# SPEC® CPU2017 Integer Rate Result

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## Supermicro
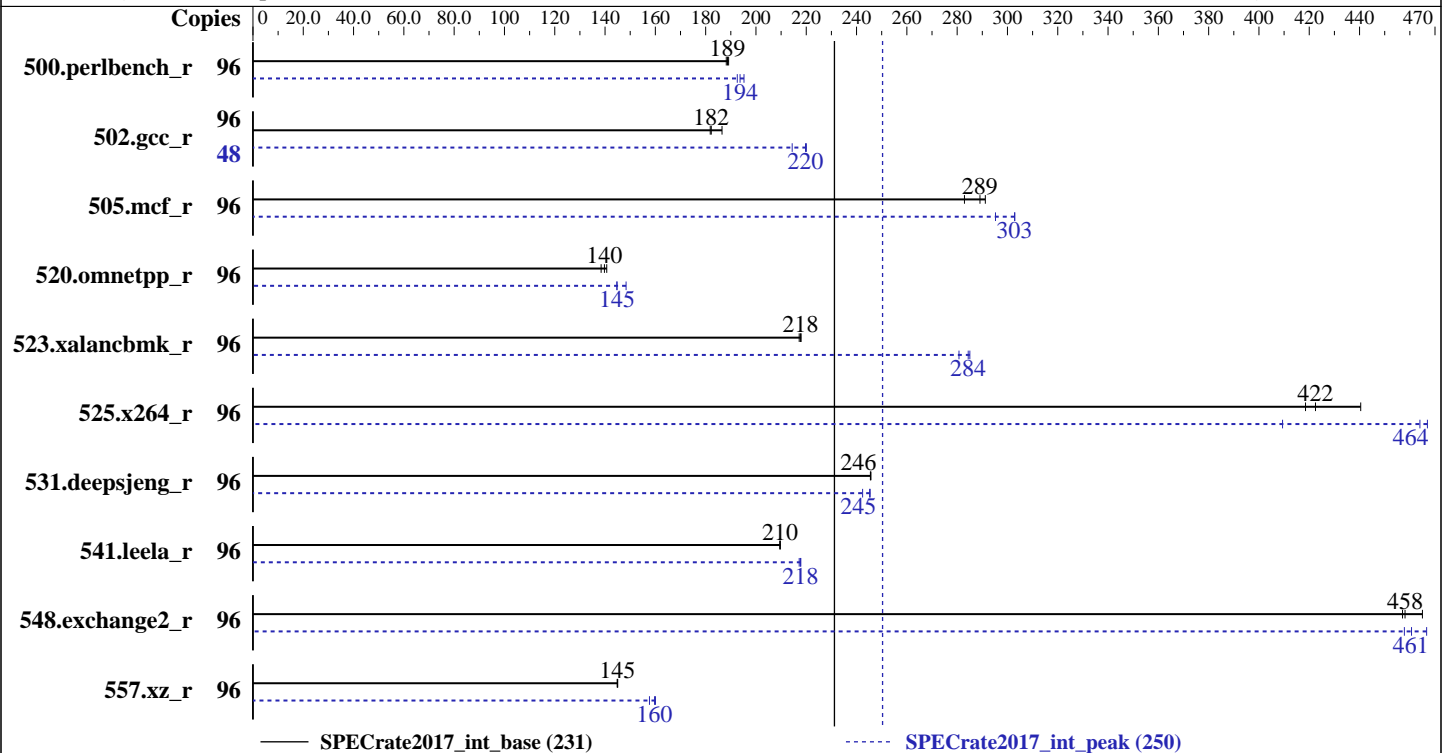
A+ Server 4023S-TRT
(H11DSi-NT , AMD EPYC 7451)

SPECrate2017_int_base =  231

SPECrate2017_int_peak =  250

**CPU2017 License:** 001176

**Test Sponsor:** Supermicro

**Tested by:** Supermicro

**Test Date:** Mar-2018

**Hardware Availability:** Jun-2017

**Software Availability:** Nov-2017



| Benchmark | Copies | base | peak |
|---|---|---|---|
| 500.perlbench_r | 96 | 189 | 194 |
| 502.gcc_r | 96 / 48 | 182 | 220 |
| 505.mcf_r | 96 | 289 | 303 |
| 520.omnetpp_r | 96 | 140 | 145 |
| 523.xalancbmk_r | 96 | 218 | 284 |
| 525.x264_r | 96 | 422 | 464 |
| 531.deepsjeng_r | 96 | 246 | 245 |
| 541.leela_r | 96 | 210 | 218 |
| 548.exchange2_r | 96 | 458 | 461 |
| 557.xz_r | 96 | 145 | 160 |

SPECrate2017_int_base (231)
SPECrate2017_int_peak (250)

## Hardware

CPU Name: AMD EPYC 7451
 Max MHz.: 3200
 Nominal: 2300
Enabled: 48 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 / 3 cores
 Other: None
Memory: 1 TB (16 x 64 GB 4Rx4 PC4-2666V-L)
Storage: 1 x 500 GB SATAIII, 7200 RPM
Other: None

## Software

OS: SUSE Linux Enterprise Server 12 SP3 (x86_64)
 kernel 4.4.114-94.11-default
Compiler: C/C++: Version 1.0.0 of AOCC
 Fortran: Version 4.8.2 of GCC
Parallel: No
Firmware: Supermicro BIOS version 1.0c released Feb-2018
File System: xfs
System State: Run level 3 (multi-user)
Base Pointers: 64-bit
Peak Pointers: 32/64-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 |
| 500.perlbench_r | 96 | 808 | 189 | 812 | 188 | **810** | **189** | 96 | 783 | 195 | 794 | 193 | **789** | **194** |
| 502.gcc_r | 96 | 748 | 182 | 729 | 187 | **746** | **182** | 48 | 317 | 214 | 309 | 220 | **309** | **220** |
| 505.mcf_r | 96 | 533 | 291 | 548 | 283 | **537** | **289** | 96 | 512 | 303 | **512** | **303** | 525 | 295 |
| 520.omnetpp_r | 96 | 895 | 141 | **901** | **140** | 910 | 138 | 96 | **870** | **145** | 849 | 148 | 871 | 145 |
| 523.xalancbmk_r | 96 | **466** | **218** | 465 | 218 | 467 | 217 | 96 | 361 | 281 | 356 | 285 | **356** | **284** |
| 525.x264_r | 96 | **398** | **422** | 402 | 419 | 382 | 440 | 96 | 360 | 467 | **362** | **464** | 411 | 409 |
| 531.deepsjeng_r | 96 | 448 | 246 | **448** | **246** | 448 | 246 | 96 | **449** | **245** | 454 | 242 | 448 | 245 |
| 541.leela_r | 96 | **759** | **210** | 759 | 210 | 758 | 210 | 96 | **730** | **218** | 730 | 218 | 732 | 217 |
| 548.exchange2_r | 96 | 550 | 457 | **549** | **458** | 541 | 465 | 96 | 549 | 458 | **546** | **461** | 539 | 467 |
| 557.xz_r | 96 | **715** | **145** | 716 | 145 | 715 | 145 | 96 | 658 | 158 | 648 | 160 | **649** | **160** |
| **SPECrate2017_int_base =** | | **231** | | | | | | | | | | | | |
| **SPECrate2017_int_peak =** | | **250** | | | | | | | | | | | | |

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 = "/home/cpu2017/amd1704-rate-libs-revC/64;/home/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/

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/

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.
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:
Determinism Slider = Power
cTDP Control = Manual
cTDP = 200
 Sysinfo program /home/cpu2017/bin/sysinfo
 Rev: r5797 of 2017-06-14 96c45e4568ad54c135fd618bcc091c0f
 running on linux-769d Wed Mar 28 10:25:28 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
```

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### Platform Notes (Continued)

```
     model name : AMD EPYC 7451 24-Core Processor
        2  "physical id"s (chips)
        96 "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
        physical 1: 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):                96
        On-line CPU(s) list:   0-95
        Thread(s) per core:    2
        Core(s) per socket:    24
        Socket(s):             2
        NUMA node(s):          8
        Vendor ID:             AuthenticAMD
        CPU family:            23
        Model:                 1
        Model name:            AMD EPYC 7451 24-Core Processor
        Stepping:              2
        CPU MHz:               2300.000
        CPU max MHz:           2300.0000
        CPU min MHz:           1200.0000
        BogoMIPS:              4599.61
        Virtualization:        AMD-V
        L1d cache:             32K
        L1i cache:             64K
        L2 cache:              512K
        L3 cache:              8192K
        NUMA node0 CPU(s):     0-5,48-53
        NUMA node1 CPU(s):     6-11,54-59
        NUMA node2 CPU(s):     12-17,60-65
        NUMA node3 CPU(s):     18-23,66-71
        NUMA node4 CPU(s):     24-29,72-77
        NUMA node5 CPU(s):     30-35,78-83
        NUMA node6 CPU(s):     36-41,84-89
        NUMA node7 CPU(s):     42-47,90-95
        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
```

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## Platform Notes (Continued)

```
    osvw skinit wdt tce topoext perfctr_core perfctr_nb bpext perfctr_l2 mwaitx arat cpb
    hw_pstate 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: 8 nodes (0-7)
   node 0 cpus: 0 1 2 3 4 5 48 49 50 51 52 53
   node 0 size: 128851 MB
   node 0 free: 128682 MB
   node 1 cpus: 6 7 8 9 10 11 54 55 56 57 58 59
   node 1 size: 129021 MB
   node 1 free: 128867 MB
   node 2 cpus: 12 13 14 15 16 17 60 61 62 63 64 65
   node 2 size: 129021 MB
   node 2 free: 128878 MB
   node 3 cpus: 18 19 20 21 22 23 66 67 68 69 70 71
   node 3 size: 129021 MB
   node 3 free: 128862 MB
   node 4 cpus: 24 25 26 27 28 29 72 73 74 75 76 77
   node 4 size: 129021 MB
   node 4 free: 128904 MB
   node 5 cpus: 30 31 32 33 34 35 78 79 80 81 82 83
   node 5 size: 129021 MB
   node 5 free: 128912 MB
   node 6 cpus: 36 37 38 39 40 41 84 85 86 87 88 89
   node 6 size: 129021 MB
   node 6 free: 128912 MB
   node 7 cpus: 42 43 44 45 46 47 90 91 92 93 94 95
   node 7 size: 129019 MB
   node 7 free: 128908 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
```

**(Continued on next page)**

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## Platform Notes (Continued)

```
From /proc/meminfo
   MemTotal:       1056765968 kB
   HugePages_Total:        0
   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-769d 4.4.114-94.11-default #1 SMP Thu Feb 1 19:28:26 UTC 2018 (4309ff9)
   x86_64 x86_64 x86_64 GNU/Linux

run-level 3 Mar 28 10:22

SPEC is set to: /home/cpu2017
   Filesystem      Type  Size  Used Avail Use% Mounted on
   /dev/sda4       xfs   422G   25G  397G   6% /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 American Megatrends Inc. 1.0c 02/07/2018
  Memory:
   16x Samsung M386A8K40BM2-CTD 64 GB 4 rank 2667

(End of data from sysinfo program)
```

## Compiler Version Notes

```
==============================================================================
  CC  502.gcc_r(peak)
------------------------------------------------------------------------------
```

**(Continued on next page)**

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## 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: 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)
------------------------------------------------------------------------------
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
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```

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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`

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# Base Portability Flags (Continued)

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
```

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# 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
-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

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# Peak Optimization Flags (Continued)

520.omnetpp_r (continued):
```
-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/Supermicro-Platform-Settings-V1.2-Naples-revD.html
```

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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/Supermicro-Platform-Settings-V1.2-Naples-revD.xml
```

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

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