



# SPEC CPU®2017 Floating Point Rate Result

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## Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant XL225n Gen10 Plus  
(2.80 GHz, AMD EPYC 7282)

SPECrate®2017\_fp\_base = 198

SPECrate®2017\_fp\_peak = Not Run

CPU2017 License: 3

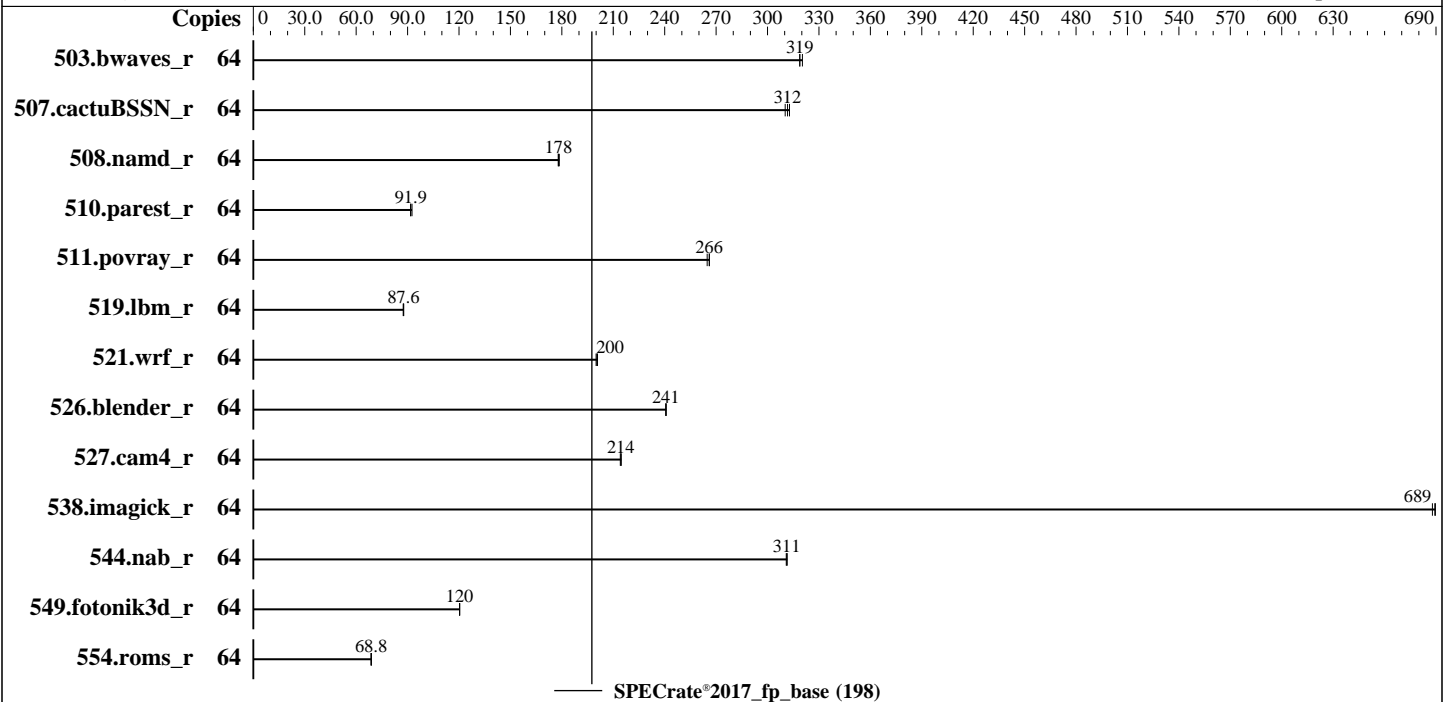
Test Sponsor: HPE

Tested by: HPE

Test Date: Jun-2020

Hardware Availability: Jun-2020

Software Availability: Apr-2020



### Hardware

CPU Name: AMD EPYC 7282  
 Max MHz: 3200  
 Nominal: 2800  
 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: 64 MB I+D on chip per chip, 16 MB shared / 4 cores  
 Other: None  
 Memory: 1 TB (16 x 64 GB 2Rx4 PC4-3200AA-R)  
 Storage: 1 x 960 GB SATA SSD, RAID 0  
 Other: None

### Software

OS: SUSE Linux Enterprise Server 15 (x86\_64) SP1  
 Kernel 4.12.14-197.40-default  
 Compiler: C/C++/Fortran: Version 2.0.0 of AOCC  
 Parallel: No  
 Firmware: HPE BIOS Version A46 1.24 05/04/2020 released Jun-2020  
 File System: btrfs  
 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: BIOS 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 |
| 503.bwaves_r    | 64     | 2003        | 320         | 2013        | 319         | <u>2013</u> | <u>319</u> |        |         |       |         |       |         |       |
| 507.cactuBSSN_r | 64     | 261         | 310         | <u>260</u>  | <u>312</u>  | 259         | 313        |        |         |       |         |       |         |       |
| 508.namd_r      | 64     | <u>341</u>  | <u>178</u>  | 341         | 179         | 342         | 178        |        |         |       |         |       |         |       |
| 510.parest_r    | 64     | <u>1822</u> | <u>91.9</u> | 1825        | 91.7        | 1808        | 92.6       |        |         |       |         |       |         |       |
| 511.povray_r    | 64     | 562         | 266         | 564         | 265         | <u>562</u>  | <u>266</u> |        |         |       |         |       |         |       |
| 519.lbm_r       | 64     | <u>770</u>  | <u>87.6</u> | 771         | 87.4        | 769         | 87.7       |        |         |       |         |       |         |       |
| 521.wrf_r       | 64     | <u>715</u>  | <u>200</u>  | 714         | 201         | 717         | 200        |        |         |       |         |       |         |       |
| 526.blender_r   | 64     | 405         | 241         | <u>405</u>  | <u>241</u>  | 405         | 241        |        |         |       |         |       |         |       |
| 527.cam4_r      | 64     | 522         | 215         | <u>522</u>  | <u>214</u>  | 523         | 214        |        |         |       |         |       |         |       |
| 538.imagick_r   | 64     | <u>231</u>  | <u>689</u>  | 231         | 690         | 231         | 688        |        |         |       |         |       |         |       |
| 544.nab_r       | 64     | 346         | 311         | 346         | 311         | <u>346</u>  | <u>311</u> |        |         |       |         |       |         |       |
| 549.fotonik3d_r | 64     | 2072        | 120         | 2073        | 120         | <u>2072</u> | <u>120</u> |        |         |       |         |       |         |       |
| 554.roms_r      | 64     | 1480        | 68.7        | <u>1479</u> | <u>68.8</u> | 1476        | 68.9       |        |         |       |         |       |         |       |

SPECrate®2017\_fp\_base = 198

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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  
'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

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## Operating System Notes (Continued)

dirty\_ratio, swappiness, zone\_reclaim\_mode and drop\_caches were all set using privileged echo (e.g. echo 1 > /proc/sys/vm/swappiness).

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

## Environment Variables Notes

Environment variables set by runcpu before the start of the run:

```
LD_LIBRARY_PATH =  
    "/cpu2017/amd_rate_aocc200_rome_C_lib/64;/cpu2017/amd_rate_aocc200_rome_  
    C_lib/32:"  
MALLOC_CONF = "retain:true"
```

## General Notes

Binaries were compiled on a system with 2x 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 v9.1.0 in Ubuntu 19.04 with -O3 -znver2 -flto  
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:

Determinism Control set to Manual  
Performance Determinism set to Power Deterministic  
Memory Patrol Scrubbing set to Disabled  
Thermal Configuration set to Maximum Cooling  
NUMA memory domains per socket set to Four memory domains per socket  
Last-Level Cache (LLC) As NUMA Node set to Disabled  
Workload Profile set to General Throughput Compute

Sysinfo program /cpu2017/bin/sysinfo  
Rev: r6365 of 2019-08-21 295195f888a3d7edble6e46a485a0011  
running on xl225gen10plus Fri Apr 17 23:24:20 2020

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## Platform Notes (Continued)

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 7282 16-Core Processor
 2 "physical id"s (chips)
 64 "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 : 16
siblings : 32
physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
```

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): 2
Vendor ID: AuthenticAMD
CPU family: 23
Model: 49
Model name: AMD EPYC 7282 16-Core Processor
Stepping: 0
CPU MHz: 2794.738
BogoMIPS: 5589.47
Virtualization: AMD-V
L1d cache: 32K
L1i cache: 32K
L2 cache: 512K
L3 cache: 16384K
NUMA node0 CPU(s): 0-15,32-47
NUMA node1 CPU(s): 16-31,48-63
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 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
```

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## Platform Notes (Continued)

```
rdseed adx smap clflushopt clwb sha_ni xsaveopt xsavec xgetbv1 xsaves 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: 2 nodes (0-1)
node 0 cpus: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 32 33 34 35 36 37 38 39 40 41 42 43
44 45 46 47
node 0 size: 515767 MB
node 0 free: 515070 MB
node 1 cpus: 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 48 49 50 51 52 53 54 55 56
57 58 59 60 61 62 63
node 1 size: 516058 MB
node 1 free: 515440 MB
node distances:
node 0 1
0: 10 32
1: 32 10
```

```
From /proc/meminfo
MemTotal: 1056589332 kB
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 xl225gen10plus 4.12.14-197.40-default #1 SMP Fri Apr 17 12:23:07 UTC 2020
(b27cbb3) x86_64 x86_64 x86_64 GNU/Linux
```

Kernel self-reported vulnerability status:

```
itlb_multihit: Not affected
```

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## Platform Notes (Continued)

CVE-2018-3620 (L1 Terminal Fault): Not affected  
 Microarchitectural Data Sampling: Not affected  
 CVE-2017-5754 (Meltdown): 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/swaps barriers and \_\_user pointer sanitization  
 CVE-2017-5715 (Spectre variant 2): Mitigation: Full AMD retpoline, IBPB: conditional, IBRS\_FW, STIBP: conditional, RSB filling  
 tsx\_async\_abort: Not affected

run-level 3 Apr 17 09:13

SPEC is set to: /cpu2017

| Filesystem | Type  | Size | Used | Avail | Use% | Mounted on |
|------------|-------|------|------|-------|------|------------|
| /dev/sda3  | btrfs | 351G | 15G  | 336G  | 5%   | /          |

From /sys/devices/virtual/dmi/id  
 BIOS: HPE A46 05/04/2020  
 Vendor: HPE  
 Product: ProLiant XL225n Gen10 Plus  
 Product Family: ProLiant  
 Serial: T19CPP0023

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.

Memory:  
 16x Micron 36ASF8G72PZ-3G2B2 64 GB 2 rank 3200

(End of data from sysinfo program)

## Compiler Version Notes

```
=====
C | 519.lbm_r(base) 538.imagick_r(base) 544.nab_r(base)
-----
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
=====
```

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## Compiler Version Notes (Continued)

=====  
C++ | 508.namd\_r(base) 510.parest\_r(base)  
-----

AOCC.LLVM.2.0.0.B191.2019\_07\_19 clang version 8.0.0 (CLANG: Jenkins  
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Target: x86\_64-unknown-linux-gnu  
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-----

=====  
C++, C | 511.povray\_r(base) 526.blender\_r(base)  
-----

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InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin  
-----

=====  
C++, C, Fortran | 507.cactuBSSN\_r(base)  
-----

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Target: x86\_64-unknown-linux-gnu  
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-----

=====  
Fortran | 503.bwaves\_r(base) 549.fotonik3d\_r(base) 554.roms\_r(base)  
-----

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Target: x86\_64-unknown-linux-gnu  
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-----

=====  
Fortran, C | 521.wrf\_r(base) 527.cam4\_r(base)  
-----

AOCC.LLVM.2.0.0.B191.2019\_07\_19 clang version 8.0.0 (CLANG: Jenkins  
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Target: x86\_64-unknown-linux-gnu  
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InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin  
-----

## Base Compiler Invocation

C benchmarks:  
clang

C++ benchmarks:  
clang++

Fortran benchmarks:  
flang

Benchmarks using both Fortran and C:  
flang clang

Benchmarks using both C and C++:  
clang++ clang

Benchmarks using Fortran, C, and C++:  
clang++ clang flang





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## Base Portability Flags

```
503.bwaves_r: -DSPEC_LP64
507.cactuBSSN_r: -DSPEC_LP64
508.namd_r: -DSPEC_LP64
510.parest_r: -DSPEC_LP64
511.povray_r: -DSPEC_LP64
519.lbm_r: -DSPEC_LP64
521.wrf_r: -DSPEC_CASE_FLAG -Mbyteswapio -DSPEC_LP64
526.blender_r: -funsigned-char -D__BOOL_DEFINED -DSPEC_LP64
527.cam4_r: -DSPEC_CASE_FLAG -DSPEC_LP64
538.imagick_r: -DSPEC_LP64
544.nab_r: -DSPEC_LP64
549.fotonik3d_r: -DSPEC_LP64
554.roms_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
-freemap-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:

```
-std=c++98 -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 -O3 -march=znver2
-funroll-loops -Mrecursive -mllvm -vector-library=LIBMVEC -z muldefs
-Kieee -fno-finite-math-only -lmvec -lamdlibm -ljemalloc -lflang
```

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## Base Optimization Flags (Continued)

Benchmarks using both Fortran and C:

```
-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
-freemap-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 -funroll-loops -Mrecursive -z muldefs
-Kieee -fno-finite-math-only -lmvec -lamdlibm -ljemalloc -lflang
```

Benchmarks using both C and C++:

```
-std=c++98 -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
-fstruct-layout=3 -mllvm -unroll-threshold=50 -freemap-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 -mllvm -loop-unswitch-threshold=200000
-mllvm -unroll-threshold=100 -mllvm -enable-partial-unswitch -z muldefs
-lmvec -lamdlibm -ljemalloc -lflang
```

Benchmarks using Fortran, C, and C++:

```
-std=c++98 -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
-fstruct-layout=3 -mllvm -unroll-threshold=50 -freemap-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 -mllvm -loop-unswitch-threshold=200000
-mllvm -unroll-threshold=100 -mllvm -enable-partial-unswitch
-funroll-loops -Mrecursive -z muldefs -Kieee -fno-finite-math-only
-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-revJ.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-revJ.xml>



# SPEC CPU®2017 Floating Point Rate Result

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**Hewlett Packard Enterprise**

(Test Sponsor: HPE)

ProLiant XL225n Gen10 Plus  
(2.80 GHz, AMD EPYC 7282)

SPECrate®2017\_fp\_base = 198

SPECrate®2017\_fp\_peak = Not Run

**CPU2017 License:** 3

**Test Sponsor:** HPE

**Tested by:** HPE

**Test Date:** Jun-2020

**Hardware Availability:** Jun-2020

**Software Availability:** Apr-2020

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