SPEC CPU®2017 Floating Point Rate Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

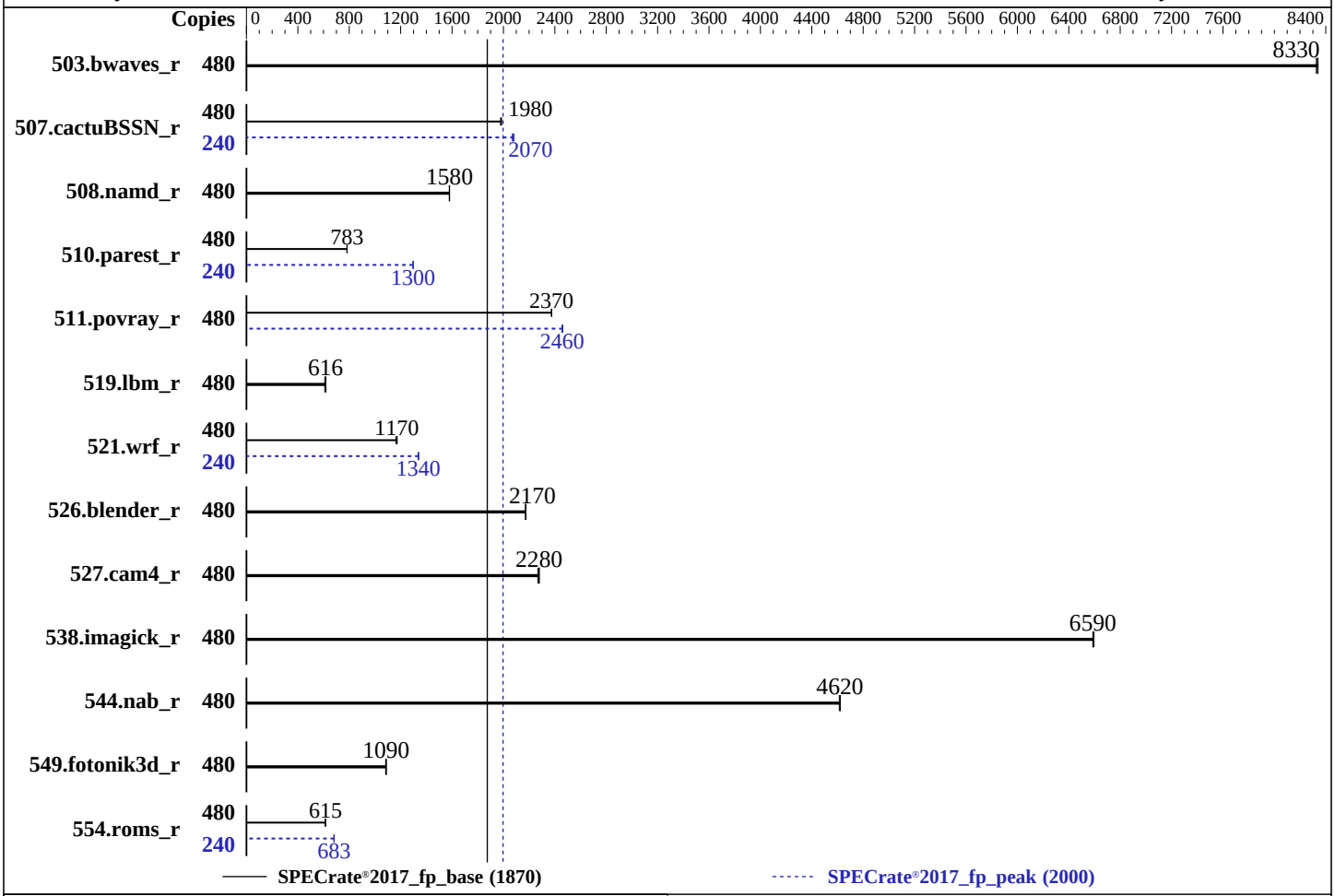
ProLiant DL560 Gen11
(1.90 GHz, Intel Xeon Platinum 8490H)

SPECrate®2017_fp_base = 1870

SPECrate®2017_fp_peak = 2000

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

Test Date: Apr-2023
Hardware Availability: May-2023
Software Availability: Mar-2023



Hardware

CPU Name:	Intel Xeon Platinum 8490H
Max MHz:	3500
Nominal:	1900
Enabled:	240 cores, 4 chips, 2 threads/core
Orderable:	1, 2, 4 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:	1 TB (32 x 32 GB 2Rx8 PC5-4800B-R)
Storage:	1 x 480 GB SATA SSD
Other:	None

Software

OS:	Ubuntu 22.04.1 LTS Kernel 5.15.0-69-generic
Compiler:	C/C++: Version 2023.0 of Intel oneAPI DPC++/C++ Compiler for Linux; Fortran: Version 2023.0 of Intel Fortran Compiler for Linux;
Parallel:	No
Firmware:	HPE BIOS Version v1.30 03/01/2023 released Mar-2023
File System:	ext4
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						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
503.bwaves_r	480	578	8330	577	8340	**578**	**8330**	480	578	8330	577	8340	**578**	**8330**
507.cactuBSSN_r	480	**307**	**1980**	307	1980	306	1990	240	147	2070	**147**	**2070**	146	2080
508.namd_r	480	289	1580	**289**	**1580**	288	1580	480	289	1580	**289**	**1580**	288	1580
510.parest_r	480	**1605**	**783**	1603	783	1606	782	240	**484**	**1300**	484	1300	484	1300
511.povray_r	480	**472**	**2370**	472	2370	472	2370	480	456	2460	**456**	**2460**	455	2460
519.lbm_r	480	830	609	**821**	**616**	818	618	480	830	609	**821**	**616**	818	618
521.wrf_r	480	924	1160	917	1170	**918**	**1170**	240	402	1340	401	1340	**402**	**1340**
526.blender_r	480	336	2180	**336**	**2170**	337	2170	480	336	2180	**336**	**2170**	337	2170
527.cam4_r	480	370	2270	368	2280	**369**	**2280**	480	370	2270	368	2280	**369**	**2280**
538.imagick_r	480	181	6600	**181**	**6590**	181	6590	480	181	6600	**181**	**6590**	181	6590
544.nab_r	480	175	4610	**175**	**4620**	175	4620	480	175	4610	**175**	**4620**	175	4620
549.fotonik3d_r	480	1727	1080	**1720**	**1090**	1719	1090	480	1727	1080	**1720**	**1090**	1719	1090
554.roms_r	480	1244	613	**1240**	**615**	1240	615	240	**559**	**683**	561	680	559	683

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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 0x2b0001b0 for
the Intel Xeon Platinum 8490H Processor
BIOS Configuration
 Workload Profile set to General Throughput Compute
 Memory Patrol Scrubbing set to Disabled
 Last Level Cache (LLC) Dead Line Allocation set to Disabled
 Enhanced Processor Performance Profile set to Aggressive
 Thermal Configuration set to Maximum Cooling
 Workload Profile set to Custom
 Adjacent Sector Prefetch set to Disabled
 DCU Stream Prefetcher 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 admin1 Thu Mar  2 13:15:17 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 (249.11-0ubuntu3.7)
 12. Failed units, from systemctl list-units --state=failed
 13. Services, from systemctl list-unit-files
 14. Linux kernel boot-time arguments, from /proc/cmdline
 15. cpupower frequency-info
 16. tuned-adm active
 17. sysctl
 18. /sys/kernel/mm/transparent_hugepage
 19. /sys/kernel/mm/transparent_hugepage/khugepaged
 20. OS release
 21. Disk information
 22. /sys/devices/virtual/dmi/id
 23. dmidecode
```

(Continued on next page)

Platform Notes (Continued)

```
24. BIOS
------------------------------------------------------------

------------------------------------------------------------
1. uname -a
  Linux admin1 5.15.0-69-generic #76-Ubuntu SMP Fri Mar 17 17:19:29 UTC 2023 x86_64 x86_64 x86_64 GNU/Linux

------------------------------------------------------------
2. w
   13:15:17 up 17 min,  3 users,  load average: 0.00, 0.02, 0.03
  USER     TTY      FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
  admin1   tty1     -                13:07    8:02   0.02s  0.00s -bash
  admin1   pts/0    172.16.0.100     13:09    6:17   0.03s  0.01s sshd: admin1 [priv]
  admin1   pts/1    172.16.0.100     13:09   12.00s  1.01s  0.02s sudo -i

------------------------------------------------------------
3. Username
  From environment variable $USER:  root
  From the command 'logname':       admin1

------------------------------------------------------------
4. ulimit -a
  time(seconds)        unlimited
  file(blocks)         unlimited
  data(kbytes)         unlimited
  stack(kbytes)        unlimited
  coredump(blocks)     0
  memory(kbytes)       unlimited
  locked memory(kbytes) 132045760
  process              4125974
  nofiles              1024
  vmemory(kbytes)      unlimited
  locks                unlimited
  rtprio               0

------------------------------------------------------------
5. sysinfo process ancestry
 /sbin/init
 sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups
 sshd: admin1 [priv]
 sshd: admin1@pts/0
 -bash
 sudo -i
 sudo -i
 -bash
 -bash
 runcpu --nobuild --action validate --define default-platform-flags --define numcopies=480 -c
   ic2023.0-lin-sapphirerapids-rate-20221201.cfg --define smt-on --define cores=240 --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=480 --configfile
   ic2023.0-lin-sapphirerapids-rate-20221201.cfg --define smt-on --define cores=240 --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/CPU2017.012/templogs/preenv.fprate.012.0.log --lognum 012.0 --from_runcpu 2
 specperl $SPEC/bin/sysinfo
$SPEC = /home/cpu2017

------------------------------------------------------------
6. /proc/cpuinfo
    model name      : Intel(R) Xeon(R) Platinum 8490H
```

(Continued on next page)

Platform Notes (Continued)

```
     vendor_id       : GenuineIntel
     cpu family      : 6
     model           : 143
     stepping        : 6
     microcode       : 0x2b0001b0
     bugs            : spectre_v1 spectre_v2 spec_store_bypass swapgs eibrs_pbrsb
     cpu cores       : 60
     siblings        : 120
     4 physical ids (chips)
     480 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 0: apicids 0-119
     physical id 1: apicids 128-247
     physical id 2: apicids 256-375
     physical id 3: apicids 384-503
   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 2.37.2:
   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):                          480
   On-line CPU(s) list:             0-479
   Vendor ID:                       GenuineIntel
   Model name:                      Intel(R) Xeon(R) Platinum 8490H
   CPU family:                      6
   Model:                           143
   Thread(s) per core:              2
   Core(s) per socket:              60
   Socket(s):                       4
   Stepping:                        6
   BogoMIPS:                        3800.00
   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 amx_bf16 avx512_fp16 amx_tile amx_int8 flush_l1d
                                    arch_capabilities
   Virtualization:                  VT-x
   L1d cache:                       11.3 MiB (240 instances)
```

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Platform Notes (Continued)

```
  L1i cache:                       7.5 MiB (240 instances)
  L2 cache:                        480 MiB (240 instances)
  L3 cache:                        450 MiB (4 instances)
  NUMA node(s):                    16
  NUMA node0 CPU(s):               0-14,240-254
  NUMA node1 CPU(s):               15-29,255-269
  NUMA node2 CPU(s):               30-44,270-284
  NUMA node3 CPU(s):               45-59,285-299
  NUMA node4 CPU(s):               60-74,300-314
  NUMA node5 CPU(s):               75-89,315-329
  NUMA node6 CPU(s):               90-104,330-344
  NUMA node7 CPU(s):               105-119,345-359
  NUMA node8 CPU(s):               120-134,360-374
  NUMA node9 CPU(s):               135-149,375-389
  NUMA node10 CPU(s):              150-164,390-404
  NUMA node11 CPU(s):              165-179,405-419
  NUMA node12 CPU(s):              180-194,420-434
  NUMA node13 CPU(s):              195-209,435-449
  NUMA node14 CPU(s):              210-224,450-464
  NUMA node15 CPU(s):              225-239,465-479
  Vulnerability Itlb multihit:     Not affected
  Vulnerability L1tf:              Not affected
  Vulnerability Mds:               Not affected
  Vulnerability Meltdown:          Not affected
  Vulnerability Mmio stale data:   Not affected
  Vulnerability Retbleed:          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, PBRSB-eIBRS SW
                                   sequence
  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    11.3M   12 Data            1     64        1             64
     L1i       32K     7.5M    8 Instruction     1     64        1             64
     L2         2M     480M   16 Unified         2   2048        1             64
     L3     112.5M     450M   15 Unified         3 122880        1             64

------------------------------------------------------------
8. numactl --hardware
NOTE: a numactl 'node' might or might not correspond to a physical chip.
  available: 16 nodes (0-15)
  node 0 cpus: 0-14,240-254
  node 0 size: 64055 MB
  node 0 free: 63046 MB
  node 1 cpus: 15-29,255-269
  node 1 size: 64504 MB
  node 1 free: 63652 MB
  node 2 cpus: 30-44,270-284
  node 2 size: 64504 MB
  node 2 free: 64251 MB
  node 3 cpus: 45-59,285-299
  node 3 size: 64504 MB
  node 3 free: 64217 MB
  node 4 cpus: 60-74,300-314
  node 4 size: 64504 MB
  node 4 free: 64259 MB
  node 5 cpus: 75-89,315-329
```

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Platform Notes (Continued)

```
   node 5 size: 64504 MB
   node 5 free: 64228 MB
   node 6 cpus: 90-104,330-344
   node 6 size: 64504 MB
   node 6 free: 64247 MB
   node 7 cpus: 105-119,345-359
   node 7 size: 64504 MB
   node 7 free: 64249 MB
   node 8 cpus: 120-134,360-374
   node 8 size: 64504 MB
   node 8 free: 64222 MB
   node 9 cpus: 135-149,375-389
   node 9 size: 64504 MB
   node 9 free: 64251 MB
   node 10 cpus: 150-164,390-404
   node 10 size: 64504 MB
   node 10 free: 64276 MB
   node 11 cpus: 165-179,405-419
   node 11 size: 64504 MB
   node 11 free: 64200 MB
   node 12 cpus: 180-194,420-434
   node 12 size: 64504 MB
   node 12 free: 64253 MB
   node 13 cpus: 195-209,435-449
   node 13 size: 64504 MB
   node 13 free: 64232 MB
   node 14 cpus: 210-224,450-464
   node 14 size: 64504 MB
   node 14 free: 64221 MB
   node 15 cpus: 225-239,465-479
   node 15 size: 64484 MB
   node 15 free: 64219 MB
   node distances:
   node   0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15
     0:  10  20  30  30  30  30  30  30  30  30  30  30  30  30  30  30
     1:  20  10  30  30  30  30  30  30  30  30  30  30  30  30  30  30
     2:  30  30  10  20  30  30  30  30  30  30  30  30  30  30  30  30
     3:  30  30  20  10  30  30  30  30  30  30  30  30  30  30  30  30
     4:  30  30  30  30  10  20  30  30  30  30  30  30  30  30  30  30
     5:  30  30  30  30  20  10  30  30  30  30  30  30  30  30  30  30
     6:  30  30  30  30  30  30  10  20  30  30  30  30  30  30  30  30
     7:  30  30  30  30  30  30  20  10  30  30  30  30  30  30  30  30
     8:  30  30  30  30  30  30  30  30  10  20  30  30  30  30  30  30
     9:  30  30  30  30  30  30  30  30  20  10  30  30  30  30  30  30
    10:  30  30  30  30  30  30  30  30  30  30  10  20  30  30  30  30
    11:  30  30  30  30  30  30  30  30  30  30  20  10  30  30  30  30
    12:  30  30  30  30  30  30  30  30  30  30  30  30  10  20  30  30
    13:  30  30  30  30  30  30  30  30  30  30  30  30  20  10  30  30
    14:  30  30  30  30  30  30  30  30  30  30  30  30  30  30  10  20
    15:  30  30  30  30  30  30  30  30  30  30  30  30  30  30  20  10

------------------------------------------------------------
9. /proc/meminfo
   MemTotal:       1056366104 kB

------------------------------------------------------------
10. who -r
  run-level 5 Mar 2 13:00

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

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Platform Notes (Continued)

```
11. Systemd service manager version: systemd 249 (249.11-0ubuntu3.7)
  Default Target  Status
  graphical       degraded

------------------------------------------------------------
12. Failed units, from systemctl list-units --state=failed
    UNIT                                LOAD   ACTIVE SUB    DESCRIPTION
  * systemd-networkd-wait-online.service loaded failed failed Wait for Network to be Configured

------------------------------------------------------------
13. Services, from systemctl list-unit-files
  STATE            UNIT FILES
  enabled          ModemManager apparmor blk-availability cloud-config cloud-final cloud-init
                   cloud-init-local console-setup cron dmesg e2scrub_reap finalrd getty@ gpu-manager
                   grub-common grub-initrd-fallback irqbalance keyboard-setup lvm2-monitor lxd-agent
                   multipathd networkd-dispatcher open-iscsi open-vm-tools pollinate rsyslog secureboot-db
                   setvtrgb snapd ssh systemd-networkd systemd-networkd-wait-online systemd-pstore
                   systemd-resolved systemd-timesyncd thermald tuned ua-reboot-cmds ubuntu-advantage udisks2
                   ufw unattended-upgrades vgauth
  enabled-runtime  netplan-ovs-cleanup systemd-fsck-root systemd-remount-fs
  disabled         console-getty debug-shell iscsid nftables powertop rsync serial-getty@
                   systemd-boot-check-no-failures systemd-network-generator systemd-sysext
                   systemd-time-wait-sync upower
  generated        apport
  indirect         uuidd
  masked           cryptdisks cryptdisks-early hwclock lvm2 multipath-tools-boot rc rcS screen-cleanup sudo
                   x11-common

------------------------------------------------------------
14. Linux kernel boot-time arguments, from /proc/cmdline
  BOOT_IMAGE=/vmlinuz-5.15.0-69-generic
  root=/dev/mapper/ubuntu--vg-ubuntu--lv
  ro

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

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

------------------------------------------------------------
17. 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                    40
  vm.dirty_writeback_centisecs     500
  vm.dirtytime_expire_seconds    43200
  vm.extfrag_threshold             500
  vm.min_unmapped_ratio              1
```

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Platform Notes (Continued)

```
  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

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

------------------------------------------------------------
19. /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

------------------------------------------------------------
20. OS release
  From /etc/*-release /etc/*-version
  os-release Ubuntu 22.04.1 LTS

------------------------------------------------------------
21. Disk information
SPEC is set to: /home/cpu2017
  Filesystem                      Type  Size  Used Avail Use% Mounted on
  /dev/mapper/ubuntu--vg-ubuntu--lv ext4  437G  283G  136G  68% /

------------------------------------------------------------
22. /sys/devices/virtual/dmi/id
    Vendor:         HPE
    Product:        ProLiant DL560 Gen11
    Product Family: ProLiant
    Serial:         CNX2250G5V

------------------------------------------------------------
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:
    3x Samsung M321R4GA3BB0-CQKDG 32 GB 2 rank 4800
    29x Samsung M321R4GA3BB6-CQKDG 32 GB 2 rank 4800
    32x UNKNOWN NOT AVAILABLE


------------------------------------------------------------
24. BIOS
(This section combines info from /sys/devices and dmidecode.)
   BIOS Vendor:       HPE
   BIOS Version:      1.30
```

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Platform Notes (Continued)

```
    BIOS Date:          03/01/2023
    BIOS Revision:      1.30
    Firmware Revision: 1.30
```

Compiler Version Notes

```
==============================================================================================================
C               | 519.lbm_r(base, peak) 538.imagick_r(base, peak) 544.nab_r(base, peak)
--------------------------------------------------------------------------------------------------------------
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==============================================================================================================
C++             | 508.namd_r(base, peak) 510.parest_r(base, peak)
--------------------------------------------------------------------------------------------------------------
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==============================================================================================================
C++, C          | 511.povray_r(base, peak) 526.blender_r(base, peak)
--------------------------------------------------------------------------------------------------------------
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--------------------------------------------------------------------------------------------------------------

==============================================================================================================
C++, C, Fortran | 507.cactuBSSN_r(base, peak)
--------------------------------------------------------------------------------------------------------------
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==============================================================================================================
Fortran         | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak) 554.roms_r(base, peak)
--------------------------------------------------------------------------------------------------------------
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==============================================================================================================
Fortran, C      | 521.wrf_r(base, peak) 527.cam4_r(base, peak)
--------------------------------------------------------------------------------------------------------------
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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

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Base Optimization Flags (Continued)

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
-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

(Continued on next page)

Peak Compiler Invocation (Continued)

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

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

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Peak Optimization Flags (Continued)

Benchmarks using both Fortran and C:

521.wrf_r: `-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`

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 -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-rev1.1.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-rev1.1.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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