



# SPEC CPU®2017 Floating Point Rate Result

Copyright 2017-2022 Standard Performance Evaluation Corporation

## Hewlett Packard Enterprise

(Test Sponsor: HPE)

### ProLiant DL560 Gen10

(2.30 GHz, Intel Xeon Gold 6230N)

SPECrate®2017\_fp\_base = 452

SPECrate®2017\_fp\_peak = Not Run

CPU2017 License: 3

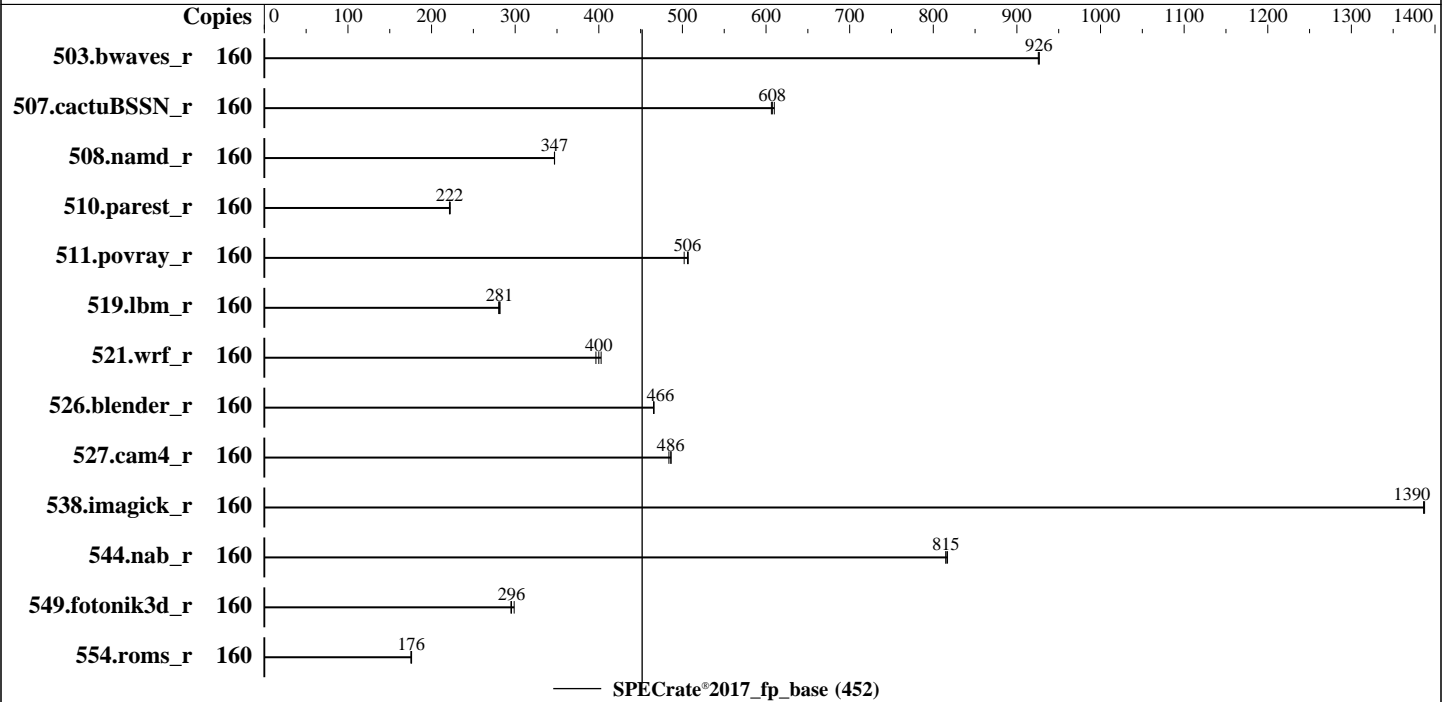
Test Sponsor: HPE

Tested by: HPE

Test Date: May-2022

Hardware Availability: Feb-2022

Software Availability: Dec-2020



### Hardware

CPU Name: Intel Xeon Gold 6230N  
 Max MHz: 3500  
 Nominal: 2300  
 Enabled: 80 cores, 4 chips, 2 threads/core  
 Orderable: 1, 2, 4 chip(s)  
 Cache L1: 32 KB I + 32 KB D on chip per core  
 L2: 1 MB I+D on chip per core  
 L3: 27.5 MB I+D on chip per chip  
 Other: None  
 Memory: 1536 GB (48 x 32 GB 2Rx4 PC4-2933Y-R, running at 2666)  
 Storage: 1 x 800 GB SAS SSD  
 Other: None

### Software

OS: SUSE Linux Enterprise Server 15 SP2 (x86\_64)  
 Kernel 5.3.18-22-default  
 Compiler: 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;  
 Parallel: No  
 Firmware: HPE BIOS Version U34 v2.62 02/23/2022 released Feb-2022  
 File System: btrfs  
 System State: Run level 3 (multi-user)  
 Base Pointers: 64-bit  
 Peak Pointers: Not Applicable  
 Other: jemalloc memory allocator V5.0.1  
 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	160	1731	927	<b><u>1732</u></b>	<b><u>926</u></b>	1733	926							
507.cactuBSSN_r	160	332	610	<b><u>333</u></b>	<b><u>608</u></b>	334	606							
508.namd_r	160	<b><u>438</u></b>	<b><u>347</u></b>	438	347	438	347							
510.parest_r	160	1891	221	1883	222	<b><u>1889</u></b>	<b><u>222</u></b>							
511.povray_r	160	744	502	737	507	<b><u>738</u></b>	<b><u>506</u></b>							
519.lbm_r	160	<b><u>599</u></b>	<b><u>281</u></b>	598	282	602	280							
521.wrf_r	160	890	403	<b><u>896</u></b>	<b><u>400</u></b>	904	397							
526.blender_r	160	523	465	<b><u>523</u></b>	<b><u>466</u></b>	523	466							
527.cam4_r	160	<b><u>576</u></b>	<b><u>486</u></b>	578	484	575	486							
538.imagick_r	160	<b><u>287</u></b>	<b><u>1390</u></b>	287	1390	287	1390							
544.nab_r	160	330	815	<b><u>330</u></b>	<b><u>815</u></b>	330	817							
549.fotonik3d_r	160	2087	299	<b><u>2109</u></b>	<b><u>296</u></b>	2114	295							
554.roms_r	160	1444	176	1449	175	<b><u>1448</u></b>	<b><u>176</u></b>							

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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>

## 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"



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## General Notes

Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM memory using Red Hat Enterprise Linux 8.1

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

sources available from jemalloc.net or <https://github.com/jemalloc/jemalloc/releases>

## Platform Notes

BIOS Configuration:

Workload Profile set to General Throughput Compute

Memory Patrol Scrubbing set to Disabled

LLC Prefetch set to Enabled

Last Level Cache (LLC) Dead Line Allocation set to Disabled

Enhanced Processor Performance set to Enabled

Thermal Configuration set to Maximum Cooling

Workload Profile set to Custom

Energy/Performance Bias set to Balanced Power

Sysinfo program /home/cpu2017/bin/sysinfo

Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d

running on localhost Fri May 20 10:11:14 2022

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 6230N CPU @ 2.30GHz

4 "physical id"s (chips)

160 "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 : 20

siblings : 40

physical 0: cores 0 1 2 3 8 9 10 11 12 16 17 18 19 20 24 25 26 27 28

physical 1: cores 0 1 2 3 8 9 10 11 12 16 17 18 19 20 24 25 26 27 28

physical 2: cores 0 1 2 3 8 9 10 11 12 16 17 18 19 20 24 25 26 27 28

physical 3: cores 0 1 2 3 8 9 10 11 12 16 17 18 19 20 24 25 26 27 28

From lscpu from util-linux 2.33.1:

(Continued on next page)



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## Platform Notes (Continued)

```

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):                 160
On-line CPU(s) list:   0-159
Thread(s) per core:    2
Core(s) per socket:    20
Socket(s):              4
NUMA node(s):          8
Vendor ID:              GenuineIntel
CPU family:             6
Model:                  85
Model name:             Intel(R) Xeon(R) Gold 6230N CPU @ 2.30GHz
Stepping:               7
CPU MHz:                1049.331
BogoMIPS:               4600.00
Virtualization:         VT-x
L1d cache:              32K
L1i cache:              32K
L2 cache:               1024K
L3 cache:               28160K
NUMA node0 CPU(s):     0-9,80-89
NUMA node1 CPU(s):     10-19,90-99
NUMA node2 CPU(s):     20-29,100-109
NUMA node3 CPU(s):     30-39,110-119
NUMA node4 CPU(s):     40-49,120-129
NUMA node5 CPU(s):     50-59,130-139
NUMA node6 CPU(s):     60-69,140-149
NUMA node7 CPU(s):     70-79,150-159

```

```

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
aperfperf 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 fl6c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb cat_l3 cdp_l3
invpcid_single intel_ppin ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi
flexpriority ept vpid ept_ad 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 xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc
cqm_mbm_total cqm_mbm_local dtherm ida arat pln pts pku ospke avx512_vnni md_clear
flush_lld arch_capabilities

```

```

/proc/cpuinfo cache data
cache size : 28160 KB

```

From numactl --hardware

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## Platform Notes (Continued)

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 4 5 6 7 8 9 80 81 82 83 84 85 86 87 88 89

node 0 size: 193124 MB

node 0 free: 192872 MB

node 1 cpus: 10 11 12 13 14 15 16 17 18 19 90 91 92 93 94 95 96 97 98 99

node 1 size: 193497 MB

node 1 free: 193021 MB

node 2 cpus: 20 21 22 23 24 25 26 27 28 29 100 101 102 103 104 105 106 107 108 109

node 2 size: 193531 MB

node 2 free: 193245 MB

node 3 cpus: 30 31 32 33 34 35 36 37 38 39 110 111 112 113 114 115 116 117 118 119

node 3 size: 193531 MB

node 3 free: 193375 MB

node 4 cpus: 40 41 42 43 44 45 46 47 48 49 120 121 122 123 124 125 126 127 128 129

node 4 size: 193531 MB

node 4 free: 193368 MB

node 5 cpus: 50 51 52 53 54 55 56 57 58 59 130 131 132 133 134 135 136 137 138 139

node 5 size: 193531 MB

node 5 free: 193376 MB

node 6 cpus: 60 61 62 63 64 65 66 67 68 69 140 141 142 143 144 145 146 147 148 149

node 6 size: 193531 MB

node 6 free: 193350 MB

node 7 cpus: 70 71 72 73 74 75 76 77 78 79 150 151 152 153 154 155 156 157 158 159

node 7 size: 193529 MB

node 7 free: 193180 MB

node distances:

node	0	1	2	3	4	5	6	7
0:	10	21	31	31	31	31	31	31
1:	21	10	31	31	31	31	31	31
2:	31	31	10	21	31	31	31	31
3:	31	31	21	10	31	31	31	31
4:	31	31	31	31	10	21	31	31
5:	31	31	31	31	21	10	31	31
6:	31	31	31	31	31	31	10	21
7:	31	31	31	31	31	31	21	10

From /proc/meminfo

MemTotal: 1584954096 kB

HugePages\_Total: 0

Hugepagesize: 2048 kB

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

os-release:

NAME="SLES"

VERSION="15-SP2"

VERSION\_ID="15.2"

(Continued on next page)



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## Platform Notes (Continued)

PRETTY\_NAME="SUSE Linux Enterprise Server 15 SP2"

ID="sles"

ID\_LIKE="suse"

ANSI\_COLOR="0;32"

CPE\_NAME="cpe:/o:suse:sles:15:sp2"

uname -a:

```
Linux localhost 5.3.18-22-default #1 SMP Wed Jun 3 12:16:43 UTC 2020 (720aeba) x86_64
x86_64 x86_64 GNU/Linux
```

Kernel self-reported vulnerability status:

CVE-2018-12207 (iTLB Multihit):

KVM: Mitigation: Split huge pages

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 sanitization

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):

Mitigation: Clear CPU buffers; SMT vulnerable

run-level 3 May 20 03:47

SPEC is set to: /home/cpu2017

Filesystem	Type	Size	Used	Avail	Use%	Mounted on
/dev/sda2	btrfs	743G	33G	709G	5%	/home

From /sys/devices/virtual/dmi/id

```
Vendor: HPE
Product: ProLiant DL560 Gen10
Product Family: ProLiant
Serial: CN77110DQW
```

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:

48x UNKNOWN NOT AVAILABLE 32 GB 2 rank 2933, configured at 2666

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## Platform Notes (Continued)

BIOS:

BIOS Vendor: HPE  
 BIOS Version: U34  
 BIOS Date: 02/23/2022  
 BIOS Revision: 2.62  
 Firmware Revision: 2.55

(End of data from sysinfo program)

## Compiler Version Notes

```
=====
C | 519.lbm_r(base) 538.imagick_r(base) 544.nab_r(base)
-----
```

```
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
-----
```

```
=====
C++ | 508.namd_r(base) 510.parest_r(base)
-----
```

```
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
-----
```

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

```
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
-----
```

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

```
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
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## Compiler Version Notes (Continued)

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

=====

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

-----

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

=====

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

-----

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





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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:

```
-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
```

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## Base Optimization Flags (Continued)

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
```

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-revH.html>

[http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64\\_revA.html](http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64_revA.html)

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

<http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.0-ICX-revH.xml>

[http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64\\_revA.xml](http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64_revA.xml)

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