



SPEC CPU®2017 Integer Rate Result

Copyright 2017-2023 Standard Performance Evaluation Corporation

Dell Inc.

SPECrate®2017_int_base = 896

PowerEdge R6615 (AMD EPYC 9684X 96-Core Processor)

SPECrate®2017_int_peak = Not Run

CPU2017 License: 6573

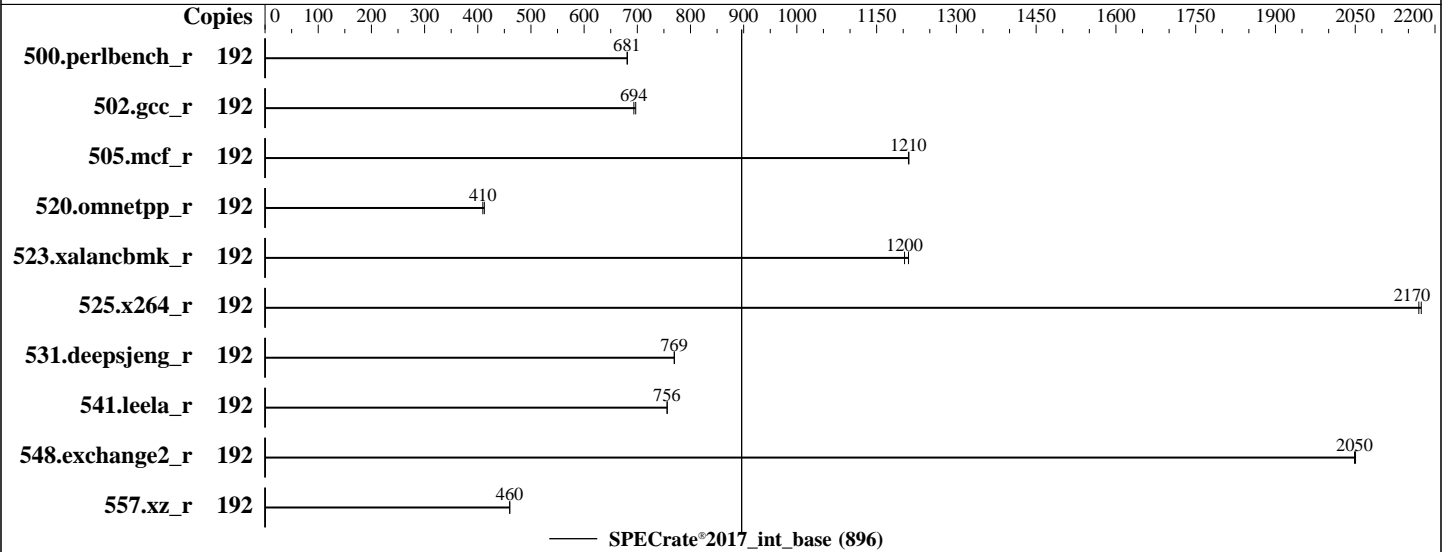
Test Date: May-2023

Test Sponsor: Dell Inc.

Hardware Availability: Jul-2023

Tested by: Dell Inc.

Software Availability: Jan-2023



Hardware

CPU Name: AMD EPYC 9684X
 Max MHz: 3700
 Nominal: 2550
 Enabled: 96 cores, 1 chip, 2 threads/core
 Orderable: 1 chip
 Cache L1: 32 KB I + 32 KB D on chip per core
 L2: 1 MB I+D on chip per core
 L3: 1152 MB I+D on chip per chip, 96 MB shared / 8 cores
 Other: None
 Memory: 768 GB (12 x 64 GB 2Rx4 PC5-4800B-R)
 Storage: 110 GB on tmpfs
 Other: None

Software

OS: Ubuntu 22.04.1 LTS
 5.15.0-58-generic
 Compiler: C/C++/Fortran: Version 4.0.0 of AOCC
 Parallel: No
 Firmware: Version 1.4.2 released May-2023
 File System: tmpfs
 System State: Run level 3 (multi-user)
 Base Pointers: 64-bit
 Peak Pointers: Not Applicable
 Other: None
 Power Management: BIOS and OS set to prefer performance at the cost of additional power usage.



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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	192	449	682	449	681											
502.gcc_r	192	390	697	392	694											
505.mcf_r	192	256	1210	256	1210											
520.omnetpp_r	192	611	412	615	410											
523.xalancbmk_r	192	168	1210	169	1200											
525.x264_r	192	155	2170	155	2170											
531.deepsjeng_r	192	286	770	286	769											
541.leela_r	192	420	756	421	756											
548.exchange2_r	192	245	2050	246	2050											
557.xz_r	192	451	460	451	460											

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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.

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.



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Environment Variables Notes

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

```
LD_LIBRARY_PATH =
"/mnt/ramdisk/cpu2017-1.1.9-aocc400-znver4-A1/amd_rate_aocc400_znver4_A_lib/lib:/mnt/ramdisk/cpu2017-1.1.9-aocc400-znver4-A1/amd_rate_aocc400_znver4_A_lib/lib32:"
MALLOCONF = "retain:true"
```

General Notes

Binaries were compiled on a system with 2x AMD EPYC 9174F CPU + 1.5TiB Memory using RHEL 8.6

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.

Benchmark run from a 110 GB ramdisk created with the cmd: "mount -t tmpfs -o size=110G tmpfs /mnt/ramdisk"

Platform Notes

BIOS settings:

```
DRAM Refresh Delay : Performance
DIMM Self Healing on
Uncorrectable Memory Error : Disabled
Virtualization Technology : Disabled
NUMA Nodes per Socket : 4
L3 Cache as NUMA Domain : Enabled
```

```
System Profile : Custom
Memory Patrol Scrub : Disabled
PCI ASPM L1 Link
Power Management : Disabled
Determinism Slider : Power Determinism
```

Sysinfo program /mnt/ramdisk/cpu2017-1.1.9-aocc400-znver4-A1/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on amd-sut Mon May 15 05:25:47 2023

SUT (System Under Test) info as seen by some common utilities.

Table of contents

1. uname -a
2. w
3. Username
4. ulimit -a
5. sysinfo process ancestry
6. /proc/cpuinfo
7. lscpu
8. numactl --hardware
9. /proc/meminfo
10. who -r
11. Systemd service manager version: systemd 249 (249.11-0ubuntu3.6)

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Platform Notes (Continued)

- 12. Failed units, from systemctl list-units --state=failed
- 13. Services, from systemctl list-unit-files
- 14. Linux kernel boot-time arguments, from /proc/cmdline
- 15. cpupower frequency-info
- 16. tuned-adm active
- 17. systemctl
- 18. /sys/kernel/mm/transparent_hugepage
- 19. /sys/kernel/mm/transparent_hugepage/khugepaged
- 20. OS release
- 21. Disk information
- 22. /sys/devices/virtual/dmi/id
- 23. dmidecode
- 24. BIOS

```
-----
1. uname -a
Linux amd-sut 5.15.0-58-generic #64-Ubuntu SMP Thu Jan 5 11:43:13 UTC 2023 x86_64 x86_64 x86_64 GNU/Linux
-----
```

```
-----
2. w
05:25:48 up 3 min, 1 user, load average: 0.23, 0.11, 0.04
USER      TTY      FROM          LOGIN@   IDLE   JCPU   PCPU   WHAT
root      ttyL    -             05:24   27.00s 1.97s  0.30s /bin/bash ./amd_rate_aocc400_znver4_A1.sh
-----
```

```
-----
3. Username
From environment variable $USER: root
-----
```

```
-----
4. ulimit -a
time(seconds)      unlimited
file(blocks)       unlimited
data(kbytes)       unlimited
stack(kbytes)      unlimited
coredump(blocks)   0
memory(kbytes)     unlimited
locked memory(kbytes) 2097152
process            3093803
nofiles            1024
vmemory(kbytes)    unlimited
locks              unlimited
rtprio             0
-----
```

```
-----
5. sysinfo process ancestry
/sbin/init
/bin/login -p --
-bash
/bin/bash ./DELL_rate.sh --tune base
/bin/bash ./dell-run-main.sh rate --tune base
/bin/bash ./dell-run-main.sh rate --tune base
/bin/bash ./dell-run-speccpu.sh rate --define DL-BIOSinc=Dell-BIOS_EPYC-4.inc --define DL-BIOS-adddcD=1
--define DL-BIOS-VirtD=1 --define DL-VERS=v4.5 --output_format html,pdf,txt --tune base
python3 ./run_amd_rate_aocc400_znver4_A1.py
/bin/bash ./amd_rate_aocc400_znver4_A1.sh
runcpu --config amd_rate_aocc400_znver4_A1.cfg --tune all --reportable --iterations 2 --define
DL-BIOSinc=Dell-BIOS_EPYC-4.inc --define DL-BIOS-adddcD=1 --define DL-BIOS-VirtD=1 --define DL-VERS=v4.5
--output_format html,pdf,txt --tune base intrate
runcpu --configfile amd_rate_aocc400_znver4_A1.cfg --tune all --reportable --iterations 2 --define
-----
```

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Platform Notes (Continued)

```
DL-BIOSinc=Dell-BIOS_EPYC-4.inc --define DL-BIOS-addcd=1 --define DL-BIOS-VirtD=1 --define DL-VERS=v4.5
--output_format html,pdf,txt --tune base --nopower --runmode rate --tune base --size test:train:refrate
intrate --nopreenv --note-preenv --logfile $SPEC/tmp/CPU2017.001/templogs/preenv.intrate.001.0.log
--lognum 001.0 --from_runcpu 2
specperl $SPEC/bin/sysinfo
$SPEC = /mnt/ramdisk/cpu2017-1.1.9-aocc400-znver4-A1
```

```
6. /proc/cpuinfo
model name      : AMD EPYC 9684X 96-Core Processor
vendor_id      : AuthenticAMD
cpu family     : 25
model          : 17
stepping       : 2
microcode      : 0xa101207
bugs           : sysret_ss_attrs spectre_v1 spectre_v2 spec_store_bypass
TLB size      : 3584 4K pages
cpu cores     : 96
siblings      : 192
1 physical ids (chips)
192 processors (hardware threads)
physical id 0: core ids 0-95
physical id 0: apicids 0-191
```

Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for virtualized systems. Use the above data carefully.

7. lscpu

```
From lscpu from util-linux 2.37.2:
Architecture:      x86_64
CPU op-mode(s):   32-bit, 64-bit
Address sizes:    52 bits physical, 57 bits virtual
Byte Order:       Little Endian
CPU(s):           192
On-line CPU(s) list: 0-191
Vendor ID:        AuthenticAMD
Model name:       AMD EPYC 9684X 96-Core Processor
CPU family:       25
Model:           17
Thread(s) per core: 2
Core(s) per socket: 96
Socket(s):        1
Stepping:         2
Frequency boost:  enabled
CPU max MHz:     3716.0000
CPU min MHz:     400.0000
BogoMIPS:        5101.08
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 rapl
                 pni pclmulqdq monitor ssse3 fma cx16 pcid sse4_1 sse4_2 x2apic movbe
                 popcnt aes xsave avx f16c rdrand lahf_lm cmp_legacy svm extapic cr8_legacy
                 abm sse4a misalignsse 3dnowprefetch osvw ibs skinit wdt tce topoext
                 perfctr_core perfctr_nb bpeext perfctr_llc mwaitx cpb cat_l3 cdp_l3
                 invpcid_single hw_pstate ssbd mba ibrs ibpb stibp vmmcall fsgsbase bmi1
                 avx2 smep bmi2 erms invpcid cqm rdt_a avx512f avx512dq rdseed adx smap
                 avx512ifma clflushopt clwb avx512cd sha_ni avx512bw avx512vl xsaveopt
                 xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local
                 avx512_bf16 clzero irperf xsaveerptr rdpru wbnoinvd amd_ppin cppc arat npt
```

(Continued on next page)



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Platform Notes (Continued)

```
lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists
pausefilter pfthreshold avic v_vmsave_vmload vgif v_spec_ctrl avx512vbmi
umip pku ospke avx512_vbmi2 gfni vaes vpclmulqdq avx512_vnni avx512_bitalg
avx512_vpopcntdq la57 rdpid overflow_recov succor smca fsrm flush_lld
```

```
Virtualization: AMD-V
L1d cache: 3 MiB (96 instances)
L1i cache: 3 MiB (96 instances)
L2 cache: 96 MiB (96 instances)
L3 cache: 1.1 GiB (12 instances)
NUMA node(s): 4
NUMA node0 CPU(s): 0-23,96-119
NUMA node1 CPU(s): 24-47,120-143
NUMA node2 CPU(s): 48-71,144-167
NUMA node3 CPU(s): 72-95,168-191
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Mmio stale data: Not affected
Vulnerability Retbleed: Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
Vulnerability Spectre v1: Mitigation; usercopy/swaps barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Retpolines, IBPB conditional, IBRS_FW, STIBP always-on, RSB
filling, PBRSE-eIBRS Not affected
Vulnerability Srbds: Not affected
Vulnerability Tsx async abort: Not affected
```

From lscpu --cache:

NAME	ONE-SIZE	ALL-SIZE	WAYS	TYPE	LEVEL	SETS	PHY-LINE	COHERENCY-SIZE
L1d	32K	3M	8	Data	1	64	1	64
L1i	32K	3M	8	Instruction	1	64	1	64
L2	1M	96M	8	Unified	2	2048	1	64
L3	96M	1.1G	16	Unified	3	98304	1	64

8. numactl --hardware

NOTE: a numactl 'node' might or might not correspond to a physical chip.

```
available: 4 nodes (0-3)
node 0 cpus: 0-23,96-119
node 0 size: 193069 MB
node 0 free: 192025 MB
node 1 cpus: 24-47,120-143
node 1 size: 193522 MB
node 1 free: 192699 MB
node 2 cpus: 48-71,144-167
node 2 size: 193522 MB
node 2 free: 189034 MB
node 3 cpus: 72-95,168-191
node 3 size: 193446 MB
node 3 free: 192583 MB
node distances:
node  0  1  2  3
0:  10  12  12  12
1:  12  10  12  12
2:  12  12  10  12
3:  12  12  12  10
```

9. /proc/meminfo

MemTotal: 792127400 kB

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Platform Notes (Continued)

10. who -r
run-level 3 May 15 05:24

11. Systemd service manager version: systemd 249 (249.11-0ubuntu3.6)
Default Target Status
multi-user degraded

12. Failed units, from systemctl list-units --state=failed
UNIT LOAD ACTIVE SUB DESCRIPTION
* systemd-networkd-wait-online.service loaded failed failed Wait for Network to be Configured

13. Services, from systemctl list-unit-files
STATE UNIT FILES
enabled blk-availability console-setup cron dmesg e2scrub_reap finalrd getty@ gpu-manager grub-common grub-initrd-fallback irqbalance keyboard-setup lm-sensors networkd-dispatcher open-iscsi open-vm-tools pollinate rsyslog secureboot-db setvtrgb ssh systemd-networkd systemd-pstore systemd-resolved systemd-timesyncd thermald tuned ua-reboot-cmds ubuntu-advantage udisks2 vgauth wpa_supplicant
enabled-runtime netplan-ovs-cleanup systemd-fsck-root systemd-networkd-wait-online systemd-remount-fs ModemManager apparmor console-getty debug-shell iscsid lvm2-monitor lxd-agent multipathd disabled nftables rsync serial-getty@ systemd-boot-check-no-failures systemd-network-generator systemd-sysext systemd-time-wait-sync ufw upower wpa_supplicant-nl80211@ wpa_supplicant-wired@ wpa_supplicant@
generated apport
indirect uidd
masked NetworkManager NetworkManager-dispatcher NetworkManager-wait-online cryptdisks cryptdisks-early hwclock lvm2 multipath-tools-boot rc rcS screen-cleanup sudo x11-common

14. Linux kernel boot-time arguments, from /proc/cmdline
BOOT_IMAGE=/boot/vmlinuz-5.15.0-58-generic
root=UUID=593ab29a-c8fe-4d75-821a-b60d5c945311
ro

15. cpupower frequency-info
analyzing CPU 0:
current policy: frequency should be within 400 MHz and 3.72 GHz.
The governor "performance" may decide which speed to use within this range.
boost state support:
Supported: yes
Active: yes
Boost States: 0
Total States: 3
Pstate-P0: 2550MHz

16. tuned-adm active
Current active profile: latency-performance

17. sysctl
kernel.numa_balancing 1
kernel.randomize_va_space 0

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Platform Notes (Continued)

```

vm.compaction_proactiveness      20
vm.dirty_background_bytes        0
vm.dirty_background_ratio        3
vm.dirty_bytes                   0
vm.dirty_expire_centisecs       3000
vm.dirty_ratio                   8
vm.dirty_writeback_centisecs    500
vm.dirtytime_expire_seconds     43200
vm.extfrag_threshold             500
vm.min_unmapped_ratio           1
vm.nr_hugepages                  0
vm.nr_hugepages_mempolicy        0
vm.nr_overcommit_hugepages      0
vm.swappiness                    1
vm.watermark_boost_factor       15000
vm.watermark_scale_factor       10
vm.zone_reclaim_mode            1

```

```

-----
18. /sys/kernel/mm/transparent_hugepage
defrag      [always] defer+madvise madvise never
enabled     [always] madvise never
hpage_pmd_size  2097152
shmem_enabled  always within_size advise [never] deny force

```

```

-----
19. /sys/kernel/mm/transparent_hugepage/khugepaged
alloc_sleep_millisecs  60000
defrag                 1
max_ptes_none          511
max_ptes_shared        256
max_ptes_swap          64
pages_to_scan          4096
scan_sleep_millisecs  10000

```

```

-----
20. OS release
From /etc/*-release /etc/*-version
os-release Ubuntu 22.04.1 LTS

```

```

-----
21. Disk information
SPEC is set to: /mnt/ramdisk/cpu2017-1.1.9-aocc400-znver4-A1
Filesystem      Type  Size  Used Avail Use% Mounted on
tmpfs           tmpfs 110G  3.5G 107G   4% /mnt/ramdisk

```

```

-----
22. /sys/devices/virtual/dmi/id
Vendor:      Dell Inc.
Product:     PowerEdge R6615
Product Family: PowerEdge
Serial:      GLM4018

```

```

-----
23. dmidecode
Additional information from dmidecode 3.3 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)

12x 802C0000802C MTC40F2046S1RC48BA1 64 GB 2 rank 4800

24. BIOS

(This section combines info from /sys/devices and dmidecode.)

BIOS Vendor: Dell Inc.
BIOS Version: 1.4.2
BIOS Date: 05/05/2023
BIOS Revision: 1.4

Compiler Version Notes

C | 500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base) 525.x264_r(base) 557.xz_r(base)

AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#434 2022_10_28) (based on LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-4.0.0/bin

C++ | 520.omnetpp_r(base) 523.xalancbmk_r(base) 531.deepsjeng_r(base) 541.leela_r(base)

AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#434 2022_10_28) (based on LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-4.0.0/bin

Fortran | 548.exchange2_r(base)

AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#434 2022_10_28) (based on LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-4.0.0/bin

Base Compiler Invocation

C benchmarks:

clang

C++ benchmarks:

clang++

Fortran benchmarks:

flang



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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:

```

-m64 -flto -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-ldist-scalar-expand -fenable-aggressive-gather
-z muldefs -O3 -march=znver4 -fveclib=AMDLIBM -ffast-math
-fstruct-layout=7 -mllvm -unroll-threshold=50
-mllvm -inline-threshold=1000 -fremap-arrays -fstrip-mining
-mllvm -reduce-array-computations=3 -zopt -lamdlibm -lflang
-lamdalloc

```

C++ benchmarks:

```

-m64 -flto -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -z muldefs -O3
-march=znver4 -fveclib=AMDLIBM -ffast-math
-mllvm -unroll-threshold=100 -finline-aggressive
-mllvm -loop-unswitch-threshold=200000
-mllvm -reduce-array-computations=3 -zopt
-fvirtual-function-elimination -fvisibility=hidden -lamdlibm -lflang
-lamdalloc-ext

```

Fortran benchmarks:

```

-m64 -flto -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-inline-recursion=4 -Wl,-mllvm -Wl,-lsr-in-nested-loop
-Wl,-mllvm -Wl,-enable-iv-split -z muldefs -O3 -march=znver4
-fveclib=AMDLIBM -ffast-math -fepilog-vectorization-of-inductions
-mllvm -optimize-strided-mem-cost -floop-transform
-mllvm -unroll-aggressive -mllvm -unroll-threshold=500 -lamdlibm
-lflang -lamdalloc

```



SPEC CPU®2017 Integer Rate Result

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Dell Inc.

SPECrate®2017_int_base = 896

PowerEdge R6615 (AMD EPYC 9684X 96-Core Processor)

SPECrate®2017_int_peak = Not Run

CPU2017 License: 6573

Test Sponsor: Dell Inc.

Tested by: Dell Inc.

Test Date: May-2023

Hardware Availability: Jul-2023

Software Availability: Jan-2023

Base Other Flags

C benchmarks:

-Wno-unused-command-line-argument

C++ benchmarks:

-Wno-unused-command-line-argument

Fortran benchmarks:

-Wno-unused-command-line-argument

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

<http://www.spec.org/cpu2017/flags/aocc400-flags.html>

<http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-AMD-EPYC-v1.1.html>

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

<http://www.spec.org/cpu2017/flags/aocc400-flags.xml>

<http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-AMD-EPYC-v1.1.xml>

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