SPEC CPU®2017 Floating Point Speed Result

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Dell Inc.

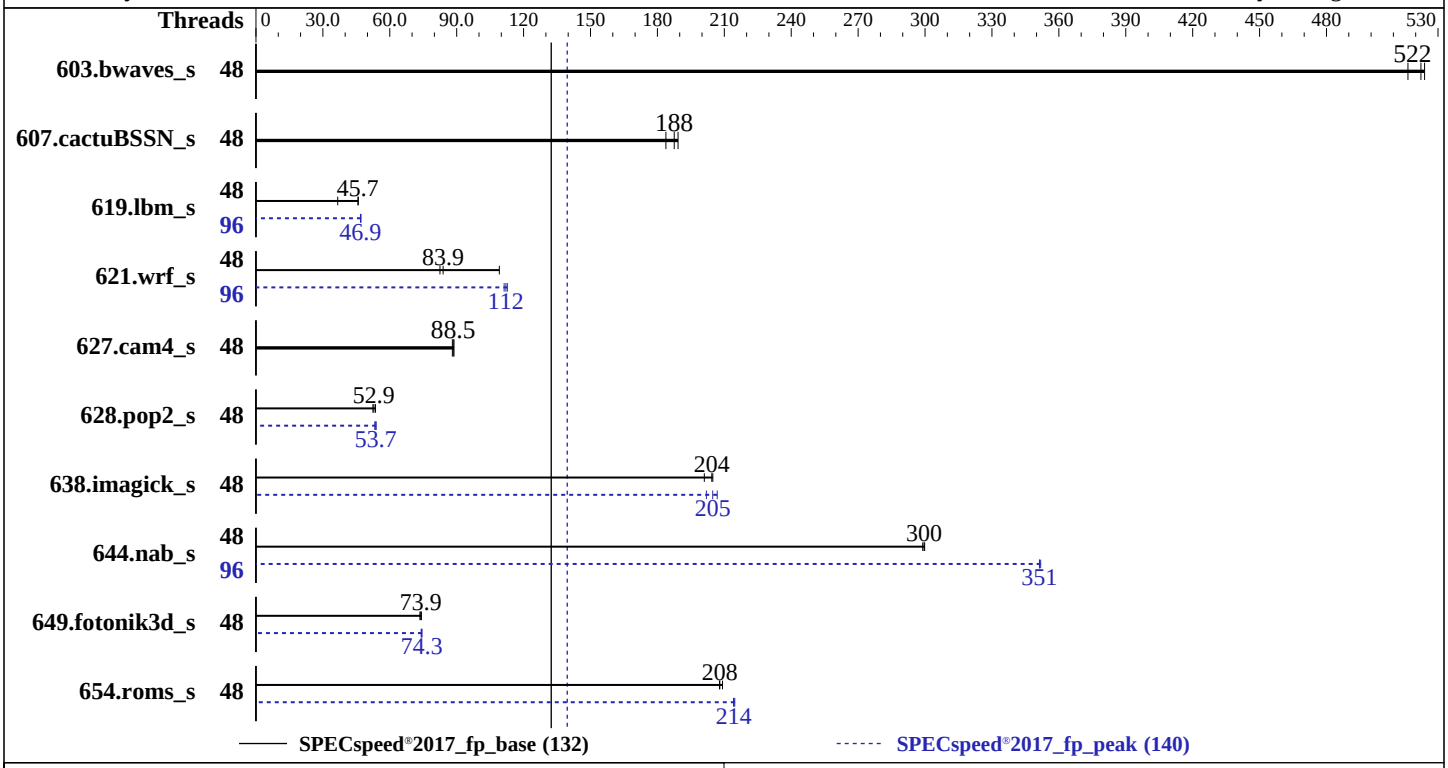
PowerEdge C6525 (AMD EPYC 7F72, 3.20 GHz)

SPECspeed®2017_fp_base = 132

SPECspeed®2017_fp_peak = 140

CPU2017 License: 55
Test Sponsor: Dell Inc.
Tested by: Dell Inc.

Test Date: Jan-2020
Hardware Availability: Apr-2020
Software Availability: Aug-2019



Hardware

CPU Name:	AMD EPYC 7F72
Max MHz:	3700
Nominal:	3200
Enabled:	48 cores, 2 chips, 2 threads/core
Orderable:	1,2 chips
Cache L1:	32 KB I + 32 KB D on chip per core
L2:	512 KB I+D on chip per core
L3:	192 MB I+D on chip per chip, 16 MB shared / 2 cores
Other:	None
Memory:	512 GB (16 x 32 GB 2Rx4 PC4-3200AA-R, running at 3200)
Storage:	1 x 480 GB SATA SSD
Other:	None

Software

OS:	SUSE Linux Enterprise Server 15 SP1 kernel 4.12.14-195-default
Compiler:	C/C++/Fortran: Version 2.0.0 of AOCC
Parallel:	Yes
Firmware:	Version 1.2.2 released Nov-2019
File System:	xfs
System State:	Run level 3 (multi-user)
Base Pointers:	64-bit
Peak Pointers:	64-bit
Other:	jemalloc: jemalloc memory allocator library v5.2.0
Power Management:	BIOS set to prefer performance at the cost of additional power usage.

Results Table

Benchmark	Base							Peak						
	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
603.bwaves_s	48	114	517	**113**	**522**	113	524	48	114	517	**113**	**522**	113	524
607.cactuBSSN_s	48	90.7	184	88.1	189	**88.9**	**188**	48	90.7	184	88.1	189	**88.9**	**188**
619.lbm_s	48	**115**	**45.7**	114	45.9	143	36.7	96	**112**	**46.9**	111	47.1	112	46.8
621.wrf_s	48	160	82.5	121	109	**158**	**83.9**	96	117	113	119	111	**118**	**112**
627.cam4_s	48	101	88.1	**100**	**88.5**	99.8	88.8	48	101	88.1	**100**	**88.5**	99.8	88.8
628.pop2_s	48	226	52.4	**224**	**52.9**	221	53.6	48	223	53.3	**221**	**53.7**	220	53.9
638.imagick_s	48	**70.6**	**204**	70.4	205	71.8	201	48	69.8	207	**70.4**	**205**	71.4	202
644.nab_s	48	58.3	300	**58.3**	**300**	58.4	299	96	49.7	351	**49.7**	**351**	49.7	352
649.fotonik3d_s	48	**123**	**73.9**	124	73.5	123	74.2	48	123	74.1	**123**	**74.3**	122	74.4
654.roms_s	48	75.3	209	75.7	208	**75.7**	**208**	48	73.3	215	**73.5**	**214**	73.5	214

SPECspeed®2017_fp_base = 132

SPECspeed®2017_fp_peak = 140

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

Compiler Notes

```
The AMD64 AOCC Compiler Suite is available at
http://developer.amd.com/amd-aocc/
```

Submit Notes

```
The config file option 'submit' was used.
'numactl' was used to bind copies to the cores.
See the configuration file for details.
```

Operating System Notes

```
'ulimit -s unlimited' was used to set environment stack size
'ulimit -l 2097152' was used to set environment locked pages in memory limit

runcpu command invoked through numactl i.e.:
numactl --interleave=all runcpu <etc>

Set dirty_ratio=8 to limit dirty cache to 8% of memory
Set swappiness=1 to swap only if necessary
Set zone_reclaim_mode=1 to free local node memory and avoid remote memory
sync then drop_caches=3 to reset caches before invoking runcpu

dirty_ratio, swappiness, zone_reclaim_mode and drop_caches were
all set using privileged echo (e.g. echo 1 > /proc/sys/vm/swappiness).

Transparent huge pages set to 'always' for this run (OS default)
```

Environment Variables Notes

```
Environment variables set by runcpu before the start of the run:
GOMP_CPU_AFFINITY = "0-95"
LD_LIBRARY_PATH =
     "/root/cpu2017-1.1.0/amd_speed_aocc200_rome_C_lib/64;/root/cpu2017-1.1.0
     /amd_speed_aocc200_rome_C_lib/32:"
MALLOC_CONF = "retain:true"
OMP_DYNAMIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "96"

Environment variables set by runcpu during the 619.lbm_s peak run:
GOMP_CPU_AFFINITY = "0 48 1 49 2 50 3 51 4 52 5 53 6 54 7 55 8 56 9 57 10 58
     11 59 12 60 13 61 14 62 15 63 16 64 17 65 18 66 19 67 20 68 21 69 22 70
     23 71 24 72 25 73 26 74 27 75 28 76 29 77 30 78 31 79 32 80 33 81 34 82
     35 83 36 84 37 85 38 86 39 87 40 88 41 89 42 90 43 91 44 92 45 93 46 94
     47 95"

Environment variables set by runcpu during the 621.wrf_s peak run:
GOMP_CPU_AFFINITY = "0 48 1 49 2 50 3 51 4 52 5 53 6 54 7 55 8 56 9 57 10 58
     11 59 12 60 13 61 14 62 15 63 16 64 17 65 18 66 19 67 20 68 21 69 22 70
     23 71 24 72 25 73 26 74 27 75 28 76 29 77 30 78 31 79 32 80 33 81 34 82
     35 83 36 84 37 85 38 86 39 87 40 88 41 89 42 90 43 91 44 92 45 93 46 94
     47 95"

Environment variables set by runcpu during the 628.pop2_s peak run:
GOMP_CPU_AFFINITY = "0-47"

Environment variables set by runcpu during the 638.imagick_s peak run:
GOMP_CPU_AFFINITY = "0-47"

Environment variables set by runcpu during the 644.nab_s peak run:
GOMP_CPU_AFFINITY = "0 48 1 49 2 50 3 51 4 52 5 53 6 54 7 55 8 56 9 57 10 58
     11 59 12 60 13 61 14 62 15 63 16 64 17 65 18 66 19 67 20 68 21 69 22 70
     23 71 24 72 25 73 26 74 27 75 28 76 29 77 30 78 31 79 32 80 33 81 34 82
     35 83 36 84 37 85 38 86 39 87 40 88 41 89 42 90 43 91 44 92 45 93 46 94
     47 95"

Environment variables set by runcpu during the 649.fotonik3d_s peak run:
GOMP_CPU_AFFINITY = "0-47"

Environment variables set by runcpu during the 654.roms_s peak run:
GOMP_CPU_AFFINITY = "0-47"
```

General Notes

```
Binaries were compiled on a system with 2x AMD EPYC 7601 CPU + 512GB Memory using Fedora 26

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: configured and built with GCC v9.1.0 in Ubuntu 19.04 with -O3 -znver2 -flto
jemalloc 5.2.0 is available here:
https://github.com/jemalloc/jemalloc/releases/download/5.2.0/jemalloc-5.2.0.tar.bz2
```

Platform Notes

```
 BIOS settings:
 NUMA Nodes Per Socket set to 2
 CCX as NUMA Domain set to Enabled
 System Profile set to Custom
 CPU Power Management set to Maximum Performance
 Memory Frequency set to Maximum Performance
 Turbo Boost Enabled
 Cstates set to Enabled
 Memory Patrol Scrub Disabled
 Memory Refresh Rate set to 1x
 PCI ASPM L1 Link Power Management Disabled
 Determinism Slider set to Power Determinism
 Efficiency Optimized Mode Disabled
 Memory Interleaving set to Disabled

 Sysinfo program /root/cpu2017-1.1.0/bin/sysinfo
 Rev: r6365 of 2019-08-21 295195f888a3d7edb1e6e46a485a0011
 running on linux-g3ob Tue Jan 21 07:26:08 2020

 SUT (System Under Test) info as seen by some common utilities.
 For more information on this section, see
    https://www.spec.org/cpu2017/Docs/config.html#sysinfo

 From /proc/cpuinfo
    model name : AMD EPYC 7F72 24-Core Processor
       2  "physical id"s (chips)
       96 "processors"
    cores, siblings (Caution: counting these is hw and system dependent. The following
    excerpts from /proc/cpuinfo might not be reliable.  Use with caution.)
       cpu cores : 24
```

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Platform Notes (Continued)

```
       siblings  : 48
      physical 0: cores 0 1 4 5 8 9 12 13 16 17 20 21 24 25 28 29 32 33 36 37 40 41 44 45
      physical 1: cores 0 1 4 5 8 9 12 13 16 17 20 21 24 25 28 29 32 33 36 37 40 41 44 45

 From lscpu:
      Architecture:        x86_64
      CPU op-mode(s):      32-bit, 64-bit
      Byte Order:          Little Endian
      Address sizes:       43 bits physical, 48 bits virtual
      CPU(s):              96
      On-line CPU(s) list: 0-95
      Thread(s) per core:  2
      Core(s) per socket:  24
      Socket(s):           2
      NUMA node(s):        24
      Vendor ID:           AuthenticAMD
      CPU family:          23
      Model:               49
      Model name:          AMD EPYC 7F72 24-Core Processor
      Stepping:            0
      CPU MHz:             3193.885
      BogoMIPS:            6387.77
      Virtualization:      AMD-V
      L1d cache:           32K
      L1i cache:           32K
      L2 cache:            512K
      L3 cache:            16384K
      NUMA node0 CPU(s):   0,1,48,49
      NUMA node1 CPU(s):   2,3,50,51
      NUMA node2 CPU(s):   4,5,52,53
      NUMA node3 CPU(s):   6,7,54,55
      NUMA node4 CPU(s):   8,9,56,57
      NUMA node5 CPU(s):   10,11,58,59
      NUMA node6 CPU(s):   12,13,60,61
      NUMA node7 CPU(s):   14,15,62,63
      NUMA node8 CPU(s):   16,17,64,65
      NUMA node9 CPU(s):   18,19,66,67
      NUMA node10 CPU(s):  20,21,68,69
      NUMA node11 CPU(s):  22,23,70,71
      NUMA node12 CPU(s):  24,25,72,73
      NUMA node13 CPU(s):  26,27,74,75
      NUMA node14 CPU(s):  28,29,76,77
      NUMA node15 CPU(s):  30,31,78,79
      NUMA node16 CPU(s):  32,33,80,81
      NUMA node17 CPU(s):  34,35,82,83
      NUMA node18 CPU(s):  36,37,84,85
      NUMA node19 CPU(s):  38,39,86,87
```

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Platform Notes (Continued)

```
      NUMA node20 CPU(s):  40,41,88,89
      NUMA node21 CPU(s):  42,43,90,91
      NUMA node22 CPU(s):  44,45,92,93
      NUMA node23 CPU(s):  46,47,94,95
      Flags:               fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
      pat pse36 clflush mmx fxsr sse sse2 ht syscall nx mmxext fxsr_opt pdpe1gb rdtscp lm
      constant_tsc rep_good nopl xtopology nonstop_tsc cpuid extd_apicid aperfmperf pni
      pclmulqdq monitor ssse3 fma cx16 sse4_1 sse4_2 x2apic movbe popcnt aes xsave avx
      f16c rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse
      3dnowprefetch osvw ibs skinit wdt tce topoext perfctr_core perfctr_nb bpext
      perfctr_l2 mwaitx cpb cat_l3 cdp_l3 hw_pstate sme ssbd sev ibrs ibpb stibp vmmcall
      fsgsbase bmi1 avx2 smep bmi2 cqm rdt_a rdseed adx smap clflushopt clwb sha_ni
      xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local
      clzero irperf xsaveerptr arat npt lbrv svm_lock nrip_save tsc_scale vmcb_clean
      flushbyasid decodeassists pausefilter pfthreshold avic v_vmsave_vmload vgif umip
      rdpid overflow_recov succor smca

  /proc/cpuinfo cache data
     cache size : 512 KB

  From numactl --hardware  WARNING: a numactl 'node' might or might not correspond to a
  physical chip.
    available: 24 nodes (0-23)
    node 0 cpus: 0 1 48 49
    node 0 size: 21052 MB
    node 0 free: 21009 MB
    node 1 cpus: 2 3 50 51
    node 1 size: 21473 MB
    node 1 free: 21451 MB
    node 2 cpus: 4 5 52 53
    node 2 size: 21503 MB
    node 2 free: 21471 MB
    node 3 cpus: 6 7 54 55
    node 3 size: 21502 MB
    node 3 free: 21476 MB
    node 4 cpus: 8 9 56 57
    node 4 size: 21502 MB
    node 4 free: 21459 MB
    node 5 cpus: 10 11 58 59
    node 5 size: 21504 MB
    node 5 free: 21483 MB
    node 6 cpus: 12 13 60 61
    node 6 size: 21502 MB
    node 6 free: 21485 MB
    node 7 cpus: 14 15 62 63
    node 7 size: 21502 MB
    node 7 free: 21485 MB
```

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Platform Notes (Continued)

```
node 8 cpus: 16 17 64 65
node 8 size: 21503 MB
node 8 free: 21487 MB
node 9 cpus: 18 19 66 67
node 9 size: 21502 MB
node 9 free: 21485 MB
node 10 cpus: 20 21 68 69
node 10 size: 21502 MB
node 10 free: 21485 MB
node 11 cpus: 22 23 70 71
node 11 size: 21491 MB
node 11 free: 21473 MB
node 12 cpus: 24 25 72 73
node 12 size: 21502 MB
node 12 free: 21468 MB
node 13 cpus: 26 27 74 75
node 13 size: 21502 MB
node 13 free: 21367 MB
node 14 cpus: 28 29 76 77
node 14 size: 21503 MB
node 14 free: 21452 MB
node 15 cpus: 30 31 78 79
node 15 size: 21502 MB
node 15 free: 21369 MB
node 16 cpus: 32 33 80 81
node 16 size: 21502 MB
node 16 free: 21435 MB
node 17 cpus: 34 35 82 83
node 17 size: 21504 MB
node 17 free: 21444 MB
node 18 cpus: 36 37 84 85
node 18 size: 21502 MB
node 18 free: 21484 MB
node 19 cpus: 38 39 86 87
node 19 size: 21502 MB
node 19 free: 21484 MB
node 20 cpus: 40 41 88 89
node 20 size: 21503 MB
node 20 free: 21481 MB
node 21 cpus: 42 43 90 91
node 21 size: 21502 MB
node 21 free: 21481 MB
node 22 cpus: 44 45 92 93
node 22 size: 21502 MB
node 22 free: 21485 MB
node 23 cpus: 46 47 94 95
node 23 size: 21502 MB
```

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Platform Notes (Continued)

```
node 23 free: 21483 MB
node distances:
node   0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
20  21  22  23
  0:  10  11  11  11  11  11  12  12  12  12  12  12  32  32  32  32  32  32  32  32
  32  32  32  32
  1:  11  10  11  11  11  11  12  12  12  12  12  12  32  32  32  32  32  32  32  32
  32  32  32  32
  2:  11  11  10  11  11  11  12  12  12  12  12  12  32  32  32  32  32  32  32  32
  32  32  32  32
  3:  11  11  11  10  11  11  12  12  12  12  12  12  32  32  32  32  32  32  32  32
  32  32  32  32
  4:  11  11  11  11  10  11  12  12  12  12  12  12  32  32  32  32  32  32  32  32
  32  32  32  32
  5:  11  11  11  11  11  10  12  12  12  12  12  12  32  32  32  32  32  32  32  32
  32  32  32  32
  6:  12  12  12  12  12  12  10  11  11  11  11  11  32  32  32  32  32  32  32  32
  32  32  32  32
  7:  12  12  12  12  12  12  11  10  11  11  11  11  32  32  32  32  32  32  32  32
  32  32  32  32
  8:  12  12  12  12  12  12  11  11  10  11  11  11  32  32  32  32  32  32  32  32
  32  32  32  32
  9:  12  12  12  12  12  12  11  11  11  10  11  11  32  32  32  32  32  32  32  32
  32  32  32  32
 10:  12  12  12  12  12  12  11  11  11  11  10  11  32  32  32  32  32  32  32  32
 32  32  32  32
 11:  12  12  12  12  12  12  11  11  11  11  11  10  32  32  32  32  32  32  32  32
 32  32  32  32
 12:  32  32  32  32  32  32  32  32  32  32  32  32  10  11  11  11  11  11  12  12
 12  12  12  12
 13:  32  32  32  32  32  32  32  32  32  32  32  32  11  10  11  11  11  11  12  12
 12  12  12  12
 14:  32  32  32  32  32  32  32  32  32  32  32  32  11  11  10  11  11  11  12  12
 12  12  12  12
 15:  32  32  32  32  32  32  32  32  32  32  32  32  11  11  11  10  11  11  12  12
 12  12  12  12
 16:  32  32  32  32  32  32  32  32  32  32  32  32  11  11  11  11  10  11  12  12
 12  12  12  12
 17:  32  32  32  32  32  32  32  32  32  32  32  32  11  11  11  11  11  10  12  12
 12  12  12  12
 18:  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12  12  12  10  11
 11  11  11  11
 19:  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12  12  12  11  10
 11  11  11  11
 20:  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12  12  12  11  11
 10  11  11  11
 21:  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12  12  12  11  11
```


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Platform Notes (Continued)

```
    11  10  11  11
    22:  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12  12  12  11  11
    11  11  10  11
    23:  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12  12  12  11  11
    11  11  11  10

  From /proc/meminfo
     MemTotal:       527949252 kB
     HugePages_Total:       0
     Hugepagesize:       2048 kB

  From /etc/*release* /etc/*version*
     os-release:
        NAME="SLES"
        VERSION="15-SP1"
        VERSION_ID="15.1"
        PRETTY_NAME="SUSE Linux Enterprise Server 15 SP1"
        ID="sles"
        ID_LIKE="suse"
        ANSI_COLOR="0;32"
        CPE_NAME="cpe:/o:suse:sles:15:sp1"

  uname -a:
     Linux linux-g3ob 4.12.14-195-default #1 SMP Tue May 7 10:55:11 UTC 2019 (8fba516)
     x86_64 x86_64 x86_64 GNU/Linux

  Kernel self-reported vulnerability status:

  CVE-2018-3620 (L1 Terminal Fault):        Not affected
  Microarchitectural Data Sampling:         Not affected
  CVE-2017-5754 (Meltdown):                 Not affected
  CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled
                                            via prctl and seccomp
  CVE-2017-5753 (Spectre variant 1):        Mitigation: __user pointer sanitization
  CVE-2017-5715 (Spectre variant 2):        Mitigation: Full AMD retpoline, IBPB:
                                           conditional, IBRS_FW, STIBP: conditional, RSB
                                            filling

  run-level 3 Jan 17 17:31

  SPEC is set to: /root/cpu2017-1.1.0
     Filesystem     Type  Size  Used Avail Use% Mounted on
     /dev/sdb2      xfs   440G   34G  407G   8% /

  From /sys/devices/virtual/dmi/id
      BIOS:    Dell Inc. 1.2.2 11/13/2019
      Vendor:  Dell Inc.
```

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Platform Notes (Continued)

```
     Product: PowerEdge C6525
     Product Family: PowerEdge

  Additional information from dmidecode 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:
      16x 80AD863280AD HMA84GR7CJR4N-XN 32 GB 2 rank 3200

  (End of data from sysinfo program)
```

Compiler Version Notes

```
==============================================================================
C               | 619.lbm_s(base, peak) 638.imagick_s(base, peak)
                | 644.nab_s(base, peak)
------------------------------------------------------------------------------
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
------------------------------------------------------------------------------

==============================================================================
C++, C, Fortran | 607.cactuBSSN_s(base, peak)
------------------------------------------------------------------------------
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
------------------------------------------------------------------------------

==============================================================================
```


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Compiler Version Notes (Continued)

```
Fortran          | 603.bwaves_s(base, peak) 649.fotonik3d_s(base, peak)
                 | 654.roms_s(base, peak)
------------------------------------------------------------------------------
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
------------------------------------------------------------------------------

==============================================================================
Fortran, C       | 621.wrf_s(base, peak) 627.cam4_s(base, peak)
                 | 628.pop2_s(base, peak)
------------------------------------------------------------------------------
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
------------------------------------------------------------------------------
```

Base Compiler Invocation

C benchmarks:
`clang`

Fortran benchmarks:
`flang`

Benchmarks using both Fortran and C:
`flang clang`

Benchmarks using Fortran, C, and C++:
`clang++ clang flang`

Base Portability Flags

603.bwaves_s: `-DSPEC_LP64`

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Base Portability Flags (Continued)

607.cactuBSSN_s: -DSPEC_LP64
619.lbm_s: -DSPEC_LP64
621.wrf_s: -DSPEC_CASE_FLAG -Mbyteswapio -DSPEC_LP64
627.cam4_s: -DSPEC_CASE_FLAG -DSPEC_LP64
628.pop2_s: -DSPEC_CASE_FLAG -Mbyteswapio -DSPEC_LP64
638.imagick_s: -DSPEC_LP64
644.nab_s: -DSPEC_LP64
649.fotonik3d_s: -DSPEC_LP64
654.roms_s: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -ffast-math
-march=znver2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-fremap-arrays -mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp
-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000
-flv-function-specialization -z muldefs -DSPEC_OPENMP -fopenmp
-fopenmp=libomp -lomp -lpthread -ldl -lmvec -lamdlibm -ljemalloc
-lflang

Fortran benchmarks:
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver2
-funroll-loops -Mrecursive -mllvm -vector-library=LIBMVEC -z muldefs
-Kieee -fno-finite-math-only -DSPEC_OPENMP -fopenmp -fopenmp=libomp
-lomp -lpthread -ldl -lmvec -lamdlibm -ljemalloc -lflang

Benchmarks using both Fortran and C:
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -ffast-math
-march=znver2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-fremap-arrays -mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp
-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000
-flv-function-specialization -funroll-loops -Mrecursive -z muldefs
-Kieee -fno-finite-math-only -DSPEC_OPENMP -fopenmp -fopenmp=libomp
-lomp -lpthread -ldl -lmvec -lamdlibm -ljemalloc -lflang

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Base Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++:
-std=c++98 -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-suppress-fmas -O3 -ffast-math -march=znver2
-fstruct-layout=3 -mllvm -unroll-threshold=50 -fremap-arrays
-mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp
-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000
-flv-function-specialization -mllvm -loop-unswitch-threshold=200000
-mllvm -unroll-threshold=100 -mllvm -enable-partial-unswitch
-funroll-loops -Mrecursive -z muldefs -Kieee -fno-finite-math-only
-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lpthread -ldl -lmvec
-lamdlibm -ljemalloc -lflang

Base Other Flags

C benchmarks:
-Wno-return-type -DUSE_OPENMP

Fortran benchmarks:
-DUSE_OPENMP -Wno-return-type

Benchmarks using both Fortran and C:
-DUSE_OPENMP -Wno-return-type

Benchmarks using Fortran, C, and C++:
-Wno-return-type -DUSE_OPENMP

Peak Compiler Invocation

C benchmarks:
clang

Fortran benchmarks:
flang

Benchmarks using both Fortran and C:
flang clang

Benchmarks using Fortran, C, and C++:
clang++ clang flang

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast -march=znver2
-mno-sse4a -fstruct-layout=5 -mllvm -vectorize-memory-aggressively
-mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -unroll-threshold=50 -fremap-arrays
-mllvm -vector-library=LIBMVEC -mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp -mllvm -inline-threshold=1000
-flv-function-specialization -DSPEC_OPENMP -fopenmp -lmvec -lamdlibm
-fopenmp=libomp -lomp -lpthread -ldl -ljemalloc -lflang

Fortran benchmarks:

603.bwaves_s: basepeak = yes

649.fotonik3d_s: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3
-march=znver2 -funroll-loops -Mrecursive
-mllvm -vector-library=LIBMVEC -Kieee
-fno-finite-math-only -DSPEC_OPENMP -fopenmp
-fopenmp=libomp -lomp -lpthread -ldl -lmvec -lamdlibm
-ljemalloc -lflang

654.roms_s: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -O3 -march=znver2
-funroll-loops -Mrecursive -mllvm -vector-library=LIBMVEC
-Kieee -fno-finite-math-only -DSPEC_OPENMP -fopenmp
-fopenmp=libomp -lomp -lpthread -ldl -lmvec -lamdlibm
-ljemalloc -lflang

Benchmarks using both Fortran and C:

621.wrf_s: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize

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Peak Optimization Flags (Continued)

621.wrf_s (continued):
-Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver2 -mno-sse4a -fstruct-layout=5
-mllvm -vectorize-memory-aggressively
-mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -unroll-threshold=50 -fremap-arrays
-mllvm -vector-library=LIBMVEC
-mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp -mllvm -inline-threshold=1000
-flv-function-specialization -O3 -funroll-loops
-Mrecursive -Kieee -fno-finite-math-only -DSPEC_OPENMP
-fopenmp -fopenmp=libomp -lomp -lpthread -ldl -lmvec
-lamdlibm -ljemalloc -lflang

627.cam4_s: basepeak = yes

628.pop2_s: Same as 621.wrf_s

Benchmarks using Fortran, C, and C++:

607.cactuBSSN_s: basepeak = yes

Peak Other Flags

C benchmarks:
-Wno-return-type -DUSE_OPENMP

Fortran benchmarks:
-DUSE_OPENMP -Wno-return-type

Benchmarks using both Fortran and C:
-DUSE_OPENMP -Wno-return-type

Benchmarks using Fortran, C, and C++:
-Wno-return-type -DUSE_OPENMP

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/aocc200-flags-B1.html
http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-revE9.html

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

http://www.spec.org/cpu2017/flags/aocc200-flags-B1.xml
http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-revE9.xml

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