**SPEC CPU®2017 Floating Point Rate Result**

**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
ProLiant DL360 Gen10  
(3.20 GHz, Intel Xeon Silver 4215R)

**SPECrate®2017_fp_base = 109**  
**SPECrate®2017_fp_peak = 114**

<table>
<thead>
<tr>
<th>Test Sponsor: HPE</th>
<th>Hardware Availability: Apr-2020</th>
<th>Software Availability: Jun-2019</th>
</tr>
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<tbody>
<tr>
<td>Tested by: HPE</td>
<td></td>
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<tr>
<td>CPU2017 License: 3</td>
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</table>

### Hardware

- **CPU Name:** Intel Xeon Silver 4215R  
- **Max MHz:** 4000  
- **Nominal:** 3200  
- **Enabled:** 16 cores, 2 chips, 2 threads/core  
- **Orderable:** 1, 2 chip(s)  
- **Cache L1:** 32 KB I + 32 KB D on chip per core  
- **L2:** 1 MB I+D on chip per core  
- **L3:** 11 MB I+D on chip per chip  
- **Other:** None  
- **Memory:** 384 GB (24 x 16 GB 2Rx8 PC4-2933Y-R, running at 2400)  
- **Storage:** 1 x 400 GB SAS SSD, RAID 0  
- **Other:** None  

### Software

- **OS:** SUSE Linux Enterprise Server 15 SP1 (x86_64)  
  - Kernel 4.12.14-195-default  
- **Compiler:** C/C++: Version 19.0.4.227 of Intel C/C++ Compiler Build 20190416 for Linux;  
  - Fortran: Version 19.0.4.227 of Intel Fortran Compiler Build 20190416 for Linux;  
- **Parallel:** No  
- **Firmware:** HPE BIOS Version U32 v2.22 (11/13/2019) released Apr-2020  
- **File System:** btrfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 64-bit  
- **Other:** None  
- **Power Management:** BIOS set to prefer performance at the cost of additional power usage

---

<table>
<thead>
<tr>
<th>SPECrate®2017_fp_base</th>
<th>SPECrate®2017_fp_peak</th>
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SPECrate®2017_fp_base = 109
SPECrate®2017_fp_peak = 114

Results Table

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<thead>
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</table>

Submit Notes

The numactl mechanism was used to bind copies to processors. The config file option 'submit' was used to generate numactl commands to bind each copy to a specific processor. For details, please see the config file.

Operating System Notes

Stack size set to unlimited using "ulimit -s unlimited"
Transparent Huge Pages enabled by default
Prior to runcpu invocation
Filesystem page cache synced and cleared with:
    sync; echo 3 > /proc/sys/vm/drop_caches

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = "/cpu2017/lib/intel64"

General Notes

Binaries compiled on a system with 1x Intel Core i9-7900X CPU + 32GB RAM
memory using Redhat Enterprise Linux 7.5
NA: The test sponsor attests, as of date of publication, that CVE-2017-5754 (Meltdown)

(Continued on next page)
General Notes (Continued)

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:
Thermal Configuration set to Maximum Cooling
Memory Patrol Scrubbing set to Disabled
LLC Prefetch set to Enabled
LLC Dead Line Allocation set to Disabled
Enhanced Processor Performance set to Enabled
Workload Profile set to General Throughput Compute
Workload Profile set to Custom
Energy/Performance Bias set to Balanced Performance

Sysinfo program /cpu2017/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7edble6e46a485a0011
running on linux-9e6o Sun Mar 1 21:24:01 2020

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 : Intel(R) Xeon(R) Silver 4215R CPU @ 3.20GHz
  2   "physical id"s (chips)
  32   "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 : 8
siblings : 16
physical 0: cores 0 1 2 3 4 5 6 7
physical 1: cores 0 1 2 3 4 5 6 7

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
Address sizes: 46 bits physical, 48 bits virtual
CPU(s): 32
On-line CPU(s) list: 0-31
Thread(s) per core: 2
Core(s) per socket: 8
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Test Sponsor: HPE
Tested by: HPE

Platform Notes (Continued)

Socket(s): 2
NUMA node(s): 2
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Silver 4215R CPU @ 3.20GHz
Stepping: 7
CPU MHz: 3200.000
BogoMIPS: 6400.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 11264K
NUMA node0 CPU(s): 0-7,16-23
NUMA node1 CPU(s): 8-15,24-31

Flags: fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdelgb rdtscp
lm constant_tsc arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid
aperfmperf pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16
xtpmr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave
avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb cat_l3 cdp_l3
invhyp_single intel_pni ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vmi
flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm
cqm mpx rdt_a avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd
avx512bw avx512vl xsaveopt xsaves cqm_llc cqm_occup_llc cqm_mbm_total
cqm_mbm_local dtherm ida arat pln pts pku ospke avx512_vnni md_clear flush_l1d
arch_capabilities

From /proc/cpuinfo cache data
cache size : 11264 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 16 17 18 19 20 21 22 23
node 0 size: 193128 MB
node 0 free: 190808 MB
node 1 cpus: 8 9 10 11 12 13 14 15 24 25 26 27 28 29 30 31
node 1 size: 193502 MB
node 1 free: 193135 MB
node distances:
  node 0:  10  21
  node 1:  21  10

From /proc/meminfo

(Continued on next page)
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-spec-  
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Platform Notes (Continued)

MemTotal: 395910320 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 linux-9e6o 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-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: __user pointer sanitization  
CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling

run-level 3 Mar 1 21:21

SPEC is set to: /cpu2017  
Filesystem Type Size Used Avail Use% Mounted on  
/dev/sda2 btrfs 369G 135G 234G 37% /

From /sys/devices/virtual/dmi/id  
  BIOS: HPE U32 11/13/2019  
  Vendor: HPE  
  Product: ProLiant DL360 Gen10  
  Product Family: ProLiant  
  Serial: MXQ94204PS

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.

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Platform Notes (Continued)

Memory:
24x UNKNOWN NOT AVAILABLE 16 GB 2 rank 2933

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
C | 519.lbm_r(base, peak) 538.imagick_r(base, peak)
   544.nab_r(base, peak)
==============================================================================
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

==============================================================================
C++ | 508.namd_r(base, peak) 510.parest_r(base, peak)
==============================================================================
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

==============================================================================
C++, C | 511.povray_r(base, peak) 526.blender_r(base, peak)
==============================================================================
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

==============================================================================
C++, C, Fortran | 507.cactuBSSN_r(base, peak)
==============================================================================
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
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Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.4.227 Build 20190416

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CPU2017 License: 3  
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Tested by: HPE

Compiler Version Notes (Continued)

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------------------------------------------------------------------------------
Fortran | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak)  
        | 554.roms_r(base, peak)
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Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)  
64, Version 19.0.4.227 Build 20190416  
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.
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Fortran, C | 521.wrf_r(base, peak) 527.cam4_r(base, peak)
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Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)  
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Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,  
Version 19.0.4.227 Build 20190416  
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------

Base Compiler Invocation

C benchmarks:  
icc -m64 -std=c11

C++ benchmarks:  
icpc -m64

Fortran benchmarks:  
ifort -m64

Benchmarks using both Fortran and C:  
ifort -m64 icc -m64 -std=c11

Benchmarks using both C and C++:  
icpc -m64 icc -m64 -std=c11

Benchmarks using Fortran, C, and C++:  
icpc -m64 icc -m64 -std=c11 ifort -m64
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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_LP64 -DSPEC_CASE_FLAG -convert big_endian
526.blender_r: -DSPEC_LP64 -DSPEC_LINUX -funsigned-char
527.cam4_r: -DSPEC_LP64 -DSPEC_CASE_FLAG
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:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4

C++ benchmarks:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4

Fortran benchmarks:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
-align array32byte

Benchmarks using both Fortran and C:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
-align array32byte

Benchmarks using both C and C++:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4

Benchmarks using Fortran, C, and C++:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
-align array32byte
**Peak Compiler Invocation**

C benchmarks:
```plaintext
icc -m64 -std=c11
```

C++ benchmarks:
```plaintext
icpc -m64
```

Fortran benchmarks:
```plaintext
ifort -m64
```

Benchmarks using both Fortran and C:
```plaintext
ifort -m64 icc -m64 -std=c11
```

Benchmarks using both C and C++:
```plaintext
icpc -m64 icc -m64 -std=c11
```

Benchmarks using Fortran, C, and C++:
```plaintext
icpc -m64 icc -m64 -std=c11 ifort -m64
```

**Peak Portability Flags**

Same as Base Portability Flags

**Peak Optimization Flags**

C benchmarks:
```plaintext
519.lbm_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4
```

```plaintext
538.imagick_r: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4
```

```plaintext
544.nab_r: Same as 538.imagick_r
```

C++ benchmarks:
```plaintext
508.namd_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4
```
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CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Test Date: Mar-2020
Hardware Availability: Apr-2020
Software Availability: Jun-2019

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SPECrater®2017_fp_peak = 114

Peak Optimization Flags (Continued)

510.parest_r: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4

Fortran benchmarks:
503.bwaves_r: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -auto
-nostandard-realloc-lhs -align array32byte
549.fotonik3d_r: same as 503.bwaves_r
554.roms_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
-align array32byte

Benchmarks using both Fortran and C:
-prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
-align array32byte

Benchmarks using both C and C++:
511.povray_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4
526.blender_r: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4

Benchmarks using Fortran, C, and C++:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
-align array32byte

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.2-CLX-revB.html
You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.2-CLX-revB.xml
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<td>ProLiant DL360 Gen10</td>
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<td>(3.20 GHz, Intel Xeon Silver 4215R)</td>
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| Test Sponsor: HPE         | Hardware Availability: | Apr-2020 |
| Tested by: HPE            | Software Availability: | Jun-2019 |

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