



SPEC® CPU2017 Integer Rate Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

Cisco Systems

Cisco UCS C125 (AMD EPYC 7251)

CPU2017 License: 9019

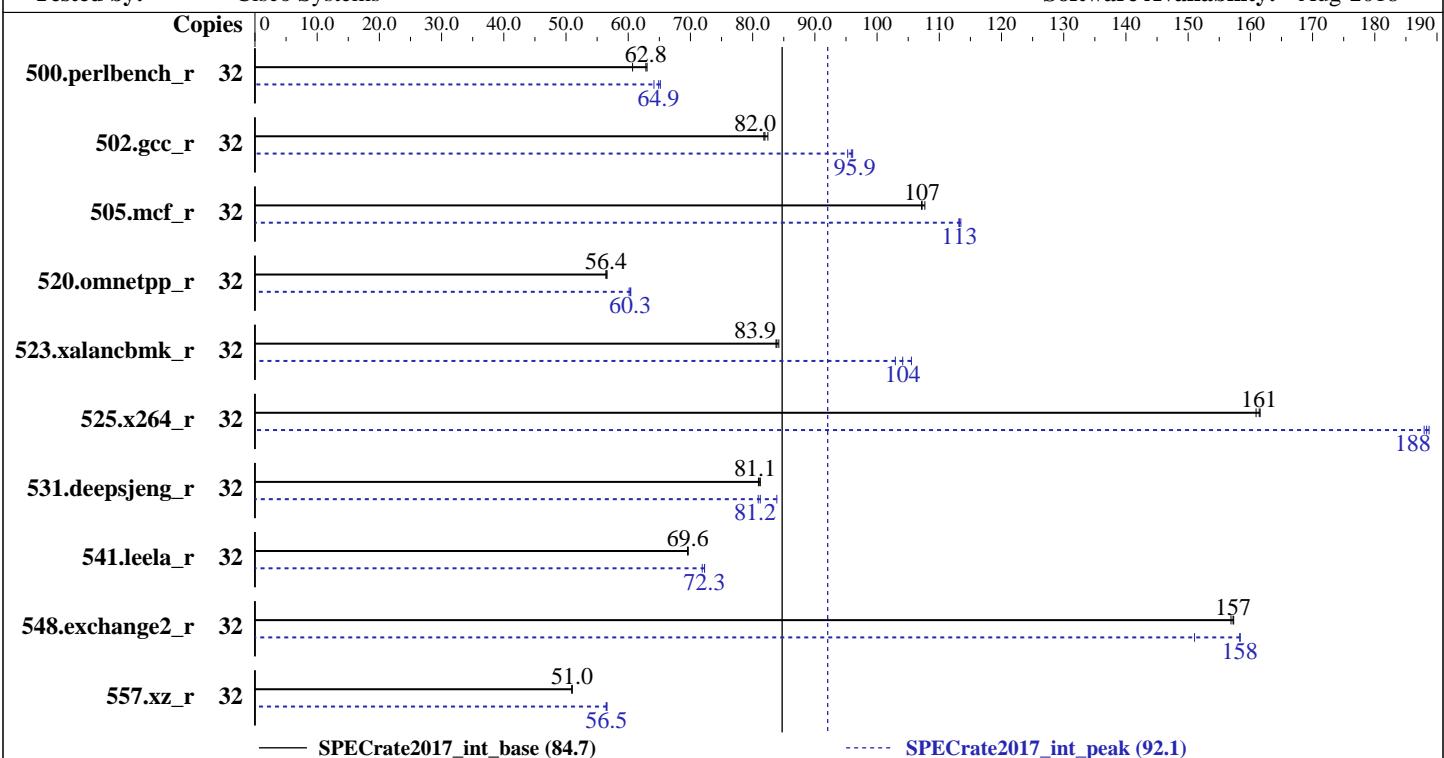
Test Sponsor: Cisco Systems

Tested by: Cisco Systems

Test Date: Sep-2018

Hardware Availability: Jul-2018

Software Availability: Aug-2018



| Hardware | | Software | |
|------------|---|----------------|---|
| CPU Name: | AMD EPYC 7251 | OS: | SUSE Linux Enterprise Server 12 SP3 x86_64 kernel 4.4.143-94.47-default |
| Max MHz.: | 2900 | Compiler: | C/C++: Version 1.0.0 of AOCC |
| Nominal: | 2100 | Firmware: | Fortran: Version 4.8.2 of GCC |
| Enabled: | 16 cores, 2 chips, 2 threads/core | Parallel: | No |
| Orderable: | 1,2 chip | Firmware: | Cisco Systems, Inc. BIOS Version C125.4.0.0.15.0504180159 released May-2018 |
| Cache L1: | 64 KB I + 32 KB D on chip per core | File System: | xfs |
| L2: | 512 KB I+D on chip per core | System State: | Run level 3 (multi-user) |
| L3: | 32 MB I+D on chip per chip | Base Pointers: | 64-bit |
| Other: | None | Peak Pointers: | 32/64-bit |
| Memory: | 1 TB (16 x 64 GB 4Rx4 PC4-2667V-R, running at 2400) | Other: | jemalloc general purpose malloc implementation v4.5.0 |
| Storage: | 600 GB SAS HDD, 15K RPM | | |
| Other: | None | | |



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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 | 808 | 63.0 | 839 | 60.7 | 811 | 62.8 | 32 | 794 | 64.1 | 785 | 64.9 | 782 | 65.2 |
| 502.gcc_r | 32 | 550 | 82.4 | 553 | 82.0 | 554 | 81.8 | 32 | 476 | 95.3 | 472 | 96.1 | 473 | 95.9 |
| 505.mcf_r | 32 | 483 | 107 | 482 | 107 | 480 | 108 | 32 | 457 | 113 | 457 | 113 | 456 | 113 |
| 520.omnetpp_r | 32 | 744 | 56.4 | 744 | 56.4 | 742 | 56.6 | 32 | 696 | 60.3 | 695 | 60.4 | 698 | 60.1 |
| 523.xalancbmk_r | 32 | 403 | 83.8 | 401 | 84.2 | 403 | 83.9 | 32 | 328 | 103 | 325 | 104 | 320 | 106 |
| 525.x264_r | 32 | 347 | 161 | 348 | 161 | 347 | 162 | 32 | 297 | 189 | 298 | 188 | 298 | 188 |
| 531.deepsjeng_r | 32 | 452 | 81.1 | 451 | 81.2 | 453 | 80.9 | 32 | 437 | 83.9 | 451 | 81.2 | 453 | 80.9 |
| 541.leela_r | 32 | 761 | 69.6 | 762 | 69.5 | 761 | 69.6 | 32 | 733 | 72.3 | 737 | 71.9 | 733 | 72.3 |
| 548.exchange2_r | 32 | 533 | 157 | 534 | 157 | 533 | 157 | 32 | 530 | 158 | 529 | 158 | 555 | 151 |
| 557.xz_r | 32 | 678 | 51.0 | 678 | 50.9 | 678 | 51.0 | 32 | 611 | 56.6 | 612 | 56.5 | 612 | 56.5 |

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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

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.



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General Notes

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

LD_LIBRARY_PATH = "/opt/cpu2017/amd1704-rate-libs-revC/64;/opt/cpu2017/amd1704-rate-libs-revC/32;"
MALLOC_CONF = "lg_chunk:26"

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

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 $2^{21} = 2\text{MiB}$.

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.

Platform Notes

BIOS Settings:

Performance Determinism set to Power Deterministic
Sysinfo program /opt/cpu2017/bin/sysinfo
Rev: r5797 of 2017-06-14 96c45e4568ad54c135fd618bcc091c0f
running on linux-7bdx Tue Oct 9 05:00:11 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>

From /proc/cpuinfo
model name : AMD EPYC 7251 8-Core Processor
2 "physical id"s (chips)
32 "processors"

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Platform Notes (Continued)

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 4 8 12 16 20 24 28
physical 1: cores 0 4 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:               2100.000
CPU max MHz:          2100.0000
CPU min MHz:          1200.0000
BogoMIPS:              4192.04
Virtualization:        AMD-V
L1d cache:             32K
L1i cache:             64K
L2 cache:              512K
L3 cache:              4096K
NUMA node0 CPU(s):    0,1,16,17
NUMA node1 CPU(s):    2,3,18,19
NUMA node2 CPU(s):    4,5,20,21
NUMA node3 CPU(s):    6,7,22,23
NUMA node4 CPU(s):    8,9,24,25
NUMA node5 CPU(s):    10,11,26,27
NUMA node6 CPU(s):    12,13,28,29
NUMA node7 CPU(s):    14,15,30,31
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 extd_apicid amd_dcm aperfmpfperf eagerfpu dni
                      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 skininit 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
```

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Platform Notes (Continued)

```
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 16 17  
node 0 size: 128831 MB  
node 0 free: 128644 MB  
node 1 cpus: 2 3 18 19  
node 1 size: 129020 MB  
node 1 free: 128808 MB  
node 2 cpus: 4 5 20 21  
node 2 size: 129020 MB  
node 2 free: 128880 MB  
node 3 cpus: 6 7 22 23  
node 3 size: 129020 MB  
node 3 free: 128906 MB  
node 4 cpus: 8 9 24 25  
node 4 size: 129020 MB  
node 4 free: 128923 MB  
node 5 cpus: 10 11 26 27  
node 5 size: 129020 MB  
node 5 free: 128924 MB  
node 6 cpus: 12 13 28 29  
node 6 size: 129020 MB  
node 6 free: 128907 MB  
node 7 cpus: 14 15 30 31  
node 7 size: 116923 MB  
node 7 free: 116828 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  
7: 32 32 32 32 16 16 16 10
```

From /proc/meminfo
MemTotal: 1044358108 kB
HugePages_Total: 0

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Platform Notes (Continued)

Hugepagesize: 2048 kB

```
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-7bdx 4.4.143-94.47-default #1 SMP Thu Aug 9 12:47:15 UTC 2018 (6bff971)
x86_64 x86_64 x86_64 GNU/Linux
```

run-level 3 Oct 9 04:59

SPEC is set to: /opt/cpu2017

| Filesystem | Type | Size | Used | Avail | Use% | Mounted on |
|------------|------|------|------|-------|------|------------|
| /dev/sda3 | xfs | 450G | 20G | 431G | 5% | / |

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 Cisco Systems, Inc. C125.4.0.0.15.0504180159 05/04/2018

Memory:

16x 0xCE00 M386A8K40BM2-CTD 64 GB 4 rank 2667, configured at 2400

(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
```

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Compiler Version Notes (Continued)

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)

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

=====

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Compiler Version Notes (Continued)

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++

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
```



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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 -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  
505.mcf_r: -DSPEC_LP64  
520.omnetpp_r: -DSPEC_LP64  
523.xalancbmk_r: -DSPEC_LINUX  
525.x264_r: -DSPEC_LP64  
531.deepsjeng_r: -DSPEC_LP64  
541.leela_r: -DSPEC_LP64  
548.exchange2_r: -DSPEC_LP64
```

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Peak Portability Flags (Continued)

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 -ml llvm -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 -ml llvm -vectorize-memory-aggressively  
-mno-avx2 -unroll-threshold=100 -fremap-arrays  
-inline-threshold=1000 -fgnu89-inline  
-D_FILE_OFFSET_BITS=64(*) -ljemalloc
```

```
505.mcf_r: -flto -Wl, -plugin-opt= -merge-constant  
-lsr-in-nested-loop -Ofast -march=znver1  
-fstruct-layout=3 -ml llvm -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 -ml llvm -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 -ml llvm -unroll-threshold=100  
-fremap-arrays -inline-threshold=1000  
-D_FILE_OFFSET_BITS=64(*) -ljemalloc
```

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Peak Optimization Flags (Continued)

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
-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

(*) Indicates an optimization flag that was found in a portability variable.

Peak Other Flags

C benchmarks:

502.gcc_r: -L/root/work/lib/jemalloc/lib32

C++ benchmarks:

523.xalancbmk_r: -L/root/work/lib/jemalloc/lib32

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

<http://www.spec.org/cpu2017/flags/aocc100-flags-revC-I.2018-02-16.html>

<http://www.spec.org/cpu2017/flags/gcc.2018-02-16.html>

<http://www.spec.org/cpu2017/flags/Cisco-Platform-Settings-AMD-V1-revA.html>

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

<http://www.spec.org/cpu2017/flags/aocc100-flags-revC-I.2018-02-16.xml>

<http://www.spec.org/cpu2017/flags/gcc.2018-02-16.xml>

<http://www.spec.org/cpu2017/flags/Cisco-Platform-Settings-AMD-V1-revA.xml>

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Tested with SPEC CPU2017 v1.0.2 on 2018-10-09 08:00:10-0400.

Report generated on 2018-11-13 15:09:41 by CPU2017 PDF formatter v6067.

Originally published on 2018-11-13.