SPEC CPU®2017 Integer Rate Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

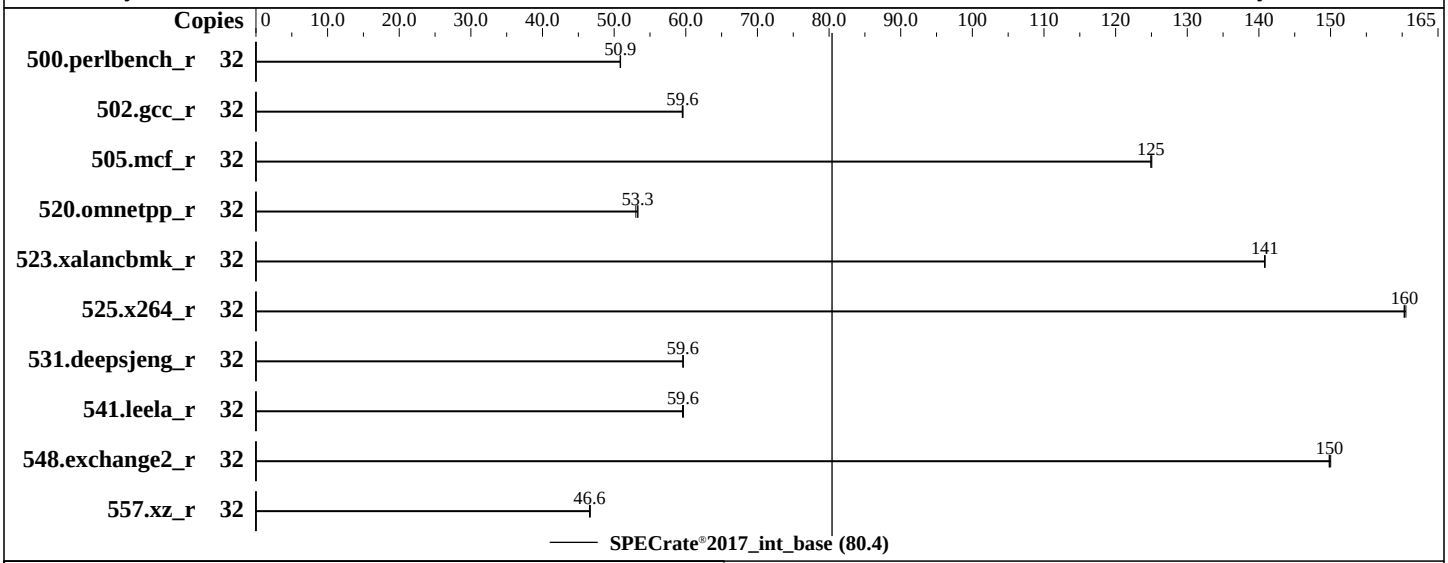
ProLiant DL380 Gen9
(2.10 GHz, Intel Xeon E5-2620 v4)

SPECrate®2017_int_base = 80.4

SPECrate®2017_int_peak = Not Run

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

Test Date: May-2023
Hardware Availability: Feb-2023
Software Availability: Dec-2022



Hardware

CPU Name:	Intel Xeon E5-2620 v4
Max MHz:	3000
Nominal:	2100
Enabled:	16 cores, 2 chips, 2 threads/core
Orderable:	1, 2 chip (s)
Cache L1:	32 KB I + 32 KB D on chip per core
L2:	256 KB I+D on chip per core
L3:	20 MB I+D on chip per chip
Other:	None
Memory:	128 GB (8 x 16 GB 2Rx4 PC4-2400T-R, running at 2133)
Storage:	1 x 900 GB SAS 10K HDD, RAID 0
Other:	None

Software

OS:	Red Hat Enterprise Linux 9.0 (Plow) Kernel 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:	HPE BIOS Version P89 v3.08 01/12/2023 released Feb-2023
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
500.perlbench_r	32	**1001**	**50.9**	1001	50.9	1002	50.8							
502.gcc_r	32	760	59.6	**761**	**59.6**	761	59.5							
505.mcf_r	32	414	125	**414**	**125**	414	125							
520.omnetpp_r	32	**788**	**53.3**	788	53.3	792	53.0							
523.xalancbmk_r	32	240	141	**240**	**141**	240	141							
525.x264_r	32	**349**	**160**	350	160	349	161							
531.deepsjeng_r	32	**615**	**59.6**	615	59.6	615	59.7							
541.leela_r	32	890	59.5	**889**	**59.6**	888	59.7							
548.exchange2_r	32	559	150	**559**	**150**	560	150							
557.xz_r	32	742	46.6	741	46.7	**742**	**46.6**							

SPECrate®2017_int_base = 80.4

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

```
This benchmark result is intended to provide perspective on
past performance using the historical hardware
and/or software described on this result page.
The system as described on this result page was formerly
generally available. At the time of this publication, it may
not be shipping, and/or may not be supported, and/or may fail
to meet other tests of General Availability described in the
SPEC OSG Policy document, http://www.spec.org/osg/policy.html
This measured result may not be representative of the result
that would be measured were this benchmark run with hardware
and software available as of the publication date.

This benchmark run is conducted using the latest binaries based
on IC23 and to suffice the minimum software requirement, the
Operating System used is RHEL9.0
```

Operating System Notes

```
Stack size set to unlimited using "ulimit -s unlimited"
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>
```

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 8480+ CPU + 512GB RAM
 memory using Red Hat Enterprise Linux 9.0
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

```
The system ROM used for this result contains Intel microcode version 0xb000040 for
the Intel Xeon E5-2620 v4 processor.
BIOS Configuration:
 Power Profile set to Custom
 Power Regulator to Static High Performance Mode
 Minimum Processor Idle Power Core C-State set to C1E State
 Minimum Processor Idle Power Package C-State set to No Package State
 QPI Snoop Configuration set to Cluster on Die
 Thermal Configuration set to Maximum Cooling
 Collaborative Power Control set to Disabled
 Processor Power and Utilization Monitoring set to Disabled
 Memory Refresh Rate set to 1x Refresh


 Sysinfo program /home/cpu2017/bin/sysinfo
 Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
 running on localhost.localdomain Mon May 15 23:08:13 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
```

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Platform Notes (Continued)

```
  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. sysctl
 17. /sys/kernel/mm/transparent_hugepage
 18. /sys/kernel/mm/transparent_hugepage/khugepaged
 19. OS release
 20. Disk information
 21. /sys/devices/virtual/dmi/id
 22. dmidecode
 23. 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
   23:08:13 up  5:39,  1 user,  load average: 0.00, 0.00, 0.00
  USER     TTY        LOGIN@   IDLE   JCPU   PCPU WHAT
  root     pts/0     23:05   12.00s  3.15s  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) 514921
  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) 514921
  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]
```

(Continued on next page)

Platform Notes (Continued)

```
 sshd: root@pts/0
 -bash
 -bash
 runcpu --nobuild --action validate --define default-platform-flags --define numcopies=32 -c
   ic2023.0-lin-core-avx2-rate-20221201.cfg --define smt-on --define cores=16 --define physicalfirst --define
   invoke_with_interleave --define drop_caches --tune base -o all intrate
 runcpu --nobuild --action validate --define default-platform-flags --define numcopies=32 --configfile
   ic2023.0-lin-core-avx2-rate-20221201.cfg --define smt-on --define cores=16 --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/CPU2017.003/templogs/preenv.intrate.003.0.log --lognum 003.0 --from_runcpu 2
 specperl $SPEC/bin/sysinfo
$SPEC = /home/cpu2017

------------------------------------------------------------
6. /proc/cpuinfo
    model name      : Intel(R) Xeon(R) CPU E5-2620 v4 @ 2.10GHz
    vendor_id       : GenuineIntel
    cpu family      : 6
    model           : 79
    stepping        : 1
    microcode       : 0xb000040
    bugs            : cpu_meltdown spectre_v1 spectre_v2 spec_store_bypass l1tf mds swapgs taa itlb_multihit
    cpu cores       : 8
    siblings        : 16
    2 physical ids (chips)
    32 processors (hardware threads)
    physical id 0: core ids 0-7
    physical id 1: core ids 0-7
    physical id 0: apicids 0-15
    physical id 1: apicids 16-31
  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, 48 bits virtual
  Byte Order:                      Little Endian
  CPU(s):                          32
  On-line CPU(s) list:             0-31
  Vendor ID:                       GenuineIntel
  BIOS Vendor ID:                  Intel(R) Corporation
  Model name:                      Intel(R) Xeon(R) CPU E5-2620 v4 @ 2.10GHz
  BIOS Model name:                 Intel(R) Xeon(R) CPU E5-2620 v4 @ 2.10GHz
  CPU family:                      6
  Model:                           79
  Thread(s) per core:              2
  Core(s) per socket:              8
  Socket(s):                       2
  Stepping:                        1
  CPU max MHz:                     3000.0000
  CPU min MHz:                     1200.0000
  BogoMIPS:                        4194.88
  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 arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc
```

(Continued on next page)

Platform Notes (Continued)

```
                                cpuid aperfmperf 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 cdp_l3 invpcid_single pti intel_ppin ssbd ibrs ibpb
                                stibp tpr_shadow vnmi flexpriority ept vpid ept_ad fsgsbase tsc_adjust
                                bmi1 hle avx2 smep bmi2 erms invpcid rtm cqm rdt_a rdseed adx smap
                                intel_pt xsaveopt cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local dtherm
                                ida arat pln pts md_clear flush_l1d
  Virtualization:               VT-x
  L1d cache:                    512 KiB (16 instances)
  L1i cache:                    512 KiB (16 instances)
  L2 cache:                     4 MiB (16 instances)
  L3 cache:                     40 MiB (2 instances)
  NUMA node(s):                 2
  NUMA node0 CPU(s):            0-7,16-23
  NUMA node1 CPU(s):            8-15,24-31
  Vulnerability Itlb multihit:  KVM: Mitigation: VMX disabled
  Vulnerability L1tf:           Mitigation; PTE Inversion; VMX conditional cache flushes, SMT vulnerable
  Vulnerability Mds:            Mitigation; Clear CPU buffers; SMT vulnerable
  Vulnerability Meltdown:       Mitigation; PTI
  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; Retpolines, IBPB conditional, IBRS_FW, STIBP conditional, RSB
                                filling
  Vulnerability Srbds:          Not affected
  Vulnerability Tsx async abort: Mitigation; Clear CPU buffers; SMT vulnerable

From lscpu --cache:
     NAME ONE-SIZE ALL-SIZE WAYS TYPE        LEVEL  SETS PHY-LINE COHERENCY-SIZE
     L1d       32K     512K    8 Data            1    64        1             64
     L1i       32K     512K    8 Instruction     1    64        1             64
     L2       256K       4M    8 Unified         2   512        1             64
     L3        20M      40M   20 Unified         3 16384        1             64

------------------------------------------------------------
8. numactl --hardware
NOTE: a numactl 'node' might or might not correspond to a physical chip.
  available: 2 nodes (0-1)
  node 0 cpus: 0-7,16-23
  node 0 size: 64267 MB
  node 0 free: 63370 MB
  node 1 cpus: 8-15,24-31
  node 1 size: 64499 MB
  node 1 free: 64107 MB
  node distances:
  node   0   1
    0:  10  21
    1:  21  10

------------------------------------------------------------
9. /proc/meminfo
   MemTotal:       131857840 kB

------------------------------------------------------------
10. who -r
  run-level 3 May 15 17:29

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

(Continued on next page)

Platform Notes (Continued)

```
  multi-user      degraded

------------------------------------------------------------
12. Failed units, from systemctl list-units --state=failed
    UNIT                  LOAD   ACTIVE SUB    DESCRIPTION
  * dnf-makecache.service loaded failed failed dnf makecache

------------------------------------------------------------
13. Services, from systemctl list-unit-files
  STATE            UNIT FILES
  enabled          NetworkManager NetworkManager-dispatcher NetworkManager-wait-online auditd chronyd crond
                   dbus-broker firewalld getty@ irqbalance kdump mdmonitor microcode nis-domainname rhsmcertd
                   rsyslog selinux-autorelabel-mark sshd sssd systemd-network-generator udisks2
  enabled-runtime  systemd-remount-fs
  disabled         chrony-wait 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=(hd1,gpt2)/vmlinuz-5.14.0-70.13.1.el9_0.x86_64
  root=UUID=d531e150-0015-45b7-86fe-77ec5632fb82
  ro
  resume=UUID=fd7d4f1b-2763-4897-8297-b8f9fd0825e6

------------------------------------------------------------
15. cpupower frequency-info
  analyzing CPU 0:
    current policy: frequency should be within 1.20 GHz and 3.00 GHz.
                    The governor "performance" may decide which speed to use
                    within this range.
    boost state support:
      Supported: yes
      Active: yes

------------------------------------------------------------
16. 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

------------------------------------------------------------
17. /sys/kernel/mm/transparent_hugepage
```

(Continued on next page)

Platform Notes (Continued)

```
  defrag          always defer defer+madvise [madvise] never
  enabled         [always] madvise never
  hpage_pmd_size  2097152
  shmem_enabled   always within_size advise [never] deny force

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

------------------------------------------------------------
19. 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)

------------------------------------------------------------
20. Disk information
SPEC is set to: /home/cpu2017
  Filesystem     Type  Size  Used Avail Use% Mounted on
  /dev/sda5      xfs   763G   23G  741G   3% /home

------------------------------------------------------------
21. /sys/devices/virtual/dmi/id
    Vendor:         HP
    Product:        ProLiant DL380 Gen9
    Product Family: ProLiant
    Serial:         USE63487A0

------------------------------------------------------------
22. 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:
    8x HP 809081-081 16 GB 2 rank 2400, configured at 2133


------------------------------------------------------------
23. BIOS
(This section combines info from /sys/devices and dmidecode.)
   BIOS Vendor:       HP
   BIOS Version:      P89
   BIOS Date:         01/12/2023
   BIOS Revision:     3.0
   Firmware Revision: 2.70
```

Compiler Version Notes

```
==============================================================================================================
C       | 500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base) 525.x264_r(base) 557.xz_r(base)
--------------------------------------------------------------------------------------------------------------
```

(Continued on next page)

Compiler Version Notes (Continued)

```
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.
------------------------------------------------------------------------------------------------------------------------

==============================================================================================================
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 -xCORE-AVX2 -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 -xCORE-AVX2 -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
```

Fortran benchmarks:
```
-w -m64 -Wl,-z,muldefs -xCORE-AVX2 -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/HPE-Platform-Flags-Intel-V1.1-HSW-revB.html
http://www.spec.org/cpu2017/flags/Intel-ic2023-official-linux64.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.1-HSW-revB.xml
http://www.spec.org/cpu2017/flags/Intel-ic2023-official-linux64.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 2023-05-15 23:08:11-0400.
Report generated on 2024-01-29 17:47:56 by CPU2017 PS formatter v6716.
Originally published on 2023-06-06.