SPEC CPU®2017 Floating Point Rate Result

Copyright 2017-2023 Standard Performance Evaluation Corporation

xFusion

FusionServer 2288H V6 (Intel Xeon Silver 4310)

SPECrate®2017_fp_base = 240

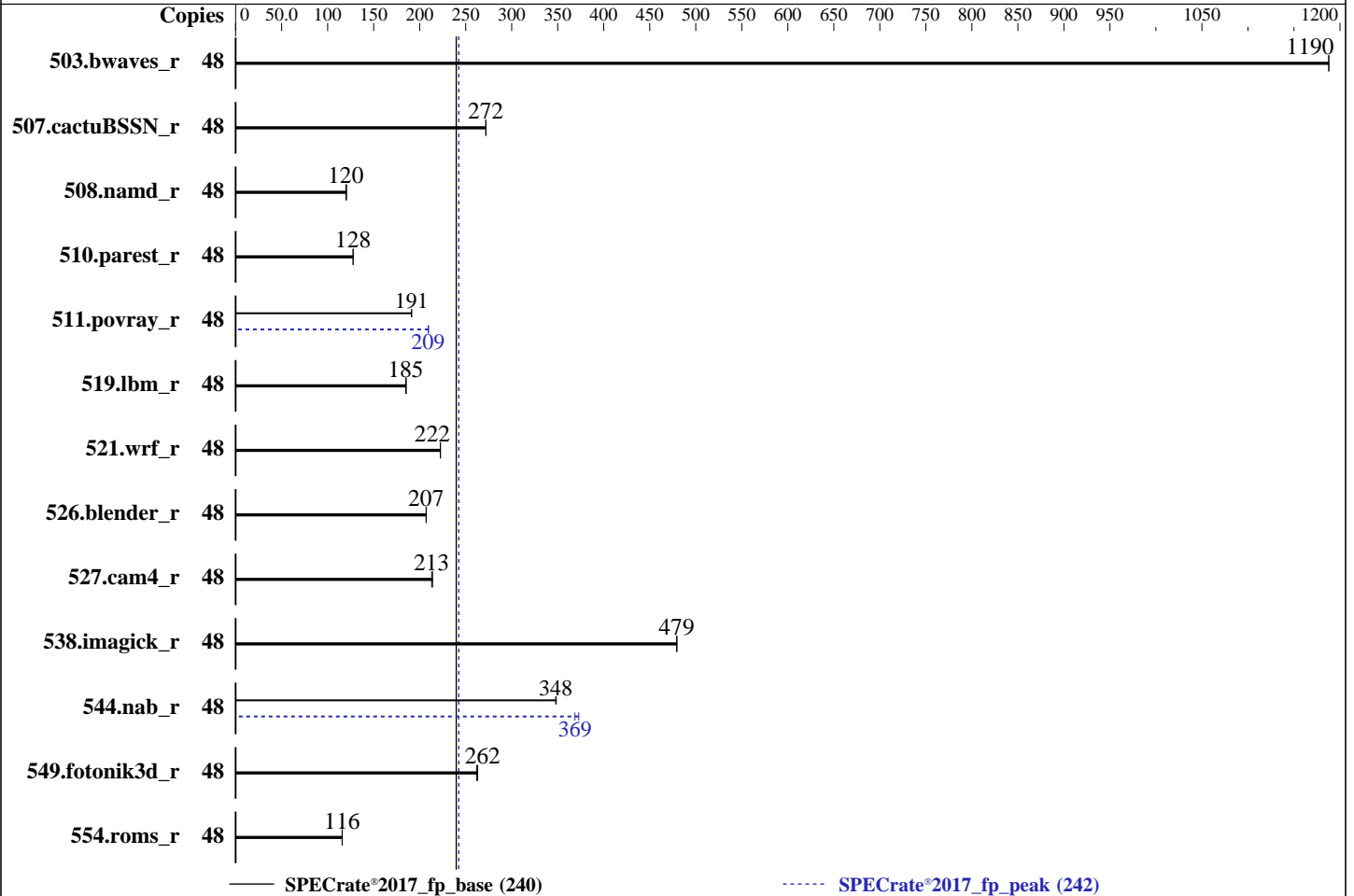## SPECrate®2017_fp_peak = 242

CPU2017 License: 6488
Test Sponsor: xFusion
Tested by: xFusion

Test Date: Jun-2023
Hardware Availability: Apr-2021
Software Availability: Dec-2022

Benchmark	Copies	Result
503.bwaves_r	48	1190
507.cactuBSSN_r	48	272
508.namd_r	48	120
510.parest_r	48	128
511.povray_r	48	191 (base) / 209 (peak)
519.lbm_r	48	185
521.wrf_r	48	222
526.blender_r	48	207
527.cam4_r	48	213
538.imagick_r	48	479
544.nab_r	48	348 (base) / 369 (peak)
549.fotonik3d_r	48	262
554.roms_r	48	116

SPECrate®2017_fp_base (240)   SPECrate®2017_fp_peak (242)

Hardware

CPU Name: Intel Xeon Silver 4310
Max MHz: 3300
Nominal: 2100
Enabled: 24 cores, 2 chips, 2 threads/core
Orderable: 1,2 chips
Cache L1: 32 KB I + 48 KB D on chip per core
L2: 1.25 MB I+D on chip per core
L3: 18 MB I+D on chip per chip
Other: None
Memory: 512 GB (16 x 32 GB 2Rx4 PC4-3200AA-R, running at 2666)
Storage: 1 x 1920 GB SATA SSD
Other: None

Software

OS: Red Hat Enterprise Linux release 8.4 (Ootpa) 4.18.0-305.el8.x86_64
Compiler: C/C++: Version 2023.0 of Intel oneAPI DPC++/C++ Compiler for Linux; Fortran: Version 2023.0 of Intel Fortran Compiler for Linux;
Parallel: No
Firmware: Version 1.55 Released May-2023
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
Power Management: BIOS and OS set to prefer performance at the cost of additional power usage

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Results Table

Benchmark	Copies	Base Seconds	Base Ratio	Base Seconds	Base Ratio	Base Seconds	Base Ratio	Copies	Peak Seconds	Peak Ratio	Peak Seconds	Peak Ratio	Peak Seconds	Peak Ratio
503.bwaves_r	48	**405**	**1190**	405	1190			48	**405**	**1190**	405	1190		
507.cactuBSSN_r	48	**224**	**272**	223	272			48	**224**	**272**	223	272		
508.namd_r	48	**381**	**120**	378	121			48	**381**	**120**	378	121		
510.parest_r	48	983	128	**984**	**128**			48	983	128	**984**	**128**		
511.povray_r	48	586	191	**586**	**191**			48	535	210	**536**	**209**		
519.lbm_r	48	273	185	**274**	**185**			48	273	185	**274**	**185**		
521.wrf_r	48	**483**	**222**	483	223			48	**483**	**222**	483	223		
526.blender_r	48	**353**	**207**	353	207			48	**353**	**207**	353	207		
527.cam4_r	48	**394**	**213**	392	214			48	**394**	**213**	392	214		
538.imagick_r	48	**249**	**479**	249	480			48	**249**	**479**	249	480		
544.nab_r	48	**232**	**348**	232	348			48	217	373	**219**	**369**		
549.fotonik3d_r	48	**714**	**262**	711	263			48	**714**	**262**	711	263		
554.roms_r	48	659	116	**659**	**116**			48	659	116	**659**	**116**		

SPECrate®2017_fp_base =   **240**

SPECrate®2017_fp_peak =   **242**

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"

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = "/spec2017-icc2023.0/lib/intel64:/spec2017-icc2023.0/je5.0.1-64"
MALLOC_CONF = "retain:true"

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.

(Continued on next page)

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

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Test Date: Jun-2023
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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:
Performance Profile Set to Performance
SNC Set to Enabled SNC2 (2-clusters)

Sysinfo program /spec2017-icc2023.0/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost.localdomain Tue Jun 20 17:21:32 2023

SUT (System Under Test) info as seen by some common utilities.

-----------------------------------------------------------
Table of contents
-----------------------------------------------------------
 1. uname -a
 2. w
 3. Username
 4. ulimit -a
 5. sysinfo process ancestry
 6. /proc/cpuinfo
 7. lscpu
 8. numactl --hardware
 9. /proc/meminfo
10. who -r
11. Systemd service manager version: systemd 239 (239-45.el8)
12. Services, from systemctl list-unit-files
13. Linux kernel boot-time arguments, from /proc/cmdline
14. cpupower frequency-info
15. tuned-adm active
16. sysctl
17. /sys/kernel/mm/transparent_hugepage
18. /sys/kernel/mm/transparent_hugepage/khugepaged
19. OS release
20. Kernel self-reported vulnerability status, from /sys/devices/system/cpu/vulnerabilities
21. Disk information
22. /sys/devices/virtual/dmi/id
23. dmidecode
24. BIOS
-----------------------------------------------------------

-----------------------------------------------------------
1. uname -a
  Linux localhost.localdomain 4.18.0-305.el8.x86_64 #1 SMP Thu Apr 29 08:54:30 EDT 2021 x86_64 x86_64 x86_64
  GNU/Linux

-----------------------------------------------------------
2. w
   17:21:32 up 8 min,  1 user,  load average: 1.67, 0.66, 0.32
   USER     TTY      FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
   root     tty1     -                17:19   60.00s  1.58s  0.10s -bash
```

(Continued on next page)

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Platform Notes (Continued)

```
    ----------------------------------------------------------
    3. Username
      From environment variable $USER:  root


    ----------------------------------------------------------
    4. ulimit -a
      core file size          (blocks, -c) 0
      data seg size           (kbytes, -d) unlimited
      scheduling priority             (-e) 0
      file size               (blocks, -f) unlimited
      pending signals                 (-i) 2060583
      max locked memory       (kbytes, -l) 64
      max memory size         (kbytes, -m) unlimited
      open files                      (-n) 1024
      pipe size            (512 bytes, -p) 8
      POSIX message queues     (bytes, -q) 819200
      real-time priority              (-r) 0
      stack size              (kbytes, -s) unlimited
      cpu time               (seconds, -t) unlimited
      max user processes              (-u) 2060583
      virtual memory          (kbytes, -v) unlimited
      file locks                      (-x) unlimited


    ----------------------------------------------------------
    5. sysinfo process ancestry
     /usr/lib/systemd/systemd --switched-root --system --deserialize 18
     login -- root
     -bash
     -bash
     runcpu --define default-platform-flags --copies 48 -c ic2023.0-lin-core-avx512-rate-20221201.cfg --define
       smt-on --define cores=24 --define physicalfirst --define invoke_with_interleave --define drop_caches
       --tune base,peak --iterations 2 -o all fprate
     runcpu --define default-platform-flags --copies 48 --configfile ic2023.0-lin-core-avx512-rate-20221201.cfg
       --define smt-on --define cores=24 --define physicalfirst --define invoke_with_interleave --define
       drop_caches --tune base,peak --iterations 2 --output_format all --nopower --runmode rate --tune base:peak
       --size refrate fprate --nopreenv --note-preenv --logfile
       $SPEC/tmp/CPU2017.030/templogs/preenv.fprate.030.0.log --lognum 030.0 --from_runcpu 2
     specperl $SPEC/bin/sysinfo
     $SPEC = /spec2017-icc2023.0


    ----------------------------------------------------------
    6. /proc/cpuinfo
       model name      : Intel(R) Xeon(R) Silver 4310 CPU @ 2.10GHz
       vendor_id       : GenuineIntel
       cpu family      : 6
       model           : 106
       stepping        : 6
       microcode       : 0xd000363
       bugs            : spectre_v1 spectre_v2 spec_store_bypass swapgs
       cpu cores       : 12
       siblings        : 24
       2 physical ids (chips)
       48 processors (hardware threads)
       physical id 0: core ids 0-11
       physical id 1: core ids 0-11
       physical id 0: apicids 0-23
       physical id 1: apicids 64-87
      Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for
      virtualized systems.  Use the above data carefully.
```

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CPU2017 License: 6488

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Hardware Availability: Apr-2021

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Platform Notes (Continued)

```
      --------------------------------------------------------
      7. lscpu

      From lscpu from util-linux 2.32.1:
        Architecture:        x86_64
        CPU op-mode(s):      32-bit, 64-bit
        Byte Order:          Little Endian
        CPU(s):              48
        On-line CPU(s) list: 0-47
        Thread(s) per core:  2
        Core(s) per socket:  12
        Socket(s):           2
        NUMA node(s):        4
        Vendor ID:           GenuineIntel
        BIOS Vendor ID:      Intel(R) Corporation
        CPU family:          6
        Model:               106
        Model name:          Intel(R) Xeon(R) Silver 4310 CPU @ 2.10GHz
        BIOS Model name:     Intel(R) Xeon(R) Silver 4310 CPU @ 2.10GHz
        Stepping:            6
        CPU MHz:             2700.000
        BogoMIPS:            4200.00
        Virtualization:      VT-x
        L1d cache:           48K
        L1i cache:           32K
        L2 cache:            1280K
        L3 cache:            18432K
        NUMA node0 CPU(s):   0-5,24-29
        NUMA node1 CPU(s):   6-11,30-35
        NUMA node2 CPU(s):   12-17,36-41
        NUMA node3 CPU(s):   18-23,42-47
        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 pni
                             pclmulqdq dtes64 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 epb cat_l3 invpcid_single 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 cqm rdt_a avx512f avx512dq rdseed adx smap avx512ifma
                             clflushopt clwb intel_pt avx512cd sha_ni avx512bw avx512vl xsaveopt xsavec xgetbv1
                             xsaves cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local split_lock_detect wbnoinvd
                             dtherm ida arat pln pts hwp_epp avx512vbmi umip pku ospke avx512_vbmi2 gfni vaes
                             vpclmulqdq avx512_vnni avx512_bitalg tme avx512_vpopcntdq la57 rdpid fsrm md_clear
                             pconfig flush_l1d arch_capabilities

      --------------------------------------------------------
      8. numactl --hardware
      NOTE: a numactl 'node' might or might not correspond to a physical chip.
        available: 4 nodes (0-3)
        node 0 cpus: 0-5,24-29
        node 0 size: 128158 MB
        node 0 free: 127196 MB
        node 1 cpus: 6-11,30-35
        node 1 size: 129021 MB
        node 1 free: 128428 MB
        node 2 cpus: 12-17,36-41
        node 2 size: 129021 MB
        node 2 free: 128490 MB
        node 3 cpus: 18-23,42-47
```

(Continued on next page)

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Platform Notes (Continued)

```
   node 3 size: 128981 MB
   node 3 free: 128443 MB
   node distances:
   node   0   1   2   3
     0:  10  11  20  20
     1:  11  10  20  20
     2:  20  20  10  11
     3:  20  20  11  10


   -----------------------------------------------------------
9. /proc/meminfo
   MemTotal:       527546776 kB


   -----------------------------------------------------------
10. who -r
   run-level 3 Jun 20 17:13


   -----------------------------------------------------------
11. Systemd service manager version: systemd 239 (239-45.el8)
   Default Target  Status
   multi-user      running


   -----------------------------------------------------------
12. Services, from systemctl list-unit-files
   STATE       UNIT FILES
   enabled     NetworkManager NetworkManager-dispatcher NetworkManager-wait-online atd auditd autovt@ chronyd
               crond firewalld getty@ import-state irqbalance iscsi iscsi-onboot kdump libstoragemgmt
               loadmodules lvm2-monitor mcelog mdmonitor microcode multipathd nis-domainname
               nvmefc-boot-connections rhsmcertd rsyslog selinux-autorelabel-mark smartd sshd sssd syslog
               sysstat timedatex tuned udisks2 vdo
   disabled    arp-ethers blk-availability chrony-wait console-getty cpupower debug-shell ebtables iprdump
               iprinit iprupdate ipsec iscsid iscsiuio kpatch kvm_stat ledmon nftables nvmf-autoconnect oddjobd
               psacct rdisc rhcd rhsm rhsm-facts serial-getty@ sshd-keygen@ systemd-resolved tcsd
   generated   SystemTap compile-server gcc-toolset-10-stap-server gcc-toolset-10-systemtap
               gcc-toolset-9-stap-server gcc-toolset-9-systemtap scripts startup
   indirect    sssd-autofs sssd-kcm sssd-nss sssd-pac sssd-pam sssd-ssh sssd-sudo
   masked      systemd-timedated


   -----------------------------------------------------------
13. Linux kernel boot-time arguments, from /proc/cmdline
   BOOT_IMAGE=(hd0,gpt3)/boot/vmlinuz-4.18.0-305.el8.x86_64
   root=UUID=711de346-1631-4b60-a626-37488271d525
   ro
   crashkernel=auto
   resume=UUID=d6a3ac10-1ea1-4e42-a80b-54c427bcad19
   rhgb
   quiet


   -----------------------------------------------------------
14. cpupower frequency-info
   analyzing CPU 0:
     Unable to determine current policy
     boost state support:
       Supported: yes
       Active: yes


   -----------------------------------------------------------
15. tuned-adm active
   No current active profile.
```

(Continued on next page)

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Platform Notes (Continued)

```
    ----------------------------------------------------------
    16. sysctl
      kernel.numa_balancing            1
      kernel.randomize_va_space        2
      vm.compaction_proactiveness      0
      vm.dirty_background_bytes        0
      vm.dirty_background_ratio        10
      vm.dirty_bytes                   0
      vm.dirty_expire_centisecs        3000
      vm.dirty_ratio                   20
      vm.dirty_writeback_centisecs     500
      vm.dirtytime_expire_seconds      43200
      vm.extfrag_threshold             500
      vm.min_unmapped_ratio            1
      vm.nr_hugepages                  0
      vm.nr_hugepages_mempolicy        0
      vm.nr_overcommit_hugepages       0
      vm.swappiness                    60
      vm.watermark_boost_factor        15000
      vm.watermark_scale_factor        10
      vm.zone_reclaim_mode             0


    ----------------------------------------------------------
    17. /sys/kernel/mm/transparent_hugepage
      defrag         always defer defer+madvise [madvise] never
      enabled        [always] madvise never
      hpage_pmd_size 2097152
      shmem_enabled  always within_size advise [never] deny force


    ----------------------------------------------------------
    18. /sys/kernel/mm/transparent_hugepage/khugepaged
      alloc_sleep_millisecs   60000
      defrag                  1
      max_ptes_none           511
      max_ptes_swap           64
      pages_to_scan           4096
      scan_sleep_millisecs    10000


    ----------------------------------------------------------
    19. OS release
      From /etc/*-release /etc/*-version
      os-release     Red Hat Enterprise Linux 8.4 (Ootpa)
      redhat-release Red Hat Enterprise Linux release 8.4 (Ootpa)
      system-release Red Hat Enterprise Linux release 8.4 (Ootpa)


    ----------------------------------------------------------
    20. Kernel self-reported vulnerability status, from /sys/devices/system/cpu/vulnerabilities
      itlb_multihit        Not affected
      l1tf                 Not affected
      mds                  Not affected
      meltdown             Not affected
      spec_store_bypass    Mitigation: Speculative Store Bypass disabled via prctl and seccomp
      spectre_v1           Mitigation: usercopy/swapgs barriers and __user pointer sanitization
      spectre_v2           Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling
      srbds                Not affected
      tsx_async_abort      Not affected
    For more information, see the Linux documentation on hardware vulnerabilities, for example
        https://www.kernel.org/doc/html/latest/admin-guide/hw-vuln/index.html


    ----------------------------------------------------------
```

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Platform Notes (Continued)

```
  21. Disk information
  SPEC is set to: /spec2017-icc2023.0
    Filesystem      Type  Size  Used Avail Use% Mounted on
    /dev/sda3       xfs   420G   43G  377G  11% /

  ------------------------------------------------------------
  22. /sys/devices/virtual/dmi/id
      Vendor:         XFUSION
      Product:        2288H V6
      Product Family: Whitley
      Serial:         Serial

  ------------------------------------------------------------
  23. dmidecode
    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:
      16x Samsung M393A4K40DB3-CWE 32 GB 2 rank 3200, configured at 2666


  ------------------------------------------------------------
  24. BIOS
  (This section combines info from /sys/devices and dmidecode.)
    BIOS Vendor:     XFUSION
    BIOS Version:    1.55
    BIOS Date:       05/09/2023
    BIOS Revision:   1.55
```

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 2023.0.0 Build 20221201
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 2023.0.0 Build 20221201
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 2023.0.0 Build 20221201
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
Copyright (C) 1985-2022 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, Version 2023.0.0 Build 20221201
```

(Continued on next page)

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Compiler Version Notes (Continued)

```
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
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 2023.0.0 Build 20221201
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------------------------------

==============================================================================================
Fortran, C    | 521.wrf_r(base, peak) 527.cam4_r(base, peak)
------------------------------------------------------------------------------------------------------
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
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`

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`

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SPEC CPU®2017 Floating Point Rate Result

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xFusion

FusionServer 2288H V6 (Intel Xeon Silver 4310)

SPECrate®2017_fp_base = 240

SPECrate®2017_fp_peak = 242

CPU2017 License: 6488
Test Sponsor: xFusion
Tested by: xFusion

Test Date: Jun-2023
Hardware Availability: Apr-2021
Software Availability: Dec-2022

Base Portability Flags (Continued)

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
-Wno-implicit-int -ljemalloc -L/usr/local/jemalloc64-5.0.1/lib
```

C++ benchmarks:
```
-w -std=c++14 -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
```

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
-Wno-implicit-int -nostandard-realloc-lhs -align array32byte -auto
-ljemalloc -L/usr/local/jemalloc64-5.0.1/lib
```

Benchmarks using both C and C++:
```
-w -std=c++14 -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast
-ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -Wno-implicit-int -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib
```

Benchmarks using Fortran, C, and C++:
```
-w -std=c++14 -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast
```

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Base Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++ (continued):
```
-ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -Wno-implicit-int -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:
```
ifx
```

Benchmarks using both Fortran and C:
```
ifx icx
```

Benchmarks using both C and C++:
```
icpx icx
```

Benchmarks using Fortran, C, and C++:
```
icpx icx ifx
```

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-AVX512 -Ofast`
```
-ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -Wno-implicit-int
```

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Peak Optimization Flags (Continued)

544.nab_r (continued):
`-qopt-zmm-usage=high -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:

521.wrf_r: `basepeak = yes`

527.cam4_r: `basepeak = yes`

Benchmarks using both C and C++:

511.povray_r: `-w -std=c++14 -m64 -std=c11 -Wl,-z,muldefs`
`-fprofile-generate(pass 1)`
`-fprofile-use=default.profdata(pass 2) -xCORE-AVX2(pass 1)`
`-flto -Ofast -xCORE-AVX512 -ffast-math -mfpmath=sse`
`-funroll-loops -qopt-mem-layout-trans=4 -Wno-implicit-int`
`-ljemalloc -L/usr/local/jemalloc64-5.0.1/lib`

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/Intel-ic2023-official-linux64.html`
`http://www.spec.org/cpu2017/flags/xFusion-Platform-Settings-ICX-V1.2.html`

You can also download the XML flags sources by saving the following links:
`http://www.spec.org/cpu2017/flags/Intel-ic2023-official-linux64.xml`
`http://www.spec.org/cpu2017/flags/xFusion-Platform-Settings-ICX-V1.2.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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