SPEC CPU®2017 Floating Point Rate Result

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Hewlett Packard Enterprise
(Test Sponsor: HPE)
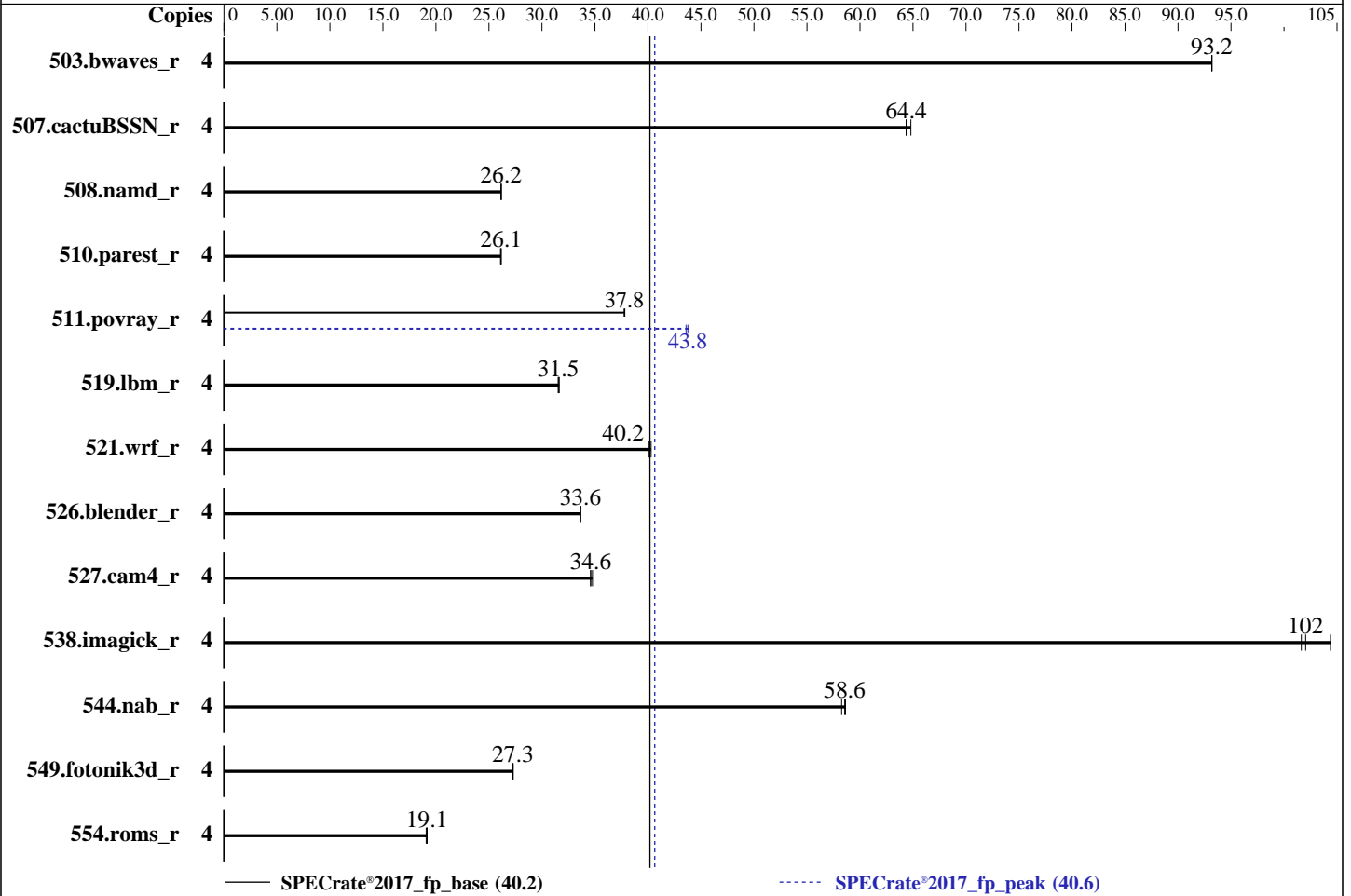
MicroServer Gen10 Plus v2
(2.80 GHz, Intel Xeon E-2314)

$SPECrate^®2017\_fp\_base = 40.2$

$SPECrate^®2017\_fp\_peak = 40.6$

CPU2017 License: 3

Test Sponsor: HPE

Tested by: HPE

Benchmark	Copies	Result
503.bwaves_r	4	93.2
507.cactuBSSN_r	4	64.4
508.namd_r	4	26.2
510.parest_r	4	26.1
511.povray_r	4	37.8 / 43.8
519.lbm_r	4	31.5
521.wrf_r	4	40.2
526.blender_r	4	33.6
527.cam4_r	4	34.6
538.imagick_r	4	102
544.nab_r	4	58.6
549.fotonik3d_r	4	27.3
554.roms_r	4	19.1

SPECrate®2017_fp_base (40.2)

SPECrate®2017_fp_peak (40.6)

Hardware

CPU Name: Intel Xeon E-2314
 Max MHz: 4500
 Nominal: 2800
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: 64 GB (2 x 32 GB 2Rx8 PC4-3200AA-E)
Storage: 2 x 400 GB SATA SSD
Other: None

Software

OS: Red Hat Enterprise Linux release 8.5 (Ootpa)
Kernel 4.18.0-348.el8.x86_64
Compiler: C/C++: Version 2021.4.0 of Intel oneAPI
DPC++/C++
Compiler Build 20210924 for Linux;
Fortran: Version 2021.4.0 of Intel Fortran
Compiler
Classic Build 20210910 for Linux;
C/C++: Version 2021.4.0 of Intel C/C++
Compiler Classic Build 20210910 for Linux;
Parallel: No
Firmware: HPE BIOS Version U64 v1.60 (06/30/2022) released
Jun-2022
File System: xfs
System State: Run level 3 (multi-user)
Base Pointers: 64-bit
Peak Pointers: 64-bit

(Continued on next page)

Standard Performance Evaluation Corporation (info@spec.org) https://www.spec.org/

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CPU2017 License: 3	**Test Date:**	Aug-2022
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Tested by: HPE	**Software Availability:**	Nov-2021

Software (Continued)

Other:	jemalloc memory allocator V5.0.1
Power Management:	BIOS and OS set to prefer performance at the cost of additional power usage

Results Table

Benchmark	Base						Peak					
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
503.bwaves_r	4	430	93.2	430	93.2	**430**	**93.2**	4	430	93.2	430	93.2	**430**	**93.2**
507.cactuBSSN_r	4	**78.7**	**64.4**	78.1	64.8	78.7	64.4	4	**78.7**	**64.4**	78.1	64.8	78.7	64.4
508.namd_r	4	145	26.1	145	26.2	**145**	**26.2**	4	145	26.1	145	26.2	**145**	**26.2**
510.parest_r	4	400	26.1	**400**	**26.1**	401	26.1	4	400	26.1	**400**	**26.1**	401	26.1
511.povray_r	4	247	37.8	247	37.8	**247**	**37.8**	4	213	43.9	**213**	**43.8**	214	43.6
519.lbm_r	4	134	31.5	133	31.6	**134**	**31.5**	4	134	31.5	133	31.6	**134**	**31.5**
521.wrf_r	4	222	40.3	**223**	**40.2**	223	40.1	4	222	40.3	**223**	**40.2**	223	40.1
526.blender_r	4	**181**	**33.6**	181	33.6	181	33.6	4	**181**	**33.6**	181	33.6	181	33.6
527.cam4_r	4	201	34.8	**202**	**34.6**	202	34.6	4	201	34.8	**202**	**34.6**	202	34.6
538.imagick_r	4	**97.5**	**102**	97.9	102	95.3	104	4	**97.5**	**102**	97.9	102	95.3	104
544.nab_r	4	**115**	**58.6**	116	58.3	115	58.6	4	**115**	**58.6**	116	58.3	115	58.6
549.fotonik3d_r	4	**572**	**27.3**	571	27.3	572	27.2	4	**572**	**27.3**	571	27.3	572	27.2
554.roms_r	4	**332**	**19.1**	333	19.1	332	19.2	4	**332**	**19.1**	333	19.1	332	19.2
SPECrate®2017_fp_base =		**40.2**										
SPECrate®2017_fp_peak =		**40.6**										

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

Submit Notes

```
The taskset mechanism was used to bind copies to processors. The config file option 'submit'
was used to generate taskset 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 =
    "/home/cpu2017_newbinaries/lib/intel64:/home/cpu2017_newbinaries/je5.0.1
    -64"
```

(Continued on next page)

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Tested by:	HPE	**Software Availability:**	Nov-2021

Environment Variables Notes (Continued)

```
MALLOC_CONF = "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.
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
  Minimum Processor Idle Power Package C-State set to No Package State
  Intel Hyper-Threading set to Disabled

 Sysinfo program /home/cpu2017_newbinaries/bin/sysinfo
 Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
 running on localhost.localdomain Wed Aug 24 21:48:27 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-2314 CPU @ 2.80GHz
       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 2.32.1:
      Architecture:        x86_64
```

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Test Date: Aug-2022

Hardware Availability: Sep-2022

Software Availability: Nov-2021

Platform Notes (Continued)

```
        CPU op-mode(s):        32-bit, 64-bit
        Byte Order:            Little Endian
        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
        Vendor ID:             GenuineIntel
        BIOS Vendor ID:        Intel(R) Corporation
        CPU family:            6
        Model:                 167
        Model name:            Intel(R) Xeon(R) E-2314 CPU @ 2.80GHz
        BIOS Model name:       Intel(R) Xeon(R) E-2314 CPU @ 2.80GHz
        Stepping:              1
        CPU MHz:               2800.000
        BogoMIPS:              5616.00
        Virtualization:        VT-x
        L1d cache:             48K
        L1i cache:             32K
        L2 cache:              512K
        L3 cache:              8192K
        NUMA node0 CPU(s):     0-3
        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 sgx 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 sgx_lc fsrm
    md_clear flush_l1d arch_capabilities

 /proc/cpuinfo cache data
    cache size : 8192 KB

 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: 64325 MB
   node 0 free: 63628 MB
   node distances:
   node    0
```

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CPU2017 License: 3	**Test Date:** Aug-2022
Test Sponsor: HPE	**Hardware Availability:** Sep-2022
Tested by: HPE	**Software Availability:** Nov-2021

Platform Notes (Continued)

```
     0:  10

 From /proc/meminfo
    MemTotal:       65869344 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="8.5 (Ootpa)"
       ID="rhel"
       ID_LIKE="fedora"
       VERSION_ID="8.5"
       PLATFORM_ID="platform:el8"
       PRETTY_NAME="Red Hat Enterprise Linux 8.5 (Ootpa)"
       ANSI_COLOR="0;31"
    redhat-release: Red Hat Enterprise Linux release 8.5 (Ootpa)
    system-release: Red Hat Enterprise Linux release 8.5 (Ootpa)
    system-release-cpe: cpe:/o:redhat:enterprise_linux:8::baseos

 uname -a:
    Linux localhost.localdomain 4.18.0-348.el8.x86_64 #1 SMP Mon Oct 4 12:17:22 EDT 2021
    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
                                                    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

 run-level 3 Aug 24 21:47
```

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Platform Notes (Continued)

```
  SPEC is set to: /home/cpu2017_newbinaries
    Filesystem              Type  Size  Used Avail Use% Mounted on
    /dev/mapper/rhel-home xfs   270G   75G  195G  28% /home

  From /sys/devices/virtual/dmi/id
     Vendor:            HPE
     Product:           ProLiant MicroServer Gen10 Plus v2
     Product Family: ProLiant
     Serial:            MSG10PV2001

  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:
      2x Micron 18ASF4G72AZ-3G2B1 32 GB 2 rank 3200

  BIOS:
     BIOS Vendor:        HPE
     BIOS Version:       U64
     BIOS Date:          06/30/2022
     BIOS Revision:      1.60
     Firmware Revision: 2.70

  (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 2021.4.0 Build 20210924
Copyright (C) 1985-2021 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,
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------------------------------------------------------------------------------


==============================================================================
```

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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 2021.4.0 Build 20210910_000000
Copyright (C) 1985-2021 Intel Corporation.  All rights reserved.
Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R)
  64, Version 2021.4.0 Build 20210910_000000
Copyright (C) 1985-2021 Intel Corporation.  All rights reserved.
-------------------------------------------------------------------------------


===============================================================================
C++, C           | 511.povray_r(base) 526.blender_r(base, peak)
-------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
  Version 2021.4.0 Build 20210924
Copyright (C) 1985-2021 Intel Corporation. All rights reserved.
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  Version 2021.4.0 Build 20210924
Copyright (C) 1985-2021 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 2021.4.0 Build 20210910_000000
Copyright (C) 1985-2021 Intel Corporation.  All rights reserved.
Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R)
  64, Version 2021.4.0 Build 20210910_000000
Copyright (C) 1985-2021 Intel Corporation.  All rights reserved.
-------------------------------------------------------------------------------


===============================================================================
C++, C           | 511.povray_r(base) 526.blender_r(base, peak)
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Copyright (C) 1985-2021 Intel Corporation. All rights reserved.
-------------------------------------------------------------------------------


===============================================================================
C++, C, Fortran | 507.cactuBSSN_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)

```
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
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Copyright (C) 1985-2021 Intel Corporation. All rights reserved.
Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on
  Intel(R) 64, Version 2021.4.0 Build 20210910_000000
Copyright (C) 1985-2021 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 2021.4.0 Build 20210910_000000
Copyright (C) 1985-2021 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
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
  Version 2021.4.0 Build 20210924
Copyright (C) 1985-2021 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------
```

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

(Continued on next page)

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Base Compiler Invocation (Continued)

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-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`

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Base Optimization Flags (Continued)

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`

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SPEC CPU®2017 Floating Point Rate Result

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Hewlett Packard Enterprise
(Test Sponsor: HPE)

MicroServer Gen10 Plus v2
(2.80 GHz, Intel Xeon E-2314)

$SPECrate^{®}2017\_fp\_base = 40.2$

$SPECrate^{®}2017\_fp\_peak = 40.6$

CPU2017 License:	3	**Test Date:**	Aug-2022
Test Sponsor:	HPE	**Hardware Availability:**	Sep-2022
Tested by:	HPE	**Software Availability:**	Nov-2021

Peak Compiler Invocation (Continued)

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: `basepeak = yes`

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:

 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`

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Standard Performance Evaluation Corporation (info@spec.org)   https://www.spec.org/

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Peak Optimization Flags (Continued)

511.povray_r (continued):

```
-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-revF.html
http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64_revA.html

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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-revF.xml
http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64_revA.xml

For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

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