SPEC CPU®2017 Integer Speed Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

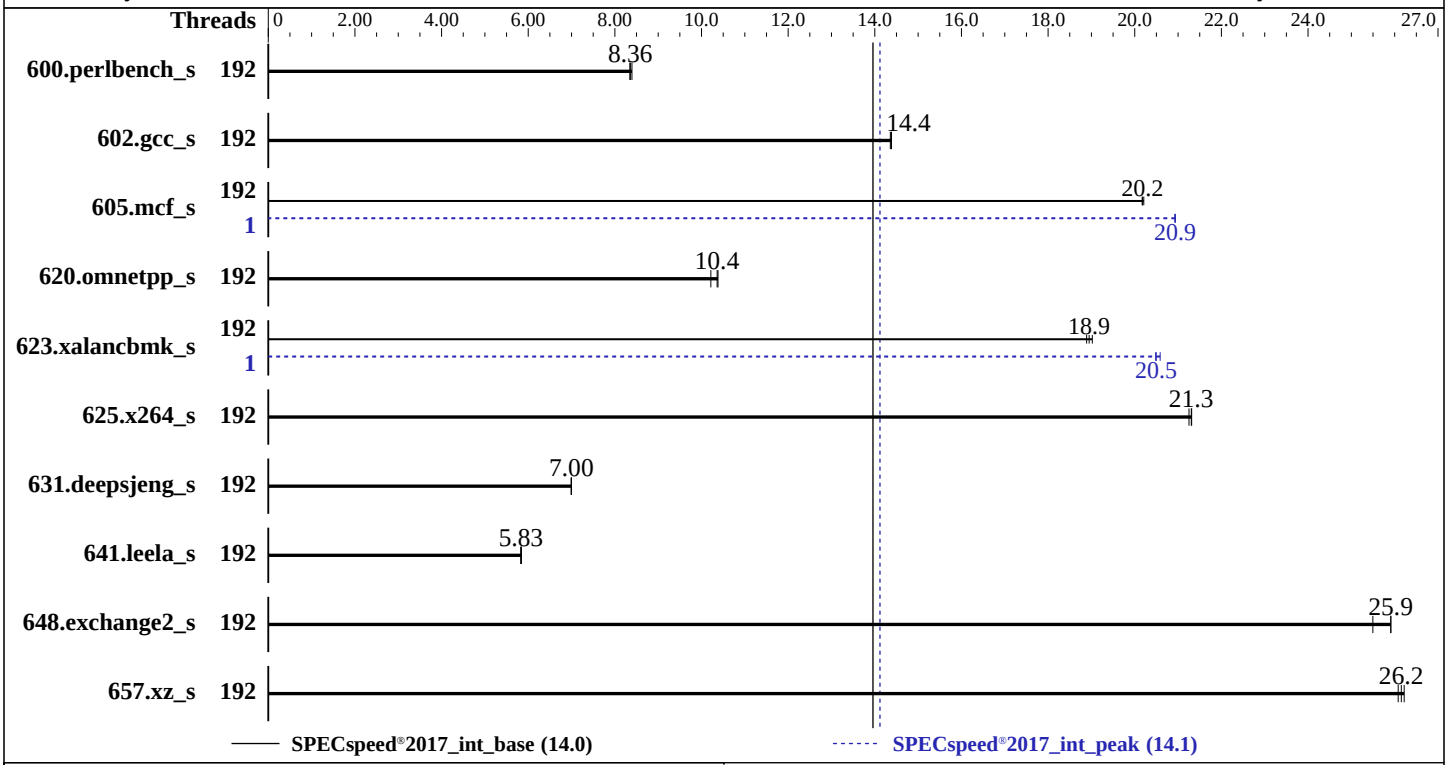
ProLiant DL365 Gen11
(2.40 GHz, AMD EPYC 9654)

SPECspeed®2017_int_base = 14.0

SPECspeed®2017_int_peak = 14.1

CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

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



Hardware

CPU Name:	AMD EPYC 9654
Max MHz:	3700
Nominal:	2400
Enabled:	192 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:	384 MB I+D on chip per chip, 32 MB shared / 8 cores
Other:	None
Memory:	768 GB (24 x 32 GB 2Rx8 PC5-4800B-R)
Storage:	2 x 480 GB SATA SSD
Other:	None

Software

OS:	Ubuntu 22.04.1 LTS Kernel 5.15.0-50-generic
Compiler:	C/C++/Fortran: Version 4.0.0 of AOCC
Parallel:	Yes
Firmware:	HPE BIOS Version v1.10 10/06/2022 released Oct-2022
File System:	ext4
System State:	Run level 5 (multi-user)
Base Pointers:	64-bit
Peak Pointers:	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						
	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
600.perlbench_s	192	211	8.39	**212**	**8.36**	213	8.35	192	211	8.39	**212**	**8.36**	213	8.35
602.gcc_s	192	277	14.4	**277**	**14.4**	277	14.4	192	277	14.4	**277**	**14.4**	277	14.4
605.mcf_s	192	234	20.2	234	20.2	**234**	**20.2**	1	225	20.9	**226**	**20.9**	226	20.9
620.omnetpp_s	192	160	10.2	**157**	**10.4**	157	10.4	192	160	10.2	**157**	**10.4**	157	10.4
623.xalancbmk_s	192	74.5	19.0	75.0	18.9	**74.8**	**18.9**	1	68.8	20.6	**69.1**	**20.5**	69.2	20.5
625.x264_s	192	82.8	21.3	83.0	21.3	**82.8**	**21.3**	192	82.8	21.3	83.0	21.3	**82.8**	**21.3**
631.deepsjeng_s	192	205	7.00	**205**	**7.00**	205	6.99	192	205	7.00	**205**	**7.00**	205	6.99
641.leela_s	192	293	5.83	292	5.84	**292**	**5.83**	192	293	5.83	292	5.84	**292**	**5.83**
648.exchange2_s	192	113	25.9	115	25.5	**113**	**25.9**	192	113	25.9	115	25.5	**113**	**25.9**
657.xz_s	192	237	26.1	236	26.2	**236**	**26.2**	192	237	26.1	236	26.2	**236**	**26.2**

SPECspeed®2017_int_base = 14.0

SPECspeed®2017_int_peak = 14.1

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.
```

(Continued on next page)

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 = "0-191"
LD_LIBRARY_PATH = "/home/CPU2017/amd_speed_aocc400_genoa_B_lib/lib:"
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 = "192"

Environment variables set by runcpu during the 605.mcf_s peak run:
GOMP_CPU_AFFINITY = "15"

Environment variables set by runcpu during the 623.xalancbmk_s peak run:
GOMP_CPU_AFFINITY = "15"

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
 Workload Profile set to General Peak Frequency Compute
 Determinism Control set to Manual
   Performance Determinism set to Power Deterministic
 AMD SMT Option set to Disabled
 NUMA memory domains per socket set to Four memory domains per socket
 Last-Level Cache (LLC) as NUMA Node set to Enabled

(Continued on next page)

Platform Notes (Continued)

```
 ACPI CST C2 Latency set to 18 microseconds
 Memory PStates set to Disabled
 Thermal Configuration set to Maximum Cooling

The system ROM used for this result contains microcode version 0xa10110d for the
AMD EPYC 9nn4X family of processors. The reference code/AGESA version used in this
ROM is version GenoaPI 1.0.0.1-L2

 Sysinfo program /home/CPU2017/bin/sysinfo
 Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
 running on admin1 Sun Oct 23 13:38:11 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 9654 96-Core Processor
       2  "physical id"s (chips)
       192 "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 : 96
       siblings  : 96
       physical 0: cores 0 1 2 3 4 5 6 7 16 17 18 19 20 21 22 23 32 33 34 35 36 37 38 39
       48 49 50 51 52 53 54 55 64 65 66 67 68 69 70 71 80 81 82 83 84 85 86 87 96 97 98 99
       100 101 102 103 112 113 114 115 116 117 118 119 128 129 130 131 132 133 134 135 144
       145 146 147 148 149 150 151 160 161 162 163 164 165 166 167 176 177 178 179 180 181
       182 183
       physical 1: cores 0 1 2 3 4 5 6 7 16 17 18 19 20 21 22 23 32 33 34 35 36 37 38 39
       48 49 50 51 52 53 54 55 64 65 66 67 68 69 70 71 80 81 82 83 84 85 86 87 96 97 98 99
       100 101 102 103 112 113 114 115 116 117 118 119 128 129 130 131 132 133 134 135 144
       145 146 147 148 149 150 151 160 161 162 163 164 165 166 167 176 177 178 179 180 181
       182 183

 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 9654 96-Core Processor
      CPU family:                      25
      Model:                           17
      Thread(s) per core:              1
```

(Continued on next page)

Platform Notes (Continued)

```
Core(s) per socket:                  96
Socket(s):                           2
Stepping:                            1
Frequency boost:                     enabled
CPU max MHz:                         3709.0000
CPU min MHz:                         400.0000
BogoMIPS:                            4792.88
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:                           6 MiB (192 instances)
L1i cache:                           6 MiB (192 instances)
L2 cache:                            192 MiB (192 instances)
L3 cache:                            768 MiB (24 instances)
NUMA node(s):                        24
NUMA node0 CPU(s):                   0-7
NUMA node1 CPU(s):                   8-15
NUMA node2 CPU(s):                   16-23
NUMA node3 CPU(s):                   24-31
NUMA node4 CPU(s):                   32-39
NUMA node5 CPU(s):                   40-47
NUMA node6 CPU(s):                   48-55
NUMA node7 CPU(s):                   56-63
NUMA node8 CPU(s):                   64-71
NUMA node9 CPU(s):                   72-79
NUMA node10 CPU(s):                  80-87
NUMA node11 CPU(s):                  88-95
NUMA node12 CPU(s):                  96-103
NUMA node13 CPU(s):                  104-111
NUMA node14 CPU(s):                  112-119
NUMA node15 CPU(s):                  120-127
NUMA node16 CPU(s):                  128-135
NUMA node17 CPU(s):                  136-143
NUMA node18 CPU(s):                  144-151
```

(Continued on next page)

Platform Notes (Continued)

```
      NUMA node19 CPU(s):              152-159
      NUMA node20 CPU(s):              160-167
      NUMA node21 CPU(s):              168-175
      NUMA node22 CPU(s):              176-183
      NUMA node23 CPU(s):              184-191
      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/swapgs barriers and __user
      pointer sanitization
      Vulnerability Spectre v2:        Mitigation; Retpolines, IBPB conditional, IBRS_FW,
      STIBP disabled, RSB filling, PBRSB-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       6M    8 Data            1    64        1             64
       L1i       32K       6M    8 Instruction     1    64        1             64
       L2         1M     192M    8 Unified         2  2048        1             64
       L3        32M     768M   16 Unified         3 32768        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: 24 nodes (0-23)
    node 0 cpus: 0 1 2 3 4 5 6 7
    node 0 size: 31943 MB
    node 0 free: 31663 MB
    node 1 cpus: 8 9 10 11 12 13 14 15
    node 1 size: 32253 MB
    node 1 free: 32112 MB
    node 2 cpus: 16 17 18 19 20 21 22 23
    node 2 size: 32253 MB
    node 2 free: 32101 MB
    node 3 cpus: 24 25 26 27 28 29 30 31
    node 3 size: 32253 MB
    node 3 free: 32100 MB
    node 4 cpus: 32 33 34 35 36 37 38 39
    node 4 size: 32253 MB
```

(Continued on next page)

Platform Notes (Continued)

```
node 4 free: 32043 MB
node 5 cpus: 40 41 42 43 44 45 46 47
node 5 size: 32253 MB
node 5 free: 32103 MB
node 6 cpus: 48 49 50 51 52 53 54 55
node 6 size: 32253 MB
node 6 free: 32005 MB
node 7 cpus: 56 57 58 59 60 61 62 63
node 7 size: 32253 MB
node 7 free: 32123 MB
node 8 cpus: 64 65 66 67 68 69 70 71
node 8 size: 32253 MB
node 8 free: 32084 MB
node 9 cpus: 72 73 74 75 76 77 78 79
node 9 size: 32253 MB
node 9 free: 32123 MB
node 10 cpus: 80 81 82 83 84 85 86 87
node 10 size: 32253 MB
node 10 free: 31997 MB
node 11 cpus: 88 89 90 91 92 93 94 95
node 11 size: 32253 MB
node 11 free: 32136 MB
node 12 cpus: 96 97 98 99 100 101 102 103
node 12 size: 32253 MB
node 12 free: 32136 MB
node 13 cpus: 104 105 106 107 108 109 110 111
node 13 size: 32218 MB
node 13 free: 32104 MB
node 14 cpus: 112 113 114 115 116 117 118 119
node 14 size: 32253 MB
node 14 free: 32141 MB
node 15 cpus: 120 121 122 123 124 125 126 127
node 15 size: 32253 MB
node 15 free: 32138 MB
node 16 cpus: 128 129 130 131 132 133 134 135
node 16 size: 32253 MB
node 16 free: 32151 MB
node 17 cpus: 136 137 138 139 140 141 142 143
node 17 size: 32253 MB
node 17 free: 32140 MB
node 18 cpus: 144 145 146 147 148 149 150 151
node 18 size: 32253 MB
node 18 free: 32138 MB
node 19 cpus: 152 153 154 155 156 157 158 159
node 19 size: 32253 MB
node 19 free: 32141 MB
node 20 cpus: 160 161 162 163 164 165 166 167
```

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Platform Notes (Continued)

```
node 20 size: 32253 MB
node 20 free: 32132 MB
node 21 cpus: 168 169 170 171 172 173 174 175
node 21 size: 32200 MB
node 21 free: 32082 MB
node 22 cpus: 176 177 178 179 180 181 182 183
node 22 size: 32253 MB
node 22 free: 32142 MB
node 23 cpus: 184 185 186 187 188 189 190 191
node 23 size: 32253 MB
node 23 free: 32134 MB
node distances:
node   0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
20  21  22  23
  0:  10  12  12  12  11  12  12  12  11  12  12  12  32  32  32  32  32  32  32  32
  32  32  32  32
  1:  12  10  12  12  12  11  12  12  12  11  12  12  32  32  32  32  32  32  32  32
  32  32  32  32
  2:  12  12  10  12  12  12  11  12  12  12  11  12  32  32  32  32  32  32  32  32
  32  32  32  32
  3:  12  12  12  10  12  12  12  11  12  12  12  11  32  32  32  32  32  32  32  32
  32  32  32  32
  4:  11  12  12  12  10  12  12  12  11  12  12  12  32  32  32  32  32  32  32  32
  32  32  32  32
  5:  12  11  12  12  12  10  12  12  12  11  12  12  32  32  32  32  32  32  32  32
  32  32  32  32
  6:  12  12  11  12  12  12  10  12  12  12  11  12  32  32  32  32  32  32  32  32
  32  32  32  32
  7:  12  12  12  11  12  12  12  10  12  12  12  11  32  32  32  32  32  32  32  32
  32  32  32  32
  8:  11  12  12  12  11  12  12  12  10  12  12  12  32  32  32  32  32  32  32  32
  32  32  32  32
  9:  12  11  12  12  12  11  12  12  12  10  12  12  32  32  32  32  32  32  32  32
  32  32  32  32
 10:  12  12  11  12  12  12  11  12  12  12  10  12  32  32  32  32  32  32  32  32
 32  32  32  32
 11:  12  12  12  11  12  12  12  11  12  12  12  10  32  32  32  32  32  32  32  32
 32  32  32  32
 12:  32  32  32  32  32  32  32  32  32  32  32  32  10  12  12  12  11  12  12  12
 11  12  12  12
 13:  32  32  32  32  32  32  32  32  32  32  32  32  12  10  12  12  12  11  12  12
 12  11  12  12
 14:  32  32  32  32  32  32  32  32  32  32  32  32  12  12  10  12  12  12  11  12
 12  12  11  12
 15:  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  10  12  12  12  11
 12  12  12  11
 16:  32  32  32  32  32  32  32  32  32  32  32  32  11  12  12  12  10  12  12  12
```

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Platform Notes (Continued)

```
    11  12  12  12
    17:  32  32  32  32  32  32  32  32  32  32  32  32  12  11  12  12  12  10  12  12
    12  11  12  12
    18:  32  32  32  32  32  32  32  32  32  32  32  32  12  12  11  12  12  12  10  12
    12  12  11  12
    19:  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  11  12  12  12  10
    12  12  12  11
    20:  32  32  32  32  32  32  32  32  32  32  32  32  11  12  12  12  11  12  12  12
    10  12  12  12
    21:  32  32  32  32  32  32  32  32  32  32  32  32  12  11  12  12  12  11  12  12
    12  10  12  12
    22:  32  32  32  32  32  32  32  32  32  32  32  32  12  12  11  12  12  12  11  12
    12  12  10  12
    23:  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  11  12  12  12  11
    12  12  12  10

  From /proc/meminfo
     MemTotal:       792263924 kB
     HugePages_Total:       0
     Hugepagesize:       2048 kB

  /sbin/tuned-adm active
      Current active profile: balanced

  /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 admin1 5.15.0-50-generic #56-Ubuntu SMP Tue Sep 20 13:23:26 UTC 2022 x86_64
     x86_64 x86_64 GNU/Linux

  Kernel self-reported vulnerability status:
```

(Continued on next page)

Platform Notes (Continued)

```
 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,
                                                        PBRSB-eIBRS: Not affected
 CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
 CVE-2019-11135 (TSX Asynchronous Abort):               Not affected

 run-level 5 Oct 23 13:27

 SPEC is set to: /home/CPU2017
    Filesystem                         Type  Size  Used Avail Use% Mounted on
    /dev/mapper/ubuntu--vg-ubuntu--lv ext4  437G  142G  277G  34% /

 From /sys/devices/virtual/dmi/id
     Vendor:         HPE
     Product:        ProLiant DL365 Gen11
     Product Family: ProLiant
     Serial:         DL365G11-001

 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 Hynix HMCG88MEBRA113N 32 GB 2 rank 4800

 BIOS:
    BIOS Vendor:       HPE
    BIOS Version:      1.10
    BIOS Date:         10/06/2022
    BIOS Revision:     1.10
    Firmware Revision: 1.10

 (End of data from sysinfo program)
```

Compiler Version Notes

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

==============================================================================
Fortran | 648.exchange2_s(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

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`

Peak Compiler Invocation

C benchmarks:
`clang`

C++ benchmarks:
`clang++`

Fortran benchmarks:
`flang`

Peak Portability Flags

`Same as Base Portability Flags`

Peak Optimization Flags

C benchmarks:

600.perlbench_s: `basepeak = yes`

602.gcc_s: `basepeak = yes`

605.mcf_s: `-m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6`
`-Wl,-mllvm -Wl,-reduce-array-computations=3`
`-Wl,-allow-multiple-definition -Ofast -march=znver4`
`-fveclib=AMDLIBM -ffast-math -fopenmp -flto`
`-fstruct-layout=9 -mllvm -unroll-threshold=50`
`-fremap-arrays -fstrip-mining`
`-mllvm -inline-threshold=1000`
`-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt`

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Peak Optimization Flags (Continued)

605.mcf_s (continued):
-fopenmp=libomp -lomp -lamdlibm -lamdalloc -lflang

625.x264_s: basepeak = yes

657.xz_s: basepeak = yes

C++ benchmarks:

620.omnetpp_s: basepeak = yes

623.xalancbmk_s: -m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-do-block-reorder=aggressive -Ofast
-march=znver4 -fveclib=AMDLIBM -ffast-math -fopenmp
-flto -finline-aggressive -mllvm -unroll-threshold=100
-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt
-mllvm -do-block-reorder=aggressive
-fvirtual-function-elimination -fvisibility=hidden
-fopenmp=libomp -lomp -lamdlibm -lamdalloc-ext -lflang

631.deepsjeng_s: basepeak = yes

641.leela_s: basepeak = yes

Fortran benchmarks:

648.exchange2_s: basepeak = yes

Peak 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/HPE-Platform-Flags-AMD-Genoa-rev2.0.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/HPE-Platform-Flags-AMD-Genoa-rev2.0.xml
http://www.spec.org/cpu2017/flags/aocc400-flags.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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