lognum 029.0 --from_runccpu 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 : 7
microcode : 0x2b000571
bugs : spectre_v1 spectre_v2 spec_store_bypass swapgs eibrs_pbrsb
cpu cores : 24
siblings : 48
4 physical ids (chips)
192 processors (hardware threads)
```

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## Platform Notes (Continued)

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  
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 2.37.2:

```
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): 192
On-line CPU(s) list: 0-191
Vendor ID: GenuineIntel
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: 7
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 aperfmperf 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_l3 cat_l2
 cdp_l3 invpcid_single 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 amx_bf16 avx512_fp16 amx_tile
 amx_int8 flush_l1d arch_capabilities
Virtualization: VT-x
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
```

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## Platform Notes (Continued)

```

NUMA node6 CPU(s): 72-83,168-179
NUMA node7 CPU(s): 84-95,180-191
Vulnerability Gather data sampling: Not affected
Vulnerability Itlb multihit: Not affected
Vulnerability Lltf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Mmio stale data: Not affected
Vulnerability Retbleed: Not affected
Vulnerability Spec rstack overflow: 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, PBRBS-eIBRS
 SW sequence
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: 128585 MB
node 0 free: 127942 MB
node 1 cpus: 12-23,108-119
node 1 size: 129018 MB
node 1 free: 128404 MB
node 2 cpus: 24-35,120-131
node 2 size: 129018 MB
node 2 free: 128552 MB
node 3 cpus: 36-47,132-143
node 3 size: 129018 MB
node 3 free: 128458 MB
node 4 cpus: 48-59,144-155
node 4 size: 129018 MB
node 4 free: 128699 MB
node 5 cpus: 60-71,156-167
node 5 size: 129018 MB
node 5 free: 128691 MB
node 6 cpus: 72-83,168-179
node 6 size: 128970 MB
node 6 free: 128647 MB
node 7 cpus: 84-95,180-191
node 7 size: 129010 MB
node 7 free: 128659 MB
node distances:
node 0 1 2 3 4 5 6 7
0: 10 20 30 30 30 30 30 30
1: 20 10 30 30 30 30 30 30
2: 30 30 10 20 30 30 30 30
3: 30 30 20 10 30 30 30 30
4: 30 30 30 30 10 20 30 30
5: 30 30 30 30 20 10 30 30

```

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## Platform Notes (Continued)

```
6: 30 30 30 30 30 30 30 10 20
7: 30 30 30 30 30 30 30 20 10
```

```
9. /proc/meminfo
MemTotal: 1056416680 kB
```

```
10. who -r
run-level 5 Apr 23 00:32
```

```
11. Systemd service manager version: systemd 249 (249.11-0ubuntu3.7)
Default Target Status
graphical degraded
```

```
12. Failed units, from systemctl list-units --state=failed
UNIT LOAD ACTIVE SUB DESCRIPTION
* systemd-networkd-wait-online.service loaded failed failed Wait for Network to be Configured
```

```
13. Services, from systemctl list-unit-files
STATE UNIT FILES
enabled ModemManager apparmor blk-availability cloud-config cloud-final cloud-init
cloud-init-local console-setup cron dmesg e2scrub_reap finalrd getty@ gpu-manager
grub-common grub-initrd-fallback hv-fcopy-daemon hv-kvp-daemon hv-vss-daemon irqbalance
keyboard-setup lvm2-monitor lxd-agent multipathd networkd-dispatcher open-iscsi
open-vm-tools pollinate rsyslog secureboot-db setvtrgb snapd ssh systemd-networkd
systemd-networkd-wait-online systemd-pstore systemd-resolved thermald tuned ua-reboot-cmds
ubuntu-advantage udisks2 ufw unattended-upgrades vgauth
enabled-runtime netplan-ovs-cleanup systemd-fsck-root systemd-remount-fs
disabled console-getty debug-shell intel-sgx-load-module iscsid nftables powertop rsync
serial-getty@ systemd-boot-check-no-failures systemd-network-generator systemd-sysext
systemd-time-wait-sync systemd-timesyncd upower
generated apport
indirect uidd
masked cryptdisks cryptdisks-early hwclock lvm2 multipath-tools-boot rc rcS screen-cleanup sudo
x11-common
```

```
14. Linux kernel boot-time arguments, from /proc/cmdline
BOOT_IMAGE=/vmlinuz-5.15.0-105-generic
root=/dev/mapper/ubuntuvg--l-ubuntu--lv
ro
```

```
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: accelerator-performance
```

```
17. sysctl
```

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## Platform Notes (Continued)

```

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
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+madvice [madvice] never
enabled always [madvice] 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 Ubuntu 22.04.1 LTS

```

```

21. Disk information
SPEC is set to: /home/cpu2017
Filesystem Type Size Used Avail Use% Mounted on
/dev/mapper/ubuntu--vg--1-ubuntu--lv ext4 437G 166G 253G 40% /

```

```

22. /sys/devices/virtual/dmi/id
Vendor: HPE
Product: ProLiant DL560 Gen11
Product Family: ProLiant
Serial: CNX2250G5V

```

```

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

```

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## Platform Notes (Continued)

"DMTF SMBIOS" standard.

Memory:

1x Samsung M321R4GA3BB0-CQKDG 32 GB 2 rank 4800  
31x Samsung M321R4GA3BB6-CQKDG 32 GB 2 rank 4800  
32x UNKNOWN NOT AVAILABLE

-----  
24. BIOS

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

BIOS Vendor: HPE  
BIOS Version: 2.12  
BIOS Date: 12/13/2023  
BIOS Revision: 2.12  
Firmware Revision: 1.58

## 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



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## 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/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.html>

<http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-SPR-rev3.0.html>

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

<http://www.spec.org/cpu2017/flags/Intel-ic2024-official-linux64.xml>

<http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-SPR-rev3.0.xml>

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For questions about this result, please contact the tester. For other inquiries, please contact [info@spec.org](mailto:info@spec.org).

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