



SPEC CPU®2017 Integer Rate Result

Copyright 2017-2023 Standard Performance Evaluation Corporation

Lenovo Global Technology

ThinkSystem SD665 V3
(3.00 GHz,AMD EPYC 9124)

SPECrate®2017_int_base = 355

SPECrate®2017_int_peak = 364

CPU2017 License: 9017

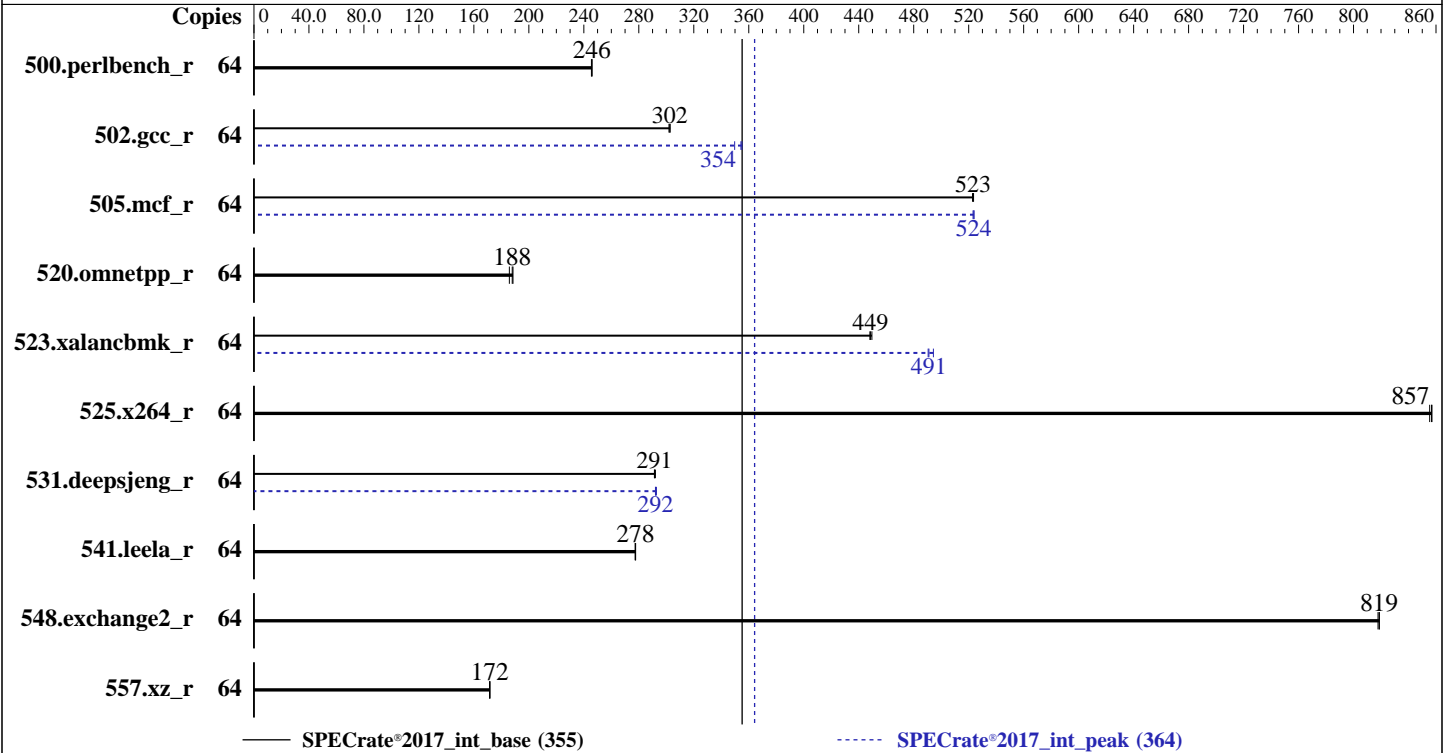
Test Sponsor: Lenovo Global Technology

Tested by: Lenovo Global Technology

Test Date: Feb-2023

Hardware Availability: Dec-2022

Software Availability: Nov-2022



Hardware

CPU Name: AMD EPYC 9124
 Max MHz: 3700
 Nominal: 3000
 Enabled: 32 cores, 2 chips, 2 threads/core
 Orderable: 2 chips
 Cache L1: 32 KB I + 32 KB D on chip per core
 L2: 1 MB I+D on chip per core
 L3: 64 MB I+D on chip per chip,
 16 MB shared / 4 cores
 Other: None
 Memory: 768 GB (24 x 32 GB 2Rx8 PC5-4800B-R)
 Storage: 1 x 3.84 TB NVME SSD
 Other: None

Software

OS: SUSE Linux Enterprise Server 15 SP4
 Kernel 5.14.21-150400.22-default
 Compiler: C/C++/Fortran: Version 4.0.0 of AOCC
 Parallel: No
 Firmware: Lenovo BIOS Version QGE109D 1.20 released Jan-2023
 File System: xfs
 System State: Run level 3 (multi-user)
 Base Pointers: 64-bit
 Peak Pointers: 32/64-bit
 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	64	414	246	415	246	414	246	64	414	246	415	246	414	246
502.gcc_r	64	299	303	300	302	300	302	64	256	354	259	350	255	355
505.mcf_r	64	198	524	198	523	198	523	64	197	524	197	524	198	523
520.omnetpp_r	64	446	188	452	186	447	188	64	446	188	452	186	447	188
523.xalancbmk_r	64	151	449	150	450	151	448	64	138	491	137	494	138	491
525.x264_r	64	131	857	131	855	131	857	64	131	857	131	855	131	857
531.deepsjeng_r	64	252	291	252	291	251	292	64	250	293	251	292	251	292
541.leela_r	64	382	278	382	277	382	278	64	382	278	382	277	382	278
548.exchange2_r	64	205	819	205	819	205	818	64	205	819	205	819	205	818
557.xz_r	64	403	172	403	172	403	171	64	403	172	403	172	403	171

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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/cpu2017-1.1.9-amd-aocc400-genoa-B1c/amd_rate_aocc400_genoa_B_lib/  
    lib:/home/cpu2017-1.1.9-amd-aocc400-genoa-B1c/amd_rate_aocc400_genoa_B_l  
    ib/lib32:"  
MALLOC_CONF = "retain:true"
```

Environment variables set by runcpu during the 523.xalanbmk_r peak run:

```
MALLOC_CONF = "thp:never"
```

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.

Platform Notes

BIOS configuration:

Operating Mode set to Maximum Performance and then set it to Custom Mode
NUMA Nodes per Socket set to NPS4

```
Sysinfo program /home/cpu2017-1.1.9-amd-aocc400-genoa-B1c/bin/sysinfo  
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197  
running on localhost Wed Feb 8 18:54:23 2023
```

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

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Platform Notes (Continued)

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```
1. uname -a
Linux localhost 5.14.21-150400.22-default #1 SMP PREEMPT_DYNAMIC Wed May 11 06:57:18 UTC 2022 (49db222)
x86_64 x86_64 x86_64 GNU/Linux
```

```
2. w
18:54:23 up 2 min, 1 user, load average: 0.09, 0.06, 0.02
USER      TTY      FROM          LOGIN@      IDLE        JCPU      PCPU      WHAT
root      ttyl    -              18:53       1:01       1.25s    0.17s    /bin/bash ./amd_rate_aocc400_genoa_B1.sh
```

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

```
4. ulimit -a
core file size          (blocks, -c) unlimited
data seg size           (kbytes, -d) unlimited
scheduling priority     (-e) 0
```

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Platform Notes (Continued)

```

file size                (blocks, -f) unlimited
pending signals          (-i) 3094067
max locked memory       (kbytes, -l) 2097152
max memory size         (kbytes, -m) unlimited
open files               (-n) 1024
pipe size                (512 bytes, -p) 8
POSIX message queues    (bytes, -q) 819200
real-time priority      (-r) 0
stack size               (kbytes, -s) unlimited
cpu time                 (seconds, -t) unlimited
max user processes      (-u) 3094067
virtual memory           (kbytes, -v) unlimited
file locks               (-x) unlimited

```

5. sysinfo process ancestry

```

/usr/lib/systemd/systemd --switched-root --system --deserialize 34
login -- root
-bash
/bin/bash ./run_SD665V3_genoa.sh
/bin/bash ./Run025-compliant-amd-rateint.sh
python3 ./run_amd_rate_aocc400_genoa_B1.py
/bin/bash ./amd_rate_aocc400_genoa_B1.sh
runcpu --config amd_rate_aocc400_genoa_B1.cfg --tune all --reportable --iterations 3 intrate
runcpu --configfile amd_rate_aocc400_genoa_B1.cfg --tune all --reportable --iterations 3 --nopower --runmode
rate --tune base:peak --size test:train:refrate intrate --nopreenv --note-preenv --logfile
$SPEC/tmp/CPU2017.021/temlogs/preenv.intrate.021.0.log --lognum 021.0 --from_runcpu 2
specperl $SPEC/bin/sysinfo
$SPEC = /home/cpu2017-1.1.9-amd-aocc400-genoa-B1c

```

6. /proc/cpuinfo

```

model name      : AMD EPYC 9124 16-Core Processor
vendor_id      : AuthenticAMD
cpu family     : 25
model          : 17
stepping       : 1
microcode      : 0xa101111
bugs           : sysret_ss_attrs spectre_v1 spectre_v2 spec_store_bypass
TLB size      : 3584 4K pages
cpu cores     : 16
siblings      : 32
2 physical ids (chips)
64 processors (hardware threads)
physical id 0: core ids 0-3,8-11,16-19,24-27
physical id 1: core ids 0-3,8-11,16-19,24-27
physical id 0: apicids 0-7,16-23,32-39,48-55

```

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Platform Notes (Continued)

physical id 1: apicids 64-71,80-87,96-103,112-119

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):                64
On-line CPU(s) list:   0-63
Vendor ID:             AuthenticAMD
Model name:            AMD EPYC 9124 16-Core Processor
CPU family:            25
Model:                 17
Thread(s) per core:    2
Core(s) per socket:    16
Socket(s):              2
Stepping:              1
Frequency boost:       enabled
CPU max MHz:           3711.9141
CPU min MHz:           1500.0000
BogoMIPS:              5999.61

```

```

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 bpext 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 arat npt 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_l1d

```

```

Virtualization:        AMD-V
L1d cache:             1 MiB (32 instances)
L1i cache:             1 MiB (32 instances)
L2 cache:              32 MiB (32 instances)
L3 cache:              128 MiB (8 instances)

```

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Platform Notes (Continued)

```

NUMA node(s): 8
NUMA node0 CPU(s): 0-3,32-35
NUMA node1 CPU(s): 4-7,36-39
NUMA node2 CPU(s): 8-11,40-43
NUMA node3 CPU(s): 12-15,44-47
NUMA node4 CPU(s): 16-19,48-51
NUMA node5 CPU(s): 20-23,52-55
NUMA node6 CPU(s): 24-27,56-59
NUMA node7 CPU(s): 28-31,60-63
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: 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
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	1M	8	Data	1	64	1	64
L1i	32K	1M	8	Instruction	1	64	1	64
L2	1M	32M	8	Unified	2	2048	1	64
L3	16M	128M	16	Unified	3	16384	1	64

8. numactl --hardware

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

```

available: 8 nodes (0-7)
node 0 cpus: 0-3,32-35
node 0 size: 96505 MB
node 0 free: 95244 MB
node 1 cpus: 4-7,36-39
node 1 size: 96717 MB
node 1 free: 96318 MB
node 2 cpus: 8-11,40-43
node 2 size: 96752 MB
node 2 free: 96494 MB
node 3 cpus: 12-15,44-47
node 3 size: 96752 MB
node 3 free: 96484 MB
node 4 cpus: 16-19,48-51
node 4 size: 96752 MB
node 4 free: 96503 MB
node 5 cpus: 20-23,52-55

```

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Platform Notes (Continued)

```

node 5 size: 96752 MB
node 5 free: 96501 MB
node 6 cpus: 24-27,56-59
node 6 size: 96752 MB
node 6 free: 96460 MB
node 7 cpus: 28-31,60-63
node 7 size: 96557 MB
node 7 free: 96355 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

```

```

-----
9. /proc/meminfo
   MemTotal:      792105784 kB

```

```

-----
10. who -r
    run-level 3 Feb 8 18:53

```

```

-----
11. Systemd service manager version: systemd 249 (249.11+suse.124.g2bc0b2c447)
    Default Target   Status
    multi-user       running

```

```

-----
12. Services, from systemctl list-unit-files
STATE                               UNIT FILES
enabled                             YaST2-Firstboot YaST2-Second-Stage apparmor auditd cron getty@ haveged irqbalance
issue-generator kbdsettings klog lvm2-monitor nscd nvme-fc-boot-connections postfix
purge-kernels  rollback rsyslog smartd sshd wicked wickedd-auto4 wickedd-dhcp4
wickedd-dhcp6 wickedd-nanny
enabled-runtime  systemd-remount-fs
disabled         autofs autoyast-initscripts blk-availability boot-sysctl ca-certificates chrony-wait
chronyd console-getty cups cups-browsed debug-shell ebttables exchange-bmc-os-info
firewalld gpm grub2-once haveged-switch-root hwloc-dump-hwdata ipmi ipmievd
issue-add-ssh-keys kexec-load lunmask man-db-create multipathd nfs nfs-blkmap
nvmf-autoconnect rdisc rpcbind rpmconfigcheck rsyncd serial-getty@ smartd_generate_opts
snmpd snmptrapd systemd-boot-check-no-failures systemd-network-generator systemd-sysext
systemd-time-wait-sync systemd-timesyncd

```

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Platform Notes (Continued)

indirect wickedd

```

-----
13. Linux kernel boot-time arguments, from /proc/cmdline
BOOT_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default
root=UUID=598fe0ff-3760-4e42-a9c0-1c1fd78e40fa
splash=silent
mitigations=auto
quiet
security=apparmor

```

```

-----
14. cpupower frequency-info
analyzing CPU 0:
    current policy: frequency should be within 1.50 GHz and 3.00 GHz.
                    The governor "performance" may decide which speed to use
                    within this range.

    boost state support:
        Supported: yes
        Active: yes

```

```

-----
15. sysctl
kernel.numa_balancing                1
kernel.randomize_va_space            0
vm.compaction_proactiveness          20
vm.dirty_background_bytes            0
vm.dirty_background_ratio            10
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

```

```

-----
16. /sys/kernel/mm/transparent_hugepage
defrag                    [always] defer+madvise madvise never
enabled                   [always] madvise never

```

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Platform Notes (Continued)

hpage_pmd_size 2097152
shmem_enabled always within_size advise [never] deny force

17. /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

18. OS release

From /etc/*-release /etc/*-version
os-release SUSE Linux Enterprise Server 15 SP4

19. Disk information

SPEC is set to: /home/cpu2017-1.1.9-amd-aocc400-genoa-Blc
Filesystem Type Size Used Avail Use% Mounted on
/dev/nvme0n1p3 xfs 3.5T 52G 3.5T 2% /

20. /sys/devices/virtual/dmi/id

Vendor: Lenovo
Product: ThinkSystem SD665 V3
Product Family: ThinkSystem
Serial: 1234567890

21. dmidecode

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:

2x Samsung M321R4GA3BB0-CQKEG 32 GB 2 rank 4800
3x Samsung M321R4GA3BB0-CQKMG 32 GB 2 rank 4800
7x Samsung M321R4GA3BB0-CQKVG 32 GB 2 rank 4800
5x Samsung M321R4GA3BB6-CQKEG 32 GB 2 rank 4800
7x Samsung M321R4GA3BB6-CQKVG 32 GB 2 rank 4800

22. BIOS

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Platform Notes (Continued)

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

BIOS Vendor: Lenovo
BIOS Version: QGE109D-1.20
BIOS Date: 01/19/2023
BIOS Revision: 1.20
Firmware Revision: 0.90

Compiler Version Notes

=====
C | 502.gcc_r(peak)

AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)
Target: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/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 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

=====
C | 502.gcc_r(peak)

AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)
Target: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/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 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)

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SPEC CPU®2017 Integer Rate Result

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Lenovo Global Technology

ThinkSystem SD665 V3
(3.00 GHz,AMD EPYC 9124)

SPECrate®2017_int_base = 355

SPECrate®2017_int_peak = 364

CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Tested by: Lenovo Global Technology

Test Date: Feb-2023
Hardware Availability: Dec-2022
Software Availability: Nov-2022

Compiler Version Notes (Continued)

Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

=====
C++ | 523.xalancbmk_r(peak)
=====

AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)
Target: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

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

AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

=====
C++ | 523.xalancbmk_r(peak)
=====

AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)
Target: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

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

AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

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Software Availability: Nov-2022

Compiler Version Notes (Continued)

=====
Fortran | 548.exchange2_r(base, peak)
=====

AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on
LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/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.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

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Base Optimization Flags (Continued)

C benchmarks (continued):

```
-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
```

Base Other Flags

C benchmarks:

```
-Wno-unused-command-line-argument
```

C++ benchmarks:

```
-Wno-unused-command-line-argument
```

Fortran benchmarks:

```
-Wno-unused-command-line-argument
```

Peak Compiler Invocation

C benchmarks:

```
clang
```

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Peak Compiler Invocation (Continued)

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: basepeak = yes
```

```
502.gcc_r: -m32 -flto -z muldefs -Ofast -march=znver4
-fveclib=AMDLIBM -ffast-math -fstruct-layout=7
-mllvm -unroll-threshold=50 -fremap-arrays -fstrip-mining
-mllvm -inline-threshold=1000
-mllvm -reduce-array-computations=3 -zopt -fgnu89-inline
-lamdalloc
```

```
505.mcf_r: -m64 -flto -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver4 -fveclib=AMDLIBM -ffast-math
-fstruct-layout=7 -mllvm -unroll-threshold=50
-fremap-arrays -fstrip-mining
-mllvm -inline-threshold=1000
-mllvm -reduce-array-computations=3 -zopt -lamdlibm
-lflang -lamdalloc
```

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Peak Optimization Flags (Continued)

525.x264_r: basepeak = yes

557.xz_r: basepeak = yes

C++ benchmarks:

520.omnetpp_r: basepeak = yes

```
523.xalancbmk_r: -m32 -flto -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-do-block-reorder=aggressive
-fno-loop-reroll -Ofast -march=znver4 -fveclib=AMDLIBM
-ffast-math -finline-aggressive
-mllvm -unroll-threshold=100
-mllvm -reduce-array-computations=3 -zopt
-mllvm -do-block-reorder=aggressive
-fvirtual-function-elimination -fvisibility=hidden
-lamdalloc-ext
```

```
531.deepsjeng_r: -m64 -flto -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -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 -lamdalloc-ext
```

541.leela_r: basepeak = yes

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/lib32 -Wno-unused-command-line-argument

-L/home/work/cpu2017/v118/aocc4/b1/rate/amd_rate_aocc400_genoa_B_lib/lib32

C++ benchmarks (except as noted below):

-Wno-unused-command-line-argument

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Peak Other Flags (Continued)

```
523.xalancbmk_r: -L/usr/lib32 -Wno-unused-command-line-argument  
-L/home/work/cpu2017/v118/aocc4/bl/rate/amd_rate_aocc400_genoa_B_lib/lib32
```

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/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Genoa-Q.html>

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

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

<http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Genoa-Q.xml>

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

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