SPEC CPU®2017 Floating Point Rate Result

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Dell Inc.

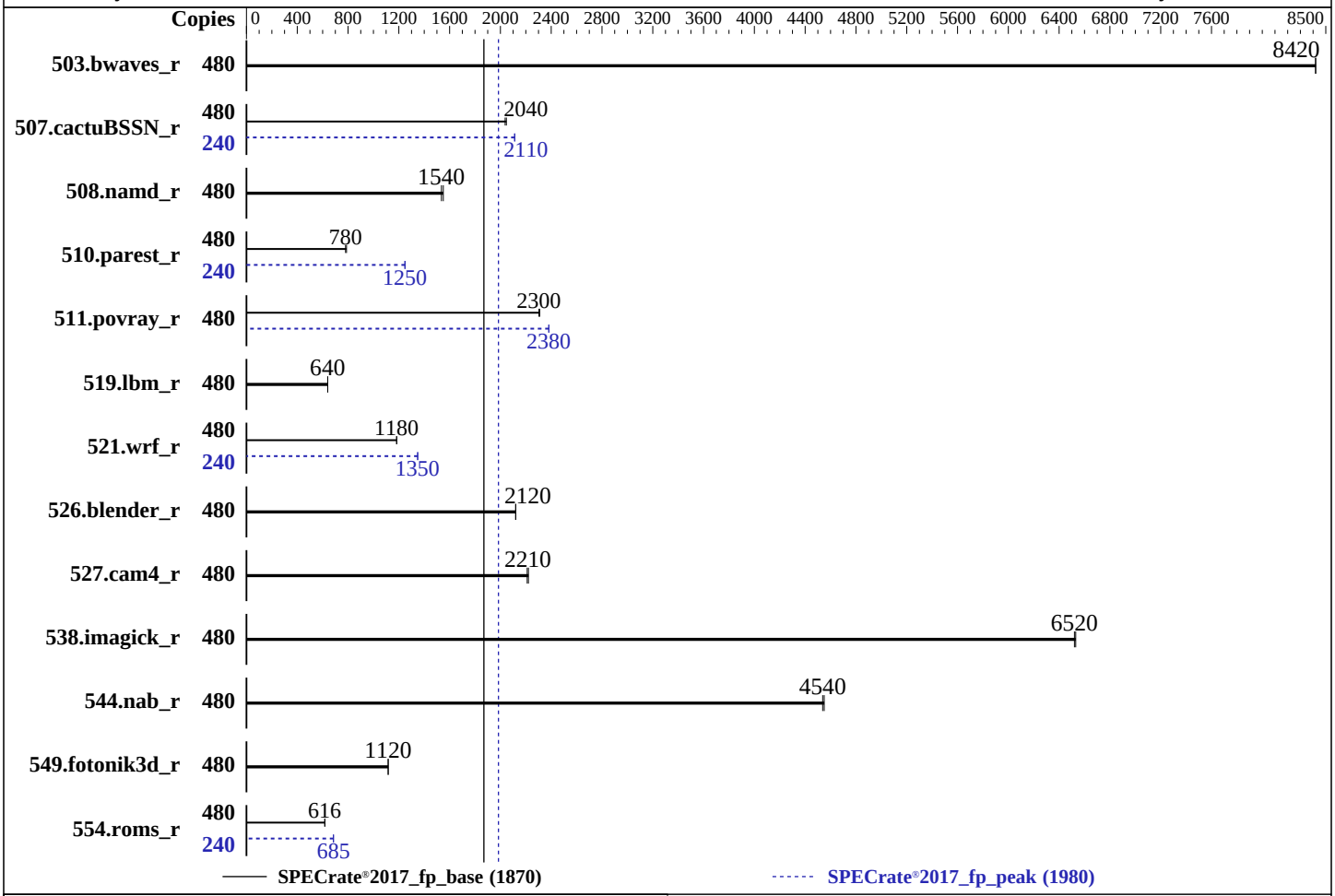
PowerEdge R960 (Intel Xeon Platinum 8490H)

SPECrate®2017_fp_base = 1870

SPECrate®2017_fp_peak = 1980

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

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



Hardware

CPU Name:	Intel Xeon Platinum 8490H
Max MHz:	3500
Nominal:	1900
Enabled:	240 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:	112.5 MB I+D on chip per chip
Other:	None
Memory:	2 TB (32 x 64 GB 2Rx4 PC5-4800B-R)
Storage:	230 GB on tmpfs
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 for Linux;
Parallel:	No
Firmware:	Version 1.4.0 released Mar-2023
File System:	tmpfs
System State:	Run level 5 (graphical 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.

Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
503.bwaves_r	480	**572**	**8420**	572	8420			480	**572**	**8420**	572	8420		
507.cactuBSSN_r	480	**298**	**2040**	297	2050			240	**144**	**2110**	144	2110		
508.namd_r	480	**297**	**1540**	294	1550			480	**297**	**1540**	294	1550		
510.parest_r	480	**1609**	**780**	1593	788			240	**503**	**1250**	503	1250		
511.povray_r	480	**487**	**2300**	485	2310			480	**471**	**2380**	471	2380		
519.lbm_r	480	**791**	**640**	790	640			480	**791**	**640**	790	640		
521.wrf_r	480	909	1180	**909**	**1180**			240	**399**	**1350**	399	1350		
526.blender_r	480	345	2120	**345**	**2120**			480	345	2120	**345**	**2120**		
527.cam4_r	480	378	2220	**380**	**2210**			480	378	2220	**380**	**2210**		
538.imagick_r	480	183	6530	**183**	**6520**			480	183	6530	**183**	**6520**		
544.nab_r	480	178	4550	**178**	**4540**			480	178	4550	**178**	**4540**		
549.fotonik3d_r	480	1676	1120	**1676**	**1120**			480	1676	1120	**1676**	**1120**		
554.roms_r	480	1234	618	**1238**	**616**			240	556	685	**557**	**685**		

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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-ic2023.0/lib/intel64:/mnt/ramdisk/cpu2017-1.1.9-ic2023.0/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
```

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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 230 GB ramdisk created with the cmd: "mount -t tmpfs -o size=230G tmpfs /mnt/ramdisk"
```

Platform Notes

```
BIOS settings:
                ADDDC Setting : Disabled
        DIMM Self Healing on
    Uncorrectable Memory Error : Disabled
       DCU Streamer Prefetcher : Disabled
              Sub NUMA Cluster : 4-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-ic2023.0/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost.localdomain Fri Apr  7 08:08:25 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. Systemd service manager version: systemd 250 (250-6.el9_0)
11. Services, from systemctl list-unit-files
12. Linux kernel boot-time arguments, from /proc/cmdline
13. cpupower frequency-info
14. sysctl
15. /sys/kernel/mm/transparent_hugepage
16. /sys/kernel/mm/transparent_hugepage/khugepaged
```

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Platform Notes (Continued)

```
17. OS release
18. Disk information
19. /sys/devices/virtual/dmi/id
20. dmidecode
21. 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
   08:08:25 up  4:50,  1 user,  load average: 196.34, 398.38, 443.99
  USER     TTY        LOGIN@   IDLE   JCPU   PCPU WHAT
  root     :1        03:19   ?xdm?   1:02m  0.00s /usr/libexec/gdm-x-session --register-session --run-script
  gnome-session

------------------------------------------------------------
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) 8254425
  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) 8254425
  virtual memory              (kbytes, -v) unlimited
  file locks                          (-x) unlimited

------------------------------------------------------------
5. sysinfo process ancestry
 /usr/lib/systemd/systemd rhgb --switched-root --system --deserialize 31
 /usr/lib/systemd/systemd --user
 /usr/libexec/gnome-terminal-server
 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-adddcD=1
   --define DL-BIOS-SNC=4 --output_format csv,html,pdf,txt
 /bin/bash ./dell-run-speccpu.sh rate --define DL-BIOSinc=Dell-BIOS_Xeon-4.inc --define DL-BIOS-adddcD=1
   --define DL-BIOS-SNC=4 --output_format csv,html,pdf,txt
 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 --iterations 2 --define
   DL-BIOSinc=Dell-BIOS_Xeon-4.inc --define DL-BIOS-adddcD=1 --define DL-BIOS-SNC=4 --output_format
```

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Platform Notes (Continued)

```
   csv,html,pdf,txt 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 --iterations 2
   --define DL-BIOSinc=Dell-BIOS_Xeon-4.inc --define DL-BIOS-adddcD=1 --define DL-BIOS-SNC=4 --output_format
   csv,html,pdf,txt --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-ic2023.0

------------------------------------------------------------
6. /proc/cpuinfo
    model name      : Intel(R) Xeon(R) Platinum 8490H
    vendor_id       : GenuineIntel
    cpu family      : 6
    model           : 143
    stepping        : 8
    microcode       : 0x2b0001b0
    bugs            : spectre_v1 spectre_v2 spec_store_bypass swapgs
    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 2.37.4:
  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):                          480
  On-line CPU(s) list:             0-479
  Vendor ID:                       GenuineIntel
  BIOS Vendor ID:                  Intel
  Model name:                      Intel(R) Xeon(R) Platinum 8490H
  BIOS 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:                        8
  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
```

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Platform Notes (Continued)

```
                        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:            11.3 MiB (240 instances)
  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):    0,8,16,24,32,40,48,56,64,72,80,88,96,104,112,240,248,256,264,272,280,288,2
                        96,304,312,320,328,336,344,352
  NUMA node1 CPU(s):    120,128,136,144,152,160,168,176,184,192,200,208,216,224,232,360,368,376,38
                        4,392,400,408,416,424,432,440,448,456,464,472
  NUMA node2 CPU(s):    4,12,20,28,36,44,52,60,68,76,84,92,100,108,116,244,252,260,268,276,284,292
                        ,300,308,316,324,332,340,348,356
  NUMA node3 CPU(s):    124,132,140,148,156,164,172,180,188,196,204,212,220,228,236,364,372,380,38
                        8,396,404,412,420,428,436,444,452,460,468,476
  NUMA node4 CPU(s):    1,9,17,25,33,41,49,57,65,73,81,89,97,105,113,241,249,257,265,273,281,289,2
                        97,305,313,321,329,337,345,353
  NUMA node5 CPU(s):    121,129,137,145,153,161,169,177,185,193,201,209,217,225,233,361,369,377,38
                        5,393,401,409,417,425,433,441,449,457,465,473
  NUMA node6 CPU(s):    5,13,21,29,37,45,53,61,69,77,85,93,101,109,117,245,253,261,269,277,285,293
                        ,301,309,317,325,333,341,349,357
  NUMA node7 CPU(s):    125,133,141,149,157,165,173,181,189,197,205,213,221,229,237,365,373,381,38
                        9,397,405,413,421,429,437,445,453,461,469,477
  NUMA node8 CPU(s):    2,10,18,26,34,42,50,58,66,74,82,90,98,106,114,242,250,258,266,274,282,290,
                        298,306,314,322,330,338,346,354
  NUMA node9 CPU(s):    122,130,138,146,154,162,170,178,186,194,202,210,218,226,234,362,370,378,38
                        6,394,402,410,418,426,434,442,450,458,466,474
  NUMA node10 CPU(s):   6,14,22,30,38,46,54,62,70,78,86,94,102,110,118,246,254,262,270,278,286,294
                        ,302,310,318,326,334,342,350,358
  NUMA node11 CPU(s):   126,134,142,150,158,166,174,182,190,198,206,214,222,230,238,366,374,382,39
                        0,398,406,414,422,430,438,446,454,462,470,478
  NUMA node12 CPU(s):   3,11,19,27,35,43,51,59,67,75,83,91,99,107,115,243,251,259,267,275,283,291,
                        299,307,315,323,331,339,347,355
  NUMA node13 CPU(s):   123,131,139,147,155,163,171,179,187,195,203,211,219,227,235,363,371,379,38
                        7,395,403,411,419,427,435,443,451,459,467,475
  NUMA node14 CPU(s):   7,15,23,31,39,47,55,63,71,79,87,95,103,111,119,247,255,263,271,279,287,295
                        ,303,311,319,327,335,343,351,359
  NUMA node15 CPU(s):   127,135,143,151,159,167,175,183,191,199,207,215,223,231,239,367,375,383,39
                        1,399,407,415,423,431,439,447,455,463,471,479
  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
```

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Platform Notes (Continued)

```
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:
  0,8,16,24,32,40,48,56,64,72,80,88,96,104,112,240,248,256,264,272,280,288,296,304,312,320,328,336,344,352
  node 0 size: 128470 MB
  node 0 free: 127021 MB
  node 1 cpus:
  120,128,136,144,152,160,168,176,184,192,200,208,216,224,232,360,368,376,384,392,400,408,416,424,432,440,448
  ,456,464,472
  node 1 size: 129017 MB
  node 1 free: 127833 MB
  node 2 cpus:
  4,12,20,28,36,44,52,60,68,76,84,92,100,108,116,244,252,260,268,276,284,292,300,308,316,324,332,340,348,356
  node 2 size: 129017 MB
  node 2 free: 127780 MB
  node 3 cpus:
  124,132,140,148,156,164,172,180,188,196,204,212,220,228,236,364,372,380,388,396,404,412,420,428,436,444,452
  ,460,468,476
  node 3 size: 129017 MB
  node 3 free: 127824 MB
  node 4 cpus:
  1,9,17,25,33,41,49,57,65,73,81,89,97,105,113,241,249,257,265,273,281,289,297,305,313,321,329,337,345,353
  node 4 size: 129017 MB
  node 4 free: 127754 MB
  node 5 cpus:
  121,129,137,145,153,161,169,177,185,193,201,209,217,225,233,361,369,377,385,393,401,409,417,425,433,441,449
  ,457,465,473
  node 5 size: 129017 MB
  node 5 free: 127814 MB
  node 6 cpus:
  5,13,21,29,37,45,53,61,69,77,85,93,101,109,117,245,253,261,269,277,285,293,301,309,317,325,333,341,349,357
  node 6 size: 129017 MB
  node 6 free: 127788 MB
  node 7 cpus:
  125,133,141,149,157,165,173,181,189,197,205,213,221,229,237,365,373,381,389,397,405,413,421,429,437,445,453
  ,461,469,477
  node 7 size: 129017 MB
  node 7 free: 127823 MB
  node 8 cpus:
  2,10,18,26,34,42,50,58,66,74,82,90,98,106,114,242,250,258,266,274,282,290,298,306,314,322,330,338,346,354
  node 8 size: 129017 MB
  node 8 free: 118936 MB
  node 9 cpus:
  122,130,138,146,154,162,170,178,186,194,202,210,218,226,234,362,370,378,386,394,402,410,418,426,434,442,450
  ,458,466,474
  node 9 size: 129017 MB
  node 9 free: 127576 MB
  node 10 cpus:
  6,14,22,30,38,46,54,62,70,78,86,94,102,110,118,246,254,262,270,278,286,294,302,310,318,326,334,342,350,358
  node 10 size: 129017 MB
  node 10 free: 127755 MB
```

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Platform Notes (Continued)

```
  node 11 cpus:
  126,134,142,150,158,166,174,182,190,198,206,214,222,230,238,366,374,382,390,398,406,414,422,430,438,446,454
  ,462,470,478
  node 11 size: 129017 MB
  node 11 free: 127814 MB
  node 12 cpus:
  3,11,19,27,35,43,51,59,67,75,83,91,99,107,115,243,251,259,267,275,283,291,299,307,315,323,331,339,347,355
  node 12 size: 129017 MB
  node 12 free: 127775 MB
  node 13 cpus:
  123,131,139,147,155,163,171,179,187,195,203,211,219,227,235,363,371,379,387,395,403,411,419,427,435,443,451
  ,459,467,475
  node 13 size: 129017 MB
  node 13 free: 126960 MB
  node 14 cpus:
  7,15,23,31,39,47,55,63,71,79,87,95,103,111,119,247,255,263,271,279,287,295,303,311,319,327,335,343,351,359
  node 14 size: 128981 MB
  node 14 free: 127762 MB
  node 15 cpus:
  127,135,143,151,159,167,175,183,191,199,207,215,223,231,239,367,375,383,391,399,407,415,423,431,439,447,455
  ,463,471,479
  node 15 size: 128988 MB
  node 15 free: 127771 MB
  node distances:
  node   0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15
    0:  10  12  12  12  21  21  21  21  21  21  21  21  21  21  21  21
    1:  12  10  12  12  21  21  21  21  21  21  21  21  21  21  21  21
    2:  12  12  10  12  21  21  21  21  21  21  21  21  21  21  21  21
    3:  12  12  12  10  21  21  21  21  21  21  21  21  21  21  21  21
    4:  21  21  21  21  10  12  12  12  21  21  21  21  21  21  21  21
    5:  21  21  21  21  12  10  12  12  21  21  21  21  21  21  21  21
    6:  21  21  21  21  12  12  10  12  21  21  21  21  21  21  21  21
    7:  21  21  21  21  12  12  12  10  21  21  21  21  21  21  21  21
    8:  21  21  21  21  21  21  21  21  10  12  12  12  21  21  21  21
    9:  21  21  21  21  21  21  21  21  12  10  12  12  21  21  21  21
   10:  21  21  21  21  21  21  21  21  12  12  10  12  21  21  21  21
   11:  21  21  21  21  21  21  21  21  12  12  12  10  21  21  21  21
   12:  21  21  21  21  21  21  21  21  21  21  21  21  10  12  12  12
   13:  21  21  21  21  21  21  21  21  21  21  21  21  12  10  12  12
   14:  21  21  21  21  21  21  21  21  21  21  21  21  12  12  10  12
   15:  21  21  21  21  21  21  21  21  21  21  21  21  12  12  12  10

------------------------------------------------------------
9. /proc/meminfo
   MemTotal:       2113195860 kB

'who -r' did not return a run level

------------------------------------------------------------
10. Systemd service manager version: systemd 250 (250-6.el9_0)
  Default Target  Status
  graphical       starting

------------------------------------------------------------
11. Services, from systemctl list-unit-files
  STATE           UNIT FILES
  enabled         ModemManager NetworkManager NetworkManager-dispatcher NetworkManager-wait-online
                  accounts-daemon atd auditd avahi-daemon bluetooth crond cups dbus-broker gdm getty@
                  insights-client-boot irqbalance iscsi iscsi-onboot kdump libstoragemgmt lm_sensors
                  low-memory-monitor lvm2-monitor mcelog mdmonitor microcode multipathd nis-domainname
```

(Continued on next page)

Platform Notes (Continued)

```
                  nvmefc-boot-connections ostree-remount pmcd pmie pmlogger power-profiles-daemon
                  qemu-guest-agent rhsmcertd rpcbind rsyslog rtkit-daemon selinux-autorelabel-mark smartd
                  sshd sssd switcheroo-control sysstat systemd-network-generator udisks2 upower vgauthd
                  virtqemud vmtoolsd
  enabled-runtime systemd-remount-fs
  disabled        arp-ethers autofs blk-availability brltty canberra-system-bootup canberra-system-shutdown
                  canberra-system-shutdown-reboot chrony-wait chronyd cni-dhcp console-getty cpupower
                  cups-browsed dbus-daemon debug-shell dnsmasq dovecot fancontrol fcoe firewalld
                  grafana-server gssproxy httpd httpd@ ibacm iprdump iprinit iprupdate ipsec iscsid iscsiuio
                  kpatch kvm_stat ledmon libvirt-guests libvirtd lldpad man-db-restart-cache-update named
                  named-chroot nfs-blkmap nfs-server nftables nmb numad nvmf-autoconnect pmfind pmie_farm
                  pmlogger_farm pmproxy podman podman-auto-update podman-restart postfix powertop psacct
                  ras-mc-ctl rasdaemon rdisc rhcd rhsm rhsm-facts rpmdb-rebuild rrdcached saslauthd
                  serial-getty@ smb snmpd snmptrapd spamassassin speech-dispatcherd srp_daemon
                  srp_daemon_port@ sshd-keygen@ systemd-boot-check-no-failures systemd-nspawn@
                  systemd-pstore systemd-sysext target targetclid tog-pegasus trace-cmd virtinterfaced
                  virtnetworkd virtnodedevd virtnwfilterd virtproxyd virtsecretd virtstoraged vsftpd
                  wpa_supplicant
  indirect        pcscd spice-vdagentd sssd-autofs sssd-kcm sssd-nss sssd-pac sssd-pam sssd-ssh sssd-sudo
                  virtlockd virtlogd vsftpd@

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

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

------------------------------------------------------------
14. sysctl
  kernel.numa_balancing               1
  kernel.randomize_va_space           2
  vm.compaction_proactiveness        20
  vm.dirty_background_bytes           0
  vm.dirty_background_ratio          10
  vm.dirty_bytes                      0
  vm.dirty_expire_centisecs        3000
  vm.dirty_ratio                     20
  vm.dirty_writeback_centisecs      500
  vm.dirtytime_expire_seconds     43200
  vm.extfrag_threshold              500
  vm.min_unmapped_ratio               1
  vm.nr_hugepages                     0
  vm.nr_hugepages_mempolicy           0
  vm.nr_overcommit_hugepages          0
  vm.swappiness                      60
  vm.watermark_boost_factor       15000
  vm.watermark_scale_factor          10
```

(Continued on next page)

Platform Notes (Continued)

```
  vm.zone_reclaim_mode              0

------------------------------------------------------------
15. /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

------------------------------------------------------------
16. /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

------------------------------------------------------------
17. 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)

------------------------------------------------------------
18. Disk information
SPEC is set to: /mnt/ramdisk/cpu2017-1.1.9-ic2023.0
  Filesystem     Type   Size  Used Avail Use% Mounted on
  tmpfs          tmpfs  230G  4.2G  226G   2% /mnt/ramdisk

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

------------------------------------------------------------
20. 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:
    2x 00AD00B300AD HMCG94MEBRA121N 64 GB 2 rank 4800
    30x 00AD063200AD HMCG94MEBRA109N 64 GB 2 rank 4800


------------------------------------------------------------
21. BIOS
(This section combines info from /sys/devices and dmidecode.)
   BIOS Vendor:       Dell Inc.
   BIOS Version:      1.4.0
   BIOS Date:         03/15/2023
   BIOS Revision:     1.4
```

Compiler Version Notes

```
==============================================================================================================
C               | 519.lbm_r(base, peak) 538.imagick_r(base, peak) 544.nab_r(base, peak)
--------------------------------------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
--------------------------------------------------------------------------------------------------------------

==============================================================================================================
C++             | 508.namd_r(base, peak) 510.parest_r(base, peak)
--------------------------------------------------------------------------------------------------------------
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--------------------------------------------------------------------------------------------------------------

==============================================================================================================
C++, C          | 511.povray_r(base, peak) 526.blender_r(base, peak)
--------------------------------------------------------------------------------------------------------------
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
--------------------------------------------------------------------------------------------------------------

==============================================================================================================
C++, C, Fortran | 507.cactuBSSN_r(base, peak)
--------------------------------------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
--------------------------------------------------------------------------------------------------------------

==============================================================================================================
Fortran         | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak) 554.roms_r(base, peak)
--------------------------------------------------------------------------------------------------------------
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
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--------------------------------------------------------------------------------------------------------------

==============================================================================================================
Fortran, C      | 521.wrf_r(base, peak) 527.cam4_r(base, peak)
--------------------------------------------------------------------------------------------------------------
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
--------------------------------------------------------------------------------------------------------------
```

Base Compiler Invocation

C benchmarks:
icx

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Base Compiler Invocation (Continued)

C++ benchmarks:
icpx

Fortran benchmarks:
ifx

Benchmarks using both Fortran and C:
ifx icx

Benchmarks using both C and C++:
icpx icx

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

Base Portability Flags

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

Base Optimization Flags

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

C++ benchmarks:
-w -std=c++14 -m64 -Wl,-z,muldefs -xsapphirerapids -Ofast
-ffast-math -flto -mfpmath=sse -funroll-loops

(Continued on next page)

Base Optimization Flags (Continued)

C++ benchmarks (continued):
-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

(Continued on next page)

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/Intel-ic2023-official-linux64.html`
`http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-Intel-Xeon-v1.3.html`

You can also download the XML flags sources by saving the following links:

`http://www.spec.org/cpu2017/flags/Intel-ic2023-official-linux64.xml`
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