SPEC CPU®2017 Floating Point Rate Result

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Hewlett Packard Enterprise
(Test Sponsor: HPE)

MicroServer Gen10 Plus
(3.40 GHz, Intel Xeon E-2224)

$SPECrate^{®}2017_fp_base = $ **30.4**
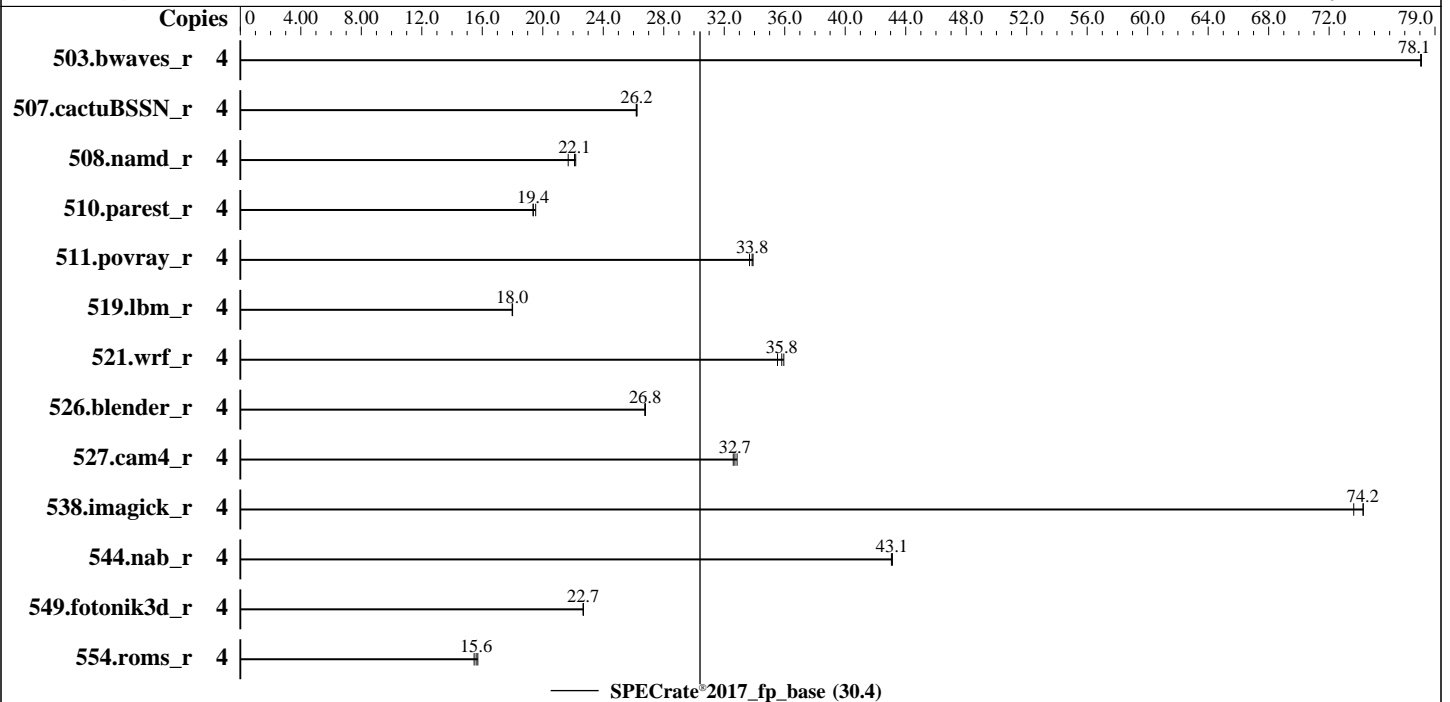
$SPECrate^{®}2017_fp_peak = $ Not Run

CPU2017 License: 3

Test Sponsor: HPE

Tested by: HPE

Test Date: Jan-2020

Hardware Availability: Apr-2020

Software Availability: May-2019

Benchmark	Copies	Result
503.bwaves_r	4	78.1
507.cactuBSSN_r	4	26.2
508.namd_r	4	22.1
510.parest_r	4	19.4
511.povray_r	4	33.8
519.lbm_r	4	18.0
521.wrf_r	4	35.8
526.blender_r	4	26.8
527.cam4_r	4	32.7
538.imagick_r	4	74.2
544.nab_r	4	43.1
549.fotonik3d_r	4	22.7
554.roms_r	4	15.6

SPECrate®2017_fp_base (30.4)

Hardware

CPU Name: Intel Xeon E-2224
 Max MHz: 4600
 Nominal: 3400
Enabled: 4 cores, 1 chip
Orderable: 1 chip
Cache L1: 32 KB I + 32 KB D on chip per core
 L2: 256 KB I+D on chip per core
 L3: 8 MB I+D on chip per chip
 Other: None
Memory: 32 GB (2 x 16 GB 2Rx8 PC4-2666V-U)
Storage: 1 x 1 TB 7.2 K SATA HDD
Other: None

Software

OS: Red Hat Enterprise Linux release 8.0 (Ootpa)
 Kernel 4.18.0-80.el8.x86_64
Compiler: C/C++: Version 19.0.4.227 of Intel C/C++
 Compiler Build 20190416 for Linux;
 Fortran: Version 19.0.4.227 of Intel Fortran
 Compiler Build 20190416 for Linux
Parallel: No
Firmware: HPE BIOS Version U48 2.00 (11/19/2019) released Apr-2020
File System: xfs
System State: Run level 3 (multi-user)
Base Pointers: 64-bit
Peak Pointers: Not Applicable
Other: None
Power Management: BIOS set to prefer performance at the cost of additional power usage

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SPECrate®2017_fp_peak = Not Run

CPU2017 License: 3	**Test Date:** Jan-2020
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Results Table

Benchmark	Copies	Base Seconds	Base Ratio	Base Seconds	Base Ratio	Base Seconds	Base Ratio	Peak Copies	Peak Seconds	Peak Ratio	Peak Seconds	Peak Ratio	Peak Seconds	Peak Ratio
503.bwaves_r	4	**514**	**78.1**	514	78.1	514	78.1							
507.cactuBSSN_r	4	**193**	**26.2**	193	26.2	193	26.2							
508.namd_r	4	**172**	**22.1**	175	21.7	171	22.2							
510.parest_r	4	**540**	**19.4**	536	19.5	541	19.4							
511.povray_r	4	275	33.9	277	33.7	**276**	**33.8**							
519.lbm_r	4	234	18.0	234	18.0	**234**	**18.0**							
521.wrf_r	4	249	35.9	252	35.5	**250**	**35.8**							
526.blender_r	4	**228**	**26.8**	227	26.8	228	26.8							
527.cam4_r	4	**214**	**32.7**	213	32.8	215	32.6							
538.imagick_r	4	134	74.3	135	73.6	**134**	**74.2**							
544.nab_r	4	156	43.1	156	43.1	**156**	**43.1**							
549.fotonik3d_r	4	687	22.7	**687**	**22.7**	688	22.7							
554.roms_r	4	411	15.5	405	15.7	**408**	**15.6**							

SPECrate®2017_fp_base = 30.4

SPECrate®2017_fp_peak = Not Run

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

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = "/home/cpu2017/lib/intel64"

General Notes

Binaries compiled on a system with 1x Intel Core i9-7900X CPU + 32GB RAM

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

Test Date: Jan-2020
Hardware Availability: Apr-2020
Software Availability: May-2019

General Notes (Continued)

```
 memory using Redhat Enterprise Linux 7.5
Yes: 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

```
 BIOS Configuration:
   Thermal Configuration set to Maximum Cooling

 Sysinfo program /home/cpu2017/bin/sysinfo
 Rev: r6365 of 2019-08-21 295195f888a3d7edb1e6e46a485a0011
 running on localhost.localdomain Sat Jan 18 00:06:23 2020

 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-2224 CPU @ 3.40GHz
       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:
      Architecture:        x86_64
      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
      CPU family:          6
      Model:               158
      Model name:          Intel(R) Xeon(R) E-2224 CPU @ 3.40GHz
      Stepping:            10
```

(Continued on next page)

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CPU2017 License: 3

Test Sponsor: HPE

Tested by: HPE

Test Date: Jan-2020

Hardware Availability: Apr-2020

Software Availability: May-2019

Platform Notes (Continued)

```
        CPU MHz:                4581.569
        BogoMIPS:               6816.00
        Virtualization:         VT-x
        L1d cache:              32K
        L1i cache:              32K
        L2 cache:               256K
        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
    pti ssbd ibrs ibpb stibp tpr_shadow vnmi flexpriority ept vpid fsgsbase tsc_adjust
    bmi1 hle avx2 smep bmi2 erms invpcid rtm mpx rdseed adx smap clflushopt intel_pt
    xsaveopt xsavec xgetbv1 xsaves dtherm ida arat pln pts flush_l1d

 /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: 32014 MB
    node 0 free: 20191 MB
    node distances:
    node   0
      0:  10

 From /proc/meminfo
    MemTotal:        32783352 kB
    HugePages_Total:        0
    Hugepagesize:        2048 kB

 From /etc/*release* /etc/*version*
    os-release:
      NAME="Red Hat Enterprise Linux"
      VERSION="8.0 (Ootpa)"
      ID="rhel"
      ID_LIKE="fedora"
      VERSION_ID="8.0"
      PLATFORM_ID="platform:el8"
      PRETTY_NAME="Red Hat Enterprise Linux 8.0 (Ootpa)"
      ANSI_COLOR="0;31"
    redhat-release: Red Hat Enterprise Linux release 8.0 (Ootpa)
```

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CPU2017 License: 3   **Test Date:**   Jan-2020
Test Sponsor: HPE   **Hardware Availability:** Apr-2020
Tested by: HPE   **Software Availability:** May-2019

Platform Notes (Continued)

```
    system-release: Red Hat Enterprise Linux release 8.0 (Ootpa)
    system-release-cpe: cpe:/o:redhat:enterprise_linux:8.0:ga

 uname -a:
    Linux localhost.localdomain 4.18.0-80.el8.x86_64 #1 SMP Wed Mar 13 12:02:46 UTC 2019
    x86_64 x86_64 x86_64 GNU/Linux

 Kernel self-reported vulnerability status:

 CVE-2018-3620 (L1 Terminal Fault):        Mitigation: PTE Inversion; VMX: conditional
                                           cache flushes, SMT disabled
 Microarchitectural Data Sampling:         No status reported
 CVE-2017-5754 (Meltdown):                 Mitigation: PTI
 CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled
                                           via prctl and seccomp
 CVE-2017-5753 (Spectre variant 1):        Mitigation: __user pointer sanitization
 CVE-2017-5715 (Spectre variant 2):        Mitigation: Full generic retpoline, IBPB:
                                           conditional, IBRS_FW, STIBP: disabled, RSB
                                           filling

 run-level 3 Jan 17 10:58

 SPEC is set to: /home/cpu2017
    Filesystem              Type  Size  Used Avail Use% Mounted on
    /dev/mapper/rhel-home xfs   864G   33G  832G   4% /home

 From /sys/devices/virtual/dmi/id
    BIOS:    HPE U48 11/19/2019
    Vendor:  HPE
    Product: ProLiant MicroServer Gen10 Plus
    Product Family: ProLiant
    Serial:  7CE936P1AD

 Additional information from dmidecode 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 UNKNOWN NOT AVAILABLE 16 GB 2 rank 2666

 (End of data from sysinfo program)
```

Compiler Version Notes

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

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Compiler Version Notes (Continued)

```
--------------------------------------------------------------------------------
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
--------------------------------------------------------------------------------


================================================================================
C++             | 508.namd_r(base) 510.parest_r(base)
--------------------------------------------------------------------------------
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
--------------------------------------------------------------------------------


================================================================================
C++, C          | 511.povray_r(base) 526.blender_r(base)
--------------------------------------------------------------------------------
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
--------------------------------------------------------------------------------


================================================================================
C++, C, Fortran | 507.cactuBSSN_r(base)
--------------------------------------------------------------------------------
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
  64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 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 for applications running on Intel(R)
  64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
--------------------------------------------------------------------------------
```

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Compiler Version Notes (Continued)

```
==============================================================================
Fortran, C       | 521.wrf_r(base) 527.cam4_r(base)
------------------------------------------------------------------------------
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
  64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------
```

Base Compiler Invocation

C benchmarks:
`icc -m64 -std=c11`

C++ benchmarks:
`icpc -m64`

Fortran benchmarks:
`ifort -m64`

Benchmarks using both Fortran and C:
`ifort -m64 icc -m64 -std=c11`

Benchmarks using both C and C++:
`icpc -m64 icc -m64 -std=c11`

Benchmarks using Fortran, C, and C++:
`icpc -m64 icc -m64 -std=c11 ifort -m64`

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`

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Base Portability Flags (Continued)

544.nab_r: `-DSPEC_LP64`
549.fotonik3d_r: `-DSPEC_LP64`
554.roms_r: `-DSPEC_LP64`

Base Optimization Flags

C benchmarks:
`-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only`
`-qopt-mem-layout-trans=4`

C++ benchmarks:
`-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only`
`-qopt-mem-layout-trans=4`

Fortran benchmarks:
`-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only`
`-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs`
`-align array32byte`

Benchmarks using both Fortran and C:
`-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only`
`-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs`
`-align array32byte`

Benchmarks using both C and C++:
`-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only`
`-qopt-mem-layout-trans=4`

Benchmarks using Fortran, C, and C++:
`-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only`
`-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs`
`-align array32byte`

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.2-CLX-revB.html
http://www.spec.org/cpu2017/flags/Intel-ic19.0u1-official-linux64.2019-07-09.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.2-CLX-revB.xml
http://www.spec.org/cpu2017/flags/Intel-ic19.0u1-official-linux64.2019-07-09.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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