# SPEC® CPU2017 Integer Rate Result



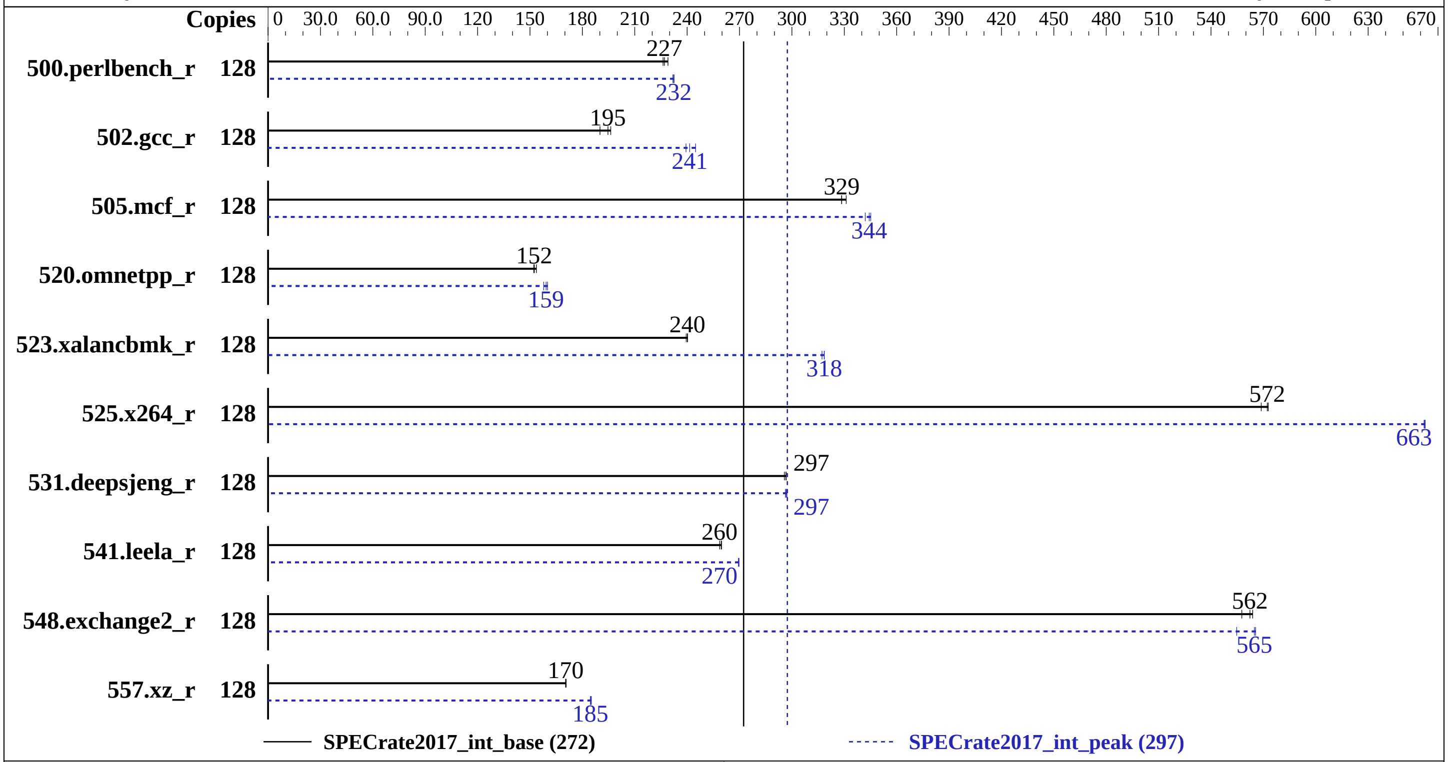
# Dell Inc.

PowerEdge R7425
(AMD EPYC 7601, 2.20 GHz)

SPECrate2017_int_base = 272

SPECrate2017_int_peak = 297

| | | | |
|---|---|---|---|
| **CPU2017 License:** | 55 | **Test Date:** | Nov-2017 |
| **Test Sponsor:** | Dell Inc. | **Hardware Availability:** | Dec-2017 |
| **Tested by:** | Dell Inc. | **Software Availability:** | Sep-2017 |




## Hardware

| | |
|---|---|
| CPU Name: | AMD EPYC 7601 |
| Max MHz.: | 3200 |
| Nominal: | 2200 |
| Enabled: | 64 cores, 2 chips, 2 threads/core |
| Orderable: | 1,2 chips |
| 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 / 4 cores |
| Other: | None |
| Memory: | 1 TB (16 x 64 GB 4Rx4 PC4-2666V-L) |
| Storage: | 1 x 960 GB SATA SSD |
| Other: | None |

## Software

| | |
|---|---|
| OS: | Ubuntu 17.04<br>kernel 4.10.0-24 |
| Compiler: | C/C++: Version 1.0.0 of AOCC<br>Fortran: Version 4.8.2 of GCC |
| Parallel: | No |
| Firmware: | Version 1.0.2 released Nov-2017 |
| File System: | ext4 |
| System State: | Run level 5 (multi-user) |
| Base Pointers: | 64-bit |
| Peak Pointers: | 32/64-bit |
| Other: | jemalloc memory allocator library, version 4.5.0 |

## Results Table

| | Base | | | | | | | Peak | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Benchmark** | **Copies** | **Seconds** | **Ratio** | **Seconds** | **Ratio** | **Seconds** | **Ratio** | **Copies** | **Seconds** | **Ratio** | **Seconds** | **Ratio** | **Seconds** | **Ratio** |
| 500.perlbench_r | 128 | 890 | 229 | 901 | 226 | **898** | **227** | 128 | 879 | 232 | **877** | **232** | 876 | 233 |
| 502.gcc_r | 128 | 924 | 196 | 953 | 190 | **931** | **195** | 128 | 740 | 245 | **751** | **241** | 757 | 239 |
| 505.mcf_r | 128 | 625 | 331 | 630 | 328 | **630** | **329** | 128 | 599 | 345 | 605 | 342 | **601** | **344** |
| 520.omnetpp_r | 128 | **1102** | **152** | 1103 | 152 | 1093 | 154 | 128 | **1055** | **159** | 1064 | 158 | 1049 | 160 |
| 523.xalancbmk_r | 128 | 563 | 240 | **563** | **240** | 564 | 239 | 128 | 424 | 319 | 426 | 317 | **424** | **318** |
| 525.x264_r | 128 | **392** | **572** | 391 | 573 | 394 | 569 | 128 | **338** | **663** | 339 | 662 | 338 | 663 |
| 531.deepsjeng_r | 128 | **495** | **297** | 496 | 296 | 494 | 297 | 128 | 495 | 296 | **494** | **297** | 494 | 297 |
| 541.leela_r | 128 | **817** | **260** | 816 | 260 | 820 | 259 | 128 | 787 | 269 | 786 | 270 | **787** | **270** |
| 548.exchange2_r | 128 | 595 | 564 | **596** | **562** | 601 | 558 | 128 | 605 | 555 | 593 | 566 | **594** | **565** |
| 557.xz_r | 128 | 810 | 171 | 811 | 170 | **811** | **170** | 128 | **749** | **185** | 747 | 185 | 749 | 185 |

**SPECrate2017_int_base =** **272**

**SPECrate2017_int_peak =** **297**

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

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.
```

## General Notes

```
Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = "/home/cpu2017/amd1704-rate-libs-revB/64;/home/cpu2017/amd1704-rate-libs-revB/32:"
MALLOC_CONF = "lg_chunk:26"

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 1.0 was used to leverage AOCC optimizers
with gfortran.

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

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 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.

NA: The test sponsor attests, as of date of publication, that CVE-2017-5754 (Meltdown)
is mitigated in the system as tested and documented.
No: 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.
No: 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.

This benchmark result is intended to provide perspective on
past performance using the historical hardware and/or
software described on this result page.

The system as described on this result page was formerly
generally available.  At the time of this publication, it may
not be shipping, and/or may not be supported, and/or may fail
to meet other tests of General Availability described in the
SPEC OSG Policy document, http://www.spec.org/osg/policy.html

This measured result may not be representative of the result
that would be measured were this benchmark run with hardware
and software available as of the publication date.
```

## Platform Notes

```
BIOS settings:
Memory Interleaving set to Channel Interleaving
```

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## Platform Notes (Continued)

```
Virtualization Technology disabled
System Profile set to Custom
CPU Power Management set to Maximum Performance
Memory Frequency set to Maximum Performance
Turbo Boost enabled
C States disabled
Memory Patrol Scrub disabled
Memory Refresh Rate set to 1x
PCI ASPM L1 Link Power Management disabled
 Sysinfo program /home/cpu2017/bin/sysinfo
 Rev: r5797 of 2017-06-14 96c45e4568ad54c135fd618bcc091c0f
 running on epyc Sat Nov 11 12:52:32 2017

 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 7601 32-Core Processor
       2  "physical id"s (chips)
       128 "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 : 32
       siblings  : 64
       physical 0: cores 0 1 2 3 4 5 6 7
       physical 1: cores 0 1 2 3 4 5 6 7

 From lscpu:
      Architecture:          x86_64
      CPU op-mode(s):        32-bit, 64-bit
      Byte Order:            Little Endian
      CPU(s):                128
      On-line CPU(s) list:   0-127
      Thread(s) per core:    2
      Core(s) per socket:    32
      Socket(s):             2
      NUMA node(s):          8
      Vendor ID:             AuthenticAMD
      CPU family:            23
      Model:                 1
      Model name:            AMD EPYC 7601 32-Core Processor
      Stepping:              2
      CPU MHz:               2195.725
      BogoMIPS:              4391.45
      Virtualization:        AMD-V
      L1d cache:             32K
```

(Continued on next page)

## Platform Notes (Continued)

```
     L1i cache:             64K
     L2 cache:              512K
     L3 cache:              8192K
     NUMA node0 CPU(s):     0,8,16,24,32,40,48,56,64,72,80,88,96,104,112,120
     NUMA node1 CPU(s):     2,10,18,26,34,42,50,58,66,74,82,90,98,106,114,122
     NUMA node2 CPU(s):     4,12,20,28,36,44,52,60,68,76,84,92,100,108,116,124
     NUMA node3 CPU(s):     6,14,22,30,38,46,54,62,70,78,86,94,102,110,118,126
     NUMA node4 CPU(s):     1,9,17,25,33,41,49,57,65,73,81,89,97,105,113,121
     NUMA node5 CPU(s):     3,11,19,27,35,43,51,59,67,75,83,91,99,107,115,123
     NUMA node6 CPU(s):     5,13,21,29,37,45,53,61,69,77,85,93,101,109,117,125
     NUMA node7 CPU(s):     7,15,23,31,39,47,55,63,71,79,87,95,103,111,119,127
     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 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 cpb hw_pstate
     vmmcall fsgsbase bmi1 avx2 smep bmi2 rdseed adx smap clflushopt sha_ni xsaveopt
     xsavec xgetbv1 xsaves clzero irperf arat npt lbrv svm_lock nrip_save tsc_scale
     vmcb_clean flushbyasid decodeassists pausefilter pfthreshold avic 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 8 16 24 32 40 48 56 64 72 80 88 96 104 112 120
  node 0 size: 128639 MB
  node 0 free: 128244 MB
  node 1 cpus: 2 10 18 26 34 42 50 58 66 74 82 90 98 106 114 122
  node 1 size: 129004 MB
  node 1 free: 128647 MB
  node 2 cpus: 4 12 20 28 36 44 52 60 68 76 84 92 100 108 116 124
  node 2 size: 129021 MB
  node 2 free: 128692 MB
  node 3 cpus: 6 14 22 30 38 46 54 62 70 78 86 94 102 110 118 126
  node 3 size: 129021 MB
  node 3 free: 128697 MB
  node 4 cpus: 1 9 17 25 33 41 49 57 65 73 81 89 97 105 113 121
  node 4 size: 129021 MB
  node 4 free: 128653 MB
  node 5 cpus: 3 11 19 27 35 43 51 59 67 75 83 91 99 107 115 123
  node 5 size: 129021 MB
  node 5 free: 128683 MB
  node 6 cpus: 5 13 21 29 37 45 53 61 69 77 85 93 101 109 117 125
```

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## Platform Notes (Continued)

```
    node 6 size: 129021 MB
    node 6 free: 128682 MB
    node 7 cpus: 7 15 23 31 39 47 55 63 71 79 87 95 103 111 119 127
    node 7 size: 129019 MB
    node 7 free: 128680 MB
    node distances:
    node   0   1   2   3   4   5   6   7
      0:  10  16  16  16  28  28  22  28
      1:  16  10  16  16  28  28  28  22
      2:  16  16  10  16  22  28  28  28
      3:  16  16  16  10  28  22  28  28
      4:  28  28  22  28  10  16  16  16
      5:  28  28  28  22  16  10  16  16
      6:  22  28  28  28  16  16  10  16
      7:  28  22  28  28  16  16  16  10

  From /proc/meminfo
     MemTotal:       1056530872 kB
     HugePages_Total:       0
     Hugepagesize:       2048 kB

  /usr/bin/lsb_release -d
     Ubuntu 17.04

  From /etc/*release* /etc/*version*
     debian_version: stretch/sid
     os-release:
        NAME="Ubuntu"
        VERSION="17.04 (Zesty Zapus)"
        ID=ubuntu
        ID_LIKE=debian
        PRETTY_NAME="Ubuntu 17.04"
        VERSION_ID="17.04"
        HOME_URL="https://www.ubuntu.com/"
        SUPPORT_URL="https://help.ubuntu.com/"

  uname -a:
     Linux epyc 4.10.0-24-generic #28-Ubuntu SMP Wed Jun 14 08:14:34 UTC 2017 x86_64 x86_64
     x86_64 GNU/Linux

  run-level 5 Jun 27 20:06

  SPEC is set to: /home/cpu2017
     Filesystem     Type  Size  Used Avail Use% Mounted on
     /dev/sda2      ext4  880G  8.9G  826G   2% /

  Additional information from dmidecode follows.  WARNING: Use caution when you interpret
```

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## Platform Notes (Continued)

```
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. 1.0.2 11/03/2017
  Memory:
   16x 802C8632802C 72ASS8G72LZ-2G6B2 64 GB 4 rank 2666
   16x Not Specified Not Specified

(End of data from sysinfo program)
```

## Compiler Version Notes

```
==============================================================================
 CC  502.gcc_r(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: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin
------------------------------------------------------------------------------

==============================================================================
 CXXC 523.xalancbmk_r(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: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/AOCC-1.0-Compiler/bin
------------------------------------------------------------------------------

==============================================================================
 CC  500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base, peak)
      525.x264_r(base) 557.xz_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 520.omnetpp_r(base, peak) 523.xalancbmk_r(base) 531.deepsjeng_r(base,
      peak) 541.leela_r(base)
```

**(Continued on next page)**

## Compiler Version Notes (Continued)

```
------------------------------------------------------------------------------
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   500.perlbench_r(peak) 525.x264_r(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 541.leela_r(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
------------------------------------------------------------------------------

==============================================================================
 FC  548.exchange2_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
------------------------------------------------------------------------------
```

## Base Compiler Invocation

C benchmarks:
clang

C++ benchmarks:
clang++

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Dell Inc.
PowerEdge R7425
(AMD EPYC 7601, 2.20 GHz)

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| **CPU2017 License:** | 55 | **Test Date:** | Nov-2017 |
| **Test Sponsor:** | Dell Inc. | **Hardware Availability:** | Dec-2017 |
| **Tested by:** | Dell Inc. | **Software Availability:** | Sep-2017 |

# Base Compiler Invocation (Continued)

Fortran benchmarks:
clang gfortran

# Base Portability Flags

500.perlbench_r: -DSPEC_LINUX_X64 -DSPEC_LP64
502.gcc_r: -DSPEC_LP64
505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
523.xalancbmk_r: -DSPEC_LINUX -DSPEC_LP64
525.x264_r: -DSPEC_LP64
531.deepsjeng_r: -DSPEC_LP64
541.leela_r: -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64

# Base Optimization Flags

C benchmarks:
-flto -Wl, -plugin-opt= -merge-constant -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 -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 -lsr-in-nested-loop
-disable-vect-cmp -O3(gfortran) -O3(clang) -mavx -madx
-funroll-loops -ffast-math -z muldefs -Ofast -fdefault-integer-8
-fplugin=dragonegg.so -fplugin-arg-dragonegg-llvm-option="
-enable-iv-split -inline-threshold:1000 -disable-vect-cmp" -ljemalloc
-lgfortran -lamdlibm

# Peak Compiler Invocation

C benchmarks:
`clang`

C++ benchmarks:
`clang++`

Fortran benchmarks:
`clang gfortran`

# Peak Portability Flags

500.perlbench_r: `-DSPEC_LINUX_X64 -DSPEC_LP64`
502.gcc_r: `-D_FILE_OFFSET_BITS=64`
505.mcf_r: `-DSPEC_LP64`
520.omnetpp_r: `-DSPEC_LP64`
523.xalancbmk_r: `-DSPEC_LINUX -D_FILE_OFFSET_BITS=64`
525.x264_r: `-DSPEC_LP64`
531.deepsjeng_r: `-DSPEC_LP64`
541.leela_r: `-DSPEC_LP64`
548.exchange2_r: `-DSPEC_LP64`
557.xz_r: `-DSPEC_LP64`

# Peak Optimization Flags

C benchmarks:

500.perlbench_r: `-flto -Wl, -plugin-opt= -merge-constant -lsr-in-nested-loop -fprofile-instr-generate`(pass 1) `-fprofile-instr-use`(pass 2) `-Ofast -march=znver1 -fstruct-layout=3 -mllvm -vectorize-memory-aggressively -mno-avx2 -unroll-threshold=100 -fremap-arrays -inline-threshold=1000 -ljemalloc`

502.gcc_r: `-m32 -flto -Wl, -plugin-opt= -merge-constant -lsr-in-nested-loop -Ofast -march=znver1 -fstruct-layout=3 -mllvm -vectorize-memory-aggressively -mno-avx2 -unroll-threshold=100 -fremap-arrays -inline-threshold=1000 -fgnu89-inline -L/root/work/lib/jemalloc/lib32 -ljemalloc`

505.mcf_r: `-flto -Wl, -plugin-opt= -merge-constant -lsr-in-nested-loop -Ofast -march=znver1`

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# Peak Optimization Flags (Continued)

505.mcf_r (continued):
-fstruct-layout=3 -mllvm -vectorize-memory-aggressively
-mno-avx2 -unroll-threshold=100 -fremap-arrays
-inline-threshold=1000 -ljemalloc

525.x264_r: Same as 500.perlbench_r

557.xz_r: Same as 505.mcf_r

C++ benchmarks:

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

523.xalancbmk_r: -m32 -flto -Wl, -plugin-opt= -merge-constant
-lsr-in-nested-loop -Ofast -march=znver1
-finline-aggressive -mllvm -unroll-threshold=100
-fremap-arrays -inline-threshold=1000
-L/root/work/lib/jemalloc/lib32 -ljemalloc

531.deepsjeng_r: Same as 520.omnetpp_r

541.leela_r: -flto -Wl, -plugin-opt= -merge-constant
-lsr-in-nested-loop -fprofile-instr-generate(pass 1)
-fprofile-instr-use(pass 2) -Ofast -march=znver1 -mllvm
-unroll-count=8 -unroll-threshold=100 -ljemalloc

Fortran benchmarks:
-flto -Wl, -plugin-opt= -merge-constant -lsr-in-nested-loop
-O3(gfortran) -O3(clang) -mavx2 -madx -funroll-loops -ffast-math
-Ofast -fdefault-integer-8 -fplugin=dragonegg.so
-fplugin-arg-dragonegg-llvm-option=" -enable-iv-split
-inline-threshold:1000 -disable-vect-cmp" -ljemalloc -lgfortran
-lamdlibm

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/aocc100-flags-revC-I.2018-02-16.html
http://www.spec.org/cpu2017/flags/amd1704-Dell-platform-revB-I.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/aocc100-flags-revC-I.2018-02-16.xml
http://www.spec.org/cpu2017/flags/amd1704-Dell-platform-revB-I.xml

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

Tested with SPEC CPU2017 v1.0.2 on 2017-11-11 13:52:31-0500.
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