### Dell Inc.

**PowerEdge R6515 (AMD EPYC 7F32, 3.70 GHz)**

- **CPU2017 License:** 55
- **Test Sponsor:** Dell Inc.
- **Tested by:** Dell Inc.
- **Test Date:** Jan-2020
- **Hardware Availability:** Apr-2020
- **Software Availability:** Aug-2019

#### SPECspeed®2017_fp_base = 44.5

- **SPECspeed®2017_fp_peak = 45.7**

<table>
<thead>
<tr>
<th>Thread</th>
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<tbody>
<tr>
<td>603.bwaves_s</td>
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<tr>
<td>607.cactuBSSN_s</td>
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<tr>
<td>619.lbm_s</td>
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<td>59.4</td>
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<tr>
<td>621.wrf_s</td>
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<tr>
<td>627.cam4_s</td>
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<tr>
<td>628.pop2_s</td>
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<td>638.imagick_s</td>
<td>38.5</td>
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<tr>
<td>649.fotonik3d_s</td>
<td>33.3</td>
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</tr>
<tr>
<td>654.roms_s</td>
<td>56.4</td>
<td>56.5</td>
</tr>
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</table>

#### SPECspeed®2017_fp_base (44.5)  

#### SPECspeed®2017_fp_peak (45.7)

#### Hardware

- **CPU Name:** AMD EPYC 7F32
- **Max MHz:** 3900
- **Nominal:** 3700
- **Enabled:** 8 cores, 1 chip, 2 threads/core
- **Orderable:** 1 chip
- **Cache L1:** 32 KB I + 32 KB D on chip per core
- **L2:** 512 KB I+D on chip per core
- **L3:** 128 MB I+D on chip per chip, 16 MB per core
- **Other:** None
- **Memory:** 128 GB (8 x 16 GB 2Rx8 PC4-3200AA-R, running at 3200)
- **Storage:** 1 x 960 GB SATA SSD
- **Other:** None

#### Software

- **OS:** SUSE Linux Enterprise Server 15 SP1
- **Compiler:** C/C++/Fortran: Version 2.0.0 of AOCC
- **Parallel:** Yes
- **Firmware:** Version 1.2.12 released Dec-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 v5.1.0
- **Power Management:** BIOS set to prefer performance at the cost of additional power usage.
## SPEC CPU®2017 Floating Point Speed Result

**Dell Inc.**

PowerEdge R6515 (AMD EPYC 7F32, 3.70 GHz)  

### SPECspeed®2017_fp_base = 44.5

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**CPU2017 License:** 55  
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---

### Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Base</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Base</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Base</th>
<th>Seconds</th>
<th>Ratio</th>
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<td>32.8</td>
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<td>8</td>
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<tr>
<td>654.roms_s</td>
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<td>1.01</td>
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<td>1.01</td>
<td>8</td>
<td>277</td>
<td>56.8</td>
</tr>
</tbody>
</table>

**SPECspeed®2017_fp_base = 44.5**

**SPECspeed®2017_fp_peak = 45.7**

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)
Dell Inc. PowerEdge R6515 (AMD EPYC 7F32, 3.70 GHz) SPECspeed®2017_fp_base = 44.5 SPECspeed®2017_fp_peak = 45.7

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
GOMP_CPU_AFFINITY = "0-15"
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 = "16"

Environment variables set by runcpu during the 603.bwaves_s peak run:
GOMP_CPU_AFFINITY = "0-7"

Environment variables set by runcpu during the 607.cactuBSSN_s peak run:
GOMP_CPU_AFFINITY = "0-7"

Environment variables set by runcpu during the 627.cam4_s peak run:
GOMP_CPU_AFFINITY = "0-7"

Environment variables set by runcpu during the 628.pop2_s peak run:
GOMP_CPU_AFFINITY = "0-7"

Environment variables set by runcpu during the 638.imagick_s peak run:
GOMP_CPU_AFFINITY = "0-7"

Environment variables set by runcpu during the 644.nab_s peak run:
GOMP_CPU_AFFINITY = "0 8 1 9 2 10 3 11 4 12 5 13 6 14 7 15"

Environment variables set by runcpu during the 649.fotonik3d_s peak run:
GOMP_CPU_AFFINITY = "0-7"

Environment variables set by runcpu during the 654.roms_s peak run:
GOMP_CPU_AFFINITY = "0-7"

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.
Dell Inc.  
PowerEdge R6515 (AMD EPYC 7F32, 3.70 GHz)

**SPEC CPU®2017 Floating Point Speed Result**

**SPECspeed®2017_fp_base = 44.5**

**SPECspeed®2017_fp_peak = 45.7**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tbody>
<tr>
<td>CPU2017 License:</td>
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<tr>
<td>Test Sponsor:</td>
<td>Dell Inc.</td>
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<td>Tested by:</td>
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<td>Hardware Availability:</td>
<td>Apr-2020</td>
</tr>
<tr>
<td>Software Availability:</td>
<td>Aug-2019</td>
</tr>
</tbody>
</table>

**General Notes (Continued)**

jemalloc: configured and built with GCC v9.1.0 in Ubuntu 19.04 with -O3 -znver2 -flto
jemalloc 5.1.0 is available here:
https://github.com/jemalloc/jemalloc/releases/download/5.1.0/jemalloc-5.1.0.tar.bz2

**Platform Notes**

BIOS settings:
- NUMA Nodes Per Socket set to 4
- 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 295195f888a3d7ed16e6e46a485a0011
running on linux-g3ob Sun Jan 12 05:46:59 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 7F32 8-Core Processor
  1  "physical id"s (chips)
  16  "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 : 8
  siblings : 16
  physical 0: cores 0 4 8 12 16 20 24 28

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

(Continued on next page)
Dell Inc.

PowerEdge R6515 (AMD EPYC 7F32, 3.70 GHz)

CPU2017 License: 55  Test Date: Jan-2020
Test Sponsor: Dell Inc.  Hardware Availability: Apr-2020
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Platform Notes (Continued)

CPU(s): 16
On-line CPU(s) list: 0-15
Thread(s) per core: 2
Core(s) per socket: 8
Socket(s): 1
NUMA node(s): 8
Vendor ID: AuthenticAMD
CPU family: 23
Model: 49
Model name: AMD EPYC 7F32 8-Core Processor
Stepping: 0
CPU MHz: 3693.113
BogoMIPS: 7386.22
Virtualization: AMD-V
L1d cache: 32K
L1i cache: 32K
L2 cache: 512K
L3 cache: 16384K
NUMA node0 CPU(s): 0,8
NUMA node1 CPU(s): 1,9
NUMA node2 CPU(s): 2,10
NUMA node3 CPU(s): 3,11
NUMA node4 CPU(s): 4,12
NUMA node5 CPU(s): 5,13
NUMA node6 CPU(s): 6,14
NUMA node7 CPU(s): 7,15
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 movbe popcnt aes xsave avx fl16c
rdseed lahf_lm cmp_legacy svm extapic cr8 Legacy abm sse4a misalignsse 3dmowprefetch
oswv 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 bmid avx2 smp
bmi2 cmq rdt_a rdseed advx smap clflushopt clwb sha ni xsaveopt xsavc xgetbv1 xsaves
cmq_llc cmq_occup_llc cmq_mbb_total cmq_mbb_local clzero irperf xsavereptr arat npt
lbv svm_lock nrip_save tsc_scale vmcb_clean flushbyasis decodeassistssafeparsefilter
pfthreshold avic v_vmsave_vmload vguf umip rdpid overflow_recov succor smca

From numactl --hardware WARNING: a numactl 'node' might or might not correspond to a
physical chip.

available: 8 nodes (0-7)
node 0 cpus: 0 8
node 0 size: 15549 MB
node 0 free: 15478 MB

(Continued on next page)
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PowerEdge R6515 (AMD EPYC 7F32, 3.70 GHz)

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Platform Notes (Continued)

node 1 cpus: 1 9
node 1 size: 16126 MB
node 1 free: 16072 MB
node 2 cpus: 2 10
node 2 size: 16127 MB
node 2 free: 16027 MB
node 3 cpus: 3 11
node 3 size: 16126 MB
node 3 free: 15926 MB
node 4 cpus: 4 12
node 4 size: 16127 MB
node 4 free: 16078 MB
node 5 cpus: 5 13
node 5 size: 16097 MB
node 5 free: 16046 MB
node 6 cpus: 6 14
node 6 size: 16127 MB
node 6 free: 16084 MB
node 7 cpus: 7 15
node 7 size: 16114 MB
node 7 free: 16083 MB
node distances:

<table>
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<th>0</th>
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<th>4</th>
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<td>12</td>
<td>12</td>
<td>12</td>
<td>11</td>
<td>10</td>
</tr>
</tbody>
</table>

From /proc/meminfo

MemTotal:     131479104 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"

(Continued on next page)
Dell Inc. PowerEdge R6515 (AMD EPYC 7F32, 3.70 GHz)

SPECspeed®2017_fp_base = 44.5
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CPU2017 License: 55
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Platform Notes (Continued)

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 Nov 25 11:37 last=5

SPEC is set to: /root/cpu2017-1.1.0
    Filesystem  Type  Size  Used Avail Use% Mounted on
    /dev/sda2  xfs   440G  36G  405G  9%  /

From /sys/devices/virtual/dmi/id
    BIOS: Dell Inc. 1.2.12 12/12/2019
    Vendor: Dell Inc.
    Product: PowerEdge R6515
    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:
    8x 80AD80B380AD HMA82GR7CJR8N-XN 16 GB 2 rank 3200
    8x Not Specified Not Specified

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
<table>
<thead>
<tr>
<th>C</th>
<th>619.lbm_s(base, peak) 638.imagick_s(base, peak)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>644.nab_s(base, peak)</td>
</tr>
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==============================================================================

AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins

(Continued on next page)
Dell Inc.
PowerEdge R6515 (AMD EPYC 7F32, 3.70 GHz)

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Test Date: Jan-2020
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Compiler Version Notes (Continued)

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

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
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(Continued on next page)
Dell Inc.

PowerEdge R6515 (AMD EPYC 7F32, 3.70 GHz)

SPECspeed®2017_fp_base = 44.5
SPECspeed®2017_fp_peak = 45.7

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

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

Compiler Version Notes (Continued)

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
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

(Continued on next page)
Base Optimization Flags (Continued)

C benchmarks (continued):
-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,-mlvm -Wl,-function-specialize
-Wl,-mlvm -Wl,-region-vectorize -Wl,-mlvm -Wl,-vector-library=LIBMVEC
-Wl,-mlvm -Wl,-reduce-array-computations=3 -O3 -march=znver2
-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

Benchmarks using both Fortran and C:
-flto -Wl,-mlvm -Wl,-function-specialize
-Wl,-mlvm -Wl,-region-vectorize -Wl,-mlvm -Wl,-vector-library=LIBMVEC
-Wl,-mlvm -Wl,-reduce-array-computations=3 -O3 -ffast-math
-march=znver2 -fstruct-layout=3 -mlvm -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

Benchmarks using Fortran, C, and C++:
-std=c++98 -flto -Wl,-mlvm -Wl,-function-specialize
-Wl,-mlvm -Wl,-region-vectorize -Wl,-mlvm -Wl,-vector-library=LIBMVEC
-Wl,-mlvm -Wl,-reduce-array-computations=3
-Wl,-mlvm -Wl,-suppress-fmas -O3 -ffast-math -march=znver2
-fstruct-layout=3 -mlvm -unroll-threshold=50 -fremap-arrays
-mllvm -function-specialize -mlvm -enable-gvn-hoist
-mllvm -reduce-array-computations=3 -mlvm -global-vectorize-slp
-mllvm -vector-library=LIBMVEC -mlvm -inline-threshold=1000
-flv-function-specialization -mlvm -loop-unswitch-threshold=200000
-mlvm -unroll-threshold=100 -mlvm -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
**SPEC CPU®2017 Floating Point Speed Result**  
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### Base Other Flags

- C benchmarks:  
  `-Wno-return-type`

- Fortran benchmarks:  
  `-Wno-return-type`

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

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

### 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:
  
  619.lbm_s: basepeak = yes

  638.imagick_s: `flto -Wl, -mlllvm -Wl, -function-specialize`  
  `-Wl, -mlllvm -Wl, -region-vectorize`  
  `-Wl, -mlllvm -Wl, -vector-library=LIBMVEC`  
  `-Wl, -mlllvm -Wl, -reduce-array-computations=3 -Ofast`

(Continued on next page)
Dell Inc.
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Peak Optimization Flags (Continued)

638.imagick_s (continued):
-march=znver2 -mno-sse4a -fstruct-layout=5
-mlirv -vectorizer-memory-aggressively
-mlirv -function-specialize -mlirv -enable-gvn-hoist
-mlirv -unroll-threshold=50 -fremap-arrays
-mlirv -vector-library=LIBMVEC
-mlirv -reduce-array-computations=3
-mlirv -global-vectorizer-slp -mlirv -inline-threshold=1000
-flv-function-specialization -DSPEC_OPENMP -fopenmp
-lmvec -lamdlibm -fopenmp=libomp -lomp -lpthread -ldl
-ljemalloc -lgfl

644.nab_s: Same as 638.imagick_s

Fortran benchmarks:

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

649.fotonik3d_s: Same as 603.bwaves_s

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

Benchmarks using both Fortran and C:

621.wrf_s: basepeak = yes

627.cam4_s: -flto -Wl,-mlirv -Wl,-function-specialize
-Wl,-mlirv -Wl,-region-vectorize
-Wl,-mlirv -Wl,-vector-library=LIBMVEC
-Wl,-mlirv -Wl,-reduce-array-computations=3 -Ofast

(Continued on next page)
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**Peak Optimization Flags (Continued)**

627.cam4\_s (continued):
- `march=znver2` `-mno-sse4a` `-fstruct-layout=5`
- `mlvm -vectorize-memory-aggressively`
- `mlvm -function-specialize` `-mlvm -enable-gvn-hoist`
- `mlvm -unroll-threshold=50` `-fremap-arrays`
- `mlvm -vector-library=LIBMVEC`
- `mlvm -reduce-array-computations=3`
- `mlvm -global-vectorize-slp` `-mlvm -inline-threshold=1000`
- `flv-function-specialization -O3 -funroll-loops`
- `Mrecursive -Klee -fnf=fno-finite-math-only -DSPEC\_OPENMP`
- `fopenmp` `-fopenmp=libomp` `-lomp` `-lpthread` `-ldl` `-lmvec`
- `lamdlibm` `-ljemalloc` `-lflang`

628.pop2\_s: Same as 627.cam4\_s

**Benchmarks using Fortran, C, and C++:**
- `std=c++98` `-ftol` `-Wl,-mllvm -function-specialize`
- `-Wl,-mlvm -Wl,-region-vectorize` `-Wl,-mlvm -Wl,-vector-library=LIBMVEC`
- `-Wl,-mlvm -Wl,-reduce-array-computations=3` `-Ofast` `-march=znver2`
- `-mno-sse4a` `-fstruct-layout=5` `-mlvm -vectorize-memory-aggressively`
- `mlvm -function-specialize` `-mlvm -enable-gvn-hoist`
- `mlvm -unroll-threshold=50` `-fremap-arrays`
- `mlvm -vector-library=LIBMVEC` `-mlvm -reduce-array-computations=3`
- `mlvm -global-vectorize-slp` `-mlvm -inline-threshold=1000`
- `flv-function-specialization` `-mlvm -unroll-threshold=100`
- `mlvm -enable-partial-unswitch` `-mlvm -loop-unswitch-threshold=200000`
- `-O3 -funroll-loops` `-Mrecursive -Klee -fnf=fno-finite-math-only`
- `-DSPEC\_OPENMP` `-fopenmp` `-fopenmp=libomp` `-lomp` `-lpthread` `-ldl` `-lmvec`
- `lamdlibm` `-ljemalloc` `-lflang`

**Peak Other Flags**

C benchmarks:
- `-Wno-return-type`

Fortran benchmarks:
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Benchmarks using both Fortran and C:
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You can also download the XML flags sources by saving the following links:

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