SPEC CPU®2017 Integer Speed Result

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Dell Inc.

PowerEdge R6615 (AMD EPYC 9224 24-Core Processor)

$SPECspeed®2017\_int\_base =$ 13.0

$SPECspeed®2017\_int\_peak =$ Not Run

CPU2017 License:	6573	**Test Date:**	Dec-2022
Test Sponsor:	Dell Inc.	**Hardware Availability:**	Dec-2022
Tested by:	Dell Inc.	**Software Availability:**	Nov-2022

Threads

Benchmark	Threads	Value
600.perlbench_s	24	8.10
602.gcc_s	24	13.5
605.mcf_s	24	19.9
620.omnetpp_s	24	7.02
623.xalancbmk_s	24	17.7
625.x264_s	24	21.0
631.deepsjeng_s	24	6.96
641.leela_s	24	5.85
648.exchange2_s	24	25.3
657.xz_s	24	22.9

SPECspeed®2017_int_base (13.0)

Hardware

CPU Name: AMD EPYC 9224
 Max MHz: 3700
 Nominal: 2500
Enabled: 24 cores, 1 chip
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: 64 MB I+D on chip per chip, 16 MB shared / 6 cores
 Other: None
Memory: 768 GB (12 x 64 GB 2Rx4 PC5-4800B-R)
Storage: 125 GB on tmpfs
Other: None

Software

OS: Ubuntu 22.04.1 LTS
 5.15.0-46-generic
Compiler: C/C++/Fortran: Version 4.0.0 of AOCC
Parallel: Yes
Firmware: Version 1.1.0 released Nov-2022
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.

Standard Performance Evaluation Corporation (info@spec.org)
https://www.spec.org/

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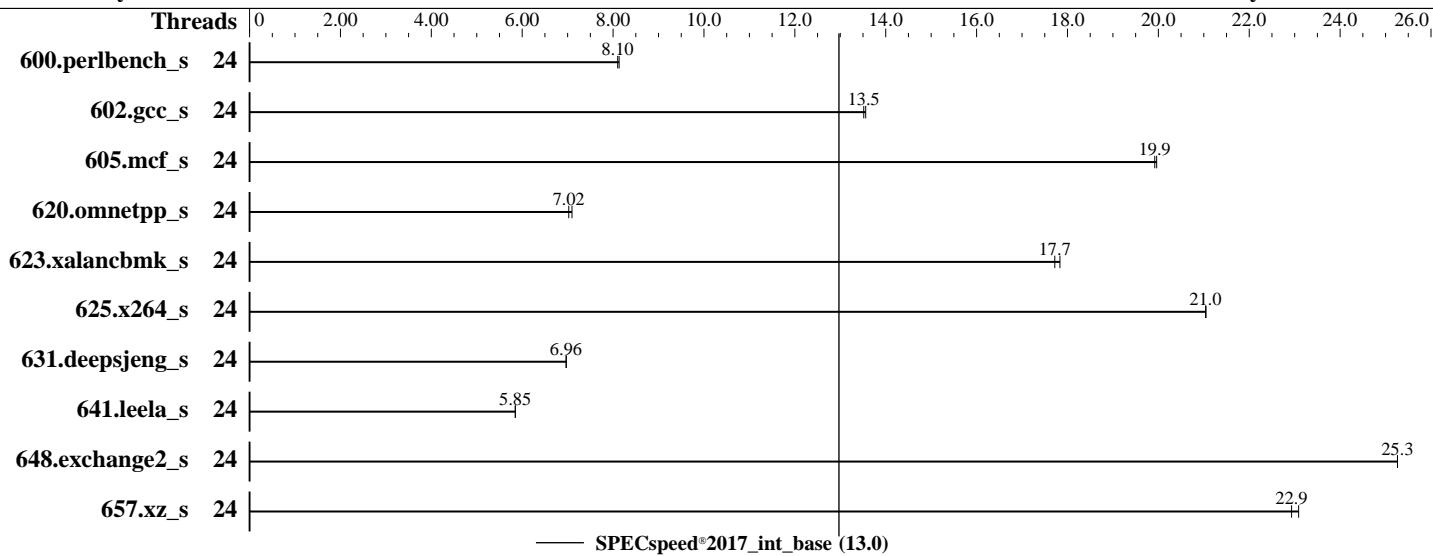SPECspeed®2017_int_peak = Not Run

CPU2017 License: 6573
Test Sponsor: Dell Inc.
Tested by: Dell Inc.

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

Results Table

Benchmark	Base							Peak						
	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
600.perlbench_s	24	218	8.13	**219**	**8.10**									
602.gcc_s	24	294	13.6	**295**	**13.5**									
605.mcf_s	24	**237**	**19.9**	236	20.0									
620.omnetpp_s	24	230	7.10	**232**	**7.02**									
623.xalancbmk_s	24	79.5	17.8	**80.0**	**17.7**									
625.x264_s	24	83.8	21.0	**83.8**	**21.0**									
631.deepsjeng_s	24	206	6.97	**206**	**6.96**									
641.leela_s	24	292	5.85	**292**	**5.85**									
648.exchange2_s	24	116	25.3	**116**	**25.3**									
657.xz_s	24	**270**	**22.9**	268	23.1									

SPECspeed®2017_int_base = 13.0

SPECspeed®2017_int_peak =   Not Run

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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CPU2017 License: 6573
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Test Date: Dec-2022
Hardware Availability: Dec-2022
Software Availability: Nov-2022

Operating System Notes (Continued)

```
To enable Transparent Hugepages (THP) for all allocations,
'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:
GOMP_CPU_AFFINITY = "0-23"
LD_LIBRARY_PATH =
      "/mnt/ramdisk/cpu2017-1.1.8-aocc400-B1b/amd_speed_aocc400_genoa_B_lib/li
      b:"
LIBOMP_NUM_HIDDEN_HELPER_THREADS = "0"
MALLOC_CONF = "oversize_threshold:0,retain:true"
OMP_DYNAMIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "24"
```

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 125 GB ramdisk created with the cmd: "mount -t tmpfs -o size=125G tmpfs /mnt/ramdisk"
```

Platform Notes

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

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

Platform Notes (Continued)

```
               System Profile : Custom
                     C-States : Disabled
          Memory Patrol Scrub : Disabled
          PCI ASPM L1 Link
             Power Management : Disabled
          Determinism Slider : Power Determinism
      Algorithm Performance
         Boost Disable (ApbDis) : Enabled

 Sysinfo program /mnt/ramdisk/cpu2017-1.1.8-aocc400-B1b/bin/sysinfo
 Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
 running on amd-sut Sun Dec 11 16:14:04 2022

 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 9224 24-Core Processor
       1  "physical id"s (chips)
       24 "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  : 24
       physical 0: cores 0 1 2 3 4 5 16 17 18 19 20 21 32 33 34 35 36 37 48 49 50 51 52 53

 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):                  24
       On-line CPU(s) list:     0-23
       Vendor ID:               AuthenticAMD
       Model name:              AMD EPYC 9224 24-Core Processor
       CPU family:              25
       Model:                   17
       Thread(s) per core:      1
       Core(s) per socket:      24
       Socket(s):               1
       Stepping:                1
       Frequency boost:         enabled
       CPU max MHz:             3707.0000
       CPU min MHz:             400.0000
       BogoMIPS:                5001.19
```

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Software Availability: Nov-2022

Platform Notes (Continued)

```
    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 cppc 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:                      768 KiB (24 instances)
    L1i cache:                      768 KiB (24 instances)
    L2 cache:                       24 MiB (24 instances)
    L3 cache:                       64 MiB (4 instances)
    NUMA node(s):                   4
    NUMA node0 CPU(s):              0-5
    NUMA node1 CPU(s):              12-17
    NUMA node2 CPU(s):              18-23
    NUMA node3 CPU(s):              6-11
    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/swapgs barriers and __user
    pointer sanitization
    Vulnerability Spectre v2:       Mitigation; Retpolines, IBPB conditional, IBRS_FW,
    STIBP disabled, 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     768K    8 Data            1    64        1             64
    L1i       32K     768K    8 Instruction    1    64        1             64
    L2         1M      24M    8 Unified        2  2048        1             64
    L3        16M      64M   16 Unified        3 16384        1             64
```

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Software Availability: Nov-2022

Platform Notes (Continued)

```
/proc/cpuinfo cache data
   cache size : 1024 KB

From numactl --hardware
WARNING: a numactl 'node' might or might not correspond to a physical chip.
  available: 4 nodes (0-3)
  node 0 cpus: 0 1 2 3 4 5
  node 0 size: 193044 MB
  node 0 free: 192059 MB
  node 1 cpus: 12 13 14 15 16 17
  node 1 size: 193533 MB
  node 1 free: 191121 MB
  node 2 cpus: 18 19 20 21 22 23
  node 2 size: 193533 MB
  node 2 free: 192023 MB
  node 3 cpus: 6 7 8 9 10 11
  node 3 size: 193497 MB
  node 3 free: 193131 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

From /proc/meminfo
   MemTotal:       792176512 kB
   HugePages_Total:        0
   Hugepagesize:        2048 kB

/sbin/tuned-adm active
    Current active profile: latency-performance

/sys/devices/system/cpu/cpu*/cpufreq/scaling_governor has
   performance

/usr/bin/lsb_release -d
   Ubuntu 22.04.1 LTS

From /etc/*release* /etc/*version*
   debian_version: bookworm/sid
   os-release:
      PRETTY_NAME="Ubuntu 22.04.1 LTS"
      NAME="Ubuntu"
      VERSION_ID="22.04"
      VERSION="22.04.1 LTS (Jammy Jellyfish)"
      VERSION_CODENAME=jammy
```

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Platform Notes (Continued)

```
        ID=ubuntu
        ID_LIKE=debian
        HOME_URL="https://www.ubuntu.com/"

uname -a:
    Linux amd-sut 5.15.0-46-generic #49-Ubuntu SMP Thu Aug 4 18:03:25 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
retbleed:                                         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/swapgs
                                                 barriers and __user pointer
                                                 sanitization
CVE-2017-5715 (Spectre variant 2):               Mitigation: Retpolines, IBPB:
                                                 conditional, IBRS_FW, STIBP:
                                                 disabled, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort):         Not affected

run-level 3 Dec 11 16:10

SPEC is set to: /mnt/ramdisk/cpu2017-1.1.8-aocc400-B1b
   Filesystem      Type   Size  Used Avail Use% Mounted on
   tmpfs           tmpfs  125G  3.4G  122G   3% /mnt/ramdisk

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


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:
    12x 802C0000802C MTC40F2046S1RC48BA1 64 GB 2 rank 4800
```

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Platform Notes (Continued)

```
 BIOS:
    BIOS Vendor:        Dell Inc.
    BIOS Version:       1.1.0
    BIOS Date:          11/25/2022
    BIOS Revision:      1.1

  (End of data from sysinfo program)
```

Compiler Version Notes

```
================================================================================
C         | 600.perlbench_s(base) 602.gcc_s(base) 605.mcf_s(base)
          | 625.x264_s(base) 657.xz_s(base)
--------------------------------------------------------------------------------
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++       | 620.omnetpp_s(base) 623.xalancbmk_s(base) 631.deepsjeng_s(base)
          | 641.leela_s(base)
--------------------------------------------------------------------------------
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
--------------------------------------------------------------------------------


================================================================================
Fortran | 648.exchange2_s(base)
--------------------------------------------------------------------------------
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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Base Compiler Invocation

C benchmarks:
`clang`

C++ benchmarks:
`clang++`

Fortran benchmarks:
`flang`

Base Portability Flags

600.perlbench_s: `-DSPEC_LINUX_X64 -DSPEC_LP64`
602.gcc_s: `-DSPEC_LP64`
605.mcf_s: `-DSPEC_LP64`
620.omnetpp_s: `-DSPEC_LP64`
623.xalancbmk_s: `-DSPEC_LINUX -DSPEC_LP64`
625.x264_s: `-DSPEC_LP64`
631.deepsjeng_s: `-DSPEC_LP64`
641.leela_s: `-DSPEC_LP64`
648.exchange2_s: `-DSPEC_LP64`
657.xz_s: `-DSPEC_LP64`

Base Optimization Flags

C benchmarks:
`-m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6`
`-Wl,-mllvm -Wl,-reduce-array-computations=3`
`-Wl,-allow-multiple-definition -O3 -march=znver4 -fveclib=AMDLIBM`
`-ffast-math -fopenmp -flto -fstruct-layout=7`
`-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000`
`-fremap-arrays -fstrip-mining -mllvm -reduce-array-computations=3`
`-DSPEC_OPENMP -zopt -fopenmp=libomp -lomp -lamdlibm -lflang`
`-lamdalloc`

C++ benchmarks:
`-m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6`
`-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver4`
`-fveclib=AMDLIBM -ffast-math -fopenmp -flto`
`-mllvm -unroll-threshold=100 -finline-aggressive`
`-mllvm -loop-unswitch-threshold=200000`
`-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt`
`-fvirtual-function-elimination -fvisibility=hidden -fopenmp=libomp`

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Base Optimization Flags (Continued)

C++ benchmarks (continued):
```
-lomp -lamdlibm -lflang -lamdalloc-ext
```

Fortran benchmarks:
```
-m64 -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 -O3 -march=znver4 -fveclib=AMDLIBM
-ffast-math -fopenmp -flto -mllvm -optimize-strided-mem-cost
-mllvm -unroll-aggressive -mllvm -unroll-threshold=150 -fopenmp=libomp
-lomp -lamdlibm -lflang -lamdalloc
```

Base Other Flags

C benchmarks:
```
-Wno-return-type -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-v1.0.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-v1.0.xml
```

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

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