## SPEC CPU®2017 Integer Rate Result

### Hewlett Packard Enterprise

**Test Sponsor:** HPE  
**HPE Compute Scale-up Server 3200**  
**(1.90 GHz, Intel Xeon Platinum 8490H)**

| Test Date: | Jan-2024  
| Hardware Availability: | Dec-2023  
| Software Availability: | Dec-2023

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

### Copies

<table>
<thead>
<tr>
<th>Specmark run number</th>
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<td>500.perlbench_r</td>
<td>960</td>
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<tr>
<td>502.gcc_r</td>
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<td>505.mcf_r</td>
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<td>520.omnetpp_r</td>
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<td>523.xalancbmk_r</td>
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<td>525.x264_r</td>
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<td>531.deepsjeng_r</td>
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<td>548.exchange2_r</td>
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<tr>
<td>557.xz_r</td>
<td>960</td>
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</tbody>
</table>

### SPECrate®2017_int_base = 3720  
### SPECrate®2017_int_peak = Not Run

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### Hardware

**CPU Name:** Intel Xeon Platinum 8490H  
**Max MHz:** 3500  
**Nominal:** 1900  
**Enabled:** 480 cores, 8 chips, 2 threads/core  
**Orderable:** 4, 8, 16 chip(s)  
**Cache L1:** 32 KB I + 48 KB D on chip per core  
**L2:** 2 MB I+D on chip per core  
**L3:** 112.5 MB I+D on chip per chip  
**Other:** None  
**Memory:** 4 TB (64 x 64 GB 2Rx4 PC5-4800B-R)  
**Storage:** 1 x 6.4 TB NVMe SSD  
**Other:** None

### Software

**OS:** Red Hat Enterprise Linux 8.8 (Ootpa)  
**Kernel:** 4.18.0-477.10.1.el8_8.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:** HPE Firmware Bundle Version 1.10.342 released Dec-2023  
**File System:** xfs  
**System State:** Run level 3 (multi-user)  
**Base Pointers:** 64-bit  
**Peak Pointers:** Not Applicable  
**Other:** HPE Foundation Software 2.5.0  
**Power Management:** BIOS and OS set to prefer performance at the cost of additional power usage
Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
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<th>Seconds</th>
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</tr>
</tbody>
</table>

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"
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>

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
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.

(Continued on next page)
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(Test Sponsor: HPE)
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CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

General Notes (Continued)

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 0x2b0004d0 for
the Intel Xeon Platinum 8490H processor.

BIOS Configuration:
Workload Profile set to Custom
Energy/Performance Bias set to Maximum Performance
Energy Efficient Turbo set to Disabled
Advanced Memory Protection set to Advanced ECC Support
SR-IOV set to Disabled
Intel Virtualization Technology (Intel VT, VT-x) set to Disabled
Adjacent Sector Prefetch set to Disabled
DCU Stream Prefetcher set to Disabled
Last Level Cache (LLC) Dead Line Allocation set to Disabled
Enhanced Processor Performance Profile set to Aggressive
Memory Patrol Scrubbing set to Disabled

Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on sph-201 Thu Jan 18 23:36:11 2024

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

2.

```
23:36:11 up 3 min,  2 users,  load average: 2.22, 3.52, 1.63
USER     TTY      FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
test     ttyS0    -                23:33   10.00s  1.23s  0.02s login -- test
test     pts/0    10.3.218.129     23:34    1:39   0.03s  0.02s sshd: test [priv]
```

3. Username

- From environment variable $USER: root
- From the command 'logname': test

4. ulimit -a

```
core file size          (blocks, -c) 0
data seg size           (kbytes, -d) unlimited
scheduling priority             (-e) 0
file size               (blocks, -f) unlimited
pending signals                 (-i) 16249854
max locked memory       (kbytes, -l) 64
max memory size         (kbytes, -m) unlimited
open files                      (-n) 40000
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) 16249854
virtual memory          (kbytes, -v) unlimited
file locks                      (-x) unlimited
```

5. sysinfo process ancestry

```
/usr/lib/systemd/systemd --switched-root --system --deserialize 18
login -- test
--bash
sudo su
su
bash
bash
runcpu --nobuild --action validate --define default-platform-flags --define numcopies=960 -c
ic2023.2.3-lin-sapphirerapids-rate-20231121.cfg --define smt-on --define cores=480 --define physicalfirst
--define invoke_with_interleave --define drop_caches --tune base -o all intrate
runcpu --nobuild --action validate --define default-platform-flags --define numcopies=960 --configfile
ic2023.2.3-lin-sapphirerapids-rate-20231121.cfg --define smt-on --define cores=480 --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/CPU2017.001/templogs/preenv.intrate.001.0.log --lognum 001.0 --from_runcpu 2
specperl $SPEC/bin/sysinfo
$SPEC = /home/cpu2017
$SPEC = /home/cpu2017
```

6. /proc/cpuinfo

```
model name      : Intel(R) Xeon(R) Platinum 8490H
vendor_id       : GenuineIntel
cpu family      : 6
model           : 143
stepping        : 8
microcode       : 0x2b0004d0
```

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Platform Notes (Continued)

bugs : spectre_v1 spectre_v2 spec_store_bypass swapgs eibrs_pbrsb
cpu cores : 60
siblings : 120
8 physical ids (chips)
960 processors (hardware threads)
physical id 0: core ids 0-59
physical id 1: core ids 0-59
physical id 2: core ids 0-59
physical id 3: core ids 0-59
physical id 4: core ids 0-59
physical id 5: core ids 0-59
physical id 6: core ids 0-59
physical id 7: core ids 0-59
physical id 0: apicids 0-119
physical id 1: apicids 128-247
physical id 2: apicids 256-375
physical id 3: apicids 384-503
physical id 4: apicids 512-631
physical id 5: apicids 640-759
physical id 6: apicids 768-887
physical id 7: apicids 896-1015
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 2.32.1:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 960
On-line CPU(s) list: 0-959
Thread(s) per core: 2
Core(s) per socket: 60
Socket(s): 8
NUMA node(s): 8
Vendor ID: GenuineIntel
BIOS Vendor ID: Intel(R) Corporation
CPU family: 6
Model: 143
Model name: Intel(R) Xeon(R) Platinum 8490H
BIOS Model name: Intel(R) Xeon(R) Platinum 8490H
Stepping: 8
CPU MHz: 3500.000
CPU max MHz: 3500.0000
CPU min MHz: 800.0000
BogoMIPS: 3800.01
L1d cache: 48K
L1i cache: 32K
L2 cache: 2048K
L3 cache: 115200K
NUMA node0 CPU(s): 0-59,480-539
NUMA node1 CPU(s): 60-119,540-599
NUMA node2 CPU(s): 120-179,600-659
NUMA node3 CPU(s): 180-239,660-719
NUMA node4 CPU(s): 240-299,720-779
NUMA node5 CPU(s): 300-359,780-839
NUMA node6 CPU(s): 360-419,840-899
NUMA node7 CPU(s): 420-479,900-959

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Platform Notes (Continued)

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 pae syscall nx pdpe1gb rdtscp lm constant_tsc arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid aperfmperf pni pclmulqdq dtes64 monitor ds_cpl axap est tm2 ssse3 sdbg fma cx16 tpr_shadow pdcz pdcm pcid dca ssecl ssse2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3nowprefetch cpuid_fault epb cat_l3 cat_l2 cmp_legacy intel_pni cpd_l2 sbind ma ibrs ibpb ibrs_enhanced fauset base 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 xsavevc xgetbv1 xsavees cqm_llc cqm_occup_llc cqm_mmm_local split_lock detect avx_vnni fma416 bmi1 avx512_vbmi2 avx512_vbmi4 bmi2 avx512_vpconfidtq la57 rdpid bus_lock_detect cldemote movdiri movdir64b enqmd farm md_clear serialize txslidtrk pconfarch lbr amx_bf16 avx512_fp16 amx_tile amx_int8 flush_l1d arch_capabilities

8. numactl --hardware
NOTE: a numactl 'node' might or might not correspond to a physical chip.
available: 8 nodes (0-7)
node 0 cpus: 0-59,480-539
node 0 size: 507182 MB
node 0 free: 506016 MB
node 1 cpus: 60-119,540-599
node 1 size: 508063 MB
node 1 free: 506538 MB
node 2 cpus: 120-179,600-659
node 2 size: 508063 MB
node 2 free: 506538 MB
node 3 cpus: 180-239,660-719
node 3 size: 508063 MB
node 3 free: 507049 MB
node 4 cpus: 240-299,720-779
node 4 size: 508063 MB
node 4 free: 507049 MB
node 5 cpus: 300-359,780-839
node 5 size: 508063 MB
node 5 free: 507049 MB
node 6 cpus: 360-419,840-899
node 6 size: 508063 MB
node 6 free: 507405 MB
node 7 cpus: 420-479,900-959
node 7 size: 506998 MB
node 7 free: 506321 MB
node distances:
node 0 1 2 3 4 5 6 7
0: 10 16 16 18 40 40 40 40
1: 16 10 18 16 40 40 40 40
2: 16 18 10 16 40 40 40 40
3: 18 16 16 10 40 40 40 40
4: 40 40 40 40 10 16 16 18
5: 40 40 40 40 16 10 18 16
6: 40 40 40 40 18 16 10 16
7: 40 40 40 40 18 16 10 16

9. /proc/meminfo
MemTotal: 4160021440 kB
Platform Notes (Continued)

10. who -r
   run-level 3 Jan 18 23:34

11. Systemd service manager version: systemd 239 (239-74.el8_8)
    Default Target  Status
    multi-user  running

12. Services, from systemctl list-unit-files
    STATE   UNIT FILES
    enabled  ModemManager NetworkManager-dispatcher NetworkManager-wait-online
             abrt-journal-core abrt-oops abrt-vmcore abrt-xorg abrtd accounts-daemon atd auditd autovt@
             avahi-daemon chronyd cgroup cgroup2log cgroup2log2 cgroup2log2init cgroup2log2initvt cgroup2log2initvtvt
cdrcrashlog crond cgroup crond@ crondchk crondchkgracefull shutdown
dcdshutdown display-manager gdm getty@ hpe-auto-config hpe_irdbalance loadaverage loadkmem 
    insights-client-boot iscsi iscsi-onboot kdump kms kasm dmcmpsd loadavg loadmodules lvm2-monitor mcrelog mcmonitor microcode multipathd nis-domainname
    nvmefs-boot-connections pmdc pmdie pmdie-hg pmdie-qemu qemu-guest-agent rpsbind rsyslog
    rtkit-daemon selinux-autorelabel-mark smartd sshd syslog syslog-ng sysstat udev udevd udevfeatures vdo
    vauthd vmsyslogd vtsftpd
    disabled  abrt-ccpp abrt-ptsreopos arp-ethers autofs blk-availability bluetooth bluetoothctl
             canberra-system-bootup canberra-system-bootup canberra-system-shutdown canberra-system-shutdown-reboot cgroup
cordon chrony-wait cni-dhcp console-getty cpupower cups cups-browsed debug-shell dnf-system-upgrade
dnsmasq dovecot dnmeter dovecot dovecot dovecot dovecot dovecot dovecot dovecot dovecot dovecot dovecot dovecot
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    indirect  pcscd serial-getty@ spide-vdagentd ssd-autofs ssdss-ksm ssdss-nss ssdss-pac ssdss-pam ssdss-ssh
             ssdss-udo virtlockd virtlogd vsftpd@
    masked   systemd-timedated

13. Linux kernel boot-time arguments, from /proc/cmdline
    BOOT_IMAGE=(hd2,gpt4)/boot/vmlinuz-4.18.0-477.10.1.el8_8.x86_64
    root=UUID=e65a817a-ecea-4172-8f09-b6a7120f7868
          ro
          loglevel=3
          rd.auto=1
          console=ttyS0,115200n8
          selinux=0
          security=
          console=ttyS0,115200
          udev.device.children-max=512
          nmi_watchdog=0
          uv_nmi.action=kdump
          add_efi_memmap
          tsc=nowatchdog
          bau=0
          earlyprintk=ttyS0,115200
          log_buf_len=8M
          numa_balancing=disable
          crashkernel=1G,high

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Platform Notes (Continued)

14. cpupower frequency-info
   analyzing CPU 0:
   current policy: frequency should be within 3.50 GHz and 3.50 GHz.
   The governor "performance" may decide which speed to use
   within this range.
   boost state support:
   Supported: yes
   Active: yes

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

16. sysctl
   kernel numa balancing 0
   kernel randomize va space 2
   vm compaction proactiveness 0
   vm dirty background bytes 0
   vm dirty background ratio 10
   vm dirty bytes 0
   vm dirty expire centiseconds 3000
   vm dirty ratio 40
   vm dirty writeback centiseconds 500
   vm dirtytime expire seconds 43200
   vm extr frag threshold 500
   vm min unmapped ratio 1
   vm nr huge pages 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

17. /sys/kernel/mm/transparent_hugepage
   defrag always defer defer+advise [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 swap 64
   pages to scan 4096
   scan sleep millisecs 10000

19. OS release
   From /etc/*-release /etc/*-version
   os release Red Hat Enterprise Linux 8.8 (Ootpa)
   hpe foundation release HPE Foundation Software 2.5.0, Build 750.0880.240110T0100.a.rhel88hpe-240110T0100
   redhat release Red Hat Enterprise Linux release 8.8 (Ootpa)
   system release Red Hat Enterprise Linux release 8.8 (Ootpa)

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Platform Notes (Continued)

20. Kernel self-reported vulnerability status, from /sys/devices/system/cpu/vulnerabilities

  itlb_multihit        Not affected
  l1tf                Not affected
  mds                Not affected
  meltdown            Not affected
  mmio_stale_data    Not affected
  retbleed             Not affected
  spec_store_bypass  Mitigation: Speculative Store Bypass disabled via prctl
  spectre_v1          Mitigation: usercopy/swaps barriers and __user pointer sanitization
  spectre_v2          Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling, PBRSB-eIBRS: SW sequence
  srbds              Not affected
  tsx_async_abort     Not affected

For more information, see the Linux documentation on hardware vulnerabilities, for example

21. Disk information
SPEC is set to: /home/cpu2017
Filesystem     Type  Size  Used Avail Use% Mounted on
/dev/nvme0n1p4 xfs   2.3T   19G  2.3T   1% /

22. /sys/devices/virtual/dmi/id
Vendor:         HPE
Product:        Compute Scale-up Server 3200
Product Family: 1590PID03030201
Serial:         5UF2491412-000

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:
  64x Samsung M321R8GA0BB0-CQKZH 64 GB 2 rank 4800

24. BIOS
(BThis section combines info from /sys/devices and dmidecode.)
BIOS Vendor:       HPE
BIOS Version:      Bundle:1.10.342-20231206_161054 SFW:009.010.108.000.2312042027
BIOS Date:         12/04/2023

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.leeel_r(base)
-----------------------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
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(Continued on next page)
Hewlett Packard Enterprise
(Test Sponsor: HPE)
HPE Compute Scale-up Server 3200
(1.90 GHz, Intel Xeon Platinum 8490H)

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**SPECrater®2017_int_base = 3720**

**SPECrater®2017_int_peak = Not Run**

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### Compiler Version Notes (Continued)

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Fortran | 548.exchange2_r(base)
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Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
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### 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.xalanchmk_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/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

(Continued on next page)
**SPEC CPU®2017 Integer Rate Result**

**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
HPE Compute Scale-up Server 3200  
(1.90 GHz, Intel Xeon Platinum 8490H)  

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<td>Software Availability: Dec-2023</td>
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### Base Optimization Flags (Continued)

**C++ benchmarks (continued):**
- `-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/HPE-Platform-Flags-Intel-SDSS-rev1.0.html](http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-SDSS-rev1.0.html)

You can also download the XML flags sources by saving the following links:
- [http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-SDSS-rev1.0.xml](http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-SDSS-rev1.0.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 2024-01-19 00:36:10-0500.  
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