# SPEC CPU®2017 Floating Point Rate Result

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## Hewlett Packard Enterprise

(Test Sponsor: HPE)

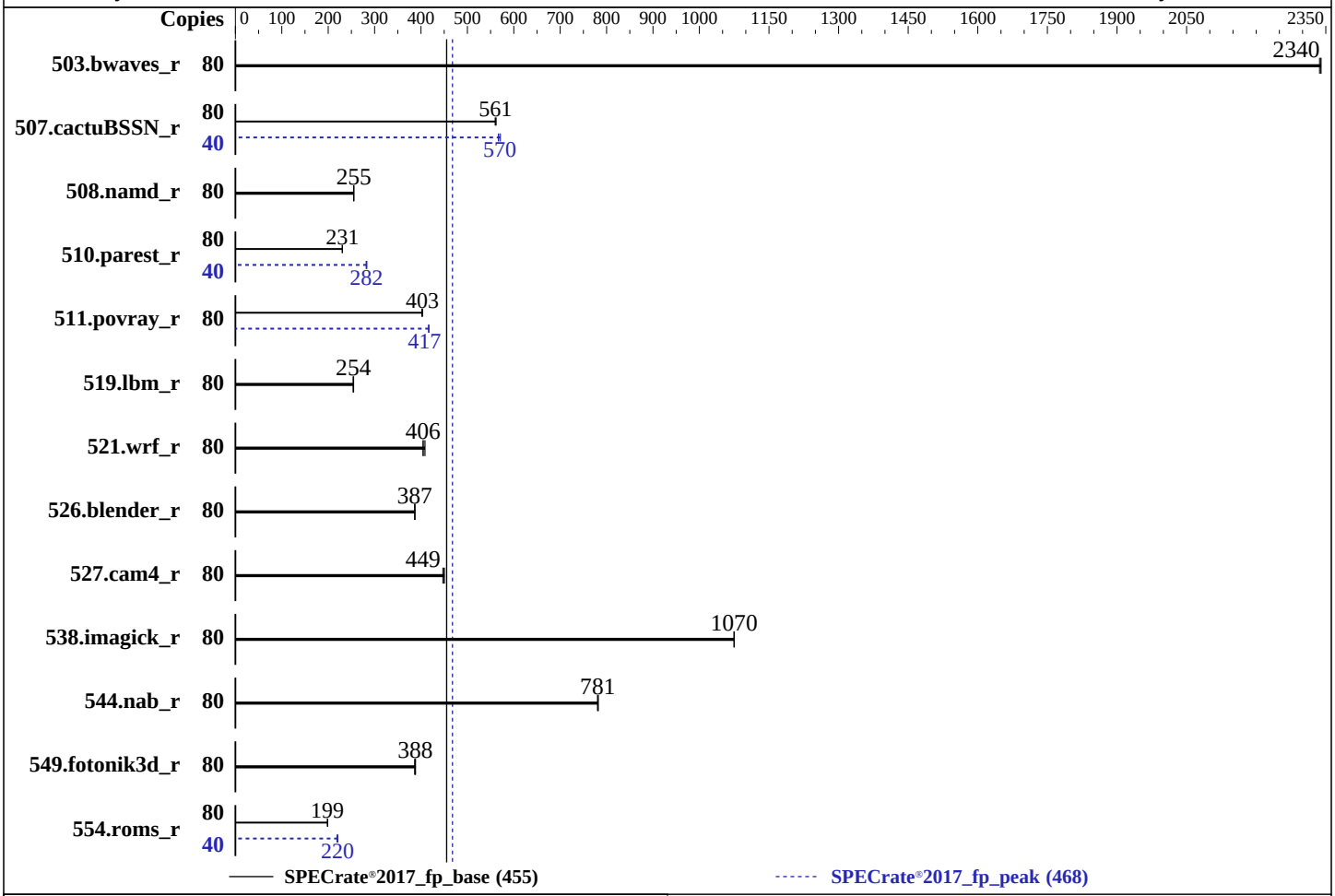
ProLiant ML350 Gen11
(2.00 GHz, Intel Xeon Silver 4416+)

**SPECrate®2017_fp_base = 455**

**SPECrate®2017_fp_peak = 468**

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

**Test Date:** Mar-2023
**Hardware Availability:** Jan-2023
**Software Availability:** Mar-2023




## Hardware

| | |
|---|---|
| CPU Name: | Intel Xeon Silver 4416+ |
| Max MHz: | 3900 |
| Nominal: | 2000 |
| Enabled: | 40 cores, 2 chips, 2 threads/core |
| Orderable: | 1, 2 chip(s) |
| Cache L1: | 32 KB I + 48 KB D on chip per core |
| L2: | 2 MB I+D on chip per core |
| L3: | 37.5 MB I+D on chip per chip |
| Other: | None |
| Memory: | 1 TB (16 x 64 GB 2Rx4 PC5-4800B-R, running at 4000) |
| Storage: | 1 x 480 GB SATA SSD |
| Other: | None |

## Software

| | |
|---|---|
| OS: | Red Hat Enterprise Linux release 9.0 (Plow)<br>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;<br>Fortran: Version 2023.0 of Intel Fortran Compiler for Linux; |
| Parallel: | No |
| Firmware: | HPE BIOS Version v1.22 01/18/2023 released Jan-2023 |
| File System: | xfs |
| System State: | Run level 3 (multi-user) |
| Base Pointers: | 64-bit |
| Peak Pointers: | 64-bit |
| Other: | jemalloc memory allocator V5.0.1 |
| 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 |
| 503.bwaves_r | 80 | 343 | 2340 | 343 | 2340 | **343** | **2340** | 80 | 343 | 2340 | 343 | 2340 | **343** | **2340** |
| 507.cactuBSSN_r | 80 | 180 | 562 | **181** | **561** | 181 | 560 | 40 | **88.9** | **570** | 89.4 | 567 | 88.6 | 571 |
| 508.namd_r | 80 | **298** | **255** | 298 | 255 | 298 | 255 | 80 | **298** | **255** | 298 | 255 | 298 | 255 |
| 510.parest_r | 80 | 907 | 231 | **907** | **231** | 909 | 230 | 40 | 369 | 283 | **371** | **282** | 371 | 282 |
| 511.povray_r | 80 | 465 | 402 | 463 | 403 | **464** | **403** | 80 | 448 | 417 | 449 | 416 | **448** | **417** |
| 519.lbm_r | 80 | 332 | 254 | **331** | **254** | 331 | 255 | 80 | 332 | 254 | **331** | **254** | 331 | 255 |
| 521.wrf_r | 80 | **441** | **406** | 444 | 404 | 438 | 409 | 80 | **441** | **406** | 444 | 404 | 438 | 409 |
| 526.blender_r | 80 | 315 | 387 | 315 | 386 | **315** | **387** | 80 | 315 | 387 | 315 | 386 | **315** | **387** |
| 527.cam4_r | 80 | 313 | 447 | **312** | **449** | 311 | 451 | 80 | 313 | 447 | **312** | **449** | 311 | 451 |
| 538.imagick_r | 80 | 185 | 1070 | 185 | 1080 | **185** | **1070** | 80 | 185 | 1070 | 185 | 1080 | **185** | **1070** |
| 544.nab_r | 80 | 172 | 782 | 173 | 780 | **172** | **781** | 80 | 172 | 782 | 173 | 780 | **172** | **781** |
| 549.fotonik3d_r | 80 | **804** | **388** | 807 | 386 | 803 | 388 | 80 | **804** | **388** | 807 | 386 | 803 | 388 |
| 554.roms_r | 80 | 641 | 198 | 640 | 199 | **640** | **199** | 40 | 288 | 221 | **289** | **220** | 291 | 219 |

**SPECrate®2017_fp_base = 455**

**SPECrate®2017_fp_peak = 468**

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 Throughput-Performance using "tuned-adm profile throughput-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/je5.0.1-64"
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.
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.
 jemalloc, a general purpose malloc implementation
 built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5
 sources available from jemalloc.net or https://github.com/jemalloc/jemalloc/releases
```

## Platform Notes

```
The system ROM used for this result contains Intel microcode version 0x2b000161 for
the Intel Xeon Silver 4416+ processor.
BIOS Configuration:
 Workload Profile set to General Throughput Compute
 Thermal Configuration set to Maximum Cooling
 Enhanced Processor Performance Profile set to Aggressive
 Last Level Cache (LLC) Dead Line Allocation set to Disabled
 Memory Patrol Scrubbing set to Disabled
 Workload Profile set to Custom
  DCU Stream Prefetcher set to Disabled
  Adjacent Sector Prefetch set to Disabled
  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 localhost.localdomain Thu Mar 23 17:18:40 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
  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
 ------------------------------------------------------------
```

**(Continued on next page)**

## Platform Notes (Continued)

```
------------------------------------------------------------
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
   17:18:40 up 15 min,  0 users,  load average: 0.00, 0.05, 0.14
  USER     TTY        LOGIN@   IDLE   JCPU   PCPU WHAT

------------------------------------------------------------
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) 4127202
  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) 4127202
  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@notty
 bash -c cd $SPEC/ && $SPEC/SPR_fprate.sh
 runcpu --nobuild --action validate --define default-platform-flags --define numcopies=80 -c
   ic2023.0-lin-sapphirerapids-rate-20221201.cfg --define smt-on --define cores=40 --define physicalfirst
   --define invoke_with_interleave --define drop_caches --tune base,peak -o all fprate
 runcpu --nobuild --action validate --define default-platform-flags --define numcopies=80 --configfile
   ic2023.0-lin-sapphirerapids-rate-20221201.cfg --define smt-on --define cores=40 --define physicalfirst
   --define invoke_with_interleave --define drop_caches --tune base,peak --output_format all --nopower
   --runmode rate --tune base:peak --size refrate fprate --nopreenv --note-preenv --logfile
   $SPEC/tmp/CPU2017.001/templogs/preenv.fprate.001.0.log --lognum 001.0 --from_runcpu 2
 specperl $SPEC/bin/sysinfo
$SPEC = /home/cpu2017

------------------------------------------------------------
6. /proc/cpuinfo
    model name      : Intel(R) Xeon(R) Silver 4416+
    vendor_id       : GenuineIntel
    cpu family      : 6
    model           : 143
    stepping        : 7
```

(Continued on next page)

## Platform Notes (Continued)

```
     microcode       : 0x2b000161
     bugs            : spectre_v1 spectre_v2 spec_store_bypass swapgs
     cpu cores       : 20
     siblings        : 40
     2 physical ids (chips)
     80 processors (hardware threads)
     physical id 0: core ids 0-19
     physical id 1: core ids 0-19
     physical id 0: apicids 0-39
     physical id 1: apicids 128-167
   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):                          80
   On-line CPU(s) list:             0-79
   Vendor ID:                       GenuineIntel
   BIOS Vendor ID:                  Intel(R) Corporation
   Model name:                      Intel(R) Xeon(R) Silver 4416+
   BIOS Model name:                 Intel(R) Xeon(R) Silver 4416+
   CPU family:                      6
   Model:                           143
   Thread(s) per core:              2
   Core(s) per socket:              20
   Socket(s):                       2
   Stepping:                        7
   BogoMIPS:                        4000.00
   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 avx512_fp16 amx_tile flush_l1d arch_capabilities
   Virtualization:                  VT-x
   L1d cache:                       1.9 MiB (40 instances)
   L1i cache:                       1.3 MiB (40 instances)
   L2 cache:                        80 MiB (40 instances)
   L3 cache:                        75 MiB (2 instances)
   NUMA node(s):                    2
   NUMA node0 CPU(s):               0-19,40-59
   NUMA node1 CPU(s):               20-39,60-79
   Vulnerability Itlb multihit:     Not affected
```

**(Continued on next page)**

## Platform Notes (Continued)

```
  Vulnerability L1tf:              Not affected
  Vulnerability Mds:               Not affected
  Vulnerability Meltdown:          Not affected
  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; 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     1.9M   12 Data            1    64        1             64
     L1i       32K     1.3M    8 Instruction     1    64        1             64
     L2         2M      80M   16 Unified         2  2048        1             64
     L3      37.5M      75M   15 Unified         3 40960        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: 0-19,40-59
  node 0 size: 515763 MB
  node 0 free: 514322 MB
  node 1 cpus: 20-39,60-79
  node 1 size: 516076 MB
  node 1 free: 515100 MB
  node distances:
  node   0   1
    0:  10  20
    1:  20  10

------------------------------------------------------------
9. /proc/meminfo
   MemTotal:       1056604484 kB

------------------------------------------------------------
10. who -r
  run-level 3 Mar 23 17:04

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

------------------------------------------------------------
12. Services, from systemctl list-unit-files
  STATE            UNIT FILES
  enabled          NetworkManager NetworkManager-dispatcher NetworkManager-wait-online auditd chronyd crond
                   dbus-broker firewalld getty@ irqbalance iscsi iscsi-onboot kdump libstoragemgmt
                   lvm2-monitor mdmonitor microcode multipathd nis-domainname rhsmcertd rpcbind rsyslog
                   selinux-autorelabel-mark sshd sssd sysstat systemd-network-generator udisks2 upower
                   virtqemud
  enabled-runtime  systemd-remount-fs
  disabled         blk-availability brltty canberra-system-bootup canberra-system-shutdown
                   canberra-system-shutdown-reboot chrony-wait console-getty cpupower debug-shell dnsmasq
                   gssproxy httpd httpd@ hwloc-dump-hwdata ipa-custodia iscsid iscsiuio kvm_stat
                   libvirt-guests libvirtd man-db-restart-cache-update ndctl-monitor nfs-blkmap nfs-server
                   nftables nmb numad pmcd pmfind pmie pmie_farm pmlogger pmlogger_farm pmproxy radiusd rdisc
                   rhsm rhsm-facts rpmdb-rebuild saslauthd serial-getty@ smb speech-dispatcherd sshd-keygen@
                   systemd-boot-check-no-failures systemd-nspawn@ systemd-pstore systemd-sysext virtnetworkd
```

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## Platform Notes (Continued)

```
                  virtproxyd virtsecretd virtstoraged winbind
  indirect        pcscd sssd-autofs sssd-kcm sssd-nss sssd-pac sssd-pam sssd-ssh sssd-sudo virtlockd
                  virtlogd

------------------------------------------------------------
13. Linux kernel boot-time arguments, from /proc/cmdline
  BOOT_IMAGE=(hd0,gpt2)/vmlinuz-5.14.0-70.13.1.el9_0.x86_64
  root=/dev/mapper/rhel-root
  ro
  resume=/dev/mapper/rhel-swap
  rd.lvm.lv=rhel/root
  rd.lvm.lv=rhel/swap

------------------------------------------------------------
14. cpupower frequency-info
  analyzing CPU 0:
    Unable to determine current policy
    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
  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
```

**(Continued on next page)**

## Platform Notes (Continued)

```
------------------------------------------------------------
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   372G  129G  243G  35% /home

------------------------------------------------------------
20. /sys/devices/virtual/dmi/id
    Vendor:         HPE
    Product:        ProLiant ML350 Gen11
    Product Family: ProLiant
    Serial:         CNX20800P4

------------------------------------------------------------
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:
    16x Samsung M321R8GA0BB0-CQKDG 64 GB 2 rank 4800, configured at 4000


------------------------------------------------------------
22. BIOS
(This section combines info from /sys/devices and dmidecode.)
   BIOS Vendor:       HPE
   BIOS Version:      1.22
   BIOS Date:         01/18/2023
   BIOS Revision:     1.22
   Firmware Revision: 1.20
```

## Compiler Version Notes

```
==============================================================================================================
C              | 519.lbm_r(base, peak) 538.imagick_r(base, peak) 544.nab_r(base, peak)
--------------------------------------------------------------------------------------------------------------
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++            | 508.namd_r(base, peak) 510.parest_r(base, peak)
--------------------------------------------------------------------------------------------------------------
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++, C         | 511.povray_r(base, peak) 526.blender_r(base, peak)
--------------------------------------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
```

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## Compiler Version Notes (Continued)

```
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
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++, C, Fortran | 507.cactuBSSN_r(base, peak)
--------------------------------------------------------------------------------------------------------------
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.
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.
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.
------------------------------------------------------------------------------------------------------------

==============================================================================================================
Fortran         | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak) 554.roms_r(base, peak)
--------------------------------------------------------------------------------------------------------------
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.
------------------------------------------------------------------------------------------------------------

==============================================================================================================
Fortran, C      | 521.wrf_r(base, peak) 527.cam4_r(base, peak)
--------------------------------------------------------------------------------------------------------------
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.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
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------------------------------------------------------------------------------------------------------------
```

## Base Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:
ifx

Benchmarks using both Fortran and C:
ifx icx

Benchmarks using both C and C++:
icpx icx

Benchmarks using Fortran, C, and C++:
icpx icx ifx

## Base Portability Flags

503.bwaves_r: -DSPEC_LP64
507.cactuBSSN_r: -DSPEC_LP64
508.namd_r: -DSPEC_LP64
510.parest_r: -DSPEC_LP64
511.povray_r: -DSPEC_LP64
519.lbm_r: -DSPEC_LP64
521.wrf_r: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
526.blender_r: -DSPEC_LP64 -DSPEC_LINUX -funsigned-char
527.cam4_r: -DSPEC_LP64 -DSPEC_CASE_FLAG
538.imagick_r: -DSPEC_LP64
544.nab_r: -DSPEC_LP64
549.fotonik3d_r: -DSPEC_LP64
554.roms_r: -DSPEC_LP64

## Base Optimization Flags

C benchmarks:
-w -std=c11 -m64 -Wl,-z,muldefs -xsapphirerapids -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-Wno-implicit-int -mprefer-vector-width=512 -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

C++ benchmarks:
-w -std=c++14 -m64 -Wl,-z,muldefs -xsapphirerapids -Ofast
-ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -mprefer-vector-width=512 -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

Fortran benchmarks:
-w -m64 -Wl,-z,muldefs -xsapphirerapids -Ofast -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte -auto -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

Benchmarks using both Fortran and C:
-w -m64 -std=c11 -Wl,-z,muldefs -xsapphirerapids -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-Wno-implicit-int -mprefer-vector-width=512 -nostandard-realloc-lhs
-align array32byte -auto -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib

Benchmarks using both C and C++:
-w -std=c++14 -m64 -std=c11 -Wl,-z,muldefs -xsapphirerapids -Ofast
-ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -Wno-implicit-int -mprefer-vector-width=512

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## Base Optimization Flags (Continued)

Benchmarks using both C and C++ (continued):
`-ljemalloc -L/usr/local/jemalloc64-5.0.1/lib`

Benchmarks using Fortran, C, and C++:
`-w -m64 -std=c++14 -std=c11 -Wl,-z,muldefs -xsapphirerapids -Ofast -ffast-math -flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -Wno-implicit-int -mprefer-vector-width=512 -nostandard-realloc-lhs -align array32byte -auto -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib`

## Peak Compiler Invocation

C benchmarks:
`icx`

C++ benchmarks:
`icpx`

Fortran benchmarks:
`ifx`

Benchmarks using both Fortran and C:
`ifx icx`

Benchmarks using both C and C++:
`icpx icx`

Benchmarks using Fortran, C, and C++:
`icpx icx ifx`

## Peak Portability Flags

`Same as Base Portability Flags`

## Peak Optimization Flags

C benchmarks:

519.lbm_r: `basepeak = yes`

**(Continued on next page)**

## Peak Optimization Flags (Continued)

538.imagick_r: `basepeak = yes`

544.nab_r: `basepeak = yes`

C++ benchmarks:

508.namd_r: `basepeak = yes`

510.parest_r: `-w -std=c++14 -m64 -Wl,-z,muldefs -xsapphirerapids -Ofast -ffast-math -flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -mprefer-vector-width=512 -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib`

Fortran benchmarks:

503.bwaves_r: `basepeak = yes`

549.fotonik3d_r: `basepeak = yes`

554.roms_r: `-w -m64 -Wl,-z,muldefs -xsapphirerapids -Ofast -ffast-math -flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte -auto -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib`

Benchmarks using both Fortran and C:

521.wrf_r: `basepeak = yes`

527.cam4_r: `basepeak = yes`

Benchmarks using both C and C++:

511.povray_r: `-w -std=c++14 -m64 -std=c11 -Wl,-z,muldefs -fprofile-generate`(pass 1) `-fprofile-use=default.profdata`(pass 2) `-xCORE-AVX2`(pass 1) `-flto -Ofast -xCORE-AVX512 -ffast-math -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -Wno-implicit-int -mprefer-vector-width=512 -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib`

526.blender_r: `basepeak = yes`

Benchmarks using Fortran, C, and C++:
`-w -m64 -std=c++14 -std=c11 -Wl,-z,muldefs -xsapphirerapids -Ofast -ffast-math -flto -mfpmath=sse -funroll-loops`

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## Peak Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++ (continued):
-qopt-mem-layout-trans=4 -Wno-implicit-int -mprefer-vector-width=512
-nostandard-realloc-lhs -align array32byte -auto -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-SPR-rev1.2.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-SPR-rev1.2.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.



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