



# SPEC CPU®2017 Floating Point Rate Result

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## Hewlett Packard Enterprise

(Test Sponsor: HPE)

### ProLiant ML30 Gen10 Plus

(3.10 GHz, Intel Xeon E-2324G)

## SPECrate®2017\_fp\_base = 40.5

## SPECrate®2017\_fp\_peak = 40.8

CPU2017 License: 3

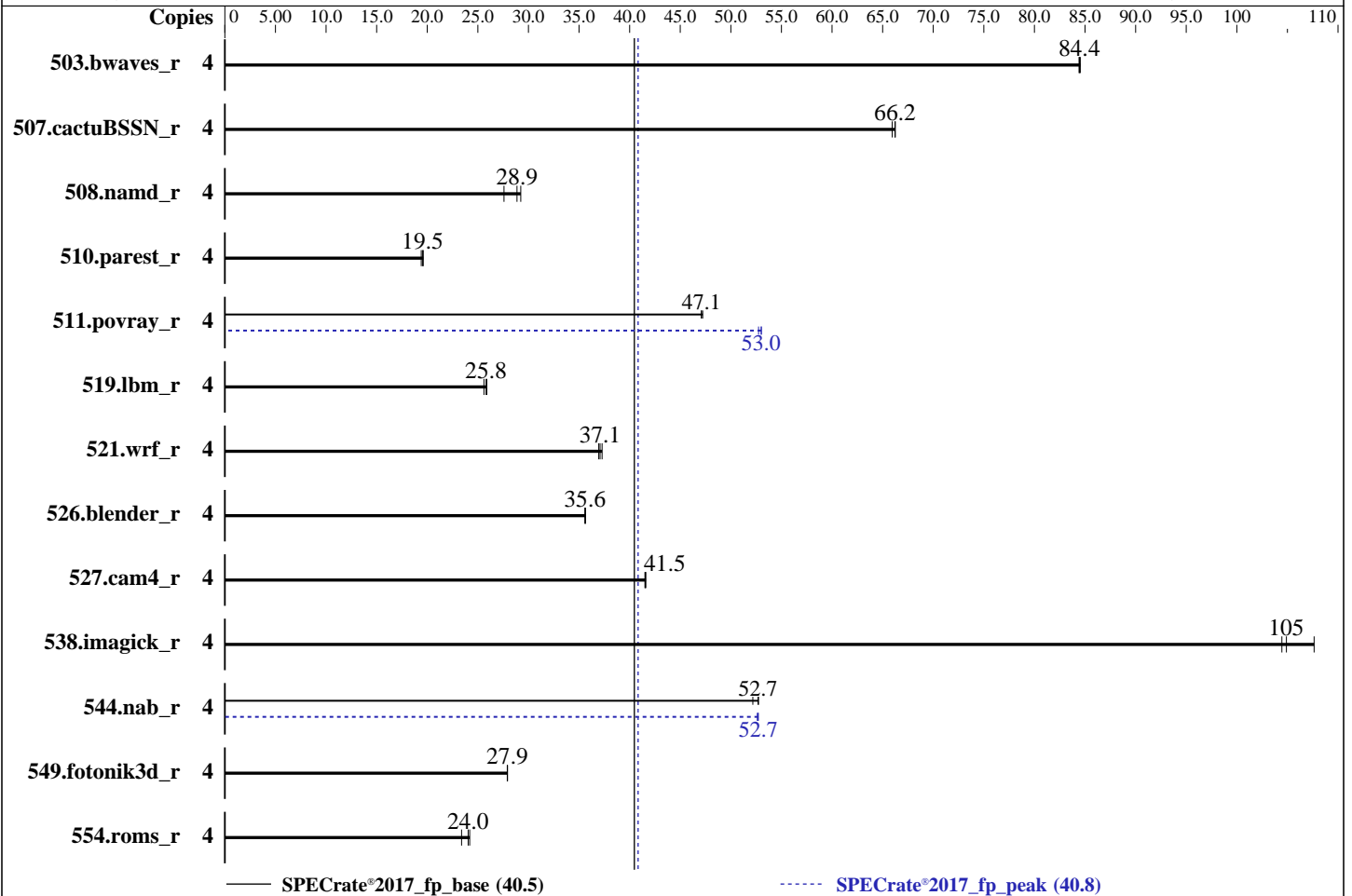
Test Sponsor: HPE

Tested by: HPE

Test Date: Mar-2022

Hardware Availability: Jan-2022

Software Availability: Jun-2021



### Hardware

CPU Name: Intel Xeon E-2324G  
 Max MHz: 4600  
 Nominal: 3100  
 Enabled: 4 cores, 1 chip  
 Orderable: 1 chip  
 Cache L1: 32 KB I + 48 KB D on chip per core  
 L2: 512 KB I+D on chip per core  
 L3: 8 MB I+D on chip per chip  
 Other: None  
 Memory: 128 GB (4 x 32 GB 2Rx8 PC4-3200AA-E, running at 2933)  
 Storage: 1 x 600 GB 15 K SAS HDD  
 Other: None

### Software

OS: SUSE Linux Enterprise Server 15 SP3  
 Kernel 5.3.18-57-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;  
 C/C++: Version 2021.1 of Intel C/C++ Compiler Classic Build 20201112 for Linux  
 Parallel: No  
 Firmware: HPE BIOS Version U61 v1.54 (01/13/2022) released Jan-2022  
 File System: xfs  
 System State: Run level 5 (multi-user)  
 Base Pointers: 64-bit  
 Peak Pointers: 64-bit  
 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    | 4      | 475        | 84.4        | 475         | 84.5        | <b>475</b>  | <b>84.4</b> | 4      | 475        | 84.4        | 475         | 84.5        | <b>475</b>  | <b>84.4</b> |
| 507.cactuBSSN_r | 4      | 76.8       | 65.9        | 76.4        | 66.2        | <b>76.5</b> | <b>66.2</b> | 4      | 76.8       | 65.9        | 76.4        | 66.2        | <b>76.5</b> | <b>66.2</b> |
| 508.namd_r      | 4      | 138        | 27.6        | <b>132</b>  | <b>28.9</b> | 130         | 29.2        | 4      | 138        | 27.6        | <b>132</b>  | <b>28.9</b> | 130         | 29.2        |
| 510.parest_r    | 4      | 539        | 19.4        | <b>535</b>  | <b>19.5</b> | 534         | 19.6        | 4      | 539        | 19.4        | <b>535</b>  | <b>19.5</b> | 534         | 19.6        |
| 511.povray_r    | 4      | <b>198</b> | <b>47.1</b> | 198         | 47.2        | 198         | 47.1        | 4      | 176        | 53.0        | <b>176</b>  | <b>53.0</b> | 177         | 52.7        |
| 519.lbm_r       | 4      | 165        | 25.6        | 163         | 25.9        | <b>163</b>  | <b>25.8</b> | 4      | 165        | 25.6        | 163         | 25.9        | <b>163</b>  | <b>25.8</b> |
| 521.wrf_r       | 4      | 240        | 37.3        | <b>242</b>  | <b>37.1</b> | 243         | 36.9        | 4      | 240        | 37.3        | <b>242</b>  | <b>37.1</b> | 243         | 36.9        |
| 526.blender_r   | 4      | 171        | 35.6        | <b>171</b>  | <b>35.6</b> | 171         | 35.6        | 4      | 171        | 35.6        | <b>171</b>  | <b>35.6</b> | 171         | 35.6        |
| 527.cam4_r      | 4      | 168        | 41.6        | 169         | 41.5        | <b>168</b>  | <b>41.5</b> | 4      | 168        | 41.6        | 169         | 41.5        | <b>168</b>  | <b>41.5</b> |
| 538.imagick_r   | 4      | 92.4       | 108         | <b>94.8</b> | <b>105</b>  | 95.2        | 104         | 4      | 92.4       | 108         | <b>94.8</b> | <b>105</b>  | 95.2        | 104         |
| 544.nab_r       | 4      | <b>128</b> | <b>52.7</b> | 129         | 52.2        | 128         | 52.7        | 4      | <b>128</b> | <b>52.7</b> | 128         | 52.7        | 128         | 52.6        |
| 549.fotonik3d_r | 4      | 558        | 27.9        | 559         | 27.9        | <b>558</b>  | <b>27.9</b> | 4      | 558        | 27.9        | 559         | 27.9        | <b>558</b>  | <b>27.9</b> |
| 554.roms_r      | 4      | 272        | 23.4        | <b>264</b>  | <b>24.0</b> | 263         | 24.2        | 4      | 272        | 23.4        | <b>264</b>  | <b>24.0</b> | 263         | 24.2        |

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

## Submit Notes

The config file option 'submit' was used.

## 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 = "/home/cpu2017/lib/intel64:/home/cpu2017/je5.0.1-64"  
MALLOCONF = "retain:true"

## 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.

(Continued on next page)



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## General Notes (Continued)

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

Thermal Configuration set to Maximum Cooling

Enhanced Processor Performance set to Enabled

Last Level Cache (LLC) prefetch set to Enabled

HW Prefetcher set to Disabled

Sysinfo program /home/cpu2017/bin/sysinfo

Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d

running on localhost Sun Mar 27 20:00:58 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) E-2324G CPU @ 3.10GHz

1 "physical id"s (chips)

4 "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 : 4

siblings : 4

physical 0: cores 0 1 2 3

From lscpu from util-linux 2.36.2:

Architecture: x86\_64

CPU op-mode(s): 32-bit, 64-bit

Byte Order: Little Endian

Address sizes: 39 bits physical, 48 bits virtual

CPU(s): 4

On-line CPU(s) list: 0-3

Thread(s) per core: 1

Core(s) per socket: 4

Socket(s): 1

NUMA node(s): 1

(Continued on next page)



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## Platform Notes (Continued)

```

Vendor ID: GenuineIntel
CPU family: 6
Model: 167
Model name: Intel(R) Xeon(R) E-2324G CPU @ 3.10GHz
Stepping: 1
CPU MHz: 3068.708
BogoMIPS: 6192.00
Virtualization: VT-x
L1d cache: 192 KiB
L1i cache: 128 KiB
L2 cache: 2 MiB
L3 cache: 8 MiB
NUMA node0 CPU(s): 0-3
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 and seccomp
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
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 aperfmperf tsc_known_freq pni pclmulqdq dtes64 monitor ds_cpl vmx
smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid sse4_1 sse4_2 x2apic movbe popcnt
tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault
epb invpcid_single ssbd ibrs_ibpb stibp ibrs_enhanced tpr_shadow vnmi flexpriority
ept vpid ept_ad fsgsbase tsc_adjust bmi1 avx2 smep bmi2 erms invpcid mpx avx512f
avx512dq rdseed adx smap avx512ifma clflushopt intel_pt avx512cd sha_ni avx512bw
avx512vl xsaveopt xsavec xgetbv1 xsaves dtherm ida arat pln pts avx512vbmi umip pku
ospke avx512_vbmi2 gfni vaes vpclmulqdq avx512_vnni avx512_bitalg avx512_vpopcntdq
rdpid fsrm md_clear flush_lld arch_capabilities

```

From lscpu --cache:

| NAME | ONE-SIZE | ALL-SIZE | WAYS | TYPE        | LEVEL | SETS | PHY-LINE | COHERENCY-SIZE |
|------|----------|----------|------|-------------|-------|------|----------|----------------|
| L1d  | 48K      | 192K     | 12   | Data        | 1     | 64   | 1        | 64             |
| L1i  | 32K      | 128K     | 8    | Instruction | 1     | 64   | 1        | 64             |
| L2   | 512K     | 2M       | 8    | Unified     | 2     | 1024 | 1        | 64             |
| L3   | 8M       | 8M       | 16   | Unified     | 3     | 8192 | 1        | 64             |

/proc/cpuinfo cache data  
cache size : 8192 KB

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## Platform Notes (Continued)

From numactl --hardware

WARNING: a numactl 'node' might or might not correspond to a physical chip.

available: 1 nodes (0)

node 0 cpus: 0 1 2 3

node 0 size: 128467 MB

node 0 free: 127472 MB

node distances:

node 0

0: 10

From /proc/meminfo

MemTotal: 131550700 kB

HugePages\_Total: 0

Hugepagesize: 2048 kB

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

os-release:

NAME="SLES"

VERSION="15-SP3"

VERSION\_ID="15.3"

PRETTY\_NAME="SUSE Linux Enterprise Server 15 SP3"

ID="sles"

ID\_LIKE="suse"

ANSI\_COLOR="0;32"

CPE\_NAME="cpe:/o:suse:sles:15:sp3"

uname -a:

Linux localhost 5.3.18-57-default #1 SMP Wed Apr 28 10:54:41 UTC 2021 (ba3c2e9) 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/swaps 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):

Not affected

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## Platform Notes (Continued)

run-level 5 Mar 27 19:59

SPEC is set to: /home/cpu2017

| Filesystem | Type | Size | Used | Avail | Use% | Mounted on |
|------------|------|------|------|-------|------|------------|
| /dev/sdc3  | xfs  | 519G | 92G  | 427G  | 18%  | /home      |

From /sys/devices/virtual/dmi/id

Vendor: HPE  
 Product: ProLiant ML30 Gen10 Plus  
 Product Family: ProLiant  
 Serial: SerNum.ACC

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:

1x Hynix HMAA4GU7AJR8N-XN 32 GB 2 rank 3200, configured at 2933  
 2x Micron 18ASF4G72AZ-3G2B1 32 GB 2 rank 3200, configured at 2933  
 1x Samsung M391A4G43AB1-CWE 32 GB 2 rank 3200, configured at 2933

BIOS:

BIOS Vendor: HPE  
 BIOS Version: U61  
 BIOS Date: 01/13/2022  
 BIOS Revision: 1.54  
 Firmware Revision: 2.55

(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 2021.1 Build 20201113  
 Copyright (C) 1985-2020 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,

(Continued on next page)



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## Compiler Version Notes (Continued)

Version 2021.1 Build 20201113  
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

=====  
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  
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.  
Intel(R) C 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.

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

-----  
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=====  
C++, C | 511.povray\_r(peak)

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

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

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Version 2021.1 Build 20201113

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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, peak) 549.fotonik3d\_r(base, peak)  
| 554.roms\_r(base, peak)  
=====

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, peak) 527.cam4\_r(base, peak)  
=====

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

Copyright (C) 1985-2020 Intel Corporation. All rights reserved.  
=====

## Base Compiler Invocation

C benchmarks:

icx

C++ benchmarks:

icpx

Fortran benchmarks:

ifort

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## Base Compiler Invocation (Continued)

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.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-AVX2 -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-AVX2 -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-AVX2 -O3 -ipo -no-prec-div
-qopt-prefetch -ffinite-math-only
```

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## Base Optimization Flags (Continued)

Fortran benchmarks (continued):

```
-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-AVX2 -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-AVX2 -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-AVX2 -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++:

(Continued on next page)



# SPEC CPU®2017 Floating Point Rate Result

Copyright 2017-2022 Standard Performance Evaluation Corporation

Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant ML30 Gen10 Plus

(3.10 GHz, Intel Xeon E-2324G)

SPECrate®2017\_fp\_base = 40.5

SPECrate®2017\_fp\_peak = 40.8

CPU2017 License: 3

Test Sponsor: HPE

Tested by: HPE

Test Date: Mar-2022

Hardware Availability: Jan-2022

Software Availability: Jun-2021

## Peak Compiler Invocation (Continued)

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-AVX2 -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:

508.namd\_r: basepeak = yes

510.parest\_r: basepeak = yes

Fortran benchmarks:

503.bwaves\_r: basepeak = yes

549.fotonik3d\_r: basepeak = yes

554.roms\_r: basepeak = yes

Benchmarks using both Fortran and C:

(Continued on next page)



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**Hardware Availability:** Jan-2022

**Software Availability:** Jun-2021

## Peak Optimization Flags (Continued)

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-AVX2 -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-revE.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-revE.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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