SPEC CPU®2017 Integer Speed Result

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Dell Inc.

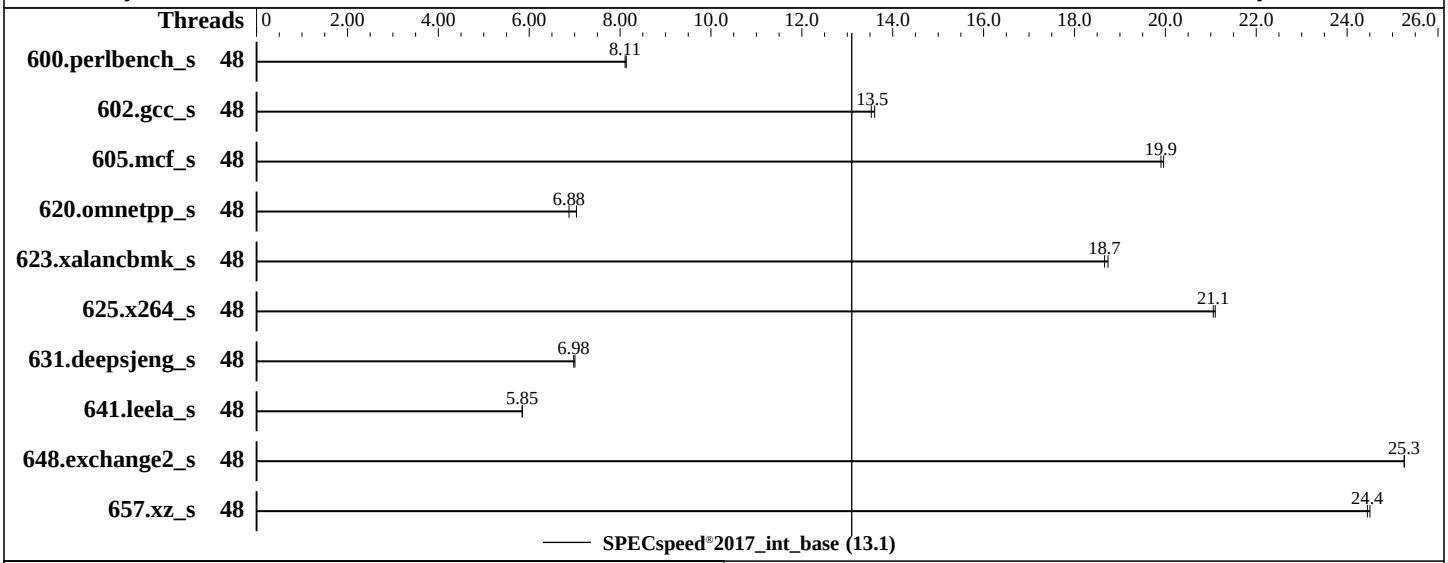
PowerEdge R6625 (AMD EPYC 9224 24-Core Processor)

SPECspeed®2017_int_base = 13.1

SPECspeed®2017_int_peak = Not Run

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

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



Hardware

CPU Name:	AMD EPYC 9224
Max MHz:	3700
Nominal:	2500
Enabled:	48 cores, 2 chips
Orderable:	1,2 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 / 6 cores
Other:	None
Memory:	1536 GB (24 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.

Results Table

Benchmark	Base							Peak						
	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
600.perlbench_s	48	**219**	**8.11**	218	8.14									
602.gcc_s	48	**294**	**13.5**	293	13.6									
605.mcf_s	48	**237**	**19.9**	237	20.0									
620.omnetpp_s	48	**237**	**6.88**	232	7.04									
623.xalancbmk_s	48	**75.9**	**18.7**	75.6	18.7									
625.x264_s	48	83.6	21.1	**83.8**	**21.1**									
631.deepsjeng_s	48	**205**	**6.98**	205	7.01									
641.leela_s	48	**292**	**5.85**	292	5.85									
648.exchange2_s	48	116	25.3	**116**	**25.3**									
657.xz_s	48	**253**	**24.4**	252	24.5									

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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) 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 = "0-47"
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 = "48"
```

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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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 Tue Dec  6 16:09:37 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
        2  "physical id"s (chips)
        48 "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
        physical 1: 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):                          48
       On-line CPU(s) list:             0-47
       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):                       2
       Stepping:                        1
       Frequency boost:                 enabled
       CPU max MHz:                     3707.0000
       CPU min MHz:                     400.0000
```

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Platform Notes (Continued)

```
      BogoMIPS:                          5001.58
      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:                         1.5 MiB (48 instances)
      L1i cache:                         1.5 MiB (48 instances)
      L2 cache:                          48 MiB (48 instances)
      L3 cache:                          128 MiB (8 instances)
      NUMA node(s):                      8
      NUMA node0 CPU(s):                 0-5
      NUMA node1 CPU(s):                 12-17
      NUMA node2 CPU(s):                 18-23
      NUMA node3 CPU(s):                 6-11
      NUMA node4 CPU(s):                 24-29
      NUMA node5 CPU(s):                 36-41
      NUMA node6 CPU(s):                 42-47
      NUMA node7 CPU(s):                 30-35
      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
```

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Platform Notes (Continued)

```
      L1d       32K     1.5M    8 Data            1    64        1             64
      L1i       32K     1.5M    8 Instruction     1    64        1             64
      L2         1M      48M    8 Unified         2  2048        1             64
      L3        16M     128M   16 Unified         3 16384        1             64

  /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: 8 nodes (0-7)
    node 0 cpus: 0 1 2 3 4 5
    node 0 size: 193080 MB
    node 0 free: 192225 MB
    node 1 cpus: 12 13 14 15 16 17
    node 1 size: 193533 MB
    node 1 free: 192706 MB
    node 2 cpus: 18 19 20 21 22 23
    node 2 size: 193533 MB
    node 2 free: 192789 MB
    node 3 cpus: 6 7 8 9 10 11
    node 3 size: 193482 MB
    node 3 free: 192601 MB
    node 4 cpus: 24 25 26 27 28 29
    node 4 size: 128998 MB
    node 4 free: 124786 MB
    node 5 cpus: 36 37 38 39 40 41
    node 5 size: 193533 MB
    node 5 free: 192720 MB
    node 6 cpus: 42 43 44 45 46 47
    node 6 size: 193533 MB
    node 6 free: 192616 MB
    node 7 cpus: 30 31 32 33 34 35
    node 7 size: 193533 MB
    node 7 free: 192586 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
```

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Platform Notes (Continued)

```
    MemTotal:       1518827780 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
        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
```

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Platform Notes (Continued)

```
 CVE-2019-11135 (TSX Asynchronous Abort):              Not affected

 run-level 3 Dec 6 15:48

 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 R6625
     Product Family: PowerEdge
     Serial:         BGP4023

 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:
     24x 80CE000080CE M321R8GA0BB0-CQKDG 64 GB 2 rank 4800

 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)
------------------------------------------------------------------------------
```


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Compiler Version Notes (Continued)

```
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
------------------------------------------------------------------------------
```

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
-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

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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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