SPEC® CPU2017 Floating Point Rate Result

Copyright 2017-2019 Standard Performance Evaluation Corporation

Dell Inc.

Dell PowerEdge R7415 (AMD EPYC 7281, 2.20GHz)

$SPECrate2017\_fp\_base = 93.5$

$SPECrate2017\_fp\_peak = 94.8$

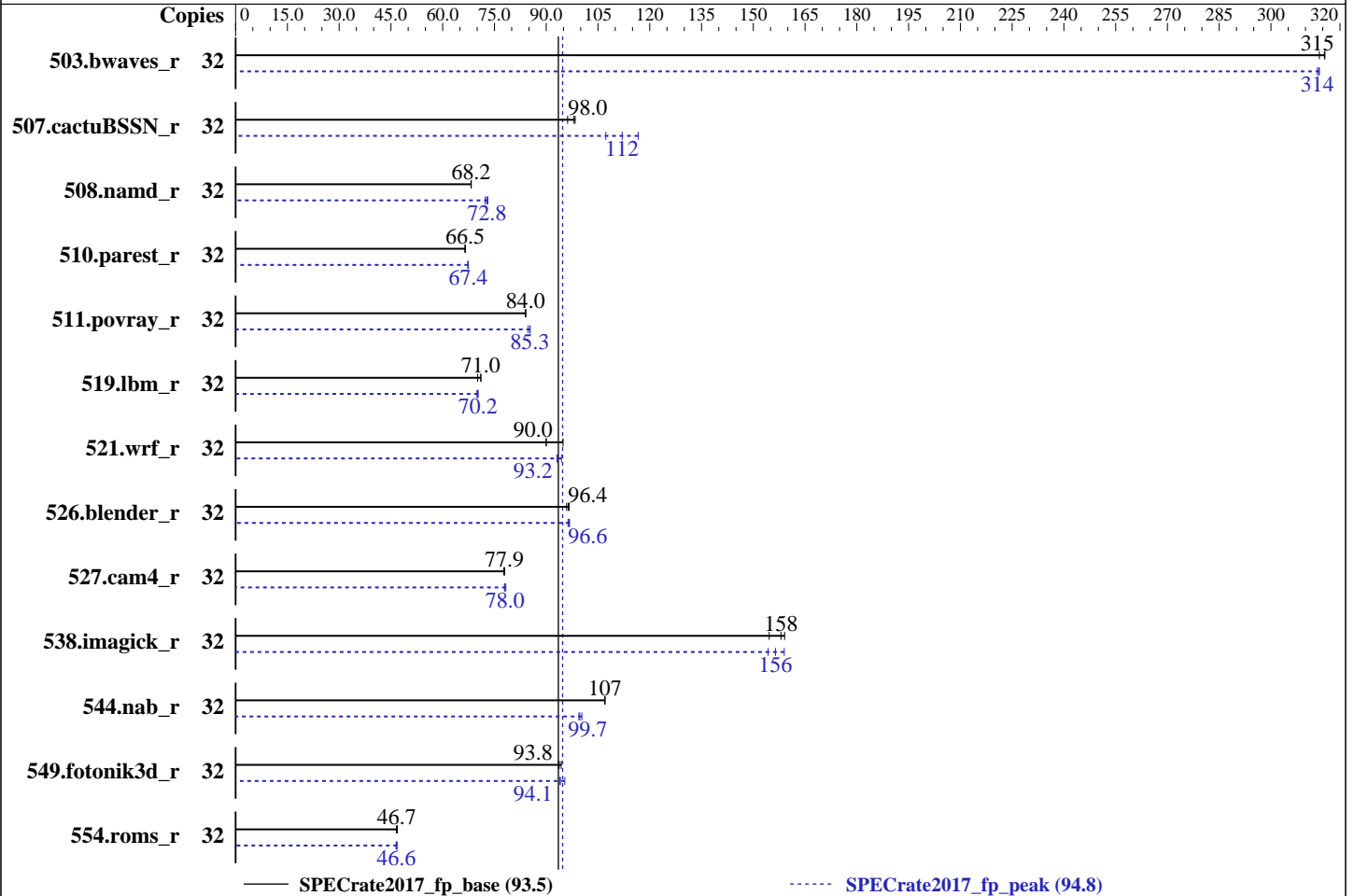**CPU2017 License:** 55　　　　　　　　　　　　**Test Date:** Mar-2019
Test Sponsor: Dell Inc.　　　　　　　　　　**Hardware Availability:** Apr-2019
Tested by: Dell Inc.　　　　　　　　　　　**Software Availability:** Feb-2019

Copies

Benchmark	Copies	base	peak
503.bwaves_r	32	315	314
507.cactuBSSN_r	32	98.0	112
508.namd_r	32	68.2	72.8
510.parest_r	32	66.5	67.4
511.povray_r	32	84.0	85.3
519.lbm_r	32	71.0	70.2
521.wrf_r	32	90.0	93.2
526.blender_r	32	96.4	96.6
527.cam4_r	32	77.9	78.0
538.imagick_r	32	158	156
544.nab_r	32	107	99.7
549.fotonik3d_r	32	93.8	94.1
554.roms_r	32	46.7	46.6

—— SPECrate2017_fp_base (93.5)　　　　- - - - SPECrate2017_fp_peak (94.8)

Hardware

CPU Name: AMD EPYC 7281
　Max MHz.: 2700
　Nominal: 2100
Enabled: 16 cores, 1 chip, 2 threads/core
Orderable: 1 chip
Cache L1: 64 KB I + 32 KB D on chip per core
　L2: 512 KB I+D on chip per core
　L3: 32 MB I+D on chip per chip, 4 MB shared / 2 cores
　Other: None
Memory: 512 GB (8 x 64 GB 4Rx4 PC4-2667V-L)
Storage: 1 x 1.92 TB SATA SSD
Other: None

Software

OS: Ubuntu 18.04.2 LTS
　　　kernel 4.15-45-generic
Compiler: C/C++: Version 1.3.0 of AOCC
　　　Fortran: Version 4.8.2 of GCC
Parallel: No
Firmware: Version 1.8.4 released Feb-2019
File System: ext4
System State: Run level 3 (multi-user)
Base Pointers: 64-bit
Peak Pointers: 64-bit
Other: jemalloc memory allocator library V4.5.0

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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	32	**1017**	**315**	1017	316	1022	314	32	1022	314	1024	313	**1022**	**314**
507.cactuBSSN_r	32	421	96.2	**413**	**98.0**	412	98.4	32	378	107	347	117	**362**	**112**
508.namd_r	32	445	68.3	**446**	**68.2**	446	68.2	32	420	72.3	416	73.1	**418**	**72.8**
510.parest_r	32	1257	66.6	**1259**	**66.5**	1259	66.5	32	**1242**	**67.4**	1242	67.4	1244	67.3
511.povray_r	32	888	84.1	890	84.0	**890**	**84.0**	32	**876**	**85.3**	882	84.8	876	85.3
519.lbm_r	32	**475**	**71.0**	481	70.1	475	71.1	32	480	70.2	482	69.9	**480**	**70.2**
521.wrf_r	32	797	90.0	756	94.9	**796**	**90.0**	32	**769**	**93.2**	770	93.1	759	94.4
526.blender_r	32	504	96.7	**506**	**96.4**	508	95.9	32	504	96.8	506	96.3	**504**	**96.6**
527.cam4_r	32	718	78.0	**719**	**77.9**	720	77.7	32	**717**	**78.0**	715	78.3	718	77.9
538.imagick_r	32	500	159	515	155	**504**	**158**	32	**509**	**156**	516	154	501	159
544.nab_r	32	**503**	**107**	503	107	503	107	32	**540**	**99.7**	541	99.5	537	100
549.fotonik3d_r	32	**1330**	**93.8**	1322	94.4	1331	93.7	32	**1326**	**94.1**	1327	94.0	1307	95.4
554.roms_r	32	1086	46.8	**1089**	**46.7**	1090	46.7	32	1093	46.5	1087	46.8	**1091**	**46.6**
SPECrate2017_fp_base =		**93.5**											
SPECrate2017_fp_peak =		**94.8**											

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/

The AOCC Gold Linker plugin was installed and used for the link stage.

The AOCC Fortran Plugin version 1.3.0 was used to leverage AOCC optimizers
with gfortran. It is available here:
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

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

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Operating System Notes (Continued)

```
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 were enabled for this run (OS default)
```

General Notes

```
Environment variables set by runcpu before the start of the run:
```
LD_LIBRARY_PATH = "/home/cpu2017-1.0.5/amd1812na_rate_revA_lib/64;/home/cpu2017-1.0.5/amd1812na_rate_revA_lib/32:"

```
Binaries were compiled on a system with 2 x AMD EPYC 7601 CPU + 512GB Memory using RHEL 7.6

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 v4.8.5
in RHEL v7.2 under default conditions.
jemalloc: sources available from jemalloc.net or
https://github.com/jemalloc/jemalloc/releases
jemalloc uses environment variable MALLOC_CONF
with values narenas and lg_chunk:
narenas: sets the maximum number of arenas to use
for automatic multiplexing
of threads and arenas.
lg_chunk: set the virtual memory chunk size (log
base 2). For example,
lg_chunk:21 sets the default chunk size to 2^21 =
2MiB.
```

Platform Notes

```
 BIOS settings:
 Virtualization Technology disabled
 System Profile set to Custom
 CPU Power Management set to Maximum Performance
 Memory Frequency set to Maximum Performance
 Turbo Boost enabled
```

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Platform Notes (Continued)

```
C States set to Autonomous
Memory Patrol Scrub disabled
Memory Refresh Rate set to 1x
PCI ASPM L1 Link Power Management disabled
Determinism Slider set to Power Determinism
Sysinfo program /home/cpu2017-1.0.5/bin/sysinfo
Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9
running on pe7415 Mon Mar 25 18:27:13 2019

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 7281 16-Core Processor
      1  "physical id"s (chips)
      32 "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 : 16
      siblings  : 32
      physical 0: cores 0 1 8 9 12 13 16 17 20 21 24 25 28 29

From lscpu:
     Architecture:        x86_64
     CPU op-mode(s):      32-bit, 64-bit
     Byte Order:          Little Endian
     CPU(s):              32
     On-line CPU(s) list: 0-31
     Thread(s) per core:  2
     Core(s) per socket:  16
     Socket(s):           1
     NUMA node(s):        4
     Vendor ID:           AuthenticAMD
     CPU family:          23
     Model:               1
     Model name:          AMD EPYC 7281 16-Core Processor
     Stepping:            2
     CPU MHz:             2641.338
     BogoMIPS:            4192.02
     Virtualization:      AMD-V
     L1d cache:           32K
     L1i cache:           64K
     L2 cache:            512K
     L3 cache:            4096K
     NUMA node0 CPU(s):   0,4,8,12,16,20,24,28
     NUMA node1 CPU(s):   1,5,9,13,17,21,25,29
```

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Platform Notes (Continued)

```
      NUMA node2 CPU(s):    2,6,10,14,18,22,26,30
      NUMA node3 CPU(s):    3,7,11,15,19,23,27,31
      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 nonstop_tsc cpuid extd_apicid amd_dcm aperfmperf pni
   pclmulqdq monitor ssse3 fma cx16 sse4_1 sse4_2 movbe popcnt aes xsave avx f16c
   rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse 3dnowprefetch
   osvw skinit wdt tce topoext perfctr_core perfctr_nb bpext perfctr_llc mwaitx cpb
   hw_pstate sme ssbd ibpb vmmcall fsgsbase bmi1 avx2 smep bmi2 rdseed adx smap
   clflushopt sha_ni xsaveopt xsavec xgetbv1 xsaves clzero irperf xsaveerptr arat npt
   lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter
   pfthreshold avic v_vmsave_vmload vgif 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: 4 nodes (0-3)
   node 0 cpus: 0 4 8 12 16 20 24 28
   node 0 size: 128635 MB
   node 0 free: 128468 MB
   node 1 cpus: 1 5 9 13 17 21 25 29
   node 1 size: 129017 MB
   node 1 free: 128846 MB
   node 2 cpus: 2 6 10 14 18 22 26 30
   node 2 size: 129017 MB
   node 2 free: 128853 MB
   node 3 cpus: 3 7 11 15 19 23 27 31
   node 3 size: 128994 MB
   node 3 free: 128812 MB
   node distances:
   node   0   1   2   3
     0:  10  16  16  16
     1:  16  10  16  16
     2:  16  16  10  16
     3:  16  16  16  10

 From /proc/meminfo
    MemTotal:       528041808 kB
    HugePages_Total:        0
    Hugepagesize:        2048 kB

 /usr/bin/lsb_release -d
    Ubuntu 18.04.2 LTS

 From /etc/*release* /etc/*version*
```

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Platform Notes (Continued)

```
    debian_version: buster/sid
    os-release:
        NAME="Ubuntu"
        VERSION="18.04.2 LTS (Bionic Beaver)"
        ID=ubuntu
        ID_LIKE=debian
        PRETTY_NAME="Ubuntu 18.04.2 LTS"
        VERSION_ID="18.04"
        HOME_URL="https://www.ubuntu.com/"
        SUPPORT_URL="https://help.ubuntu.com/"

  uname -a:
    Linux pe7415 4.15.0-45-generic #48-Ubuntu SMP Tue Jan 29 16:28:13 UTC 2019 x86_64
    x86_64 x86_64 GNU/Linux

  Kernel self-reported vulnerability status:

  CVE-2017-5754 (Meltdown):          Not affected
  CVE-2017-5753 (Spectre variant 1): Mitigation: __user pointer sanitization
  CVE-2017-5715 (Spectre variant 2): Mitigation: Full AMD retpoline, IBPB

  run-level 3 Mar 25 08:18

  SPEC is set to: /home/cpu2017-1.0.5
    Filesystem      Type  Size  Used Avail Use% Mounted on
    /dev/sda2       ext4  1.8T   18G  1.7T   2% /

  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.
    BIOS Dell Inc. 1.8.4 02/22/2019
    Memory:
     8x 80CE863280CE M386A8K40BM2-CTD 64 GB 4 rank 2666
     8x Not Specified Not Specified

  (End of data from sysinfo program)
```

Compiler Version Notes

```
==============================================================================
  CC  519.lbm_r(base, peak) 538.imagick_r(base, peak) 544.nab_r(base, peak)
------------------------------------------------------------------------------
AOCC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
  AOCC_1_3_0_Release-Build#34) (based on LLVM AOCC.LLVM.1.3.0.B34.2018_10_22)
Target: x86_64-unknown-linux-gnu
```

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Compiler Version Notes (Continued)

```
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.3.0/AOCC-1.3.0-Compiler/bin
------------------------------------------------------------------------


==============================================================================
  CXXC 508.namd_r(base, peak) 510.parest_r(base, peak)
------------------------------------------------------------------------
AOCC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
  AOCC_1_3_0_Release-Build#34) (based on LLVM AOCC.LLVM.1.3.0.B34.2018_10_22)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.3.0/AOCC-1.3.0-Compiler/bin
------------------------------------------------------------------------


==============================================================================
  CC  511.povray_r(base, peak) 526.blender_r(base, peak)
------------------------------------------------------------------------
AOCC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
  AOCC_1_3_0_Release-Build#34) (based on LLVM AOCC.LLVM.1.3.0.B34.2018_10_22)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.3.0/AOCC-1.3.0-Compiler/bin
AOCC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
  AOCC_1_3_0_Release-Build#34) (based on LLVM AOCC.LLVM.1.3.0.B34.2018_10_22)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.3.0/AOCC-1.3.0-Compiler/bin
------------------------------------------------------------------------


==============================================================================
  FC  507.cactuBSSN_r(base, peak)
------------------------------------------------------------------------
AOCC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
  AOCC_1_3_0_Release-Build#34) (based on LLVM AOCC.LLVM.1.3.0.B34.2018_10_22)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.3.0/AOCC-1.3.0-Compiler/bin
AOCC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
  AOCC_1_3_0_Release-Build#34) (based on LLVM AOCC.LLVM.1.3.0.B34.2018_10_22)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.3.0/AOCC-1.3.0-Compiler/bin
GNU Fortran (GCC) 4.8.2
Copyright (C) 2013 Free Software Foundation, Inc.
GNU Fortran comes with NO WARRANTY, to the extent permitted by law.
You may redistribute copies of GNU Fortran
under the terms of the GNU General Public License.
```

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Compiler Version Notes (Continued)

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


==============================================================================
 FC   503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak) 554.roms_r(base,
      peak)
------------------------------------------------------------------------------
GNU Fortran (GCC) 4.8.2
Copyright (C) 2013 Free Software Foundation, Inc.
GNU Fortran comes with NO WARRANTY, to the extent permitted by law.
You may redistribute copies of GNU Fortran
under the terms of the GNU General Public License.
For more information about these matters, see the file named COPYING
------------------------------------------------------------------------------


==============================================================================
 CC   521.wrf_r(base, peak) 527.cam4_r(base, peak)
------------------------------------------------------------------------------
GNU Fortran (GCC) 4.8.2
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  AOCC_1_3_0_Release-Build#34) (based on LLVM AOCC.LLVM.1.3.0.B34.2018_10_22)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.3.0/AOCC-1.3.0-Compiler/bin
------------------------------------------------------------------------------
```

Base Compiler Invocation

C benchmarks:
```
clang
```

C++ benchmarks:
```
clang++
```

Fortran benchmarks:
```
clang gfortran
```

Benchmarks using both Fortran and C:
```
clang gfortran
```

(Continued on next page)

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Base Compiler Invocation (Continued)

Benchmarks using both C and C++:
`clang++ clang`

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

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_CASE_FLAG -fconvert=big-endian -DSPEC_LP64
526.blender_r: -funsigned-char -D__BOOL_DEFINED -DSPEC_LP64
527.cam4_r: -DSPEC_CASE_FLAG -DSPEC_LP64
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:
```
-flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop
-Wl,-plugin-opt=-enable-vectorize-compares=false -O3 -ffast-math
-march=znver1 -mno-avx2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-fremap-arrays -mllvm -inline-threshold=1000
-flv-function-specialization -mllvm -enable-gvn-hoist
-mllvm -function-specialize -z muldefs -lamdlibm -lpthread -ldl
-ljemalloc
```

C++ benchmarks:
```
-std=c++98 -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop
-Wl,-plugin-opt=-enable-vectorize-compares=false -O3 -march=znver1
-mllvm -unroll-threshold=100 -finline-aggressive -fremap-arrays
-mllvm -inline-threshold=1000 -mllvm -enable-vectorize-compares=false
-z muldefs -lpthread -ldl -ljemalloc
```

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Base Optimization Flags (Continued)

Fortran benchmarks:
```
-flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop
-Wl,-plugin-opt=-enable-vectorize-compares=false -O3(gfortran)
-O3(clang) -mavx -madx -funroll-loops -ffast-math -z muldefs
-fplugin=dragonegg.so -fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-enable-vectorize-compares:false
-lpthread -ldl -ljemalloc -lgfortran -lamdlibm
```

Benchmarks using both Fortran and C:
```
-flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop
-Wl,-plugin-opt=-enable-vectorize-compares=false -O3(clang) -ffast-math
-march=znver1 -mno-avx2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-fremap-arrays -mllvm -inline-threshold=1000
-flv-function-specialization -mllvm  -enable-gvn-hoist
-mllvm -function-specialize -O3(gfortran) -mavx -madx -funroll-loops
-z muldefs -fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-enable-vectorize-compares:false
-lpthread -ldl -ljemalloc -lgfortran -lamdlibm
```

Benchmarks using both C and C++:
```
-std=c++98 -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop
-Wl,-plugin-opt=-enable-vectorize-compares=false -O3 -ffast-math
-march=znver1 -mno-avx2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-fremap-arrays -mllvm -inline-threshold=1000
-flv-function-specialization -mllvm  -enable-gvn-hoist
-mllvm -function-specialize -mllvm -unroll-threshold=100
-finline-aggressive -mllvm -enable-vectorize-compares=false -z muldefs
-lpthread -ldl -ljemalloc
```

Benchmarks using Fortran, C, and C++:
```
-std=c++98 -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop
-Wl,-plugin-opt=-enable-vectorize-compares=false -O3(clang) -ffast-math
-march=znver1 -mno-avx2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-fremap-arrays -mllvm -inline-threshold=1000
-flv-function-specialization -mllvm  -enable-gvn-hoist
-mllvm -function-specialize -mllvm -unroll-threshold=100
-finline-aggressive -mllvm -enable-vectorize-compares=false
-O3(gfortran) -mavx -madx -funroll-loops -z muldefs
-fplugin=dragonegg.so -fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-enable-vectorize-compares:false
-lpthread -ldl -ljemalloc
```

SPEC CPU2017 Floating Point Rate Result

Copyright 2017-2019 Standard Performance Evaluation Corporation

Dell Inc.

Dell PowerEdge R7415 (AMD EPYC 7281, 2.20GHz)

SPECrate2017_fp_base = 93.5

SPECrate2017_fp_peak = 94.8

CPU2017 License: 55		**Test Date:**	Mar-2019
Test Sponsor:	Dell Inc.	**Hardware Availability:**	Apr-2019
Tested by:	Dell Inc.	**Software Availability:**	Feb-2019

Peak Compiler Invocation

C benchmarks:
```
clang
```

C++ benchmarks:
```
clang++
```

Fortran benchmarks:
```
clang gfortran
```

Benchmarks using both Fortran and C:
```
clang gfortran
```

Benchmarks using both C and C++:
```
clang++ clang
```

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

Peak Portability Flags

```
Same as Base Portability Flags
```

Peak Optimization Flags

C benchmarks:
```
-flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Ofast -march=znver1
-fstruct-layout=3 -mllvm -vectorize-memory-aggressively -mno-avx2
-mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -lpthread -ldl -ljemalloc
```

C++ benchmarks:
```
-std=c++98 -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Ofast -march=znver1
-finline-aggressive -mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -lpthread -ldl -ljemalloc
```

Fortran benchmarks:
```
-flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -O3(gfortran) -O3(clang) -mavx2
-madx -funroll-loops -ffast-math -fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option=-merge-constant
```

(Continued on next page)

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Software Availability: Feb-2019

Peak Optimization Flags (Continued)

Fortran benchmarks (continued):
```
-fplugin-arg-dragonegg-llvm-option=-inline-threshold:1000 -lpthread
-ldl -ljemalloc -lgfortran -lamdlibm
```

Benchmarks using both Fortran and C:

```
521.wrf_r: -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -O3(clang) -mavx
-ffast-math -O3(gfortran) -funroll-loops
-fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-inline-threshold:1000
-lpthread -ldl -ljemalloc -lgfortran -lamdlibm
```

```
527.cam4_r: -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Ofast -march=znver1
-fstruct-layout=3 -mllvm -vectorize-memory-aggressively
-mno-avx2 -mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -O3(gfortran) -O3(clang)
-mavx2 -madx -funroll-loops -ffast-math
-fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-inline-threshold:1000
-lpthread -ldl -ljemalloc -lgfortran -lamdlibm
```

Benchmarks using both C and C++:
```
-std=c++98 -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Ofast -march=znver1
-fstruct-layout=3 -mllvm -vectorize-memory-aggressively -mno-avx2
-mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -finline-aggressive -lpthread -ldl
-ljemalloc
```

Benchmarks using Fortran, C, and C++:
```
-std=c++98 -flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Ofast -march=znver1
-fstruct-layout=3 -mllvm -vectorize-memory-aggressively -mno-avx2
-mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -finline-aggressive -O3 -mavx2 -madx
-funroll-loops -ffast-math -fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option=-merge-constant
-fplugin-arg-dragonegg-llvm-option=-inline-threshold:1000 -lpthread
-ldl -ljemalloc
```

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The flags files that were used to format this result can be browsed at

http://www.spec.org/cpu2017/flags/gcc.2018-02-16.html
http://www.spec.org/cpu2017/flags/aocc130-flags-revA2.html
http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge14G-revE2.html

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

http://www.spec.org/cpu2017/flags/gcc.2018-02-16.xml
http://www.spec.org/cpu2017/flags/aocc130-flags-revA2.xml
http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge14G-revE2.xml

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

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