## SPEC CPU®2017 Floating Point Rate Result

**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
ProLiant DL360 Gen11  
(2.50 GHz, Intel Xeon Gold 6426Y)

<table>
<thead>
<tr>
<th>Copies</th>
<th>SPECrate®2017_fp_base</th>
<th>SPECrate®2017_fp_peak</th>
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<td>503.bwaves_r</td>
<td>518</td>
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<td>507.cactuBSSN_r</td>
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<td>508.namd_r</td>
<td>245</td>
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<tr>
<td>510.parest_r</td>
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<td>554.roms_r</td>
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**CPU2017 License:** 3  
**Test Sponsor:** HPE  
**Tested by:** HPE  
**Test Date:** Jan-2023  
**Hardware Availability:** Jan-2023  
**Software Availability:** May-2022

### Hardware

- **CPU Name:** Intel Xeon Gold 6426Y  
- **Max MHz:** 4100  
- **Nominal:** 2500  
- **Enabled:** 32 cores, 2 chips, 2 threads/core  
- **Orderable:** 1, 2 chip(s)  
- **Cache L1:** 32 KB I + 48 KB D on chip per core  
- **L2:** 2 MB I+D on chip per core  
- **L3:** 37.5 MB I+D on chip per chip  
- **Other:** None  
- **Memory:** 1 TB (16 x 64 GB 2Rx4 PC5-4800B-R)  
- **Storage:** 1 x 960 GB SSD  
- **Power Management:** BIOS and OS set to prefer performance at the cost of additional power usage

### Software

- **OS:** Red Hat Enterprise Linux 9.0 (Plow)  
- **Kernel:** 5.14.0-70.13.1.el9_0.x86_64  
- **Compiler:** C/C++: Version 2022.1 of Intel oneAPI DPC++/C++ Compiler for Linux; Fortran: Version 2022.1 of Intel Fortran Compiler for Linux;  
- **Parallel:** No  
- **Firmware:** HPE BIOS Version v1.20 12/16/2022 released Dec-2022  
- **File System:** xfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 64-bit  
- **Other:** jemalloc memory allocator V5.0.1
Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL360 Gen11
(2.50 GHz, Intel Xeon Gold 6426Y)

CPU2017 License: 3
Test Sponsor: HPE
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Test Date: Jan-2023
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Software Availability: May-2022

Results Table

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</tr>
</tbody>
</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:
sync; echo 3> /proc/sys/vm/drop_caches
runcpu command invoked through numactl i.e.:
numactl --interleave=all runcpu <etc>
IRQ balance service was stopped using "systemctl stop irqbalance.service"
tuned-adm profile was set to Throughput-Performance using "tuned-adm profile throughput-performance"
perf-bias for all the CPUs is set using "cpupower set -b 0"

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = "/home/cpu2017/lib/intel64:/home/cpu2017/je5.0.1-64"
MALLOC_CONF = "retain:true"
SPEC CPU®2017 Floating Point Rate Result

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL360 Gen11
(2.50 GHz, Intel Xeon Gold 6426Y)

SPECrate®2017_fp_base = 433
SPECrate®2017_fp_peak = 446

General Notes

Binaries compiled on a system with 2x Intel Xeon Platinum 8280M CPU + 384GB RAM memory using Red Hat Enterprise Linux 8.4
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
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.

Platform Notes

The system ROM used for this result contains Intel microcode version 0x2b000161 for the Intel Xeon Gold 6426Y processor.
BIOS Configuration:
Workload Profile set to General Throughput Compute
Thermal Configuration set to Maximum Cooling
Enhanced Processor Performance Profile set to Aggressive
Last Level Cache (LLC) Dead Line Allocation set to Disabled
Memory Patrol Scrubbing set to Disabled
Workload Profile set to Custom
DCU Stream Prefetcher set to Disabled
Adjacent Sector Prefetch set to Disabled
Minimum Processor Idle Power Package C-State set to Package C6 (non-retention) State

Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16aca64d
running on localhost.localdomain Thu Jan 5 15:28:08 2023

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 6426Y
  2 "physical id"s (chips)
  64 "processors"
cores, siblings (Caution: counting these is hw and system dependent. The following

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

Hewlett Packard Enterprise  
(Test Sponsor: HPE)  
ProLiant DL360 Gen11  
(2.50 GHz, Intel Xeon Gold 6426Y)  

<table>
<thead>
<tr>
<th>SPECrate®2017_fp_base</th>
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<tr>
<td>SPECrate®2017_fp_peak</td>
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CPU2017 License: 3  
Test Sponsor: HPE  
Tested by: HPE

<table>
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<th>Test Date:</th>
<th>Jan-2023</th>
</tr>
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<tr>
<td>Hardware Availability:</td>
<td>Jan-2023</td>
</tr>
<tr>
<td>Software Availability:</td>
<td>May-2022</td>
</tr>
</tbody>
</table>

**Platform Notes (Continued)**

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 2.37.4:

- Architecture: x86_64
- CPU op-mode(s): 32-bit, 64-bit
- Address sizes: 46 bits physical, 57 bits virtual
- Byte Order: Little Endian
- CPU(s): 64
- On-line CPU(s) list: 0-63
- Vendor ID: GenuineIntel
- BIOS Vendor ID: Intel(R) Corporation
- Model name: Intel(R) Xeon(R) Gold 6426Y
- BIOS Model name: Intel(R) Xeon(R) Gold 6426Y
- CPU family: 6
- Model: 143
- Thread(s) per core: 2
- Core(s) per socket: 16
- Stepping: 7
- BogoMIPS: 5000.00
- 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 pdel1gb rdtscp lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid aperfmperf tsc_known_freq pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault eb cat_l3 cat_l2 cdp_l3 invpcid_single cdp_l2 ssbd mba ibrs ibpb stibp ibrs-enhanced tpr_shadow vnni flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmi1 avx2 smep bmi2 erms invpcid cqm rdt_a avx512f avx512dq rdseed adx smap avx512ifma clflushopt clwb intel_pt avx512cd sha ni avx512bw avx512vl xsaveopt xsaves xsavec x salvemm xsavec qm_occip llc qm_mbb_total qm_mbb_local split_lock_detect avx_vnni avx512_bf16 wbinvd dtherm ida arat pln pts avx512vbmi umip pku ospke waitpkg avx512_vbmi2 gfn vaes vpclmulqdq avx512_vnni avx512_bitalg tme avx512_vpopcntdq la57 rdpid bus_lock_detect cldemote movdir movdir64b engcmd md_clear serialize tmsldtrk pconfig arch_lbr avx512_fp16 amx_tile flush_lid arch_capabilities

Virtualization:

- VT-x
- L1d cache: 1.5 MiB (32 instances)
- L1i cache: 1 MiB (32 instances)
- L2 cache: 64 MiB (32 instances)
- L3 cache: 75 MiB (2 instances)
- NUMA node(s): 2
- NUMA node0 CPU(s): 0-15,32-47
- NUMA node1 CPU(s): 16-31,48-63

(Continued on next page)
Platform Notes (Continued)

Vulnerability Itlb multihit: Not affected
Vulnerability L1tf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl
Vulnerability Spectre v1: Mitigation; usercopy/swapgs barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Enhanced IBRS, IBPB conditional, RSB filling
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 48K 1.5M 12 Data 1 64 1 64
L1i 32K 1M 8 Instruction 1 64 1 64
L2 2M 64M 16 Unified 2 2048 1 64
L3 37.5M 75M 15 Unified 3 40960 1 64

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: 515765 MB
node 0 free: 514378 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: 516078 MB
node 1 free: 515083 MB
node distances:
node 0 1
0: 10 20
1: 20 10

From /proc/meminfo

MemTotal: 1056607892 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

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

(Continued on next page)
Platform Notes (Continued)

From /etc/*release* /etc/*version*

os-release:
- NAME="Red Hat Enterprise Linux"
- VERSION="9.0 (Plow)"
- ID="rhel"
- ID_LIKE="fedora"
- VERSION_ID="9.0"
- PLATFORM_ID="platform:el9"
- PRETTY_NAME="Red Hat Enterprise Linux 9.0 (Plow)"
- ANSI_COLOR="0;31"

redhat-release: Red Hat Enterprise Linux release 9.0 (Plow)
system-release: Red Hat Enterprise Linux release 9.0 (Plow)
system-release-cpe: cpe:/o:redhat:enterprise_linux:9::baseos

uname -a:
Linux localhost.localdomain 5.14.0-70.13.1.el9_0.x86_64 #1 SMP PREEMPT Thu Apr 14 12:42:38 EDT 2022 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): Mitigation: Speculative Store Bypass disabled via prctl
CVE-2018-3639 (Speculative Store Bypass): Mitigation: usercopy/swapgs barriers and __user pointer sanitization
CVE-2017-5753 (Spectre variant 1):
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 Jan 5 15:12

SPEC is set to: /home/cpu2017

Filesystem Type Size Used Avail Use% Mounted on
/dev/mapper/rhel-home xfs 819G 251G 568G 31% /home

From /sys/devices/virtual/dmi/id
Vendor: HPE
Product: ProLiant DL360 Gen11
Product Family: ProLiant
Serial: CNX20800PW

Additional information from dmidecode 3.3 follows. WARNING: Use caution when you

(Continued on next page)
Platform Notes (Continued)

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 Samsung M321R8GA0BB0-CQKDG 64 GB 2 rank 4800

BIOS:
BIOS Vendor: HPE
BIOS Version: 1.20
BIOS Date: 12/16/2022
BIOS Revision: 1.20
Firmware Revision: 1.10

(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) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,  
Version 2022.1.0 Build 20220316
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.  
------------------------------------------------------------------------------

C++             | 508.namd_r(base, peak) 510.parest_r(base, peak)  
------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,  
Version 2022.1.0 Build 20220316
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.  
------------------------------------------------------------------------------

C++, C          | 511.povray_r(base, peak) 526.blender_r(base, peak)  
------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,  
Version 2022.1.0 Build 20220316
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.

(Continued on next page)
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ProLiant DL360 Gen11  
(2.50 GHz, Intel Xeon Gold 6426Y)  

**SPEC CPU®2017 Floating Point Rate Result**  
Copyright 2017-2023 Standard Performance Evaluation Corporation  

**SPECrater®2017_fp_base = 433**  
**SPECrater®2017_fp_peak = 446**  

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

**Compiler Version Notes (Continued)**  

```plaintext
C++, C, Fortran | 507.cactuBSSN_r(base, peak)  
___________________________________________________________________________
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,  
Version 2022.1.0 Build 20220316  
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.  
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,  
Version 2022.1.0 Build 20220316  
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.  
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version  
2022.1.0 Build 20220316  
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.  
___________________________________________________________________________
Fortran | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak) 554.roms_r(base, peak)  
___________________________________________________________________________
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version  
2022.1.0 Build 20220316  
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.  
___________________________________________________________________________
Fortran, C | 521.wrf_r(base, peak) 527.cam4_r(base, peak)  
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Copyright (C) 1985-2022 Intel Corporation. All rights reserved.  
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,  
Version 2022.1.0 Build 20220316  
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.  
```

**Base Compiler Invocation**  

C benchmarks:  
icx  

C++ benchmarks:  
icpx  

Fortran benchmarks:  
ifx  

Benchmarks using both Fortran and C:  
ifx icx  

(Continued on next page)
Base Compiler Invocation (Continued)

Benchmarks using both C and C++:

```
icpx icx
```

Benchmarks using Fortran, C, and C++:

```
icpx icx ifx
```

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_CASE_FLAG
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:

```
-w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-fflto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -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 -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib
```

Fortran benchmarks:

```
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte -auto -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib
```

(Continued on next page)
## Base Optimization Flags (Continued)

- Benchmarks using both Fortran and C:
  ```bash
  -w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
  -flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
  -nostandard-realloc-lhs -align array32byte -auto -ljemalloc
  -L/usr/local/jemalloc64-5.0.1/lib
  ```
- Benchmarks using both C and C++:
  ```bash
  -w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
  -flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -ljemalloc
  -L/usr/local/jemalloc64-5.0.1/lib
  ```
- Benchmarks using Fortran, C, and C++:
  ```bash
  -w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
  -flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
  -nostandard-realloc-lhs -align array32byte -auto -ljemalloc
  -L/usr/local/jemalloc64-5.0.1/lib
  ```

## Peak Compiler Invocation

- C benchmarks:
  ```bash
  icx
  ```
- C++ benchmarks:
  ```bash
  icpx
  ```
- Fortran benchmarks:
  ```bash
  ifx
  ```
- Benchmarks using both Fortran and C:
  ```bash
  ifx icx
  ```
- Benchmarks using both C and C++:
  ```bash
  icpx icx
  ```
- Benchmarks using Fortran, C, and C++:
  ```bash
  icpx icx ifx
  ```

## Peak Portability Flags

Same as Base Portability Flags
Hewlett Packard Enterprise  
(Test Sponsor: HPE)  
ProLiant DL360 Gen11  
(2.50 GHz, Intel Xeon Gold 6426Y)  

SPECraten®2017_fp_base = 433  
SPECraten®2017_fp_peak = 446

**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 -Ofast  
-ffast-math -flto -mfpmath=sse -funroll-loops  
-qopt-mem-layout-trans=4 -qopt-zmm-usage=high -ljemalloc  
-L/usr/local/jemalloc64-5.0.1/lib

C++ benchmarks:

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 -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 -Ofast -ffast-math  
-flto -mfpmath=sse -funroll-loops  
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs  
-align array32byte -auto -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: basepeak = yes

526.blender_r: basepeak = yes

Benchmarks using Fortran, C, and C++:

-w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math

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

Benchmarks using Fortran, C, and C++ (continued):
-\texttt{-flto}\ -\texttt{-mfpmath=sse}\ -\texttt{-funroll-loops}\ -\texttt{-qopt-mem-layout-trans=4}
-\texttt{-nostandard-realloc-lhs}\ -\texttt{-align array32byte}\ -\texttt{-auto}\ -\texttt{-ljemalloc}
-\texttt{-L/usr/local/jemalloc64-5.0.1/lib}

The flags files that were used to format this result can be browsed at

http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-SPR-rev1.1.html

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

http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-SPR-rev1.1.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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