## SPEC CPU®2017 Integer Rate Result

### Altos Computing Inc.

**BrainSphere R385 F5 (AMD EPYC 7453)**

<table>
<thead>
<tr>
<th>Test Date:</th>
<th>Jun-2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU2017 License:</td>
<td>97</td>
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<td>Jun-2022</td>
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<td>Hardware Availability:</td>
<td>Apr-2021</td>
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</tbody>
</table>

### SPECrate®2017_int_base = 416

| SPECrate®2017_int_peak = 449 |

<table>
<thead>
<tr>
<th>Benchmark Name</th>
<th>Copies</th>
<th>SPECrate®2017_int_base</th>
<th>SPECrate®2017_int_peak</th>
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<tr>
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<td>112</td>
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<td>358</td>
</tr>
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<td>305</td>
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<tr>
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<td>112</td>
<td>169</td>
<td>622</td>
</tr>
<tr>
<td>520.omnetpp_r</td>
<td>112</td>
<td>170</td>
<td>641</td>
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<tr>
<td>523.xalancbmk_r</td>
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<tr>
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<td>393</td>
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<td>541.leela_r</td>
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</tr>
<tr>
<td>548.exchange2_r</td>
<td>112</td>
<td>235</td>
<td>235</td>
</tr>
</tbody>
</table>

**Software**

- **OS:** Ubuntu 20.04.3 LTS
- **Compiler:** C/C++/Fortran: Version 3.2.0 of AOCC
- **Parallel:** No
- **Firmware:** Version M10 Released Nov-2021
- **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
- **Power Management:** BIOS and OS set to prefer performance at the cost of additional power usage

**Hardware**

- **CPU Name:** AMD EPYC 7453
- **Max MHz:** 3450
- **Nominal:** 2750
- **Enabled:** 56 cores, 2 chips, 2 threads/core
- **Orderable:** 1.2 chips
- **Cache L1:** 32 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, 16 MB shared / 7 cores
- **Other:** None
- **Memory:** 512 GB (16 x 32 GB 2Rx4 PC4-3200AA-R)
- **Storage:** 1 x 1.6 TB SATA SSD
- **Other:** None
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Tested by: Altos Computing Inc.  

Test Date: Jun-2022  
Hardware Availability: Apr-2021  
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### Results Table

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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/

### 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 limit  
'ulimit -l 2097152' was used to set environment locked pages in memory limit

runcpu command invoked through numactl i.e.:  
numactl --interleave=all runcpu <etc>

To limit dirty cache to 8% of memory, 'sysctl -w vm.dirty_ratio=8' run as root.  
To limit swap usage to minimum necessary, 'sysctl -w vm.swappiness=1' run as root.  
To free node-local memory and avoid remote memory usage,  
'sysctl -w vm.zone_reclaim_mode=1' run as root.  
To clear filesystem caches, 'sync; sysctl -w vm.drop_caches=3' run as root.  
To disable address space layout randomization (ASLR) to reduce run-to-run variability, 'sysctl -w kernel.randomize_va_space=0' run as root.

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Operating System Notes (Continued)

To enable Transparent Hugepages (THP) only on request for base runs,
'echo madvise > /sys/kernel/mm/transparent_hugepage/enabled' run as root.
To enable THP for all allocations for peak runs,
'echo always > /sys/kernel/mm/transparent_hugepage/enabled' and
'echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root.

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH =
    ""/home/cpu2017/amd_rate_aocc320_milanx_A_lib/lib;/home/cpu2017/amd_rate_
aocc320_milanx_A_lib/lib32:""
MALLOC_CONF = "retain:true"

Environment variables set by runcpu during the 523.xalancbmk_r peak run:
MALLOC_CONF = "thp:never"

General Notes

Binaries were compiled on a system with 2x AMD EPYC 7742 CPU + 1TiB Memory using OpenSUSE 15.2
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 v4.8.2 in RHEL 7.4 (No options specified)
jemalloc 5.1.0 is available here:
https://github.com/jemalloc/jemalloc/releases/download/5.1.0/jemalloc-5.1.0.tar.bz2

Platform Notes

BIOS Configuration:
Power Policy Quick Settings set to Best Performance
NUMA Nodes Per Socket set to NPS4

Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b589ef0e16a6acfc64d
running on ubuntus Thu Jun 23 09:42:00 2022

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**Platform Notes (Continued)**

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 7453 28-Core Processor
  2 "physical id"s (chips)
  112 "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 : 28
  siblings : 56
  physical 0: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 14 16 17 18 19 20 21 22 24 25 26 27
  28 29 30
  physical 1: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 14 16 17 18 19 20 21 22 24 25 26 27
  28 29 30
```

From lscpu from util-linux 2.34:
```
Architecture:                    x86_64
CPU op-mode(s):                  32-bit, 64-bit
Byte Order:                      Little Endian
Address sizes:                   48 bits physical, 48 bits virtual
CPU(s):                          112
On-line CPU(s) list:             0-111
Thread(s) per core:              2
Core(s) per socket:              28
Socket(s):                       2
NUMA node(s):                    8
Vendor ID:                       AuthenticAMD
CPU family:                      25
Model:                           1
Model name:                      AMD EPYC 7453 28-Core Processor
Stepping:                        1
Frequency boost:                 enabled
CPU MHz:                         3203.712
CPU max MHz:                     2750.0000
CPU min MHz:                     1500.0000
BogoMIPS:                        5500.20
Virtualization:                  AMD-V
L1d cache:                       1.8 MiB
L1i cache:                       1.8 MiB
L2 cache:                        28 MiB
L3 cache:                        128 MiB
NUMA node0 CPU(s):               0-6,56-62
NUMA node1 CPU(s):               7-13,63-69
NUMA node2 CPU(s):               14-20,70-76
NUMA node3 CPU(s):               21-27,77-83
```

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Platform Notes (Continued)

NUMA node4 CPU(s): 28-34, 84-90
NUMA node5 CPU(s): 35-41, 91-97
NUMA node6 CPU(s): 42-48, 98-104
NUMA node7 CPU(s): 49-55, 105-111
Vulnerability Itlb multihit: Not affected
Vulnerability L1pf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Mmie stale data: Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
Vulnerability Spectre v1: Mitigation; usercopy/swapgs barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Retpolines, IBPB conditional, IBRS_FW, STIBF always-on, RSB filling
Vulnerability Srbd: Not affected
Vulnerability Tsx async abort: Not affected
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
  aperfmperf nmi pmlrmread monitor ssse3 fma cx16 pcid sse4_1 sse4_2 movbe popcnt aes
  xsave avx f16c rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a
  misalignsse dnowprefetch osvw ibs skinit wdt tce topoext perfctr_core perfctr_nb
  bperf perfctr_l1c mwaitx cpb cat_l3 cdp_l3 invpcid_single hw_pstate ssbd mba ibrs
  ibpb stibp vmmcall fsgsbase bmi1 avx2 smep bmi2 invpcid cqm rdt_a rdseed adx smap
  clflushopt clwb sha_ni xsaveopt xsaves xsavec xgetbv1 xsavecs cqm_llc cqm_occup_llc
  cqm_mb科技进步 cqm_mb科技进步 czero irperf xsaverpr wbnoivd arat npt lbv svm_lock
  nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter ptthreshold
  v_vmsave_vmlload vgfl umip pkp ospke vae vpclmulqdq rdpid overflow_recof succor smca

From lscpu --cache:
NAME ONE-SIZE ALL-SIZE WAYS TYPE LEVEL
L1d 32K 1.8M 8 Data 1
L1i 32K 1.8M 8 Instruction 1
L2 512K 28M 8 Unified 2
L3 16M 128M 16 Unified 3

/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 6 56 57 58 59 60 61 62
  node 0 size: 64385 MB
  node 0 free: 64081 MB
  node 1 cpus: 7 8 9 10 11 12 13 63 64 65 66 67 68 69

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Platform Notes (Continued)

```
node 1 size: 64479 MB
node 1 free: 64186 MB
node 2 cpus: 14 15 16 17 18 19 20 70 71 72 73 74 75 76
node 2 size: 64508 MB
node 2 free: 64190 MB
node 3 cpus: 21 22 23 24 25 26 27 77 78 79 80 81 82 83
node 3 size: 64496 MB
node 3 free: 64244 MB
node 4 cpus: 28 29 30 31 32 33 34 84 85 86 87 88 89 90
node 4 size: 64508 MB
node 4 free: 64271 MB
node 5 cpus: 35 36 37 38 39 40 41 91 92 93 94 95 96 97
node 5 size: 64508 MB
node 5 free: 64273 MB
node 6 cpus: 42 43 44 45 46 47 48 98 99 100 101 102 103 104
node 6 size: 64508 MB
node 6 free: 64079 MB
node 7 cpus: 49 50 51 52 53 54 55 105 106 107 108 109 110 111
node 7 size: 64506 MB
node 7 free: 64227 MB
node distances:
node   0   1   2   3   4   5   6   7
0:  10  12  12  12  32  32  32  32
1:  12  10  12  12  32  32  32  32
2:  12  12  10  12  32  32  32  32
3:  12  12  12  10  32  32  32  32
4:  32  32  32  32  10  12  12  12
5:  32  32  32  32  12  10  12  12
6:  32  32  32  32  12  12  10  12
7:  32  32  32  32  12  12  12  10
```

From /proc/meminfo

```
MemTotal:       528281472 kB
HugePages_Total:       0
Hugepagesize:       2048 kB
```

From /etc/*release* /etc/*version*

debian_version: bullseye/sid
os-release:
   NAME="Ubuntu"
   VERSION="20.04.3 LTS (Focal Fossa)"

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Platform Notes (Continued)

ID=ubuntu
ID_LIKE=debian
PRETTY_NAME="Ubuntu 20.04.3 LTS"
VERSION_ID="20.04"
HOME_URL="https://www.ubuntu.com/
SUPPORT_URL="https://help.ubuntu.com/
uname -a:
Linux ubuntu 5.4.0-120-generic #136-Ubuntu SMP Fri Jun 10 13:40:48 UTC 2022 x86_64
x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2018-12207 (iTLB Multihit): Not affected
CVE-2018-3620 (L1 Terminal Fault): Not affected
Microarchitectural Data Sampling: Not affected
CVE-2017-5754 (Meltdown): Not affected
mmio_stale_data: Not affected
CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2017-5753 (Spectre variant 1): Mitigation: usercopy/swappgs barriers and __user pointer sanitation
CVE-2017-5715 (Spectre variant 2): Mitigation: Retpolines, IBPB: conditional, IBRS_FW, STIBP: always-on, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort): Not affected

run-level 5 Jun 22 08:20

SPEC is set to: /home/cpu2017
Filesystem Type Size Used Avail Use% Mounted on
/dev/mapper/ubuntu--vg-ubuntu--lv ext4 196G 41G 145G 23% /

From /sys/devices/virtual/dmi/id
Vendor: Altos
Product: BrainSphere R385 F5
Product Family: Server
Serial: GJG9NC712A0024

Additional information from dmidecode 3.2 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.

Memory:
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Platform Notes (Continued)
16x Samsung M393A4K40DB3-CWE 32 GB 2 rank 3200
16x Unknown Unknown

BIOS:
- BIOS Vendor: GIGABYTE
- BIOS Version: M10
- BIOS Date: 11/23/2021
- BIOS Revision: 5.22

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
| C       | 502.gcc_r(peak) |
|--------------------------------|
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
LLVM Mirror.Version.13.0.0)
Target: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin

==============================================================================
| C       | 500.perlbench_r(base, peak) 502.gcc_r(base) 505.mcf_r(base, peak) 525.x264_r(base, peak) 557.xz_r(base, peak) |
|--------------------------------|
AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on
LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin

==============================================================================
| C       | 502.gcc_r(peak) |
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AMD clang version 13.0.0 (CLANG: AOCC_3.2.0-Build#128 2021_11_12) (based on LLVM Mirror.Version.13.0.0)
Target: x86_64-unknown-linux-gnu

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<td>Altos Computing Inc.</td>
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### Compiler Version Notes (Continued)

- Thread model: posix
- InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin

### Base Compiler Invocation

- C benchmarks:
  - clang

- C++ benchmarks:
  - clang++

- Fortran benchmarks:
  - flang

### 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.xalanchmk_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
Altos Computing Inc.
BrainSphere R385 F5 (AMD EPYC 7453)

**SPEC CPU®2017 Integer Rate Result**

**SPECrate®2017_int_base = 416**
**SPECrate®2017_int_peak = 449**

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**Base Optimization Flags**

C benchmarks:
- `-m64` `-Wl, -allow-multiple-definition` `-Wl, -mllvm -Wl, -enable-licom-vmr`  
- `-flto` `-Wl, -mllvm -Wl, -region-vectorize`  
- `-Wl, -mllvm -Wl, -function-specialize`  
- `-Wl, -mllvm -Wl, -align-all-nofallthru-blocks=6`  
- `-Wl, -mllvm -Wl, -reduce-array-computations=3`  
- `-Wl, -mllvm -Wl, -enable-loop-fusion -O3 -march=znver3 -fveclib=AMDLIBM`  
- `-ffast-math -fsstruct-layout=5 -mllvm -unroll-threshold=50`  
- `-mllvm -inline-threshold=1000 -fremap-arrays`  
- `-mllvm -function-specialize -flv-function-specialization`  
- `-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true`  
- `-mllvm -enable-licom-vmr -mllvm -reduce-array-computations=3`  
- `-mllvm -enable-loop-fusion -z muldefs -lamdlibm -ljemalloc -lflang`  

C++ benchmarks:
- `-m64 -std=c++98 -flto -Wl, -mllvm -Wl, -region-vectorize`  
- `-Wl, -mllvm -Wl, -function-specialize`  
- `-Wl, -mllvm -Wl, -align-all-nofallthru-blocks=6`  
- `-Wl, -mllvm -Wl, -reduce-array-computations=3`  
- `-Wl, -mllvm -Wl, -enable-loop-fusion -O3 -march=znver3 -fveclib=AMDLIBM`  
- `-ffast-math -mllvm -enable-partial-unswitch`  
- `-mllvm -unroll-threshold=100 -finline-aggressive`  
- `-flv-function-specialization -mllvm -loop-unswitch- threshold=200000`  
- `-mllvm -reroll-loops -mllvm -aggressive-loop-unswitch`  
- `-mllvm -extra-vectorizer-passes -mllvm -reduce-array-computations=3`  
- `-mllvm -global-vectorize-slp=true -mllvm -convert-pow-exp-to-int=false`  
- `-mllvm -enable-loop-fusion -z muldefs -fvirtual-function-elimination`  
- `-fvisibility=hidden -lamdlibm -ljemalloc -lflang`  

Fortran benchmarks:
- `-m64 -Wl, -mllvm -Wl, -inline-recursion=4`  
- `-Wl, -mllvm -Wl, -isr-in-nested-loop -Wl, -mllvm -Wl, -enable-iv-split`  
- `-flto -Wl, -mllvm -Wl, -region-vectorize`  
- `-Wl, -mllvm -Wl, -function-specialize`  
- `-Wl, -mllvm -Wl, -align-all-nofallthru-blocks=6`  
- `-Wl, -mllvm -Wl, -reduce-array-computations=3`  
- `-Wl, -mllvm -Wl, -enable-loop-fusion -O3 -march=znver3 -fveclib=AMDLIBM`  
- `-ffast-math -z muldefs -mllvm -unroll-aggressive`  
- `-mllvm -unroll-threshold=500 -lamdlibm -ljemalloc -lflang`  

**Base Other Flags**

C benchmarks:
- `-Wno-unused-command-line-argument`

(Continued on next page)
## Base Other Flags (Continued)

C++ benchmarks:
- `-Wno-unused-command-line-argument`

## Peak Compiler Invocation

C benchmarks:
- `clang`

C++ benchmarks:
- `clang++`

Fortran benchmarks:
- `flang`

## 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 -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`

## Peak Optimization Flags

C benchmarks:

500.perlbench_r: `-m64 -Wl,-allow-multiple-definition -Wl,-mllvm -Wl,-enable-licm-vrp -flto -Wl,-mllvm -Wl,-function-specialize -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6 -Wl,-mllvm -Wl,-reduce-array-computations=3 -fprofile-instr-generate(pass 1) -fprofile-instr-use(pass 2) -Ofast -march=znver3`
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SPEC CPU®2017 Integer Rate Result
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SPECrate®2017_int_base = 416
SPECrate®2017_int_peak = 449

500.perlbench_r (continued):
- fveclib=AMDLIBM -ffast-math -fstruct-layout=7
- mlvm -unroll-threshold=50 -fremap-arrays
- flv-function-specialization -mlvm -inline-threshold=1000
- mlvm -enable-gvn-hoist -mlvm -global-vectorize-slp=false
- mlvm -function-specialize -mlvm -enable-llicm-vrp
- mlvm -reduce-array-computations=3 -lamdlibm -ljemalloc

502.gcc_r: -m32 -Wl,-allow-multiple-definition
- Wl,-mlvm -Wl,-enable-llicm-vrp -flto
- Wl,-mlvm -Wl,-function-specialize -Ofast -march=znver3
- fveclib=AMDLIBM -ffast-math -fstruct-layout=7
- mlvm -unroll-threshold=50 -fremap-arrays
- flv-function-specialization -mlvm -inline-threshold=1000
- mlvm -enable-gvn-hoist -mlvm -global-vectorize-slp=true
- mlvm -function-specialize -mlvm -enable-llicm-vrp
- mlvm -reduce-array-computations=3 -fgnu89-inline
- ljemalloc

505.mcf_r: -m64 -Wl,-allow-multiple-definition
- Wl,-mlvm -Wl,-enable-llicm-vrp -flto
- Wl,-mlvm -Wl,-function-specialize
- Wl,-mlvm -Wl,-align-all-nofallthru-blocks=6
- Wl,-mlvm -Wl,-reduce-array-computations=3 -Ofast
- march=znver3 -fveclib=AMDLIBM -ffast-math
- fstruct-layout=7 -mlvm -unroll-threshold=50
- fremap-arrays -flv-function-specialization
- mlvm -inline-threshold=1000 -mlvm -enable-gvn-hoist
- mlvm -global-vectorize-slp=true
- mlvm -function-specialize -mlvm -enable-llicm-vrp
- mlvm -reduce-array-computations=3 -lamdlibm -ljemalloc

525.x264_r: basepeak = yes

557.xz_r: Same as 505.mcf_r

C++ benchmarks:

520.omnetpp_r: -m64 -std=c++98 -flto -Wl,-mlvm -Wl,-function-specialize
- Wl,-mlvm -Wl,-align-all-nofallthru-blocks=6
- Wl,-mlvm -Wl,-reduce-array-computations=3 -Ofast
- march=znver3 -fveclib=AMDLIBM -ffast-math
- finline-aggressive -mlvm -unroll-threshold=100
- flv-function-specialization -mlvm -enable-llicm-vrp
- mlvm -reroll-loops -mlvm -aggressive-loop-unswitch
- mlvm -reduce-array-computations=3

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BrainSphere R385 F5 (AMD EPYC 7453)

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**Test Sponsor:** Altos Computing Inc.  
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**Hardware Availability:** Apr-2021  
**Software Availability:** Jun-2022

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**Peak Optimization Flags (Continued)**

520.omnetpp_r (continued):
- `mllvm -global-vectorize-slp=true`
- `fvirtual-function-elimination -fvisibility=hidden`
- `lamdlibm -ljemalloc`

523.xalancbmk_r: `-m32 -Wl, -mllvm -Wl, -do-block-reorder=aggressive -flto`
- `-Wl, -mllvm -Wl, -function-specialize`
- `-Wl, -mllvm -Wl, -align-all-nofallback-thru-blocks=6`
- `-Wl, -mllvm -Wl, -reduce-array-computations=3 -Ofast`
- `-march=znver3 -fveclib=AMDLIBM -ffast-math`
- `-finline-aggressive -mllvm -unroll-threshold=100`
- `-fly-function-specialization -mllvm -enable-licm-vrp`
- `-mllvm -reorder-loops -mllvm -aggressive-loop-unswitch`
- `-mllvm -reduce-array-computations=3`
- `-mllvm -global-vectorize-slp=true`
- `-mllvm -do-block-reorder=aggressive`
- `fvirtual-function-elimination -fvisibility=hidden`
- `-ljemalloc`

531.deepsjeng_r: Same as 520.omnetpp_r

541.leela_r: Same as 520.omnetpp_r

Fortran benchmarks:

548.exchange2_r: `basepeak = yes`

---

**Peak Other Flags**

C benchmarks (except as noted below):
- `-Wno-unused-command-line-argument`

502.gcc_r: `-L/usr/lib -Wno-unused-command-line-argument`
- `-L/sppo/bin/cpu2017v118-aocc3-milanX/amd_rate_aocc320_milanx_A_lib/lib32`

C++ benchmarks (except as noted below):
- `-Wno-unused-command-line-argument`

523.xalancbmk_r: `-L/usr/lib -Wno-unused-command-line-argument`
- `-L/sppo/bin/cpu2017v118-aocc3-milanX/amd_rate_aocc320_milanx_A_lib/lib32`
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The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/Altos-Platform-Settings-V1.0-revF.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/Altos-Platform-Settings-V1.0-revF.xml

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