## SPEC CPU®2017 Floating Point Rate Result

**Hewlett Packard Enterprise**  
*Test Sponsor: HPE*  
**ProLiant DL360 Gen10 Plus**  
*(2.90 GHz, Intel Xeon Gold 6326)*  

**SPECrater®2017_fp_base = 292**  
**SPECrater®2017_fp_peak = 301**

### Hardware

<table>
<thead>
<tr>
<th>File</th>
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<th>SPECrate®2017_fp_base (292)</th>
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<td>544.nab_r</td>
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<td><strong>CPU Name:</strong></td>
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</tr>
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<td><strong>Max MHz:</strong></td>
<td>3500</td>
</tr>
<tr>
<td><strong>Nominal:</strong></td>
<td>2900</td>
</tr>
<tr>
<td><strong>Enabled:</strong></td>
<td>32 cores, 2 chips, 2 threads/core</td>
</tr>
<tr>
<td><strong>Orderable:</strong></td>
<td>1, 2 chip(s)</td>
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<tr>
<td><strong>Cache L1:</strong></td>
<td>32 KB I + 48 KB D on chip per core</td>
</tr>
<tr>
<td><strong>Cache L2:</strong></td>
<td>1.25 MB I+D on chip per core</td>
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<td><strong>Cache L3:</strong></td>
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<tr>
<td><strong>Memory:</strong></td>
<td>2 TB (32 x 64 GB 2Rx4 PC4-3200AA-R)</td>
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<td><strong>Storage:</strong></td>
<td>1 x 400 GB SAS SSD, RAID 0</td>
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### Software

<table>
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<tr>
<th>Item</th>
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<td><strong>OS:</strong></td>
<td>Red Hat Enterprise Linux 8.3 (Ootpa)</td>
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<td><strong>Compiler:</strong></td>
<td>C/C++: Version 2021.1 of Intel oneAPI DPC++/C++ Compiler Build 20201113 for Linux; Fortran: Version 2021.1 of Intel Fortran Compiler Classic Build 20201112 for Linux;</td>
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<td><strong>Parallel:</strong></td>
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<tr>
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<tr>
<td><strong>Peak Pointers:</strong></td>
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<td><strong>Other:</strong></td>
<td>jemalloc memory allocator V5.0.1</td>
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(Continued on next page)
SPEC CPU®2017 Floating Point Rate Result

**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
ProLiant DL360 Gen10 Plus  
(2.90 GHz, Intel Xeon Gold 6326)

**SPECrate®2017_fp_base = 292**  
**SPECrate®2017_fp_peak = 301**

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</table>

Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

**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:  
```bash  
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 =  
"/home/cpu2017_1.1.8/lib/intel64:/home/cpu2017_1.1.8/je5.0.1-64"  
MALLOC_CONF = "retain:true"  
```

Software (Continued)

Power Management: BIOS set to prefer performance at the cost of additional power usage
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Hewlett Packard Enterprise  
(Test Sponsor: HPE)  
ProLiant DL360 Gen10 Plus  
(2.90 GHz, Intel Xeon Gold 6326)  

<table>
<thead>
<tr>
<th>CPU2017 License:</th>
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<tr>
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<td>Hardware Availability:</td>
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<td>Software Availability:</td>
<td>Jun-2021</td>
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</table>

**SPECrate®2017_fp_base = 292**  
**SPECrate®2017_fp_peak = 301**

---

**General Notes**

Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM  
memory using Red Hat Enterprise Linux 8.1  
runcpu command invoked through numactl i.e.:  
numactl --interleave=all runcpu <etc>

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, a general purpose malloc implementation  
built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5  

Submitted by: "Bhatnagar, Prateek" <prateek.bhatnagar@hpe.com>  
Submitted: Mon Jun 21 10:21:12 EDT 2021  
Submission: cpu2017-20210621-27543.sub

---

**Platform Notes**

The system ROM used for this result contains Intel microcode version 0xd0002a0 for  
the Intel Xeon Gold 6326 processor.

- **BIOS Configuration:**  
  - Workload Profile set to General Throughput Compute  
  - Memory Patrol Scrubbing set to Disabled  
  - Advanced Memory Protection set to Advanced ECC  
  - Last Level Cache (LLC) Prefetch set to Enabled  
  - Last Level Cache (LLC) Dead Line Allocation set to Disabled  
  - Enhanced Processor Performance set to Enabled  
  - Enhanced Processor Performance Profile set to Aggressive  
  - Thermal Configuration set to Maximum Cooling  
  - Workload Profile set to Custom  
    - DCU Stream Prefetcher set to Disabled  
    - XPT Remote Prefetcher set to Enabled  
    - Energy/Performance Bias set to Balanced Performance

Sysinfo program /home/cpu2017_1.1.8/bin/sysinfo  
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16aaca64d4  
running on localhost.localdomain Tue Jun  8 23:16:14 2021

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) Gold 6326 CPU @ 2.90GHz  

(Continued on next page)
Platform Notes (Continued)

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 from util-linux 2.32.1:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
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): 4
Vendor ID: GenuineIntel
CPU family: 6
Model: 106
Model name: Intel(R) Xeon(R) Gold 6326 CPU @ 2.90GHz
Stepping: 6
CPU MHz: 3064.184
BogoMIPS: 5800.00
Virtualization: VT-x
L1d cache: 48K
L1i cache: 32K
L2 cache: 1280K
L3 cache: 24576K
NUMA node0 CPU(s): 0-7,32-39
NUMA node1 CPU(s): 8-15,40-47
NUMA node2 CPU(s): 16-23,48-55
NUMA node3 CPU(s): 24-31,56-63
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 pdpe1gb rdtscp
lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid
aerpmpref pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16
xtr 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_13 invpcid_single ssbd
mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vni flexpriority ept vpid ept_ad
fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid cqm rdt_a avx512ifma
rdseed adx smap avx512ifma clflushopt clwb intel_pt avx512vd avx512cd sha ni
avx512bw avx512vl xsaveopt xsavec xgetbv1 xsaveas cqm_llc cqm_occup_llc cqm_mmm_total
cqm_mbb_local split_lock_detect wbnoiwvd dtherm ida arat pin pts avx512vbmi umpk
ospke avx512_vbmi2 gfni vaes vpclmulqdq avx512_vnni avx512_bitalg tme

(Continued on next page)
SPEC CPU®2017 Floating Point Rate Result

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(Test Sponsor: HPE)
ProLiant DL360 Gen10 Plus
(2.90 GHz, Intel Xeon Gold 6326)

SPECrater®2017_fp_peak = 301
SPECrater®2017_fp_base = 292

CPU2017 License: 3
Test Date: Jun-2021
Test Sponsor: HPE
Tested by: HPE
Hardware Availability: Jun-2021
Software Availability: Jun-2021

Platform Notes (Continued)

avx512_vpopcntdq la57 rdpid md_clear pconfig flush_lld arch_capabilities

/proc/cpuinfo cache data
  cache size : 24576 KB

From numactl --hardware
WARNING: a numactl 'node' might or might not correspond to a physical chip.
  available: 4 nodes (0-3)
    node 0 cpus: 0 1 2 3 4 5 6 7 32 33 34 35 36 37 38 39
    node 0 size: 507180 MB
    node 0 free: 515365 MB
    node 1 cpus: 8 9 10 11 12 13 14 15 40 41 42 43 44 45 46 47
    node 1 size: 507301 MB
    node 1 free: 515690 MB
    node 2 cpus: 16 17 18 19 20 21 22 23 48 49 50 51 52 53 54 55
    node 2 size: 507685 MB
    node 2 free: 515786 MB
    node 3 cpus: 24 25 26 27 28 29 30 31 56 57 58 59 60 61 62 63
    node 3 size: 507205 MB
    node 3 free: 515732 MB
    node distances:
      node   0   1   2   3
      0:  10  20  30  30
      1:  20  10  30  30
      2:  30  30  10  20
      3:  30  30  20  10

From /proc/meminfo
  MemTotal: 2113488200 kB
  HugePages_Total: 0
  Hugepagesize: 2048 kB

/sbin/tuned-adm active
  Current active profile: throughput-performance

From /etc/*release* /etc/*version*
  os-release:
    NAME="Red Hat Enterprise Linux"
    VERSION="8.3 (Ootpa)"
    ID="rhel"
    ID_LIKE="fedora"
    VERSION_ID="8.3"
    PLATFORM_ID="platform:el8"
    PRETTY_NAME="Red Hat Enterprise Linux 8.3 (Ootpa)"
    ANSI_COLOR="0;31"
  redhat-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
  system-release: Red Hat Enterprise Linux release 8.3 (Ootpa)

(Continued on next page)
Platform Notes (Continued)

system-release-cpe: cpe:/o:redhat:enterprise_linux:8.3:ga

uname -a:
    Linux localhost.localdomain 4.18.0-240.el8.x86_64 #1 SMP Wed Sep 23 05:13:10 EDT 2020
    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
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 sanitation
CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort): Not affected

run-level 3 Jun 8 23:15

SPEC is set to: /home/cpu2017_1.1.8
    Filesystem Type Size Used Avail Use% Mounted on
    /dev/mapper/rhel00-home xfs 372G 217G 155G 59% /home

From /sys/devices/virtual/dmi/id
    Vendor: HPE
    Product: ProLiant DL360 Gen10 Plus
    Product Family: ProLiant
    Serial: CN701108CQ

Additional information from dmidecode 3.2 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:
    32x Micron 36ASF8G72PZ-3G2BZ 64 GB 2 rank 3200

BIOS:
    BIOS Vendor: HPE
    BIOS Version: U46
    BIOS Date: 05/16/2021
    BIOS Revision: 1.42

(Continued on next page)
SPEC CPU®2017 Floating Point Rate Result

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ProLiant DL360 Gen10 Plus
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SPECrate®2017_fp_base = 292
SPECrate®2017_fp_peak = 301

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

Platform Notes (Continued)

Firmware Revision: 2.42

(End of data from sysinfo program)

Compiler Version Notes

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<tr>
<td>Copyright (C) 1985-2020 Intel Corporation. All rights reserved.</td>
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<th>C++, C</th>
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(Continued on next page)
Hewlett Packard Enterprise
ProLiant DL360 Gen10 Plus
(2.90 GHz, Intel Xeon Gold 6326)

SPEC CPU®2017 Floating Point Rate Result

Copyright 2017-2021 Standard Performance Evaluation Corporation

SPECrates®2017_fp_base = 292
SPECrates®2017_fp_peak = 301

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

Test Date: Jun-2021
Hardware Availability: Jun-2021
Software Availability: Jun-2021

Compiler Version Notes (Continued)

C++, C | 511.povray_r(peak)

Intel(R) C++ Intel(R) 64 Compiler Classic for applications running on
Intel(R) 64, Version 2021.1 Build 20201112_000000
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Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R)
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Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

==============================================================================
C++, C | 511.povray_r(base) 526.blender_r(base, peak)

==============================================================================
C++, C, Fortran | 507.cactuBSSN_r(base, peak)

==============================================================================
Fortran, C | 521.wrf_r(base, peak) 527.cam4_r(base, peak)

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(Continued on next page)
Hewlett Packard Enterprise
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Compiler Version Notes (Continued)

Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on Intel(R) 64, Version 2021.1 Build 20201112_000000
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2021.1 Build 20201113
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Base Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:
ifort

Benchmarks using both Fortran and C:
ifort icx

Benchmarks using both C and C++:
icpx icx

Benchmarks using Fortran, C, and C++:
icpx icx ifort

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.llvm_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
Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL360 Gen10 Plus
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SPEC CPU®2017 Floating Point Rate Result
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Base Optimization Flags

C benchmarks:
- `-w -std=c11 -m64 -Wl, -z, muldefs -xCORE-AVX512 -Ofast -ffast-math`
- `-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4`
- `-mbranches-within-32B-boundaries -ljemalloc`
- `-L/usr/local/jemalloc64-5.0.1/lib`

C++ benchmarks:
- `-w -m64 -Wl, -z, muldefs -xCORE-AVX512 -Ofast -ffast-math -flto`
- `-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4`
- `-mbranches-within-32B-boundaries -ljemalloc`
- `-L/usr/local/jemalloc64-5.0.1/lib`

Fortran benchmarks:
- `-w -m64 -Wl, -z, muldefs -xCORE-AVX512 -O3 -ipo -no-prec-div`
- `-qopt-prefetch -ffinite-math-only`
- `-qopt-multiple-gather-scatter-by-shuffles -qopt-mem-layout-trans=4`
- `-nostandard-realloc-lhs -align array32byte -auto`
- `-mbranches-within-32B-boundaries -ljemalloc`
- `-L/usr/local/jemalloc64-5.0.1/lib`

Benchmarks using both Fortran and C:
- `-w -m64 -std=c11 -Wl, -z, muldefs -xCORE-AVX512 -Ofast -ffast-math`
- `-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -O3 -ipo`
- `-no-prec-div -qopt-prefetch -ffinite-math-only`
- `-qopt-multiple-gather-scatter-by-shuffles`
- `-mbranches-within-32B-boundaries -nostandard-realloc-lhs`
- `-align array32byte -auto -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib`

Benchmarks using both C and C++:
- `-w -m64 -std=c11 -Wl, -z, muldefs -xCORE-AVX512 -Ofast -ffast-math`
- `-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4`
- `-mbranches-within-32B-boundaries -ljemalloc`
- `-L/usr/local/jemalloc64-5.0.1/lib`

Benchmarks using Fortran, C, and C++:
- `-w -m64 -std=c11 -Wl, -z, muldefs -xCORE-AVX512 -Ofast -ffast-math`
- `-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -O3`
- `-no-prec-div -qopt-prefetch -ffinite-math-only`
- `-qopt-multiple-gather-scatter-by-shuffles`
- `-mbranches-within-32B-boundaries -nostandard-realloc-lhs`
- `-align array32byte -auto -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib`
Peak Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:
ifort

Benchmarks using both Fortran and C:
ifort icx

Benchmarks using both C and C++:
511.povray_r: icpc icc
526.blender_r: icpx icx

Benchmarks using Fortran, C, and C++:
icpx icx ifort

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:
519.lbm_r: basepeak = yes
538.imagick_r: basepeak = yes
544.nab_r: -w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -flto
-Ofast -qopt-mem-layout-trans=4 -fimf-accuracy-bits=14:sqrt
-mbranches-within-32B-boundaries -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

C++ benchmarks:

(Continued on next page)
Peak Optimization Flags (Continued)

508.namd_r: basepeak = yes

510.parest_r -w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
   -flto -mfpmath=sse -funroll-loops
   -qopt-mem-layout-trans=4 -mbranches-within-32B-boundaries
   -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib

Fortran benchmarks:

503.bwaves_r: basepeak = yes

549.fotonik3d_r: basepeak = yes

554.roms_r -w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ipo
   -no-prec-div -qopt-prefetch -ffinite-math-only
   -qopt-multiple-gather-scatter-by-shuffles
   -qopt-mem-layout-trans=4 -nostream-realalloc-lhs
   -align array32byte-auto -mbranches-within-32B-boundaries
   -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib

Benchmarks using both Fortran and C:

521.wrf_r: basepeak = yes

527.cam4_r: basepeak = yes

Benchmarks using both C and C++:

511.povray_r: -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX512 -O3
   -ipo -no-prec-div -qopt-prefetch -ffinite-math-only
   -qopt-multiple-gather-scatter-by-shuffles
   -qopt-mem-layout-trans=4 -mbranches-within-32B-boundaries
   -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

526.blender_r: basepeak = yes

Benchmarks using Fortran, C, and C++:

507.cactuBSSN_r: basepeak = yes

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.0-ICX-revC.html
## SPEC CPU®2017 Floating Point Rate Result

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You can also download the XML flags sources by saving the following links:

- [http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.0-ICX-revC.xml](http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.0-ICX-revC.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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