SPEC CPU®2017 Floating Point Speed Result

Hewlett Packard Enterprise
(Test Sponsor: HPE)

ProLiant ML110 Gen11
(2.00 GHz, Intel Xeon Silver 4416+)

$SPECspeed®2017\_fp\_base = 156$

$SPECspeed®2017\_fp\_peak = 156$

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

Threads

Benchmark	Threads	Result
603.bwaves_s	20	438 / 439
607.cactuBSSN_s	20	190
619.lbm_s	20	123
621.wrf_s	20	149
627.cam4_s	20	74.9
628.pop2_s	20	101
638.imagick_s	20	285
644.nab_s	20	214
649.fotonik3d_s	20	88.3
654.roms_s	20	134

——— SPECspeed®2017_fp_base (156)   ------ SPECspeed®2017_fp_peak (156)

Hardware

CPU Name: Intel Xeon Silver 4416+
 Max MHz: 3900
 Nominal: 2000
Enabled: 20 cores, 1 chip
Orderable: 1 chip
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: 256 GB (8 x 32 GB 2Rx8 PC5-4800B-R,
 running at 4000)
Storage: 1 x 240 GB SATA SSD
Other: None

Software

OS: Red Hat Enterprise Linux 9.0 (Plow)
 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
 Compiler for Linux;
Parallel: Yes
Firmware: HPE BIOS Version v1.30 03/01/2023 released
 Mar-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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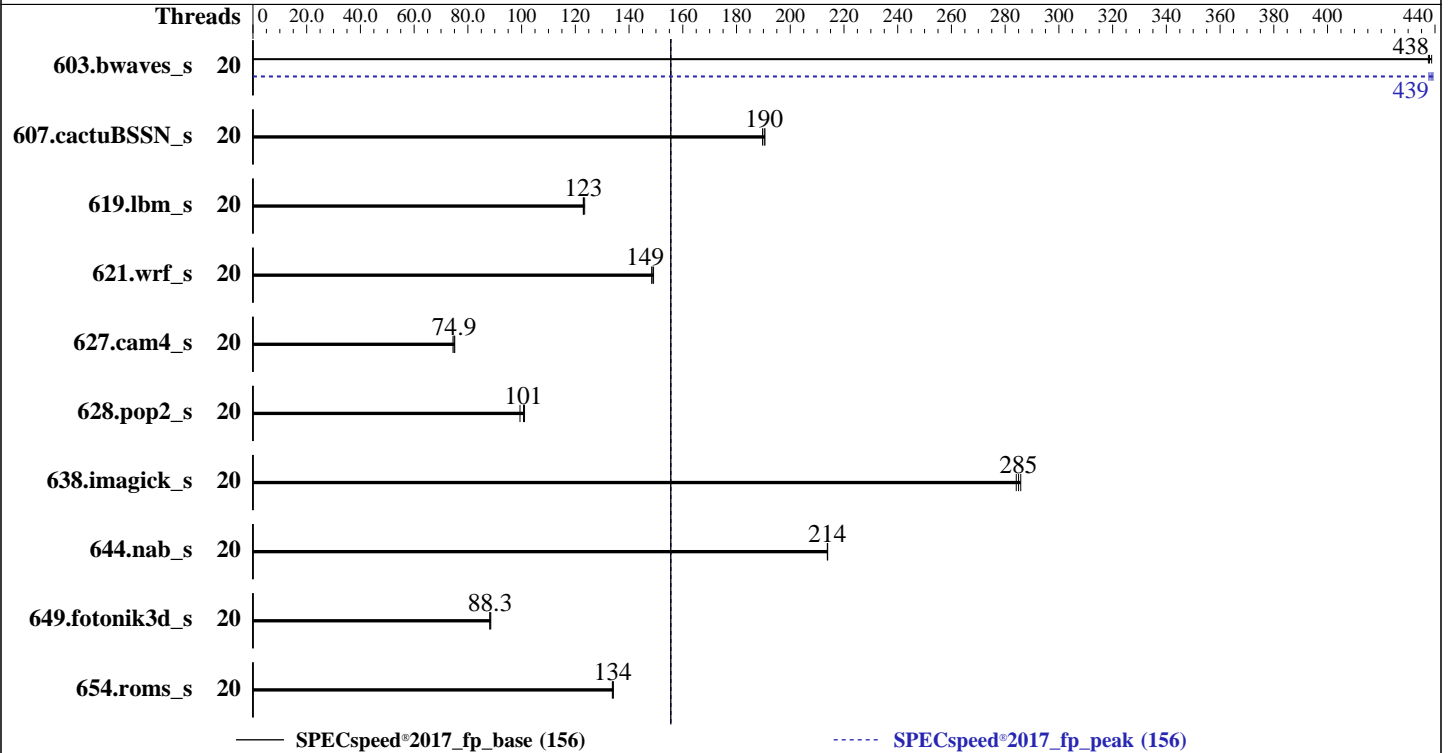**Hewlett Packard Enterprise**
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Results Table

Benchmark	Base						Peak					
	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
603.bwaves_s	20	134	439	135	438	**135**	**438**	20	135	438	134	439	**135**	**439**
607.cactuBSSN_s	20	87.9	190	87.5	191	**87.6**	**190**	20	87.9	190	87.5	191	**87.6**	**190**
619.lbm_s	20	**42.6**	**123**	42.4	123	42.6	123	20	**42.6**	**123**	42.4	123	42.6	123
621.wrf_s	20	**89.0**	**149**	88.7	149	89.1	148	20	**89.0**	**149**	88.7	149	89.1	148
627.cam4_s	20	**118**	**74.9**	119	74.5	118	75.1	20	**118**	**74.9**	119	74.5	118	75.1
628.pop2_s	20	117	101	**118**	**101**	119	99.4	20	117	101	**118**	**101**	119	99.4
638.imagick_s	20	50.5	286	**50.6**	**285**	50.8	284	20	50.5	286	**50.6**	**285**	50.8	284
644.nab_s	20	81.7	214	81.7	214	**81.7**	**214**	20	81.7	214	81.7	214	**81.7**	**214**
649.fotonik3d_s	20	103	88.1	103	88.5	**103**	**88.3**	20	103	88.1	103	88.5	**103**	**88.3**
654.roms_s	20	117	134	118	134	**118**	**134**	20	117	134	118	134	**118**	**134**
SPECspeed®2017_fp_base =	**156**											
SPECspeed®2017_fp_peak =	**156**											

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
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:
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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Platform Notes

```
The system ROM used for this result contains Intel microcode version 0x2b0001b0 for
the Intel Xeon Silver 4416+ processor.
BIOS Configuration:
 Workload Profile set to General Peak Frequency Compute
 Intel Hyper-Threading set to Disabled
 Memory Patrol Scrubbing set to Disabled
 Intel DMI Link Frequency set to Gen2 Speed
 Minimum Processor Idle Power Package C-State set to No Package State
 Adjacent Sector Prefetch set to Disabled
 Last Level Cache (LLC) Prefetch set to Enabled
 Last Level Cache (LLC) Dead Line Allocation set to Disabled
 Dead Block Predictor set to Enabled
 Numa Group Size Optimization set to flat
 Enhanced Processor Performance Profile set to Aggressive
 Thermal Configuration set to Maximum Cooling
 Workload Profile set to Custom

 Sysinfo program /home/cpu2017/bin/sysinfo
 Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
 running on localhost.localdomain Thu Apr 20 14:02:07 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. tuned-adm active
 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
    14:02:07 up 1 min,  0 users,  load average: 0.09, 0.04, 0.01
   USER     TTY      LOGIN@   IDLE   JCPU   PCPU WHAT
```

(Continued on next page)

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Standard Performance Evaluation Corporation (info@spec.org)   https://www.spec.org/

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Platform Notes (Continued)

```
   ----------------------------------------------------------
   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) 1029912
     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) 1029912
     virtual memory              (kbytes, -v) unlimited
     file locks                        (-x) unlimited


   ----------------------------------------------------------
   5. sysinfo process ancestry
    /usr/lib/systemd/systemd --switched-root --system --deserialize 27
    sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups
    sshd: root [priv]
    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=20 --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=20 --tune base,peak --output_format all
      --define drop_caches --nopower --runmode speed --tune base:peak --size refspeed fpspeed --nopreenv
      --note-preenv --logfile $SPEC/tmp/CPU2017.004/templogs/preenv.fpspeed.004.0.log --lognum 004.0
      --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        : 8
       microcode       : 0x2b0001b0
       bugs            : spectre_v1 spectre_v2 spec_store_bypass swapgs
       cpu cores       : 20
       siblings        : 20
       1 physical ids (chips)
       20 processors (hardware threads)
       physical id 0: core ids 0-19
       physical id 0: apicids 0,2,4,6,8,10,12,14,16,18,20,22,24,26,28,30,32,34,36,38
     Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for
     virtualized systems.  Use the above data carefully.
```

(Continued on next page)

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Hardware Availability: May-2023

Software Availability: Dec-2022

Platform Notes (Continued)

```
    ---------------------------------------------------------------
    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):                  20
      On-line CPU(s) list:     0-19
      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:      1
      Core(s) per socket:      20
      Socket(s):               1
      Stepping:                8
      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:               960 KiB (20 instances)
      L1i cache:               640 KiB (20 instances)
      L2 cache:                40 MiB (20 instances)
      L3 cache:                37.5 MiB (1 instance)
      NUMA node(s):            1
      NUMA node0 CPU(s):       0-19
      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
      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      960K   12 Data            1    64       1             64
        L1i      32K      640K    8 Instruction     1    64       1             64
```

(Continued on next page)

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Platform Notes (Continued)

```
    L2         2M      40M   16 Unified         2  2048     1           64
    L3       37.5M   37.5M   15 Unified         3 40960     1           64


  ---------------------------------------------------------------
8. numactl --hardware
NOTE: a numactl 'node' might or might not correspond to a physical chip.
  available: 1 nodes (0)
  node 0 cpus: 0-19
  node 0 size: 257517 MB
  node 0 free: 256728 MB
  node distances:
  node   0
    0:  10


  ---------------------------------------------------------------
9. /proc/meminfo
  MemTotal:       263698228 kB


  ---------------------------------------------------------------
10. who -r
  run-level 3 Apr 20 14:00


  ---------------------------------------------------------------
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 kdump lvm2-monitor mdmonitor microcode
                    nis-domainname rhsmcertd rsyslog selinux-autorelabel-mark sshd sssd
                    systemd-network-generator tuned udisks2
  enabled-runtime   systemd-remount-fs
  disabled          blk-availability chrony-wait console-getty cpupower debug-shell kvm_stat
                    man-db-restart-cache-update nftables powertop 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

  ---------------------------------------------------------------
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/rhel00-root
  ro
  resume=/dev/mapper/rhel00-swap
  rd.lvm.lv=rhel00/root
  rd.lvm.lv=rhel00/swap


  ---------------------------------------------------------------
14. cpupower frequency-info
  analyzing CPU 0:
    Unable to determine current policy
    boost state support:
      Supported: yes
      Active: yes


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

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Platform Notes (Continued)

```
        ----------------------------------------------------------
        16. sysctl
          kernel.numa_balancing             0
          kernel.randomize_va_space         2
          vm.compaction_proactiveness       20
          vm.dirty_background_bytes          0
          vm.dirty_background_ratio         10
          vm.dirty_bytes                     0
          vm.dirty_expire_centisecs       3000
          vm.dirty_ratio                    40
          vm.dirty_writeback_centisecs     500
          vm.dirtytime_expire_seconds    43200
          vm.extfrag_threshold             500
          vm.min_unmapped_ratio              1
          vm.nr_hugepages                    0
          vm.nr_hugepages_mempolicy          0
          vm.nr_overcommit_hugepages         0
          vm.swappiness                     10
          vm.watermark_boost_factor      15000
          vm.watermark_scale_factor         10
          vm.zone_reclaim_mode               0


        ----------------------------------------------------------
        17. /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


        ----------------------------------------------------------
        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/mapper/rhel00-home xfs   148G   60G   89G  40% /home


        ----------------------------------------------------------
        21. /sys/devices/virtual/dmi/id
            Vendor:          HPE
            Product:         ProLiant ML110 Gen11
            Product Family:  ProLiant
            Serial:          CNX2230TMQ
```

(Continued on next page)

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Platform Notes (Continued)

```
        ----------------------------------------------------------
        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 Hynix HMCG88MEBRA113N 32 GB 2 rank 4800, configured at 4000


        ----------------------------------------------------------
        23. 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: 1.10
```

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.
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         | 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
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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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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SPEC CPU®2017 Floating Point Speed Result

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Hewlett Packard Enterprise
(Test Sponsor: HPE)

ProLiant ML110 Gen11
(2.00 GHz, Intel Xeon Silver 4416+)

SPECspeed®2017_fp_base = 156

SPECspeed®2017_fp_peak = 156

CPU2017 License: 3	**Test Date:** Apr-2023
Test Sponsor: HPE	**Hardware Availability:** May-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`

(Continued on next page)

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Hewlett Packard Enterprise
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SPECspeed®2017_fp_base = 156

ProLiant ML110 Gen11
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CPU2017 License: 3		**Test Date:**	Apr-2023
Test Sponsor:	HPE	**Hardware Availability:**	May-2023
Tested by:	HPE	**Software Availability:**	Dec-2022

Peak Optimization Flags (Continued)

644.nab_s: basepeak = yes

Fortran benchmarks:

603.bwaves_s: `-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`

649.fotonik3d_s: basepeak = yes

654.roms_s: basepeak = yes

Benchmarks using both Fortran and C:

621.wrf_s: basepeak = yes

627.cam4_s: basepeak = yes

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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