



SPEC® CPU2017 Floating Point Rate Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL385 Gen10

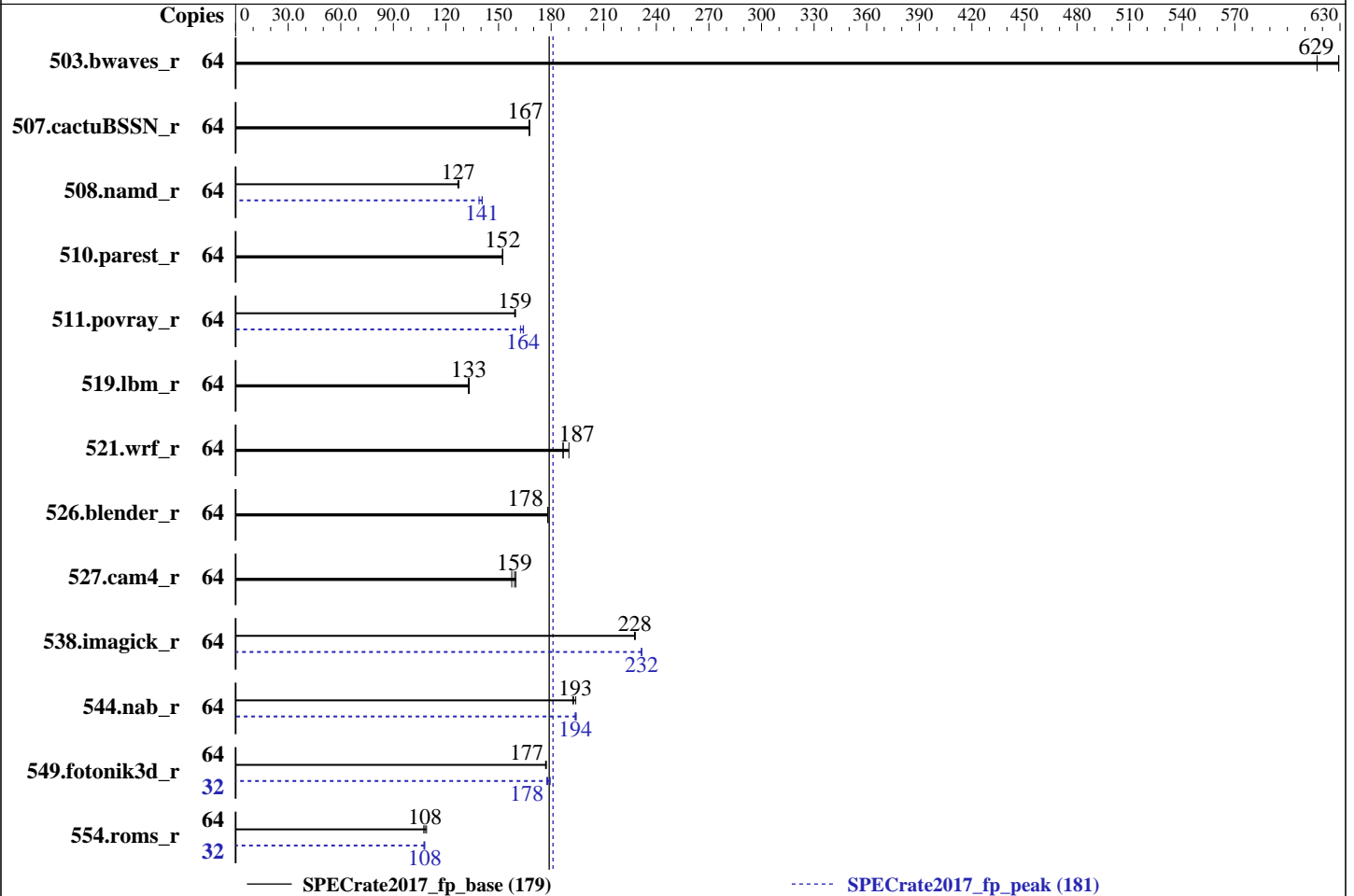
(2.20 GHz, AMD EPYC 7301)

SPECrate2017_fp_base = 179

SPECrate2017_fp_peak = 181

CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Test Date: Jul-2018
Hardware Availability: Jul-2018
Software Availability: Jul-2018



Hardware

CPU Name: AMD EPYC 7301
 Max MHz.: 2700
 Nominal: 2200
 Enabled: 32 cores, 2 chips, 2 threads/core
 Orderable: 1, 2 chip(s)
 Cache L1: 64 KB I + 32 KB D on chip per core
 L2: 512 KB I+D on chip per core
 L3: 64 MB I+D on chip per chip, 8 MB shared / 2 cores
 Other: None
 Memory: 1 TB (16 x 64 GB 4Rx4 PC4-2666V-L)
 Storage: 1 x 400 GB SAS SSD
 Other: None

Software

OS: SUSE Linux Enterprise Server 12 (x86_64) SP3
 Kernel 4.4.140-94.42-default
 Compiler: C/C++: Version 1.0.0 of AOCC
 Fortran: Version 4.8.2 of GCC
 Parallel: No
 Firmware: HPE BIOS Version A40 06/07/2018 released Jul-2018
 File System: xfs
 System State: Run level 5 (multi-user, w/GUI)
 Base Pointers: 64-bit
 Peak Pointers: 64-bit
 Other: jemalloc general purpose malloc implementation 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	64	1020	629	1040	617	1020	629	64	1020	629	1040	617	1020	629
507.cactuBSSN_r	64	484	167	484	167	483	168	64	484	167	484	167	483	168
508.namd_r	64	479	127	477	127	479	127	64	432	141	438	139	432	141
510.parest_r	64	1099	152	1100	152	1099	152	64	1099	152	1100	152	1099	152
511.povray_r	64	938	159	936	160	939	159	64	911	164	920	163	910	164
519.lbm_r	64	507	133	508	133	506	133	64	507	133	508	133	506	133
521.wrf_r	64	767	187	768	187	754	190	64	767	187	768	187	754	190
526.blender_r	64	547	178	547	178	547	178	64	547	178	547	178	547	178
527.cam4_r	64	704	159	711	158	700	160	64	704	159	711	158	700	160
538.imagick_r	64	698	228	699	228	700	228	64	687	232	687	232	687	232
544.nab_r	64	560	192	555	194	559	193	64	556	194	556	194	554	194
549.fotonik3d_r	64	1409	177	1407	177	1411	177	32	700	178	695	179	702	178
554.roms_r	64	942	108	934	109	947	107	32	472	108	473	107	472	108

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

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 were enabled for this run (OS default)

Huge pages were not configured for this run.



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General Notes

Environment variables set by runcpu before the start of the run:

```
LD_LIBRARY_PATH = "/home/cpu2017/amd1704-rate-libs-revC/64;/home/cpu2017/amd1704-rate-libs-revC/32:"
MALLOCONF = "lg_chunk:28"
```

The AMD64 AOCC Compiler Suite is available at

<http://developer.amd.com/tools-and-sdks/cpu-development/amd-optimizing-cc-compiler/>

Binaries were compiled on a system with 2x AMD EPYC 7601 CPU + 512GB Memory using RHEL 7.4

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.

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

The AOCC Fortran Plugin version 1.0 was used to leverage AOCC optimizers with gfortran. It is available here:

<http://developer.amd.com/amd-aocc/>

jemalloc, a general purpose malloc implementation, was obtained at

<https://github.com/jemalloc/jemalloc/releases/download/4.5.0/jemalloc-4.5.0.tar.bz2>

jemalloc was built with GCC v4.8.5 in RHEL v7.2 under default conditions.

jemalloc uses environment variable MALLOCONF 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 $2^{21} = 2\text{MiB}$.

Platform Notes

BIOS Configuration:

Thermal Configuration set to Maximum Cooling

Performance Determinism set to Power Deterministic

Memory Patrol Scrubbing set to Disabled

Workload Profile set to General Throughput Compute

Minimum Processor Idle Power Core C-State set to C6 State

Sysinfo program /home/cpu2017/bin/sysinfo

Rev: r5797 of 2017-06-14 96c45e4568ad54c135fd618bcc091c0f

running on linux-y3ls Tue Jul 31 16:08:18 2018

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>

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Platform Notes (Continued)

From /proc/cpuinfo

model name : AMD EPYC 7301 16-Core Processor

2 "physical id"s (chips)

64 "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 4 5 8 9 12 13 16 17 20 21 24 25 28 29

physical 1: cores 0 1 4 5 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): 64

On-line CPU(s) list: 0-63

Thread(s) per core: 2

Core(s) per socket: 16

Socket(s): 2

NUMA node(s): 8

Vendor ID: AuthenticAMD

CPU family: 23

Model: 1

Model name: AMD EPYC 7301 16-Core Processor

Stepping: 2

CPU MHz: 1200.000

CPU max MHz: 2200.0000

CPU min MHz: 1200.0000

BogoMIPS: 4391.76

Virtualization: AMD-V

L1d cache: 32K

L1i cache: 64K

L2 cache: 512K

L3 cache: 8192K

NUMA node0 CPU(s): 0-3,32-35

NUMA node1 CPU(s): 4-7,36-39

NUMA node2 CPU(s): 8-11,40-43

NUMA node3 CPU(s): 12-15,44-47

NUMA node4 CPU(s): 16-19,48-51

NUMA node5 CPU(s): 20-23,52-55

NUMA node6 CPU(s): 24-27,56-59

NUMA node7 CPU(s): 28-31,60-63

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 extd_apicid amd_dcm aperfmperf eagerfpu pni

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Platform Notes (Continued)

```
pclmulqdq monitor ssse3 fma cx16 sse4_1 sse4_2 movbe popcnt aes xsave avx fl6c
rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse 3dnowprefetch
osvw skinit wdt tce topoext perfctr_core perfctr_nb bpext perfctr_l2 mwaitx arat
hw_pstate ssbd ibpb retpoline retpoline_amd npt lbrv svm_lock nrip_save tsc_scale
vmcb_clean flushbyasid decodeassists pausefilter pfthreshold vmmcall avic fsgsbase
bmi1 avx2 smep bmi2 rdseed adx smap clflushopt sha_ni xsaveopt xsavec xgetbv1 clzero
irperf 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: 8 nodes (0-7)
node 0 cpus: 0 1 2 3 32 33 34 35
node 0 size: 128704 MB
node 0 free: 128492 MB
node 1 cpus: 4 5 6 7 36 37 38 39
node 1 size: 129022 MB
node 1 free: 128842 MB
node 2 cpus: 8 9 10 11 40 41 42 43
node 2 size: 129022 MB
node 2 free: 128848 MB
node 3 cpus: 12 13 14 15 44 45 46 47
node 3 size: 129022 MB
node 3 free: 128815 MB
node 4 cpus: 16 17 18 19 48 49 50 51
node 4 size: 129022 MB
node 4 free: 128830 MB
node 5 cpus: 20 21 22 23 52 53 54 55
node 5 size: 129022 MB
node 5 free: 128868 MB
node 6 cpus: 24 25 26 27 56 57 58 59
node 6 size: 129022 MB
node 6 free: 128875 MB
node 7 cpus: 28 29 30 31 60 61 62 63
node 7 size: 128868 MB
node 7 free: 128713 MB
node distances:
node  0  1  2  3  4  5  6  7
 0:  10  16  16  16  32  32  32  32
 1:  16  10  16  16  32  32  32  32
 2:  16  16  10  16  32  32  32  32
 3:  16  16  16  10  32  32  32  32
 4:  32  32  32  32  10  16  16  16
 5:  32  32  32  32  16  10  16  16
 6:  32  32  32  32  16  16  10  16
```

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Platform Notes (Continued)

7: 32 32 32 32 16 16 16 10

From /proc/meminfo

MemTotal: 1056465760 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

/usr/bin/lsb_release -d

SUSE Linux Enterprise Server 12 SP3

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

SuSE-release:

SUSE Linux Enterprise Server 12 (x86_64)
VERSION = 12
PATCHLEVEL = 3

This file is deprecated and will be removed in a future service pack or release.
Please check /etc/os-release for details about this release.

os-release:

NAME="SLES"
VERSION="12-SP3"
VERSION_ID="12.3"
PRETTY_NAME="SUSE Linux Enterprise Server 12 SP3"
ID="sles"
ANSI_COLOR="0;32"
CPE_NAME="cpe:/o:suse:sles:12:sp3"

uname -a:

Linux linux-y31s 4.4.140-94.42-default #1 SMP Tue Jul 17 07:44:50 UTC 2018 (0b375e4)
x86_64 x86_64 x86_64 GNU/Linux

run-level 5 Jul 30 08:00

SPEC is set to: /home/cpu2017

Filesystem	Type	Size	Used	Avail	Use%	Mounted on
/dev/sda3	xf	333G	4.9G	328G	2%	/home

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 HPE A40 06/07/2018

Memory:

16x UNKNOWN NOT AVAILABLE
16x UNKNOWN NOT AVAILABLE 64 GB 4 rank 2666

(End of data from sysinfo program)



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Compiler Version Notes

=====
CC 519.lbm_r(base, peak) 538.imagick_r(base, peak) 544.nab_r(base, peak)

AOCC.LLVM.4.0.0.B35.2017_04_26 clang version 4.0.0 (CLANG:) (based on LLVM
AOCC.LLVM.4.0.0.B35.2017_04_26)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin

=====
CXXC 508.namd_r(base, peak) 510.parest_r(base, peak)

AOCC.LLVM.4.0.0.B35.2017_04_26 clang version 4.0.0 (CLANG:) (based on LLVM
AOCC.LLVM.4.0.0.B35.2017_04_26)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin

=====
CC 511.povray_r(base, peak) 526.blender_r(base, peak)

AOCC.LLVM.4.0.0.B35.2017_04_26 clang version 4.0.0 (CLANG:) (based on LLVM
AOCC.LLVM.4.0.0.B35.2017_04_26)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin
AOCC.LLVM.4.0.0.B35.2017_04_26 clang version 4.0.0 (CLANG:) (based on LLVM
AOCC.LLVM.4.0.0.B35.2017_04_26)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin

=====
FC 507.cactuBSSN_r(base, peak)

AOCC.LLVM.4.0.0.B35.2017_04_26 clang version 4.0.0 (CLANG:) (based on LLVM
AOCC.LLVM.4.0.0.B35.2017_04_26)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin
AOCC.LLVM.4.0.0.B35.2017_04_26 clang version 4.0.0 (CLANG:) (based on LLVM
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Compiler Version Notes (Continued)

InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin

GNU Fortran (GCC) 4.8.2

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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

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=====

CC 521.wrf_r(base, peak) 527.cam4_r(base, peak)

GNU Fortran (GCC) 4.8.2

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AOCC.LLVM.4.0.0.B35.2017_04_26 clang version 4.0.0 (CLANG:) (based on LLVM

AOCC.LLVM.4.0.0.B35.2017_04_26)

Target: x86_64-unknown-linux-gnu

Thread model: posix

InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin

Base Compiler Invocation

C benchmarks:

clang

C++ benchmarks:

clang++

(Continued on next page)



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Base Compiler Invocation (Continued)

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

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 -disable-vect-cmp -O3 -ffast-math
-march=znver1 -fstruct-layout=2 -mllvm -unroll-threshold=100
-fremap-arrays -mno-avx2 -inline-threshold=1000 -z muldefs -ljemalloc

C++ benchmarks:

-flto -Wl,-plugin-opt= -merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -disable-vect-cmp -O3
-march=znver1 -mllvm -unroll-threshold=100 -finline-aggressive
-fremap-arrays -inline-threshold=1000 -z muldefs -ljemalloc

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Base Optimization Flags (Continued)

Fortran benchmarks:

```
-flto -Wl,-plugin-opt= -merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -disable-vect-cmp -O3(gfortran)
-O3(clang) -mavx -madox -funroll-loops -ffast-math -z muldefs
-fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option="-merge-constant -disable-vect-cmp"
-ljemalloc -lgfortran -lamdlibm
```

Benchmarks using both Fortran and C:

```
-flto -Wl,-plugin-opt= -merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -disable-vect-cmp -O3(clang)
-ffast-math -march=znver1 -fstruct-layout=2 -mllvm
-unroll-threshold=100 -fremap-arrays -mno-avx2 -inline-threshold=1000
-O3(gfortran) -mavx -madox -funroll-loops -z muldefs
-fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option="-merge-constant -disable-vect-cmp"
-ljemalloc -lgfortran -lamdlibm
```

Benchmarks using both C and C++:

```
-flto -Wl,-plugin-opt= -merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -disable-vect-cmp -O3 -ffast-math
-march=znver1 -fstruct-layout=2 -mllvm -unroll-threshold=100
-fremap-arrays -mno-avx2 -inline-threshold=1000 -finline-aggressive
-z muldefs -ljemalloc
```

Benchmarks using Fortran, C, and C++:

```
-flto -Wl,-plugin-opt= -merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -disable-vect-cmp -O3(clang)
-ffast-math -march=znver1 -fstruct-layout=2 -mllvm
-unroll-threshold=100 -fremap-arrays -mno-avx2 -inline-threshold=1000
-finline-aggressive -O3(gfortran) -mavx -madox -funroll-loops
-z muldefs -fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option="-merge-constant -disable-vect-cmp"
-ljemalloc
```

Peak Compiler Invocation

C benchmarks:

clang

C++ benchmarks:

clang++

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Peak Compiler Invocation (Continued)

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:

519.lbm_r: basepeak = yes

538.imagick_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 -unroll-threshold=100 -fremap-arrays
-inline-threshold=1000 -ljemalloc

544.nab_r: Same as 538.imagick_r

C++ benchmarks:

508.namd_r: -flto -Wl,-plugin-opt= -merge-constant
-Wl,-plugin-opt=-lsr-in-nested-loop -Ofast -march=znver1
-finline-aggressive -mllvm -unroll-threshold=100
-fremap-arrays -inline-threshold=1000 -ljemalloc

510.parest_r: basepeak = yes

Fortran benchmarks:

(Continued on next page)



SPEC CPU2017 Floating Point Rate Result

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ProLiant DL385 Gen10

(2.20 GHz, AMD EPYC 7301)

SPECrate2017_fp_base = 179

SPECrate2017_fp_peak = 181

CPU2017 License: 3

Test Sponsor: HPE

Tested by: HPE

Test Date: Jul-2018

Hardware Availability: Jul-2018

Software Availability: Jul-2018

Peak Optimization Flags (Continued)

503.bwaves_r: basepeak = yes

```
549.fotonik3d_r: -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
-inline-threshold:1000" -ljemalloc -lgfortran -lamdlibm
```

554.roms_r: Same as 549.fotonik3d_r

Benchmarks using both Fortran and C:

521.wrf_r: basepeak = yes

527.cam4_r: basepeak = yes

Benchmarks using both C and C++:

```
511.povray_r: -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 -unroll-threshold=100 -fremap-arrays
-inline-threshold=1000 -finline-aggressive -ljemalloc
```

526.blender_r: basepeak = yes

Benchmarks using Fortran, C, and C++:

507.cactuBSSN_r: basepeak = yes

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

<http://www.spec.org/cpu2017/flags/gcc.2017-11-20.html>

<http://www.spec.org/cpu2017/flags/aocc100-flags-revC-I.html>

<http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-V1.2-EPYC-revD.html>

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

<http://www.spec.org/cpu2017/flags/gcc.2017-11-20.xml>

<http://www.spec.org/cpu2017/flags/aocc100-flags-revC-I.xml>

<http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-V1.2-EPYC-revD.xml>



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