SPEC® CPU2017 Integer Rate Result

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Dell Inc.

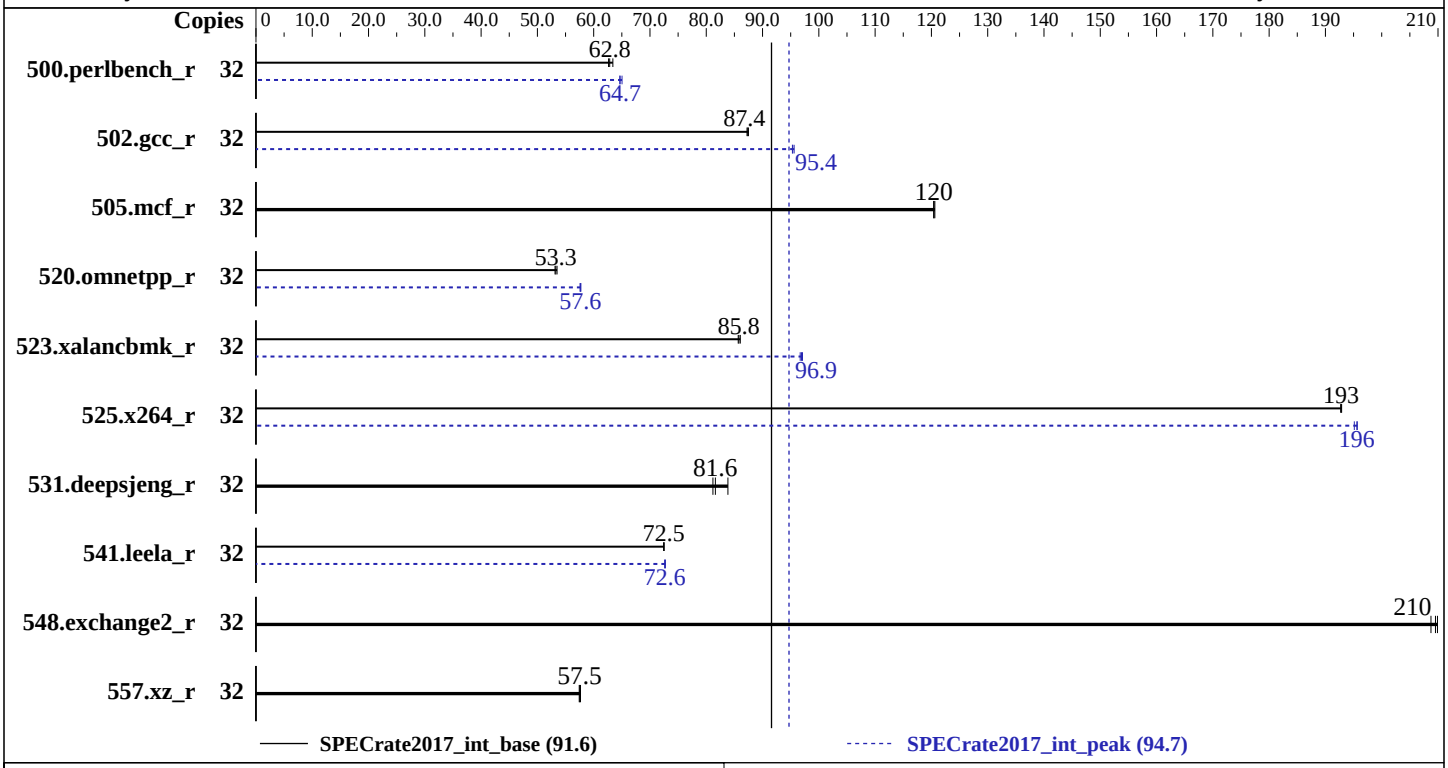
PowerEdge R7425 (AMD EPYC 7251, 2.10GHz)

SPECrate2017_int_base = 91.6

SPECrate2017_int_peak = 94.7

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

Test Date: Mar-2019
Hardware Availability: Feb-2019
Software Availability: Feb-2019



Hardware

CPU Name:	AMD EPYC 7251
Max MHz.:	2900
Nominal:	2100
Enabled:	16 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:	32 MB I+D on chip per chip
Other:	None
Memory:	1 TB (16 x 64 GB 4Rx4 PC4-2666V-L, running at 2400)
Storage:	1 x 120 GB SATA SSD
Other:	None

Software

OS:	Ubuntu 18.04.2 LTS kernel 4.15.0-45-generic
Compiler:	C/C++: Version 1.3.0 of AOCC Fortran: Version 4.8.2 of GCC
Parallel:	No
Firmware:	Version 1.7.6 released Jan-2019
File System:	ext4
System State:	Run level 5 (multi-user)
Base Pointers:	64-bit
Peak Pointers:	32/64-bit
Other:	jemalloc: jemalloc memory allocator library V5.1.0;

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Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
500.perlbench_r	32	803	63.4	813	62.6	**811**	**62.8**	32	788	64.6	**787**	**64.7**	783	65.0
502.gcc_r	32	518	87.5	**519**	**87.4**	519	87.2	32	**475**	**95.4**	475	95.3	474	95.6
505.mcf_r	32	**429**	**120**	429	121	429	120	32	**429**	**120**	429	121	429	120
520.omnetpp_r	32	785	53.5	790	53.1	**788**	**53.3**	32	727	57.7	729	57.6	**728**	**57.6**
523.xalancbmk_r	32	394	85.7	393	86.0	**394**	**85.8**	32	348	97.1	349	96.7	**349**	**96.9**
525.x264_r	32	291	193	291	193	**291**	**193**	32	286	196	**286**	**196**	287	195
531.deepsjeng_r	32	**449**	**81.6**	452	81.2	437	83.8	32	**449**	**81.6**	452	81.2	437	83.8
541.leela_r	32	731	72.5	732	72.4	**731**	**72.5**	32	729	72.7	**729**	**72.6**	730	72.6
548.exchange2_r	32	399	210	402	209	**400**	**210**	32	399	210	402	209	**400**	**210**
557.xz_r	32	**601**	**57.5**	599	57.7	602	57.4	32	**601**	**57.5**	599	57.7	602	57.4

SPECrate2017_int_base = 91.6

SPECrate2017_int_peak = 94.7

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/

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>

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
```

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Operating System Notes (Continued)

```
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:
 Determinism Slider set to Power Determinism
 Sysinfo program /home/cpu2017-1.0.5/bin/sysinfo
 Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9
 running on r7425 Tue Mar 19 10:15:42 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
```

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Platform Notes (Continued)

```
From /proc/cpuinfo
   model name : AMD EPYC 7251 8-Core Processor
      2  "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 : 8
      siblings  : 16
      physical 0: cores 0 8 12 16 20 24 28
      physical 1: cores 0 8 12 16 20 24 28

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:  8
     Socket(s):           2
     NUMA node(s):        8
     Vendor ID:           AuthenticAMD
     CPU family:          23
     Model:               1
     Model name:          AMD EPYC 7251 8-Core Processor
     Stepping:            2
     CPU MHz:             2327.974
     BogoMIPS:            4191.84
     Virtualization:      AMD-V
     L1d cache:           32K
     L1i cache:           64K
     L2 cache:            512K
     L3 cache:            4096K
     NUMA node0 CPU(s):   0,8,16,24
     NUMA node1 CPU(s):   2,10,18,26
     NUMA node2 CPU(s):   4,12,20,28
     NUMA node3 CPU(s):   6,14,22,30
     NUMA node4 CPU(s):   1,9,17,25
     NUMA node5 CPU(s):   3,11,19,27
     NUMA node6 CPU(s):   5,13,21,29
     NUMA node7 CPU(s):   7,15,23,31
     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
```

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Platform Notes (Continued)

```
      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: 8 nodes (0-7)
    node 0 cpus: 0 8 16 24
    node 0 size: 128638 MB
    node 0 free: 128492 MB
    node 1 cpus: 2 10 18 26
    node 1 size: 129020 MB
    node 1 free: 128873 MB
    node 2 cpus: 4 12 20 28
    node 2 size: 129020 MB
    node 2 free: 128904 MB
    node 3 cpus: 6 14 22 30
    node 3 size: 129020 MB
    node 3 free: 128843 MB
    node 4 cpus: 1 9 17 25
    node 4 size: 128999 MB
    node 4 free: 128871 MB
    node 5 cpus: 3 11 19 27
    node 5 size: 129020 MB
    node 5 free: 128902 MB
    node 6 cpus: 5 13 21 29
    node 6 size: 129020 MB
    node 6 free: 128882 MB
    node 7 cpus: 7 15 23 31
    node 7 size: 124986 MB
    node 7 free: 124868 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
```

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Platform Notes (Continued)

```
    MemTotal:       1052392348 kB
    HugePages_Total:       0
    Hugepagesize:       2048 kB

 /usr/bin/lsb_release -d
    Ubuntu 18.04.2 LTS

 From /etc/*release* /etc/*version*
    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 r7425 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 5 Mar 19 10:11

 SPEC is set to: /home/cpu2017-1.0.5
    Filesystem     Type  Size  Used Avail Use% Mounted on
    /dev/sda2      ext4  109G   19G   85G  19% /

 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. 1.7.6 01/14/2019
   Memory:
    16x 80CE863280CE M386A8K40BM2-CTD 64 GB 4 rank 2666, configured at 2400
    16x Not Specified Not Specified

 (End of data from sysinfo program)
```

Compiler Version Notes

```
==============================================================================
 CC  502.gcc_r(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: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.3.0/AOCC-1.3.0-Compiler/bin
------------------------------------------------------------------------------

==============================================================================
 CXXC 523.xalancbmk_r(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: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.3.0/AOCC-1.3.0-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.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
------------------------------------------------------------------------------

==============================================================================
 CXXC 520.omnetpp_r(base, peak) 523.xalancbmk_r(base) 531.deepsjeng_r(base,
     peak) 541.leela_r(base)
------------------------------------------------------------------------------
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   500.perlbench_r(peak) 525.x264_r(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)
```

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Compiler Version Notes (Continued)

```
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.3.0/AOCC-1.3.0-Compiler/bin
------------------------------------------------------------------------------

==============================================================================
CXXC 541.leela_r(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
------------------------------------------------------------------------------

==============================================================================
 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++

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

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Base Portability Flags (Continued)

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:

500.perlbench_r: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares -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

502.gcc_r: Same as 500.perlbench_r

505.mcf_r: Same as 500.perlbench_r

525.x264_r: Same as 500.perlbench_r

557.xz_r: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares -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 -lpthread -ldl -ljemalloc

C++ benchmarks:
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares -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

Fortran benchmarks:
-Wl,-mllvm -Wl,-inline-recursion=4 -Wl,-mllvm -Wl,-lsr-in-nested-loop
-Wl,-mllvm -Wl,-enable-iv-split -Wl,-mllvm -Wl,-merge-constant
-Wl,-mllvm -Wl,-unroll-aggressive -Wl,-mllvm -Wl,-unroll-threshold=150

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Base Optimization Flags (Continued)

Fortran benchmarks (continued):
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares -O3(gfortran) -O3(clang)
-mavx -madx -funroll-loops -ffast-math -frepack-arrays -z muldefs
-fplugin=dragonegg.so -specs=integrated-as.specs
-fplugin-arg-dragonegg-llvm-option=-disable-indvar-simplify
-fplugin-arg-dragonegg-llvm-option=-unroll-aggressive
-fplugin-arg-dragonegg-llvm-option=-unroll-threshold:150 -lpthread -ldl
-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,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares

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Peak Optimization Flags (Continued)

500.perlbench_r (continued):
-fprofile-instr-generate(pass 1)
-fprofile-instr-use(pass 2) -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

502.gcc_r: -m32 -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares -Ofast
-march=znver1 -fstruct-layout=3
-mllvm -vectorize-memory-aggressively -mno-avx2
-mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -fgnu89-inline -lpthread
-ldl -L/root/work/lib/jemalloc510/lib32 -ljemalloc

505.mcf_r: basepeak = yes

525.x264_r: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares
-fprofile-instr-generate(pass 1)
-fprofile-instr-use(pass 2) -Ofast -march=znver1
-mno-avx2 -fstruct-layout=5
-mllvm -vectorize-memory-aggressively
-mllvm -unroll-threshold=50 -fremap-arrays
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-flv-function-specialization -lamdlibm -ljemalloc
-lpthread -ldl

557.xz_r: basepeak = yes

C++ benchmarks:

520.omnetpp_r: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares -Ofast
-march=znver1 -finline-aggressive
-mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -lpthread -ldl -ljemalloc

523.xalancbmk_r: -m32 -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-enable-vectorize-compares -Ofast
-march=znver1 -finline-aggressive
-mllvm -unroll-threshold=100 -fremap-arrays
-mllvm -inline-threshold=1000 -lpthread -ldl
-L/root/work/lib/jemalloc510/lib32 -ljemalloc

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Peak Optimization Flags (Continued)

531.deepsjeng_r: `basepeak = yes`

541.leela_r: `-flto -Wl,-mllvm -Wl,-function-specialize -Wl,-mllvm -Wl,-enable-vectorize-compares -fprofile-instr-generate`(pass 1) `-fprofile-instr-use`(pass 2) `-Ofast -march=znver1 -mllvm -unroll-count=8 -mllvm -unroll-threshold=100 -lpthread -ldl -ljemalloc`

Fortran benchmarks:

548.exchange2_r: `basepeak = yes`

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`

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