SPEC® CPU2017 Floating Point Rate Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

Hewlett Packard Enterprise
(Test Sponsor: HPE)
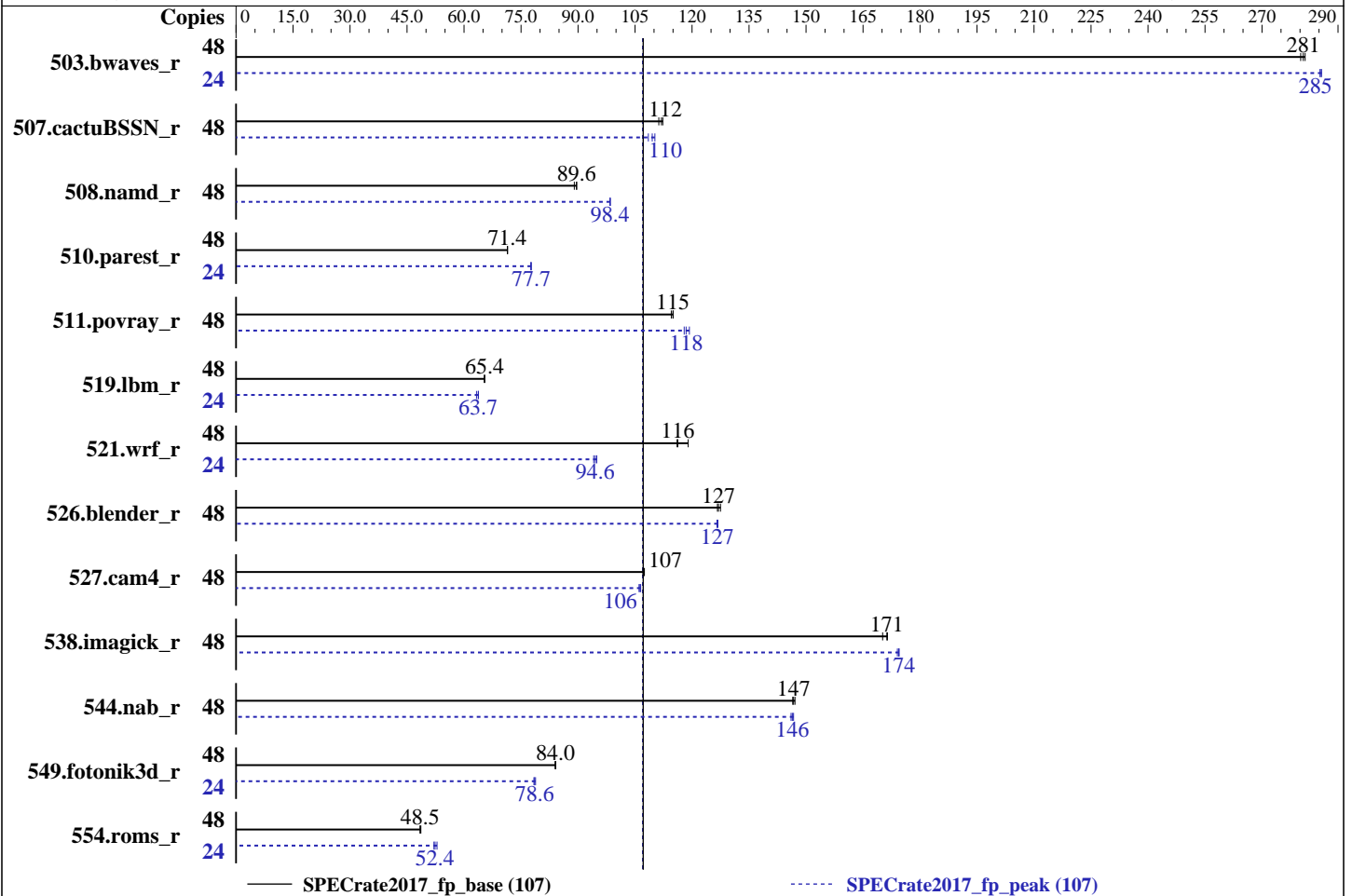
ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7401P)

$SPECrate2017\_fp\_base = 107$

$SPECrate2017\_fp\_peak = 107$

CPU2017 License:	3	**Test Date:** Jul-2017
Test Sponsor:	HPE	**Hardware Availability:** Jul-2018
Tested by:	HPE	**Software Availability:** Feb-2018

Copies

503.bwaves_r 48 — 281
24 — 285

507.cactuBSSN_r 48 — 112
110

508.namd_r 48 — 89.6
98.4

510.parest_r 48 — 71.4
24 — 77.7

511.povray_r 48 — 115
118

519.lbm_r 48 — 65.4
24 — 63.7

521.wrf_r 48 — 116
24 — 94.6

526.blender_r 48 — 127
127

527.cam4_r 48 — 107
106

538.imagick_r 48 — 171
174

544.nab_r 48 — 147
146

549.fotonik3d_r 48 — 84.0
24 — 78.6

554.roms_r 48 — 48.5
24 — 52.4

—— SPECrate2017_fp_base (107)   ------ SPECrate2017_fp_peak (107)

Hardware

CPU Name: AMD EPYC 7401P
Max MHz.: 3000
Nominal: 2000
Enabled: 24 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: 64 MB I+D on chip per chip, 8 MB shared / 3 cores
Other: None
Memory: 128 GB (8 x 16 GB 1Rx4 PC4-2666V-L, running at 2400)
Storage: 1 x 400 GB SATA SSD, RAID 0
Other: None

Software

OS: SUSE Linux Enterprise Server 12 (x86_64) SP3
Kernel 4.4.131-94.25-default
Compiler: C/C++: Version 1.0.0 of AOCC
Fortran: Version 4.8.2 of GCC
Parallel: No
Firmware: HPE BIOS Version A41 04/06/2018 released Apr-2018
File System: xfs
System State: Run level 3 (multi-user)
Base Pointers: 64-bit
Peak Pointers: 64-bit
Other: jemalloc general purpose malloc implementation v4.5.0;

SPEC CPU2017 Floating Point Rate Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

Hewlett Packard Enterprise
(Test Sponsor: HPE)

ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7401P)

$SPECrate2017\_fp\_base = 107$

$SPECrate2017\_fp\_peak = 107$

CPU2017 License: 3	**Test Date:** Jul-2017
Test Sponsor: HPE	**Hardware Availability:** Jul-2018
Tested by: HPE	**Software Availability:** Feb-2018

Results Table

Benchmark	Base Copies	Base Seconds	Base Ratio	Base Seconds	Base Ratio	Base Seconds	Base Ratio	Peak Copies	Peak Seconds	Peak Ratio	Peak Seconds	Peak Ratio	Peak Seconds	Peak Ratio
503.bwaves_r	48	**1714**	**281**	1711	281	1718	280	24	**843**	**285**	842	286	844	285
507.cactuBSSN_r	48	**543**	**112**	541	112	546	111	48	551	110	**555**	**110**	560	108
508.namd_r	48	512	89.0	**509**	**89.6**	509	89.7	48	463	98.5	**463**	**98.4**	463	98.4
510.parest_r	48	1759	71.4	1757	71.5	**1758**	**71.4**	24	809	77.6	**808**	**77.7**	808	77.7
511.povray_r	48	975	115	978	115	**975**	**115**	48	950	118	939	119	**946**	**118**
519.lbm_r	48	774	65.4	773	65.4	**774**	**65.4**	24	400	63.3	**397**	**63.7**	397	63.8
521.wrf_r	48	926	116	**925**	**116**	904	119	24	**569**	**94.6**	571	94.1	566	94.9
526.blender_r	48	577	127	573	127	**576**	**127**	48	**577**	**127**	577	127	578	127
527.cam4_r	48	784	107	**782**	**107**	781	107	48	**790**	**106**	788	106	792	106
538.imagick_r	48	702	170	696	171	**697**	**171**	48	686	174	684	175	**684**	**174**
544.nab_r	48	551	146	549	147	**551**	**147**	48	551	147	**552**	**146**	553	146
549.fotonik3d_r	48	2224	84.1	**2226**	**84.0**	2227	84.0	24	1187	78.8	**1190**	**78.6**	1193	78.4
554.roms_r	48	1568	48.6	**1574**	**48.5**	1574	48.4	24	732	52.1	721	52.9	**728**	**52.4**
SPECrate2017_fp_base =	**107**													
SPECrate2017_fp_peak =	**107**													

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

runspec command invoked through numactl i.e.:
numactl --interleave=all runspec <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
Linux governor set to performance with cpupower "cpupower frequency-set -r -g performance"
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.
IRQ balance service stopped using "systemctl stop irqbalance.service"
Tuned profile set with "tuned-adm profile throughput-performance"
```

SPEC CPU2017 Floating Point Rate Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7401P)

SPECrate2017_fp_base = 107

SPECrate2017_fp_peak = 107

CPU2017 License:	3	**Test Date:**	Jul-2017
Test Sponsor:	HPE	**Hardware Availability:**	Jul-2018
Tested by:	HPE	**Software Availability:**	Feb-2018

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:"
MALLOC_CONF = "lg_chunk:28"

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

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

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/

 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, 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 v4.8.2 in RHEL v7.2 under default conditions.
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 Configuration:
  Thermal Configuration set to Maximum Cooling
  Memory Patrol Scrubbing set to Disabled
  Performance Determinism set to Power Deterministic
  Processor Power and Utilization Monitoring set to Disabled
  Workload Profile set to General Throughput Compute
    Minimum Processor Idle Power Core C-State set to C6 State
 Sysinfo program /cpu2017/bin/sysinfo
 Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9
 running on linux-6qav Tue Jul 18 14:15:45 2017

 SUT (System Under Test) info as seen by some common utilities.

(Continued on next page)

Hewlett Packard Enterprise
(Test Sponsor: HPE)

ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7401P)

SPECrate2017_fp_base = 107

SPECrate2017_fp_peak = 107

CPU2017 License:	3	**Test Date:**	Jul-2017
Test Sponsor:	HPE	**Hardware Availability:**	Jul-2018
Tested by:	HPE	**Software Availability:**	Feb-2018

Platform Notes (Continued)

```
For more information on this section, see
   https://www.spec.org/cpu2017/Docs/config.html#sysinfo

From /proc/cpuinfo
   model name : AMD EPYC 7401P 24-Core Processor
      1  "physical id"s (chips)
      48 "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
      siblings  : 48
      physical 0: cores 0 1 2 4 5 6 8 9 10 12 13 14 16 17 18 20 21 22 24 25 26 28 29 30

From lscpu:
   Architecture:          x86_64
   CPU op-mode(s):        32-bit, 64-bit
   Byte Order:            Little Endian
   CPU(s):                48
   On-line CPU(s) list:   0-47
   Thread(s) per core:    2
   Core(s) per socket:    24
   Socket(s):             1
   NUMA node(s):          4
   Vendor ID:             AuthenticAMD
   CPU family:            23
   Model:                 1
   Model name:            AMD EPYC 7401P 24-Core Processor
   Stepping:              2
   CPU MHz:               2000.000
   CPU max MHz:           2000.0000
   CPU min MHz:           1200.0000
   BogoMIPS:              3992.46
   Virtualization:        AMD-V
   L1d cache:             32K
   L1i cache:             64K
   L2 cache:              512K
   L3 cache:              8192K
   NUMA node0 CPU(s):     0-5,24-29
   NUMA node1 CPU(s):     6-11,30-35
   NUMA node2 CPU(s):     12-17,36-41
   NUMA node3 CPU(s):     18-23,42-47
   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
   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_l2 mwaitx arat
```

(Continued on next page)

Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7401P)

SPECrate2017_fp_base =   107

SPECrate2017_fp_peak =   107

CPU2017 License: 3

Test Sponsor: HPE

Tested by: HPE

Test Date: Jul-2017

Hardware Availability: Jul-2018

Software Availability: Feb-2018

Platform Notes (Continued)

```
     hw_pstate rds 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 ibpb 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 1 2 3 4 5 24 25 26 27 28 29
   node 0 size: 32071 MB
   node 0 free: 31849 MB
   node 1 cpus: 6 7 8 9 10 11 30 31 32 33 34 35
   node 1 size: 32253 MB
   node 1 free: 32097 MB
   node 2 cpus: 12 13 14 15 16 17 36 37 38 39 40 41
   node 2 size: 32253 MB
   node 2 free: 32087 MB
   node 3 cpus: 18 19 20 21 22 23 42 43 44 45 46 47
   node 3 size: 32252 MB
   node 3 free: 32084 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:       131923792 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"
```

(Continued on next page)

Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7401P)

SPECrate2017_fp_base = 107

SPECrate2017_fp_peak = 107

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

Test Date: Jul-2017
Hardware Availability: Jul-2018
Software Availability: Feb-2018

Platform Notes (Continued)

```
        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-6qav 4.4.131-94.25-default #1 SMP Mon May 7 11:22:19 UTC 2018 (9700bac)
      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 Jul 18 01:51

   SPEC is set to: /cpu2017
      Filesystem      Type    Size  Used Avail Use% Mounted on
      /dev/sda3       btrfs  371G   21G  349G   6% /

   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 A41 04/06/2018
     Memory:
      1x HPE 809082-091 16 GB 1 rank 2400
      8x UNKNOWN NOT AVAILABLE
      7x UNKNOWN NOT AVAILABLE 16 GB 1 rank 2666, configured at 2400

   (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.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
------------------------------------------------------------------------------
```

(Continued on next page)

Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7401P)

SPECrate2017_fp_base = 107

SPECrate2017_fp_peak = 107

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

Test Date: Jul-2017
Hardware Availability: Jul-2018
Software Availability: Feb-2018

Compiler Version Notes (Continued)

```
==============================================================================
 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
  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
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
------------------------------------------------------------------------------
```

(Continued on next page)

Hewlett Packard Enterprise
(Test Sponsor: HPE)

ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7401P)

SPECrate2017_fp_base = 107

SPECrate2017_fp_peak = 107

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

Test Date: Jul-2017
Hardware Availability: Jul-2018
Software Availability: Feb-2018

Compiler Version Notes (Continued)

```
==============================================================================
  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
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
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++

Fortran benchmarks:
clang gfortran

Benchmarks using both Fortran and C:
clang gfortran

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

(Continued on next page)

Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7401P)

SPECrate2017_fp_base =   107

SPECrate2017_fp_peak =   107

CPU2017 License:	3	**Test Date:**	Jul-2017
Test Sponsor:	HPE	**Hardware Availability:**	Jul-2018
Tested by:	HPE	**Software Availability:**	Feb-2018

Base Compiler Invocation (Continued)

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
```

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

(Continued on next page)

SPEC CPU2017 Floating Point Rate Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

Hewlett Packard Enterprise
(Test Sponsor: HPE)

ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7401P)

SPECrate2017_fp_base = 107

SPECrate2017_fp_peak = 107

CPU2017 License:	3	**Test Date:**	Jul-2017
Test Sponsor:	HPE	**Hardware Availability:**	Jul-2018
Tested by:	HPE	**Software Availability:**	Feb-2018

Base Optimization Flags (Continued)

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 -madx -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 -madx -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++
```

Fortran benchmarks:
```
clang gfortran
```

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

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

(Continued on next page)

Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7401P)

SPECrate2017_fp_base =   107

SPECrate2017_fp_peak =   107

CPU2017 License:	3	**Test Date:**	Jul-2017
Test Sponsor:	HPE	**Hardware Availability:**	Jul-2018
Tested by:	HPE	**Software Availability:**	Feb-2018

Peak Compiler Invocation (Continued)

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
-unroll-threshold=100 -fremap-arrays -inline-threshold=1000 -ljemalloc
```

C++ benchmarks:
```
-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
```

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
-inline-threshold:1000" -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
-inline-threshold:1000" -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 -unroll-threshold=100 -fremap-arrays
-inline-threshold=1000 -O3(gfortran) -O3(clang) -mavx2
```

(Continued on next page)

Hewlett Packard Enterprise
(Test Sponsor: HPE)

SPECrate2017_fp_base = 107

ProLiant DL325 Gen10
(2.00 GHz, AMD EPYC 7401P)

SPECrate2017_fp_peak = 107

CPU2017 License: 3	**Test Date:** Jul-2017
Test Sponsor: HPE	**Hardware Availability:** Jul-2018
Tested by: HPE	**Software Availability:** Feb-2018

Peak Optimization Flags (Continued)

527.cam4_r (continued):
```
-madx -funroll-loops -ffast-math -fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option="-merge-constant
-inline-threshold:1000" -ljemalloc -lgfortran  -lamdlibm
```

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

Benchmarks using Fortran, C, and C++:
```
-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 -O3 -mavx2 -madx -funroll-loops -ffast-math
-fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option="-merge-constant
-inline-threshold:1000" -ljemalloc
```

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
```

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

Tested with SPEC CPU2017 v1.0.5 on 2017-07-18 15:15:44-0400.
Report generated on 2018-10-31 19:08:01 by CPU2017 PDF formatter v6067.
Originally published on 2018-10-16.