SPEC CPU®2017 Integer Rate Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

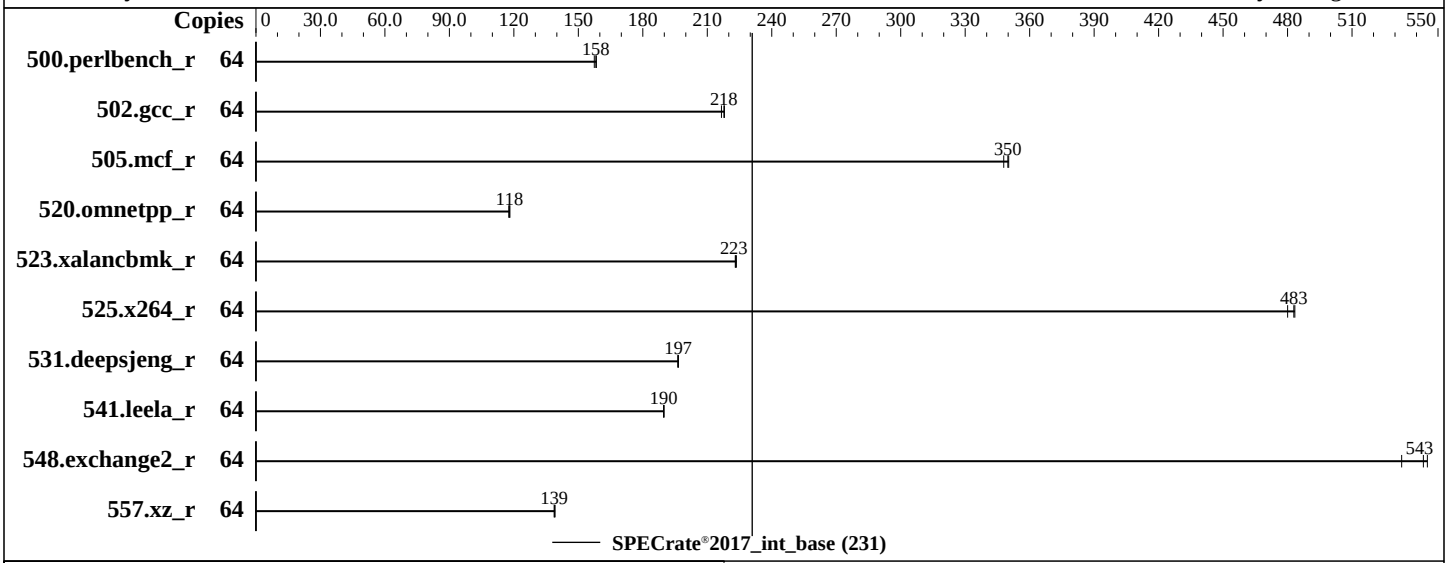
ProLiant DL385 Gen10
(3.00 GHz, AMD EPYC 7302)

SPECrate®2017_int_base = 231

SPECrate®2017_int_peak = Not Run

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

Test Date: Aug-2019
Hardware Availability: Aug-2019
Software Availability: Aug-2019



Hardware

CPU Name:	AMD EPYC 7302
Max MHz:	3300
Nominal:	3000
Enabled:	32 cores, 2 chips, 2 threads/core
Orderable:	1, 2 chip(s)
Cache L1:	32 KB I + 32 KB D on chip per core
L2:	512 KB I+D on chip per core
L3:	128 MB I+D on chip per chip, 16 MB shared / 2 cores
Other:	None
Memory:	512 GB (16 x 32 GB 2Rx4 PC4-2933Y-R)
Storage:	1 x 400 GB SAS SSD, RAID 0
Other:	None

Software

OS:	SUSE Linux Enterprise Server 15 (x86_64) SP1 Kernel 4.12.14-195-default
Compiler:	C/C++/Fortran: Version 2.0.0 of AOCC
Parallel:	No
Firmware:	HPE BIOS Version A40 07/20/2019 released Aug-2019
File System:	xfs
System State:	Run level 3 (multi-user)
Base Pointers:	64-bit
Peak Pointers:	Not Applicable
Other:	jemalloc: jemalloc memory allocator library V5.2.0;
Power Management:	--

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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	**644**	**158**	643	158	647	157							
502.gcc_r	64	418	217	416	218	**416**	**218**							
505.mcf_r	64	295	350	297	348	**296**	**350**							
520.omnetpp_r	64	714	118	**712**	**118**	711	118							
523.xalancbmk_r	64	303	223	**303**	**223**	302	224							
525.x264_r	64	**232**	**483**	232	483	233	480							
531.deepsjeng_r	64	**373**	**197**	373	197	374	196							
541.leela_r	64	**559**	**190**	559	190	558	190							
548.exchange2_r	64	308	545	**309**	**543**	315	533							
557.xz_r	64	498	139	**498**	**139**	497	139							

SPECrate®2017_int_base = 231

SPECrate®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
'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>

Set dirty_ratio=8 to limit dirty cache to 8% of memory
Set swappiness=1 to swap only if necessary
Set zone_reclaim_mode=1 to free local node memory and avoid remote memory
sync then drop_caches=3 to reset caches before invoking runcpu

dirty_ratio, swappiness, zone_reclaim_mode and drop_caches were
all set using privileged echo (e.g. echo 1 > /proc/sys/vm/swappiness).
```

(Continued on next page)

Operating System Notes (Continued)

```
Transparent huge pages set to 'always' for this run (OS default)
```

General Notes

```
Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = "/home/cpu2017_A2/amd_rate_aocc200_rome_A_lib/64;
/home/cpu2017_A2/amd_rate_aocc200_rome_A_lib/32:"
MALLOC_CONF = "retain:true"

Binaries were compiled on a system with 2p AMD EPYC 7601 CPU + 512GB Memory using Fedora 26

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.
jemalloc: configured and built with GCC 9.1.0 in Ubuntu 19.04
with flags: -Ofast -march=znver2. jemalloc 5.2.0 is available here:
https://github.com/jemalloc/jemalloc/releases/download/5.2.0/jemalloc-5.2.0.tar.bz2
```

Platform Notes

```
BIOS Configuration
 Thermal Configuration set to Maximum Cooling
 Determinism Control set to Manual
 Performance Determinism set to Power Deterministic
 Minimum Processor Idle Power core C-State set to C6 State
 Memory Patrol Scrubbing set to Disabled
 Workload Profile set to General Throughput Compute
 NUMA memory domains per socket set to Four memory domains per socket
 Sysinfo program /home/cpu2017_A2/bin/sysinfo
 Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9
 running on dl385-gen10-rome-64c Sat Feb 16 03:07:02 2019

 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 7302 16-Core Processor
       2  "physical id"s (chips)
       64 "processors"
    cores, siblings (Caution: counting these is hw and system dependent. The following
```

(Continued on next page)

Platform Notes (Continued)

```
    excerpts from /proc/cpuinfo might not be reliable.  Use with caution.)
       cpu cores : 16
       siblings  : 32
       physical 0: cores 0 1 4 5 8 9 12 13 16 17 20 21 24 25 28 29
       physical 1: cores 0 1 4 5 8 9 12 13 16 17 20 21 24 25 28 29

  From lscpu:
       Architecture:        x86_64
       CPU op-mode(s):      32-bit, 64-bit
       Byte Order:          Little Endian
       Address sizes:       48 bits physical, 48 bits virtual
       CPU(s):              64
       On-line CPU(s) list: 0-63
       Thread(s) per core:  2
       Core(s) per socket:  16
       Socket(s):           2
       NUMA node(s):        8
       Vendor ID:           AuthenticAMD
       CPU family:          23
       Model:               49
       Model name:          AMD EPYC 7302 16-Core Processor
       Stepping:            0
       CPU MHz:             3000.000
       CPU max MHz:         3000.0000
       CPU min MHz:         1500.0000
       BogoMIPS:            5988.40
       Virtualization:      AMD-V
       L1d cache:           32K
       L1i cache:           32K
       L2 cache:            512K
       L3 cache:            16384K
       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
       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 xtopology nonstop_tsc cpuid extd_apicid aperfmperf pni
      pclmulqdq monitor ssse3 fma cx16 sse4_1 sse4_2 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_l2 mwaitx cpb
      cat_l3 cdp_l3 hw_pstate ssbd ibrs ibpb stibp vmmcall fsgsbase bmi1 avx2 smep bmi2
      cqm rdt_a rdseed adx smap clflushopt clwb sha_ni xsaveopt xsavec xgetbv1 xsaves
```

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Platform Notes (Continued)

```
      cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local clzero irperf xsaveerptr arat npt
      lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter
      pfthreshold avic v_vmsave_vmload vgif umip rdpid overflow_recov succor smca

 /proc/cpuinfo cache data
    cache size : 512 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 32 33 34 35
   node 0 size: 64219 MB
   node 0 free: 64096 MB
   node 1 cpus: 4 5 6 7 36 37 38 39
   node 1 size: 64509 MB
   node 1 free: 64402 MB
   node 2 cpus: 8 9 10 11 40 41 42 43
   node 2 size: 64509 MB
   node 2 free: 64403 MB
   node 3 cpus: 12 13 14 15 44 45 46 47
   node 3 size: 64497 MB
   node 3 free: 64407 MB
   node 4 cpus: 16 17 18 19 48 49 50 51
   node 4 size: 64480 MB
   node 4 free: 64365 MB
   node 5 cpus: 20 21 22 23 52 53 54 55
   node 5 size: 64509 MB
   node 5 free: 64416 MB
   node 6 cpus: 24 25 26 27 56 57 58 59
   node 6 size: 64509 MB
   node 6 free: 64413 MB
   node 7 cpus: 28 29 30 31 60 61 62 63
   node 7 size: 64298 MB
   node 7 free: 64213 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
    MemTotal:       527908340 kB
```

(Continued on next page)

Platform Notes (Continued)

```
    HugePages_Total:       0
    Hugepagesize:       2048 kB

  From /etc/*release* /etc/*version*
    os-release:
       NAME="SLES"
       VERSION="15-SP1"
       VERSION_ID="15.1"
       PRETTY_NAME="SUSE Linux Enterprise Server 15 SP1"
       ID="sles"
       ID_LIKE="suse"
       ANSI_COLOR="0;32"
       CPE_NAME="cpe:/o:suse:sles:15:sp1"

  uname -a:
    Linux dl385-gen10-rome-64c 4.12.14-195-default #1 SMP Tue May 7 10:55:11 UTC 2019
    (8fba516) x86_64 x86_64 x86_64 GNU/Linux

  Kernel self-reported vulnerability status:

  CVE-2017-5754 (Meltdown):          Not affected
  CVE-2017-5753 (Spectre variant 1): Mitigation: __user pointer sanitization
  CVE-2017-5715 (Spectre variant 2): Mitigation: Full AMD retpoline, IBPB: conditional,
  IBRS_FW, STIBP: conditional, RSB filling

  run-level 3 Feb 14 08:21

  SPEC is set to: /home/cpu2017_A2
    Filesystem     Type   Size  Used Avail Use% Mounted on
    /dev/sda2      btrfs  371G   52G  318G  14% /home

  Additional information from dmidecode 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.
    BIOS HPE A40 07/20/2019
    Memory:
     16x UNKNOWN NOT AVAILABLE
     16x UNKNOWN NOT AVAILABLE 32 GB 2 rank 2933

  (End of data from sysinfo program)
```

Compiler Version Notes

```
==============================================================================
C       | 500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base)
```

(Continued on next page)

Compiler Version Notes (Continued)

```
        | 525.x264_r(base) 557.xz_r(base)
------------------------------------------------------------------------------
AOCC.LLVM.2.0.0.B179.2019_06_12 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#179) (based on LLVM AOCC.LLVM.2.0.0.B179.2019_06_12)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-2.0.0/bin
------------------------------------------------------------------------------

==============================================================================
C++     | 520.omnetpp_r(base) 523.xalancbmk_r(base) 531.deepsjeng_r(base)
        | 541.leela_r(base)
------------------------------------------------------------------------------
AOCC.LLVM.2.0.0.B179.2019_06_12 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#179) (based on LLVM AOCC.LLVM.2.0.0.B179.2019_06_12)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-2.0.0/bin
------------------------------------------------------------------------------

==============================================================================
Fortran | 548.exchange2_r(base)
------------------------------------------------------------------------------
AOCC.LLVM.2.0.0.B179.2019_06_12 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#179) (based on LLVM AOCC.LLVM.2.0.0.B179.2019_06_12)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-2.0.0/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:
```
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -ffast-math
-march=znver2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-fremap-arrays -mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp
-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000
-flv-function-specialization -z muldefs -lmvec -lamdlibm -ljemalloc
-lflang
```

C++ benchmarks:
```
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-suppress-fmas -O3 -ffast-math -march=znver2
-mllvm -loop-unswitch-threshold=200000 -mllvm -vector-library=LIBMVEC
-mllvm -unroll-threshold=100 -flv-function-specialization
-mllvm -enable-partial-unswitch -z muldefs -lmvec -lamdlibm
-ljemalloc -lflang
```

Fortran benchmarks:
```
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -ffast-math
-Wl,-mllvm -Wl,-inline-recursion=4 -Wl,-mllvm -Wl,-lsr-in-nested-loop
-Wl,-mllvm -Wl,-enable-iv-split -O3 -march=znver2 -funroll-loops
-Mrecursive -mllvm -vector-library=LIBMVEC -z muldefs
-mllvm -disable-indvar-simplify -mllvm -unroll-aggressive
-mllvm -unroll-threshold=150 -lmvec -lamdlibm -ljemalloc -lflang
```

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/aocc200-flags-C1-HPE.html
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-V1.2-EPYC-revE.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/aocc200-flags-C1-HPE.xml
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-V1.2-EPYC-revE.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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