SPEC CPU®2017 Floating Point Speed Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)
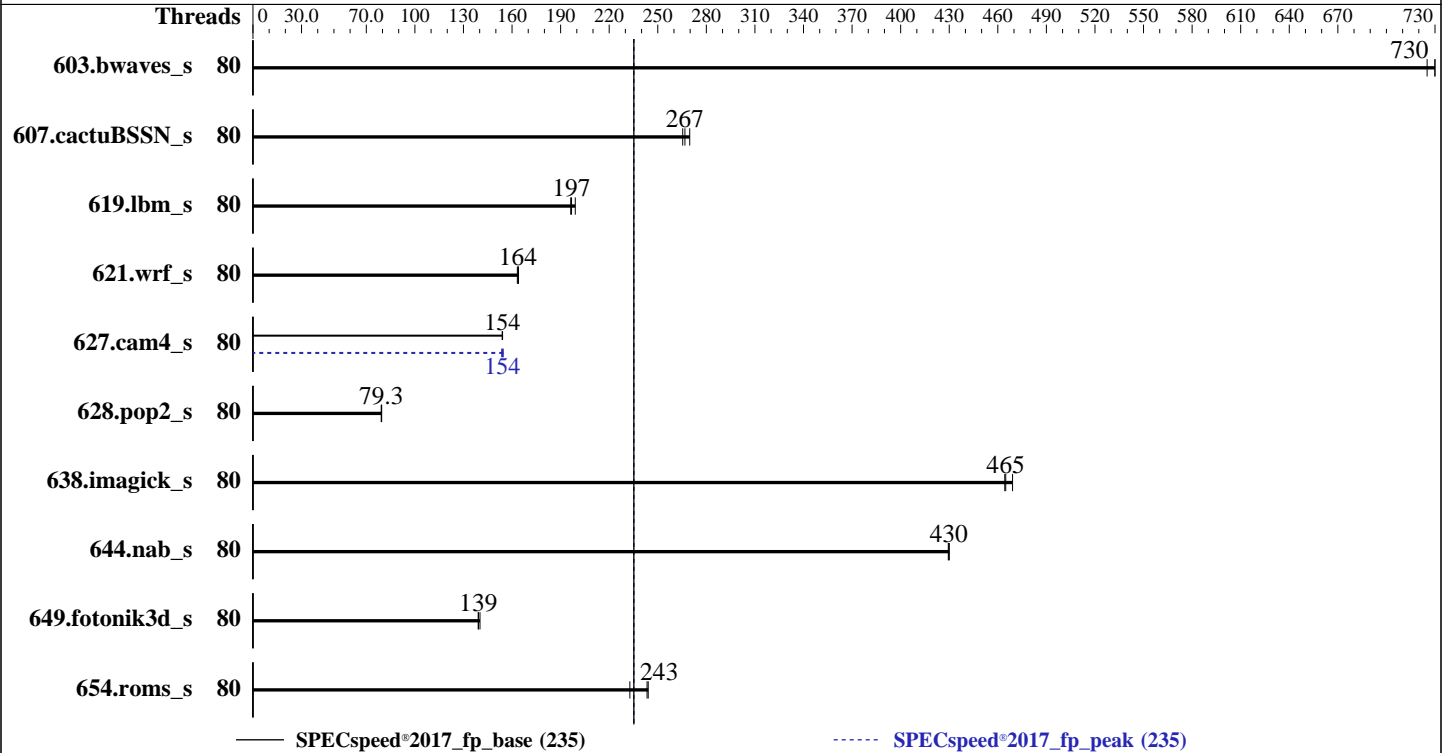
ProLiant DL360 Gen11
(2.00 GHz, Intel Xeon Silver 4416+)

$SPECspeed®2017\_fp\_base = 235$

$SPECspeed®2017\_fp\_peak = 235$

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

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

Threads	Result
603.bwaves_s 80	730
607.cactuBSSN_s 80	267
619.lbm_s 80	197
621.wrf_s 80	164
627.cam4_s 80	154 / 154
628.pop2_s 80	79.3
638.imagick_s 80	465
644.nab_s 80	430
649.fotonik3d_s 80	139
654.roms_s 80	243

SPECspeed®2017_fp_base (235) ——— SPECspeed®2017_fp_peak (235) -----

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: 512 GB (16 x 32 GB 2Rx8 PC5-4800B-R, running at 4000)
Storage: 1 x 960 GB SATA SSD
Other: None

Software

OS: SUSE Linux Enterprise Server 15 SP4
Kernel 5.14.21-150400.22-default
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: Yes
Firmware: HPE BIOS Version v1.30 03/01/2023 released Mar-2023
File System: xfs
System State: Run level 5 (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						
	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
603.bwaves_s	80	**80.8**	**730**	81.4	725	80.8	730	80	**80.8**	**730**	81.4	725	80.8	730
607.cactuBSSN_s	80	61.8	270	62.8	265	**62.5**	**267**	80	61.8	270	62.8	265	**62.5**	**267**
619.lbm_s	80	**26.6**	**197**	26.3	199	26.7	196	80	**26.6**	**197**	26.3	199	26.7	196
621.wrf_s	80	81.0	163	80.7	164	**80.8**	**164**	80	81.0	163	80.7	164	**80.8**	**164**
627.cam4_s	80	57.6	154	**57.5**	**154**	57.5	154	80	**57.5**	**154**	57.3	155	57.7	154
628.pop2_s	80	**150**	**79.3**	150	79.3	149	79.5	80	**150**	**79.3**	150	79.3	149	79.5
638.imagick_s	80	30.8	469	**31.0**	**465**	31.1	464	80	30.8	469	**31.0**	**465**	31.1	464
644.nab_s	80	40.6	430	40.7	429	**40.7**	**430**	80	40.6	430	40.7	429	**40.7**	**430**
649.fotonik3d_s	80	**65.5**	**139**	65.0	140	65.5	139	80	**65.5**	**139**	65.0	140	65.5	139
654.roms_s	80	64.5	244	**64.7**	**243**	67.6	233	80	64.5	244	**64.7**	**243**	67.6	233
SPECspeed®2017_fp_base =		**235**												
SPECspeed®2017_fp_peak =		**235**												

Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

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"
```

Environment Variables Notes

```
Environment variables set by runcpu before the start of the run:
KMP_AFFINITY = "granularity=fine,compact"
LD_LIBRARY_PATH = "/home/cpu2017/lib/intel64:/home/cpu2017/je5.0.1-64"
MALLOC_CONF = "retain:true"
OMP_STACKSIZE = "192M"
```

General Notes

```
Binaries compiled on a system with 2x Intel Xeon Platinum 8280M CPU + 384GB RAM
memory using Redhat Enterprise Linux 8.0
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.
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
```

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CPU2017 License: 3   **Test Date:**   May-2023
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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 Peak Frequency Compute
  Thermal Configuration set to Maximum Cooling
  Memory Patrol Scrubbing set to Disabled
  Last Level Cache (LLC) Prefetch set to Enabled
  Last Level Cache (LLC) Dead Line Allocation set to Disabled
  Enhanced Processor Performance Profile set to Aggressive
  Dead Block Predictor set to Enabled
  Workload Profile set to Custom
   Intel DMI Link Frequency set to Gen2 Speed
   Adjacent Sector Prefetch set to Disabled
   Minimum Processor Idle Power Package C-State set to No Package State

 Sysinfo program /home/cpu2017/bin/sysinfo
 Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
 running on localhost Mon May  8 13:09:16 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 249 (249.11+suse.124.g2bc0b2c447)
 12. Services, from systemctl list-unit-files
 13. Linux kernel boot-time arguments, from /proc/cmdline
 14. cpupower frequency-info
 15. sysctl
 16. /sys/kernel/mm/transparent_hugepage
 17. /sys/kernel/mm/transparent_hugepage/khugepaged
 18. OS release
 19. Disk information
 20. /sys/devices/virtual/dmi/id
 21. dmidecode
 22. BIOS
 ------------------------------------------------------------


 ------------------------------------------------------------
 1. uname -a
   Linux localhost 5.14.21-150400.22-default #1 SMP PREEMPT_DYNAMIC Wed May 11 06:57:18 UTC 2022 (49db222)
   x86_64 x86_64 x86_64 GNU/Linux

 ------------------------------------------------------------
 2. w
    13:09:16 up 15 min,  0 users,  load average: 0.00, 0.02, 0.01
   USER     TTY      FROM             LOGIN@   IDLE   JCPU   PCPU WHAT

 ------------------------------------------------------------
 3. Username
```

(Continued on next page)

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Platform Notes (Continued)

```
   From environment variable $USER:  root


   ----------------------------------------------------------
4. ulimit -a
   core file size          (blocks, -c) unlimited
   data seg size           (kbytes, -d) unlimited
   scheduling priority             (-e) 0
   file size               (blocks, -f) unlimited
   pending signals                 (-i) 2062803
   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) 2062803
   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@notty
 bash -c cd $SPEC/ && $SPEC/fpspeed.sh
 runcpu --nobuild --action validate --define default-platform-flags -c
   ic2023.0-lin-sapphirerapids-speed-20221201.cfg --define cores=80 --tune base,peak -o all --define
   drop_caches fpspeed
 runcpu --nobuild --action validate --define default-platform-flags --configfile
   ic2023.0-lin-sapphirerapids-speed-20221201.cfg --define cores=80 --tune base,peak --output_format all
   --define drop_caches --nopower --runmode speed --tune base:peak --size refspeed fpspeed --nopreenv
   --note-preenv --logfile $SPEC/tmp/CPU2017.001/templogs/preenv.fpspeed.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
    microcode       : 0x2b0001b0
    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
```

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Platform Notes (Continued)

```
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):                  80
  On-line CPU(s) list:     0-79
  Vendor ID:               GenuineIntel
  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 hle avx2 smep
                           bmi2 erms invpcid rtm 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
  Vulnerability L1tf:            Not affected
  Vulnerability Mds:             Not affected
  Vulnerability Meltdown:        Not affected
  Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
  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

  -----------------------------------------------------------
```

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Platform Notes (Continued)

```
 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: 257750 MB
  node 0 free: 256336 MB
  node 1 cpus: 20-39,60-79
  node 1 size: 257974 MB
  node 1 free: 256827 MB
  node distances:
  node   0   1
    0:  10  20
    1:  20  10


 ----------------------------------------------------------
 9. /proc/meminfo
  MemTotal:      528102892 kB


 ----------------------------------------------------------
10. who -r
  run-level 5 May 8 12:54


 ----------------------------------------------------------
11. Systemd service manager version: systemd 249 (249.11+suse.124.g2bc0b2c447)
  Default Target  Status
  graphical       running


 ----------------------------------------------------------
12. Services, from systemctl list-unit-files
  STATE            UNIT FILES
  enabled          ModemManager YaST2-Firstboot YaST2-Second-Stage apparmor auditd bluetooth cron
                   display-manager getty@ haveged irqbalance iscsi issue-generator kbdsettings klog
                   lvm2-monitor nscd postfix purge-kernels rollback rsyslog smartd sshd wicked wickedd-auto4
                   wickedd-dhcp4 wickedd-dhcp6 wickedd-nanny wpa_supplicant
  enabled-runtime  systemd-remount-fs
  disabled         NetworkManager NetworkManager-dispatcher NetworkManager-wait-online accounts-daemon
                   appstream-sync-cache autofs autoyast-initscripts blk-availability bluetooth-mesh
                   boot-sysctl ca-certificates chrony-wait chronyd console-getty cups cups-browsed
                   debug-shell dnsmasq ebtables exchange-bmc-os-info firewalld gpm grub2-once
                   haveged-switch-root ipmi ipmievd iscsi-init iscsid iscsiuio issue-add-ssh-keys kexec-load
                   lunmask man-db-create multipathd nfs nfs-blkmap nm-cloud-setup nmb openvpn@ ostree-remount
                   pppoe pppoe-server rdisc rpcbind rpmconfigcheck rsyncd rtkit-daemon serial-getty@
                   smartd_generate_opts smb snmpd snmptrapd speech-dispatcherd systemd-boot-check-no-failures
                   systemd-network-generator systemd-sysext systemd-time-wait-sync systemd-timesyncd udisks2
                   upower wpa_supplicant@
  indirect         pcscd saned@ wickedd

 ----------------------------------------------------------
13. Linux kernel boot-time arguments, from /proc/cmdline
  BOOT_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default
  root=UUID=1e60573a-310f-4bf6-bf70-5d68ef583396
  splash=silent
  resume=/dev/disk/by-uuid/cf0ec919-f0ba-4578-8c4a-52c5338b25df
  mitigations=auto
  quiet
  security=apparmor


 ----------------------------------------------------------
 14. cpupower frequency-info
  analyzing CPU 0:
```

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Platform Notes (Continued)

```
     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


    ----------------------------------------------------------
18. OS release
  From /etc/*-release /etc/*-version
  os-release SUSE Linux Enterprise Server 15 SP4


    ----------------------------------------------------------
19. Disk information
SPEC is set to: /home/cpu2017
  Filesystem      Type  Size  Used Avail Use% Mounted on
  /dev/sda4       xfs   349G  108G  242G  31% /home


    ----------------------------------------------------------
20. /sys/devices/virtual/dmi/id
    Vendor:         HPE
    Product:        ProLiant DL360 Gen11
    Product Family: ProLiant
```

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Platform Notes (Continued)

```
      Serial:        CNX2070DC1


   -------------------------------------------------------------
 21. dmidecode
   Additional information from dmidecode 3.2 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:
     4x Hynix HMCG88AEBRA168N 32 GB 2 rank 4800, configured at 4000
     8x Hynix HMCG88MEBRA113N 32 GB 2 rank 4800, configured at 4000
     4x Hynix HMCG88MEBRA115N 32 GB 2 rank 4800, configured at 4000



   -------------------------------------------------------------
 22. BIOS
 (This section combines info from /sys/devices and dmidecode.)
    BIOS Vendor:       HPE
    BIOS Version:      1.30
    BIOS Date:         03/01/2023
    BIOS Revision:     1.30
    Firmware Revision: 1.20
```

Compiler Version Notes

```
==============================================================================================
C              | 619.lbm_s(base, peak) 638.imagick_s(base, peak) 644.nab_s(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, Fortran | 607.cactuBSSN_s(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.
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Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
----------------------------------------------------------------------------------------------


==============================================================================================
Fortran        | 603.bwaves_s(base, peak) 649.fotonik3d_s(base, peak) 654.roms_s(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     | 621.wrf_s(base, peak) 627.cam4_s(base, peak) 628.pop2_s(base, peak)
----------------------------------------------------------------------------------------------
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
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SPECspeed®2017_fp_peak = 235

CPU2017 License:	3	**Test Date:**	May-2023
Test Sponsor:	HPE	**Hardware Availability:**	Mar-2023
Tested by:	HPE	**Software Availability:**	Dec-2022

Base Compiler Invocation

C benchmarks:
`icx`

Fortran benchmarks:
`ifx`

Benchmarks using both Fortran and C:
`ifx icx`

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

Base Portability Flags

603.bwaves_s: `-DSPEC_LP64`
607.cactuBSSN_s: `-DSPEC_LP64`
619.lbm_s: `-DSPEC_LP64`
621.wrf_s: `-DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian`
627.cam4_s: `-DSPEC_LP64 -DSPEC_CASE_FLAG`
628.pop2_s: `-DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian`
`-assume byterecl`
638.imagick_s: `-DSPEC_LP64`
644.nab_s: `-DSPEC_LP64`
649.fotonik3d_s: `-DSPEC_LP64`
654.roms_s: `-DSPEC_LP64`

Base Optimization Flags

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

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

Benchmarks using both Fortran and C:
`-m64 -std=c11 -Wl,-z,muldefs -xsapphirerapids -Ofast -ffast-math`

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Hewlett Packard Enterprise
(Test Sponsor: HPE)

SPECspeed®2017_fp_base = 235

ProLiant DL360 Gen11
(2.00 GHz, Intel Xeon Silver 4416+)

SPECspeed®2017_fp_peak = 235

CPU2017 License: 3		**Test Date:**	May-2023
Test Sponsor:	HPE	**Hardware Availability:**	Mar-2023
Tested by:	HPE	**Software Availability:**	Dec-2022

Base Optimization Flags (Continued)

Benchmarks using both Fortran and C (continued):
```
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -fiopenmp
-DSPEC_OPENMP -Wno-implicit-int -mprefer-vector-width=512
-nostandard-realloc-lhs -align array32byte -auto
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc
```

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

Peak Compiler Invocation

C benchmarks:
```
icx
```

Fortran benchmarks:
```
ifx
```

Benchmarks using both Fortran and C:
```
ifx icx
```

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

Peak Portability Flags

```
Same as Base Portability Flags
```

Peak Optimization Flags

C benchmarks:

619.lbm_s: `basepeak = yes`

638.imagick_s: `basepeak = yes`

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SPEC CPU®2017 Floating Point Speed Result

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Hewlett Packard Enterprise
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ProLiant DL360 Gen11
(2.00 GHz, Intel Xeon Silver 4416+)

SPECspeed®2017_fp_base = 235

SPECspeed®2017_fp_peak = 235

CPU2017 License: 3		**Test Date:**	May-2023
Test Sponsor: HPE		**Hardware Availability:**	Mar-2023
Tested by: HPE		**Software Availability:**	Dec-2022

Peak Optimization Flags (Continued)

644.nab_s: `basepeak = yes`

Fortran benchmarks:

603.bwaves_s: `basepeak = yes`

649.fotonik3d_s: `basepeak = yes`

654.roms_s: `basepeak = yes`

Benchmarks using both Fortran and C:

621.wrf_s: `basepeak = yes`

627.cam4_s: `-m64 -std=c11 -Wl,-z,muldefs -xsapphirerapids -Ofast`
`-ffast-math -flto -mfpmath=sse -funroll-loops`
`-qopt-mem-layout-trans=4 -fiopenmp -DSPEC_OPENMP`
`-Wno-implicit-int -mprefer-vector-width=512`
`-nostandard-realloc-lhs -align array32byte -auto`
`-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc`

628.pop2_s: `basepeak = yes`

Benchmarks using Fortran, C, and C++:

607.cactuBSSN_s: `basepeak = yes`

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`

For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

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