SPEC CPU®2017 Floating Point Rate Result

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Dell Inc.

PowerEdge R960 (Intel Xeon Gold 6416H)

SPECrate®2017_fp_base = 907

SPECrate®2017_fp_peak = 927

CPU2017 License: 6573
Test Sponsor: Dell Inc.
Tested by: Dell Inc.

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

Copies — scale: 0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000 3200 3400 3600 3800 4150

Benchmark	Copies	base	peak
503.bwaves_r	144	4110	
507.cactuBSSN_r	144 / 72	1130	1230
508.namd_r	144	468	
510.parest_r	144 / 72	513	560
511.povray_r	144	752	778
519.lbm_r	144	534	
521.wrf_r	144	823	
526.blender_r	144	722	
527.cam4_r	144	876	
538.imagick_r	144	2020	
544.nab_r	144	1470	
549.fotonik3d_r	144	910	
554.roms_r	144 / 72	445	484

SPECrate®2017_fp_base (907)   SPECrate®2017_fp_peak (927)

Hardware

CPU Name: Intel Xeon Gold 6416H
 Max MHz: 4200
 Nominal: 2200
Enabled: 72 cores, 4 chips, 2 threads/core
Orderable: 2,4 chips
Cache L1: 32 KB I + 48 KB D on chip per core
 L2: 2 MB I+D on chip per core
 L3: 45 MB I+D on chip per chip
 Other: None
Memory: 1 TB (32 x 32 GB 2Rx8 PC5-4800B-R)
Storage: 90 GB on tmpfs
Other: None

Software

OS: Red Hat Enterprise Linux 9.2 (Plow)
 5.14.0-284.11.1.el9_2.x86_64
Compiler: C/C++: Version 2023.2.3 of Intel oneAPI DPC++/C++
 Compiler for Linux;
 Fortran: Version 2023.2.3 of Intel Fortran
 Compiler for Linux;
Parallel: No
Firmware: Version 1.6.6 released Sep-2023
File System: tmpfs
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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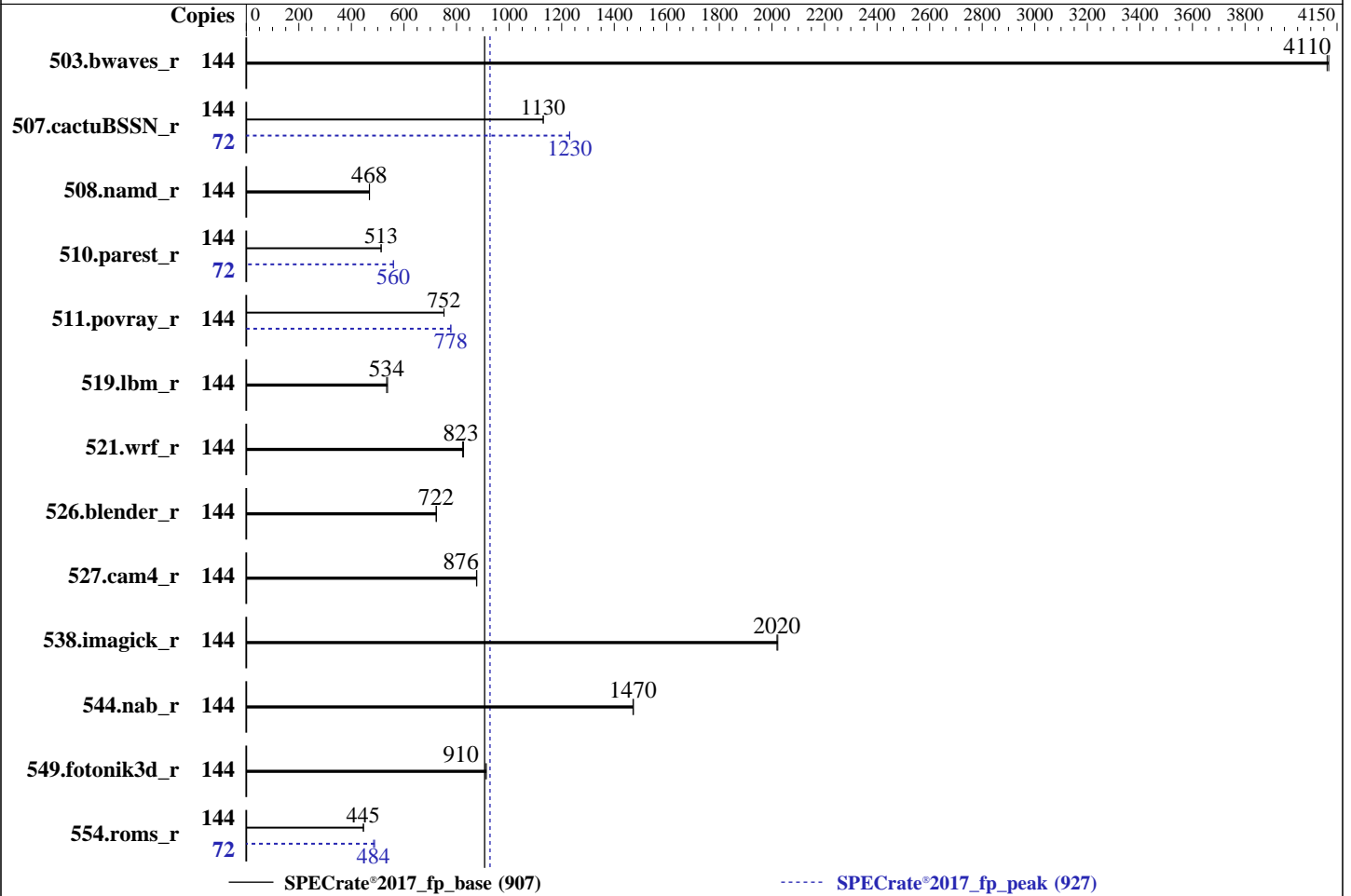
Test Sponsor: Dell Inc.   **Hardware Availability:** May-2023

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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	144	**351**	**4110**	351	4120			144	**351**	**4110**	351	4120		
507.cactuBSSN_r	144	**161**	**1130**	161	1130			72	74.1	1230	**74.1**	**1230**		
508.namd_r	144	292	469	**292**	**468**			144	292	469	**292**	**468**		
510.parest_r	144	**734**	**513**	734	513			72	**336**	**560**	336	560		
511.povray_r	144	447	753	**447**	**752**			144	432	778	**432**	**778**		
519.lbm_r	144	**284**	**534**	282	538			144	**284**	**534**	282	538		
521.wrf_r	144	390	827	**392**	**823**			144	390	827	**392**	**823**		
526.blender_r	144	303	723	**304**	**722**			144	303	723	**304**	**722**		
527.cam4_r	144	287	877	**288**	**876**			144	287	877	**288**	**876**		
538.imagick_r	144	177	2020	**177**	**2020**			144	177	2020	**177**	**2020**		
544.nab_r	144	**165**	**1470**	165	1470			144	**165**	**1470**	165	1470		
549.fotonik3d_r	144	614	914	**617**	**910**			144	614	914	**617**	**910**		
554.roms_r	144	**514**	**445**	513	446			72	234	488	**236**	**484**		
SPECrate®2017_fp_base =		907												
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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"
```

Environment Variables Notes

```
Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH =
    "/mnt/ramdisk/cpu2017-1.1.9-ic2023.2.3/lib/intel64:/mnt/ramdisk/cpu2017-1.1.9-ic2023.2.3/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
    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>
    jemalloc, a general purpose malloc implementation
```

(Continued on next page)

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General Notes (Continued)

```
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

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.

Benchmark run from a 90 GB ramdisk created with the cmd: "mount -t tmpfs -o size=90G tmpfs /mnt/ramdisk"
```

Platform Notes

```
BIOS settings:
        DIMM Self Healing on
    Uncorrectable Memory Error : Disabled

        DCU Streamer Prefetcher : Disabled
                Sub NUMA Cluster : 2-way Clustering
                    LLC Prefetch : Disabled
          Dead Line LLC Alloc : Disabled
                Optimizer Mode : Enabled

                System Profile : Custom
        CPU Power Management : Maximum Performance
                            C1E : Disabled
                      C States : Autonomous
          Memory Patrol Scrub : Disabled
      Energy Efficiency Policy : Performance
          PCI ASPM L1 Link
              Power Management : Disabled

Sysinfo program /mnt/ramdisk/cpu2017-1.1.9-ic2023.2.3/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost.localdomain Tue Dec 12 12:29:55 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 252 (252-13.el9_2)
 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
```

(Continued on next page)

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Platform Notes (Continued)

```
   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 5.14.0-284.11.1.el9_2.x86_64 #1 SMP PREEMPT_DYNAMIC Wed Apr 12 10:45:03 EDT
    2023 x86_64 x86_64 x86_64 GNU/Linux

  -------------------------------------------------------------
  2. w
    12:29:55 up  5:36,  1 user,  load average: 87.96, 129.61, 137.77
    USER     TTY       LOGIN@   IDLE   JCPU   PCPU WHAT
    root     tty1      08:22   4:07m  1.29s  0.00s /bin/bash ./dell-run-speccpu.sh rate --define
    DL-BIOSinc=Dell-BIOS_Xeon-4.inc --define DL-BIOS-LogProc=1 --define DL-VERS=v4.8.5 --output_format
    html,pdf,txt --define DL-LQC=1

  -------------------------------------------------------------
  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) 4123929
    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) 4123929
    virtual memory              (kbytes, -v) unlimited
    file locks                      (-x) unlimited

  -------------------------------------------------------------
  5. sysinfo process ancestry
  /usr/lib/systemd/systemd rhgb --switched-root --system --deserialize 31
  login -- root
  -bash
  /bin/bash ./DELL_rate.sh
  /bin/bash ./dell-run-main.sh rate
  /bin/bash ./dell-run-main.sh rate
  /bin/bash ./dell-run-speccpu.sh rate --define DL-BIOSinc=Dell-BIOS_Xeon-4.inc --define DL-BIOS-LogProc=1
    --define DL-VERS=v4.8.5 --output_format html,pdf,txt --define DL-LQC=1
  /bin/bash ./dell-run-speccpu.sh rate --define DL-BIOSinc=Dell-BIOS_Xeon-4.inc --define DL-BIOS-LogProc=1
    --define DL-VERS=v4.8.5 --output_format html,pdf,txt --define DL-LQC=1
  runcpu --nobuild --action validate --define default-platform-flags --define numcopies=144 -c
    ic2023.2.3-lin-sapphirerapids-rate-20231121.cfg --define smt-on --define cores=72 --define physicalfirst
```

(Continued on next page)

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Platform Notes (Continued)

```
     --define invoke_with_interleave --define drop_caches --tune base,peak -o all --define DL-4S=1 --define
     DL-BIOS-SNC=2 --iterations 2 --define DL-BIOSinc=Dell-BIOS_Xeon-4.inc --define DL-BIOS-LogProc=1 --define
     DL-VERS=v4.8.5 --output_format html,pdf,txt --define DL-LQC=1 fprate
   runcpu --nobuild --action validate --define default-platform-flags --define numcopies=144 --configfile
     ic2023.2.3-lin-sapphirerapids-rate-20231121.cfg --define smt-on --define cores=72 --define physicalfirst
     --define invoke_with_interleave --define drop_caches --tune base,peak --output_format all --define DL-4S=1
     --define DL-BIOS-SNC=2 --iterations 2 --define DL-BIOSinc=Dell-BIOS_Xeon-4.inc --define DL-BIOS-LogProc=1
     --define DL-VERS=v4.8.5 --output_format html,pdf,txt --define DL-LQC=1 --nopower --runmode rate --tune
     base:peak --size refrate fprate --nopreenv --note-preenv --logfile
     $SPEC/tmp/CPU2017.002/templogs/preenv.fprate.002.0.log --lognum 002.0 --from_runcpu 2
   specperl $SPEC/bin/sysinfo
  $SPEC = /mnt/ramdisk/cpu2017-1.1.9-ic2023.2.3


  ------------------------------------------------------------
  6. /proc/cpuinfo
     model name      : Intel(R) Xeon(R) Gold 6416H
     vendor_id       : GenuineIntel
     cpu family      : 6
     model           : 143
     stepping        : 7
     microcode       : 0x2b0004d0
     bugs            : spectre_v1 spectre_v2 spec_store_bypass swapgs eibrs_pbrsb
     cpu cores       : 18
     siblings        : 36
     4 physical ids (chips)
     144 processors (hardware threads)
     physical id 0: core ids 0-17
     physical id 1: core ids 0-17
     physical id 2: core ids 0-17
     physical id 3: core ids 0-17
     physical id 0: apicids 0-35
     physical id 1: apicids 128-163
     physical id 2: apicids 256-291
     physical id 3: apicids 384-419
   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):                   144
    On-line CPU(s) list:      0-143
    Vendor ID:                GenuineIntel
    BIOS Vendor ID:           Intel
    Model name:               Intel(R) Xeon(R) Gold 6416H
    BIOS Model name:          Intel(R) Xeon(R) Gold 6416H
    CPU family:               6
    Model:                    143
    Thread(s) per core:       2
    Core(s) per socket:       18
    Socket(s):                4
    Stepping:                 7
    CPU max MHz:              4200.0000
    CPU min MHz:              800.0000
    BogoMIPS:                 4400.00
```

(Continued on next page)

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Platform Notes (Continued)

```
  Flags:                          fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36
                                  clflush dts acpi mmx fxsr sse sse2 ss ht tm 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
                                  hfi 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 ibt amx_bf16 avx512_fp16 amx_tile amx_int8 flush_l1d
                                  arch_capabilities
  Virtualization:                 VT-x
  L1d cache:                      3.4 MiB (72 instances)
  L1i cache:                      2.3 MiB (72 instances)
  L2 cache:                       144 MiB (72 instances)
  L3 cache:                       180 MiB (4 instances)
  NUMA node(s):                   8
  NUMA node0 CPU(s):              0,4,12,20,32,44,48,56,64,72,76,84,92,104,116,120,128,136
  NUMA node1 CPU(s):              8,16,24,28,36,40,52,60,68,80,88,96,100,108,112,124,132,140
  NUMA node2 CPU(s):              1,9,13,21,33,45,49,61,65,73,81,85,93,105,117,121,133,137
  NUMA node3 CPU(s):              5,17,25,29,37,41,53,57,69,77,89,97,101,109,113,125,129,141
  NUMA node4 CPU(s):              10,14,18,26,34,42,46,54,66,82,86,90,98,106,114,118,126,138
  NUMA node5 CPU(s):              2,6,22,30,38,50,58,62,70,74,78,94,102,110,122,130,134,142
  NUMA node6 CPU(s):              3,11,15,27,35,39,51,55,67,75,83,87,99,107,111,123,127,139
  NUMA node7 CPU(s):              7,19,23,31,43,47,59,63,71,79,91,95,103,115,119,131,135,143
  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
  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     3.4M   12 Data             1     64        1             64
    L1i       32K     2.3M    8 Instruction      1     64        1             64
    L2         2M     144M   16 Unified          2   2048        1             64
    L3        45M     180M   15 Unified          3  49152        1             64

------------------------------------------------------------
8. numactl --hardware
NOTE: a numactl 'node' might or might not correspond to a physical chip.
  available: 8 nodes (0-7)
  node 0 cpus: 0,4,12,20,32,44,48,56,64,72,76,84,92,104,116,120,128,136
  node 0 size: 127960 MB
  node 0 free: 127070 MB
  node 1 cpus: 8,16,24,28,36,40,52,60,68,80,88,96,100,108,112,124,132,140
```

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Platform Notes (Continued)

```
   node 1 size: 129019 MB
   node 1 free: 117939 MB
   node 2 cpus: 1,9,13,21,33,45,49,61,65,73,81,85,93,105,117,121,133,137
   node 2 size: 129019 MB
   node 2 free: 128280 MB
   node 3 cpus: 5,17,25,29,37,41,53,57,69,77,89,97,101,109,113,125,129,141
   node 3 size: 129019 MB
   node 3 free: 128178 MB
   node 4 cpus: 10,14,18,26,34,42,46,54,66,82,86,90,98,106,114,118,126,138
   node 4 size: 128980 MB
   node 4 free: 128100 MB
   node 5 cpus: 2,6,22,30,38,50,58,62,70,74,78,94,102,110,122,130,134,142
   node 5 size: 129019 MB
   node 5 free: 128008 MB
   node 6 cpus: 3,11,15,27,35,39,51,55,67,75,83,87,99,107,111,123,127,139
   node 6 size: 129019 MB
   node 6 free: 128308 MB
   node 7 cpus: 7,19,23,31,43,47,59,63,71,79,91,95,103,115,119,131,135,143
   node 7 size: 129006 MB
   node 7 free: 128108 MB
   node distances:
   node   0   1   2   3   4   5   6   7
     0:  10  12  21  21  21  21  21  21
     1:  12  10  21  21  21  21  21  21
     2:  21  21  10  12  21  21  21  21
     3:  21  21  12  10  21  21  21  21
     4:  21  21  21  21  10  12  21  21
     5:  21  21  21  21  12  10  21  21
     6:  21  21  21  21  21  21  10  12
     7:  21  21  21  21  21  21  12  10


   ----------------------------------------------------------
9. /proc/meminfo
   MemTotal:       1055791448 kB


   ----------------------------------------------------------
10. who -r
   run-level 3 Dec 12 06:53


   ----------------------------------------------------------
11. Systemd service manager version: systemd 252 (252-13.el9_2)
   Default Target  Status
   multi-user      running


   ----------------------------------------------------------
12. Services, from systemctl list-unit-files
   STATE            UNIT FILES
   enabled          ModemManager NetworkManager NetworkManager-dispatcher NetworkManager-wait-online
                    accounts-daemon atd auditd avahi-daemon bluetooth chronyd crond cups dbus-broker firewalld
                    gdm getty@ insights-client-boot irqbalance iscsi iscsi-onboot kdump libstoragemgmt
                    low-memory-monitor lvm2-monitor mcelog mdmonitor microcode multipathd nis-domainname
                    nvmefc-boot-connections ostree-remount power-profiles-daemon qemu-guest-agent rhsmcertd
                    rsyslog rtkit-daemon selinux-autorelabel-mark smartd sshd sssd switcheroo-control
                    systemd-boot-update systemd-network-generator tuned udisks2 upower vgauthd vmtoolsd
   enabled-runtime  systemd-remount-fs
   disabled         arp-ethers blk-availability brltty canberra-system-bootup canberra-system-shutdown
                    canberra-system-shutdown-reboot chrony-wait cni-dhcp console-getty cpupower cups-browsed
                    dbus-daemon debug-shell dnf-system-upgrade dnsmasq iprdump iprinit iprupdate iscsid
                    iscsiuio kpatch kvm_stat ledmon man-db-restart-cache-update nftables nvmf-autoconnect
                    ostree-readonly-sysroot-migration podman podman-auto-update podman-clean-transient
```

(Continued on next page)

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Platform Notes (Continued)

```
                  podman-kube@ podman-restart psacct ras-mc-ctl rasdaemon rdisc rhcd rhsm rhsm-facts
                  rpmdb-rebuild selinux-check-proper-disable serial-getty@ speech-dispatcherd sshd-keygen@
                  systemd-boot-check-no-failures systemd-pstore systemd-sysext wpa_supplicant
  indirect        spice-vdagentd sssd-autofs sssd-kcm sssd-nss sssd-pac sssd-pam sssd-ssh sssd-sudo
                  systemd-sysupdate systemd-sysupdate-reboot

  ----------------------------------------------------------------
13. Linux kernel boot-time arguments, from /proc/cmdline
  BOOT_IMAGE=(hd0,gpt2)/vmlinuz-5.14.0-284.11.1.el9_2.x86_64
  root=/dev/mapper/rhel-root
  ro
  crashkernel=1G-4G:192M,4G-64G:256M,64G-:512M
  resume=/dev/mapper/rhel-swap
  rd.lvm.lv=rhel/root
  rd.lvm.lv=rhel/swap
  rhgb
  quiet

  ----------------------------------------------------------------
14. cpupower frequency-info
  analyzing CPU 0:
    current policy: frequency should be within 4.20 GHz and 4.20 GHz.
                    The governor "performance" may decide which speed to use
                    within this range.
    boost state support:
      Supported: yes
      Active: yes

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

  ----------------------------------------------------------------
16. sysctl
  kernel.numa_balancing            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
  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
```

(Continued on next page)

Dell Inc.

PowerEdge R960 (Intel Xeon Gold 6416H)

$SPECrate^{®}2017\_fp\_base = 907$

$SPECrate^{®}2017\_fp\_peak = 927$

CPU2017 License: 6573		**Test Date:**	Dec-2023
Test Sponsor:	Dell Inc.	**Hardware Availability:**	May-2023
Tested by:	Dell Inc.	**Software Availability:**	Dec-2023

Platform Notes (Continued)

```
  ----------------------------------------------------------------
  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 9.2 (Plow)
    redhat-release Red Hat Enterprise Linux release 9.2 (Plow)
    system-release Red Hat Enterprise Linux release 9.2 (Plow)

  ----------------------------------------------------------------
  20. Disk information
  SPEC is set to: /mnt/ramdisk/cpu2017-1.1.9-ic2023.2.3
    Filesystem      Type   Size  Used Avail Use% Mounted on
    tmpfs           tmpfs   90G  5.1G   85G   6% /mnt/ramdisk

  ----------------------------------------------------------------
  21. /sys/devices/virtual/dmi/id
      Vendor:          Dell Inc.
      Product:         PowerEdge R960
      Product Family:  PowerEdge
      Serial:          SLR9601

  ----------------------------------------------------------------
  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:
      1x 002C0632002C MTC20F2085S1RC48BA1 32 GB 2 rank 4800
      8x 00AD00B300AD HMCG88MEBRA113N 32 GB 2 rank 4800
      18x 00AD063200AD HMCG88MEBRA107N 32 GB 2 rank 4800
      5x 00AD069D00AD HMCG88MEBRA174N 32 GB 2 rank 4800

  ----------------------------------------------------------------
  23. BIOS
  (This section combines info from /sys/devices and dmidecode.)
      BIOS Vendor:      Dell Inc.
      BIOS Version:     1.6.6
      BIOS Date:        09/20/2023
      BIOS Revision:    1.6
```

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 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.
```

(Continued on next page)

Dell Inc.

PowerEdge R960 (Intel Xeon Gold 6416H)

SPECrate®2017_fp_base = 907

SPECrate®2017_fp_peak = 927

CPU2017 License: 6573　　　　　　　　　　　　　　　　**Test Date:** Dec-2023
Test Sponsor: Dell Inc.　　　　　　　　　　　　　　**Hardware Availability:** May-2023
Tested by: Dell Inc.　　　　　　　　　　　　　　　**Software Availability:** Dec-2023

Compiler Version Notes (Continued)

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

==============================================================================
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 2023.2.3 Build x
Copyright (C) 1985-2023 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 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.
--------------------------------------------------------------------------------


==============================================================================
C++, C, Fortran | 507.cactuBSSN_r(base, peak)
------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
Copyright (C) 1985-2023 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 2023.2.3 Build x
Copyright (C) 1985-2023 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 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.
--------------------------------------------------------------------------------
```

Base Compiler Invocation

C benchmarks:
```
icx
```

C++ benchmarks:
```
icpx
```

Fortran benchmarks:
```
ifx
```

(Continued on next page)

Dell Inc.

PowerEdge R960 (Intel Xeon Gold 6416H)

SPECrate®2017_fp_base = 907

SPECrate®2017_fp_peak = 927

CPU2017 License: 6573
Test Sponsor: Dell Inc.
Tested by: Dell Inc.

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

Base Compiler Invocation (Continued)

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
```

SPEC CPU®2017 Floating Point Rate Result

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Dell Inc.

PowerEdge R960 (Intel Xeon Gold 6416H)

SPECrate®2017_fp_base = 907

SPECrate®2017_fp_peak = 927

CPU2017 License: 6573
Test Sponsor: Dell Inc.
Tested by: Dell Inc.

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

Base Optimization Flags (Continued)

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
```

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

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

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https://www.spec.org/

SPEC CPU®2017 Floating Point Rate Result

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PowerEdge R960 (Intel Xeon Gold 6416H)

SPECrate®2017_fp_base = 907

SPECrate®2017_fp_peak = 927

CPU2017 License: 6573
Test Sponsor: Dell Inc.
Tested by: Dell Inc.

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

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`

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)`

(Continued on next page)

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Dell Inc.

PowerEdge R960 (Intel Xeon Gold 6416H)

SPECrate®2017_fp_base = 907

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CPU2017 License: 6573
Test Sponsor: Dell Inc.
Tested by: Dell Inc.

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

Peak Optimization Flags (Continued)

511.povray_r (continued):
```
-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/Intel-ic2023p2-official-linux64.html
http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-Intel-Xeon-v1.6.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/Intel-ic2023p2-official-linux64.xml
http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-Intel-Xeon-v1.6.xml

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

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