



SPEC CPU®2017 Floating Point Speed Result

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xFusion

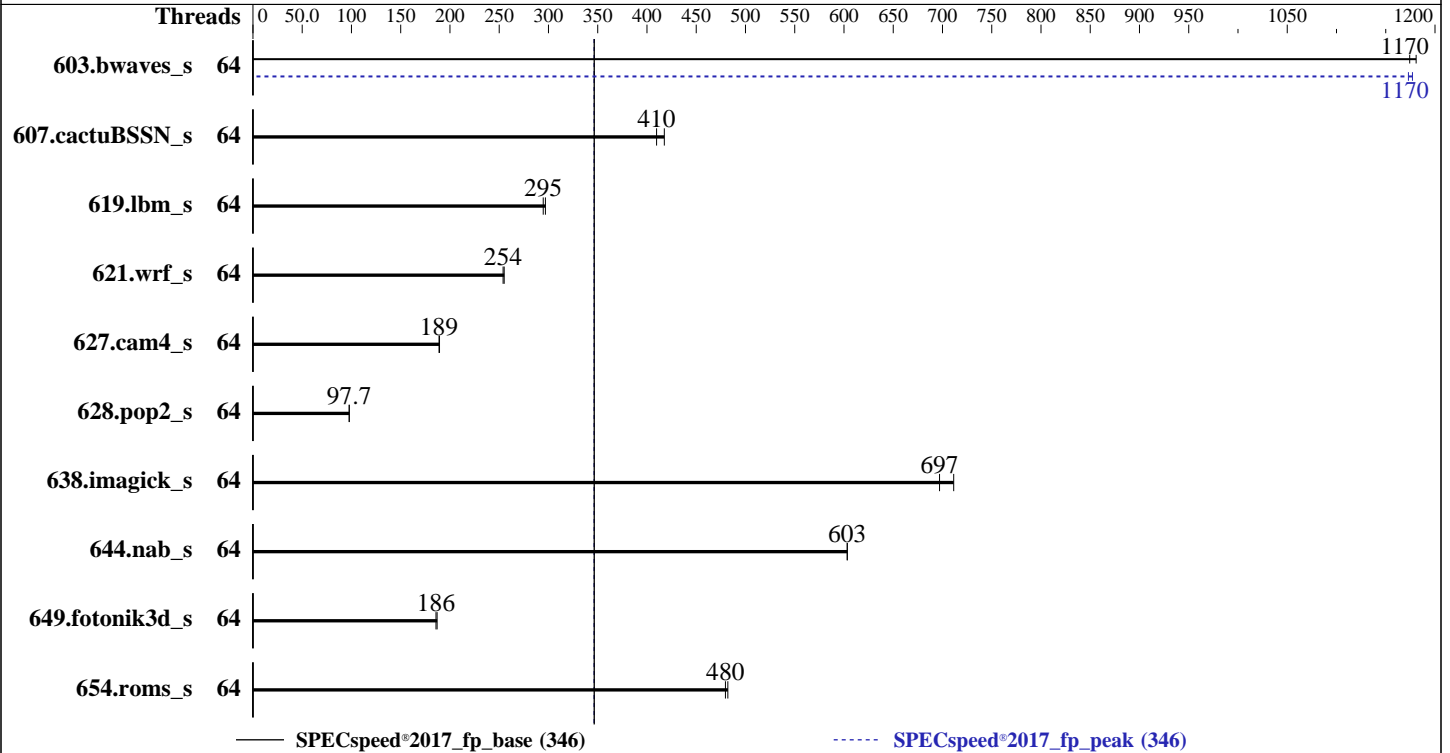
SPECspeed®2017_fp_base = 346

FusionServer 2288H V7 (Intel Xeon Gold 6448H)

SPECspeed®2017_fp_peak = 346

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

Test Date: Jun-2023
Hardware Availability: Jan-2023
Software Availability: Dec-2022



Hardware

CPU Name: Intel Xeon Gold 6448H
Max MHz: 4100
Nominal: 2400
Enabled: 64 cores, 2 chips
Orderable: 1,2 chips
Cache L1: 32 KB I + 48 KB D on chip per core
L2: 2 MB I+D on chip per core
L3: 60 MB I+D on chip per chip
Other: None
Memory: 512 GB (16 x 32 GB 2Rx8 PC5-4800B-R)
Storage: 1 x 1920 GB SATA SSD
Other: None

Software

OS: Red Hat Enterprise Linux release 9.0 (Plow)
5.14.0-70.13.1.el9_0.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: Yes
Firmware: Version 2.00.55 Released Mar-2023
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: OS set to prefer performance at the cost of additional power usage



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Results Table

Benchmark	Base								Peak							
	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio		
603.bwaves_s	64	50.0	1180	<u>50.2</u>	<u>1170</u>			64	50.1	1180	<u>50.3</u>	<u>1170</u>				
607.cactuBSSN_s	64	39.9	418	<u>40.7</u>	<u>410</u>			64	39.9	418	<u>40.7</u>	<u>410</u>				
619.lbm_s	64	17.6	297	<u>17.8</u>	<u>295</u>			64	17.6	297	<u>17.8</u>	<u>295</u>				
621.wrf_s	64	51.9	255	<u>52.1</u>	<u>254</u>			64	51.9	255	<u>52.1</u>	<u>254</u>				
627.cam4_s	64	<u>46.9</u>	<u>189</u>	46.8	189			64	<u>46.9</u>	<u>189</u>	46.8	189				
628.pop2_s	64	121	97.7	<u>122</u>	<u>97.7</u>			64	121	97.7	<u>122</u>	<u>97.7</u>				
638.imagick_s	64	20.3	711	<u>20.7</u>	<u>697</u>			64	20.3	711	<u>20.7</u>	<u>697</u>				
644.nab_s	64	<u>29.0</u>	<u>603</u>	29.0	603			64	<u>29.0</u>	<u>603</u>	29.0	603				
649.fotonik3d_s	64	<u>49.1</u>	<u>186</u>	48.8	187			64	<u>49.1</u>	<u>186</u>	48.8	187				
654.roms_s	64	32.7	482	<u>32.8</u>	<u>480</u>			64	32.7	482	<u>32.8</u>	<u>480</u>				

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

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:
KMP_AFFINITY = "granularity=fine,compact"
LD_LIBRARY_PATH = "/spec2017-icc2023.0/lib/intel64:/spec2017-icc2023.0/je5.0.1-64"
MALLOC_CONF = "retain:true"
OMP_STACKSIZE = "192M"

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
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:
Performance Profile Set to Load Balance

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Platform Notes (Continued)

Enable LP [Global] Set to Single LP

Sysinfo program /spec2017-icc2023.0/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost.localdomain Wed Jun 28 07:11:30 2023

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

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13. Services, from systemctl list-unit-files
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18. /sys/kernel/mm/transparent_hugepage/khugepaged
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23. BIOS

1. uname -a
Linux localhost.localdomain 5.14.0-70.13.1.e19_0.x86_64 #1 SMP PREEMPT Thu Apr 14 12:42:38 EDT 2022 x86_64
x86_64 x86_64 GNU/Linux

2. w
07:11:30 up 3 min, 1 user, load average: 0.03, 0.08, 0.04
USER TTY LOGIN@ IDLE JCPU PCPU WHAT
root tty2 07:11 10.00s 0.86s 0.00s -bash

3. Username
From environment variable \$USER: root

4. ulimit -a
real-time non-blocking time (microseconds, -R) unlimited
core file size (blocks, -c) 0
data seg size (kbytes, -d) unlimited
scheduling priority (-e) 0
file size (blocks, -f) unlimited
pending signals (-i) 2060157
max locked memory (kbytes, -l) 64

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Platform Notes (Continued)

```

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) 2060157
virtual memory            (kbytes, -v) unlimited
file locks                (-x) unlimited

```

```

-----
5. sysinfo process ancestry
/usr/lib/systemd/systemd rhgb --switched-root --system --deserialize 31
login -- root
-bash
-bash
runcpu --define default-platform-flags -c ic2023.0-lin-sapphirerapids-speed-20221201.cfg --define cores=64
--tune base,peak --iterations 2 -o all --define drop_caches fpspeed
runcpu --define default-platform-flags --configfile ic2023.0-lin-sapphirerapids-speed-20221201.cfg --define
cores=64 --tune base,peak --iterations 2 --output_format all --define drop_caches --nopower --runmode
speed --tune base:peak --size refspeed fpspeed --nopreenv --note-preenv --logfile
$SPEC/tmp/CPU2017.048/templogs/preenv.fpspeed.048.0.log --lognum 048.0 --from_runcpu 2
specperl $SPEC/bin/sysinfo
$SPEC = /spec2017-icc2023.0

```

```

-----
6. /proc/cpuinfo
model name      : Intel(R) Xeon(R) Gold 6448H
vendor_id      : GenuineIntel
cpu family     : 6
model          : 143
stepping      : 7
microcode     : 0x2b000111
bugs           : spectre_v1 spectre_v2 spec_store_bypass swapgs
cpu cores     : 32
siblings      : 32
2 physical ids (chips)
64 processors (hardware threads)
physical id 0: core ids 0-31
physical id 1: core ids 0-31
physical id 0: apicids
0,2,4,6,8,10,12,14,16,18,20,22,24,26,28,30,32,34,36,38,40,42,44,46,48,50,52,54,56,58,60,62
physical id 1: apicids
128,130,132,134,136,138,140,142,144,146,148,150,152,154,156,158,160,162,164,166,168,170,172,174,176,178,1
80,182,184,186,188,190
Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for
virtualized systems. Use the above data carefully.

```

```

-----
7. lscpu

From lscpu from util-linux 2.37.4:
Architecture:          x86_64
CPU op-mode(s):        32-bit, 64-bit
Address sizes:         46 bits physical, 57 bits virtual
Byte Order:            Little Endian
CPU(s):                64
On-line CPU(s) list:   0-63
Vendor ID:             GenuineIntel

```

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Platform Notes (Continued)

```

BIOS Vendor ID: Intel(R) Corporation
Model name: Intel(R) Xeon(R) Gold 6448H
BIOS Model name: Intel(R) Xeon(R) Gold 6448H
CPU family: 6
Model: 143
Thread(s) per core: 1
Core(s) per socket: 32
Socket(s): 2
Stepping: 7
Frequency boost: enabled
CPU max MHz: 2401.0000
CPU min MHz: 800.0000
BogoMIPS: 4800.00
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 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 cat_l2 cdp_l3
invpcid_single intel_ppin cdp_l2 ssbd mba ibrs ibpb stibp ibrs_enhanced
tpr_shadow vnmi flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmi1 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 xsavec cqm_llc cqm_occup_llc cqm_mbm_total
cqm_mbm_local split_lock_detect avx_vnni avx512_bf16 wbnoinvd dtherm ida
arat pln pts avx512vbmi umip pku ospke waitpkg avx512_vbmi2 gfni vaes
vpclmulqdq avx512_vnni avx512_bitalg tme avx512_vpopcntdq la57 rdpid
bus_lock_detect cldemote movdiri movdir64b enqcmd fsrm md_clear serialize
tsxldtrk pconfig arch_lbr avx512_fp16 amx_tile flush_lld arch_capabilities
Virtualization: VT-x
L1d cache: 3 MiB (64 instances)
L1i cache: 2 MiB (64 instances)
L2 cache: 128 MiB (64 instances)
L3 cache: 120 MiB (2 instances)
NUMA node(s): 2
NUMA node0 CPU(s): 0-31
NUMA node1 CPU(s): 32-63
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
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

```

From lscpu --cache:

NAME	ONE-SIZE	ALL-SIZE	WAYS	TYPE	LEVEL	SETS	PHY-LINE	COHERENCY-SIZE
L1d	48K	3M	12	Data	1	64	1	64
L1i	32K	2M	8	Instruction	1	64	1	64
L2	2M	128M	16	Unified	2	2048	1	64
L3	60M	120M	15	Unified	3	65536	1	64

8. numactl --hardware

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

available: 2 nodes (0-1)
node 0 cpus: 0-31

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Platform Notes (Continued)

```
node 0 size: 257103 MB
node 0 free: 255480 MB
node 1 cpus: 32-63
node 1 size: 257993 MB
node 1 free: 257445 MB
node distances:
node 0 1
  0: 10 21
  1: 21 10
```

```
-----
9. /proc/meminfo
   MemTotal:          527459196 kB
```

```
-----
10. who -r
    run-level 5 Jun 28 07:08
```

```
-----
11. Systemd service manager version: systemd 250 (250-6.el9_0)
    Default Target      Status
    graphical           degraded
```

```
-----
12. Failed units, from systemctl list-units --state=failed
    UNIT                LOAD    ACTIVE SUB    DESCRIPTION
    * sep5.service      loaded failed failed systemd script to load sep5 driver at boot time
```

```
-----
13. Services, from systemctl list-unit-files
    STATE      UNIT FILES
    enabled    ModemManager NetworkManager NetworkManager-dispatcher NetworkManager-wait-online
    accounts-daemon atd auditd avahi-daemon bluetooth chronyd crond cups dbus-broker gdm
    getty@ insights-client-boot irqbalance iscsi iscsi-onboot kdump libstoragemgmt
    low-memory-monitor lvm2-monitor mcelog mdmonitor microcode multipathd nis-domainname
    nvme-fc-boot-connections ostree-remount power-profiles-daemon qemu-guest-agent rhsmcertd
    rsyslog rtkit-daemon selinux-autorelabel-mark sep5 smartd sshd sssd switcheroo-control
    sysstat systemd-network-generator udisks2 upower vgauthd vmtoolsd
    enabled-runtime systemd-remount-fs
    disabled    arp-ethers blk-availability brltty canberra-system-bootup canberra-system-shutdown
    canberra-system-shutdown-reboot chrony-wait cni-dhcp console-getty cpupower cups-browsed
    dbus-daemon debug-shell dnsmasq firewalld iprump iprinit iprupdate iscsiuio kpatch
    kvm_stat ledmon man-db-restart-cache-update nftables nvme-fc-autoconnect podman
    podman-auto-update podman-restart psacct ras-mc-ctl rasdaemon rdisc rhcd rhsm rhsm-facts
    rpmdb-rebuild serial-getty@ speech-dispatcherd sshd-keygen@ systemd-boot-check-no-failures
    systemd-pstore systemd-sysextr wpa_supplicant
    indirect    spice-vdagentd sssd-autofs sssd-kcm sssd-nss sssd-pac sssd-pam sssd-ssh sssd-sudo
```

```
-----
14. Linux kernel boot-time arguments, from /proc/cmdline
    BOOT_IMAGE=(hd0,gpt3)/boot/vmlinuz-5.14.0-70.13.1.el9_0.x86_64
    root=UUID=cc4bab05-907e-44ef-b818-2b2874390234
    ro
    crashkernel=1G-4G:192M,4G-64G:256M,64G-:512M
    resume=UUID=5ba347ca-8beb-4f6e-9c11-de63dc4ddf5f
    rhgb
    quiet
```

```
-----
15. cpupower frequency-info
```

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Platform Notes (Continued)

analyzing CPU 0:
current policy: frequency should be within 800 MHz and 2.40 GHz.
The governor "performance" may decide which speed to use within this range.
boost state support:
Supported: yes
Active: yes

```
-----
16. sysctl
kernel.numa_balancing          1
kernel.randomize_va_space     2
vm.compaction_proactiveness   20
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+madvice [madvice] never
enabled        [always] madvice 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_shared        256
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 9.0 (Plow)
redhat-release  Red Hat Enterprise Linux release 9.0 (Plow)
system-release  Red Hat Enterprise Linux release 9.0 (Plow)
-----
```

```
-----
20. Disk information
SPEC is set to: /spec2017-icc2023.0
Filesystem      Type  Size  Used Avail Use% Mounted on
/dev/sda3       xfs   420G  48G  372G  12% /
-----
```

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Platform Notes (Continued)

21. /sys/devices/virtual/dmi/id
Vendor: XFUSION
Product: 2288H V7
Product Family: Eagle Stream
Serial: serial

22. dmidecode
Additional information from dmidecode 3.3 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 M321R4GA3BB6-CQKDG 32 GB 2 rank 4800

23. BIOS
(This section combines info from /sys/devices and dmidecode.)
BIOS Vendor: XFUSION
BIOS Version: 2.00.55
BIOS Date: 03/07/2023
BIOS Revision: 0.55

Compiler Version Notes

C | 619.lbm_s(base, peak) 638.imagick_s(base, peak) 644.nab_s(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, Fortran | 607.cactuBSSN_s(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.
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 | 603.bwaves_s(base, peak) 649.fotonik3d_s(base, peak) 654.roms_s(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 | 621.wrf_s(base, peak) 627.cam4_s(base, peak) 628.pop2_s(base, peak)

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
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Compiler Version Notes (Continued)

Base Compiler Invocation

C benchmarks:
icx

Fortran benchmarks:
ifx

Benchmarks using both Fortran and C:
ifx icx

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

Base Portability Flags

```
603.bwaves_s: -DSPEC_LP64
607.cactuBSSN_s: -DSPEC_LP64
619.lbm_s: -DSPEC_LP64
621.wrf_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
627.cam4_s: -DSPEC_LP64 -DSPEC_CASE_FLAG
628.pop2_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
-assume byterecl
638.imagick_s: -DSPEC_LP64
644.nab_s: -DSPEC_LP64
649.fotonik3d_s: -DSPEC_LP64
654.roms_s: -DSPEC_LP64
```

Base Optimization Flags

C benchmarks:
-m64 -std=c11 -Wl,-z,muldefs -xsapphirerapids -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -fiopenmp
-DSPEC_OPENMP -Wno-implicit-int -mprefer-vector-width=512
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Fortran benchmarks:
-m64 -Wl,-z,muldefs -DSPEC_OPENMP -xsapphirerapids -Ofast
-ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -fiopenmp -nostandard-realloc-lhs

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SPEC CPU®2017 Floating Point Speed Result

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xFusion

SPECspeed®2017_fp_base = 346

FusionServer 2288H V7 (Intel Xeon Gold 6448H)

SPECspeed®2017_fp_peak = 346

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

Test Date: Jun-2023
Hardware Availability: Jan-2023
Software Availability: Dec-2022

Base Optimization Flags (Continued)

Fortran benchmarks (continued):

```
-align array32byte -auto -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc
```

Benchmarks using both Fortran and C:

```
-m64 -std=c11 -Wl,-z,muldefs -xsaphirerapids -Ofast -ffast-math  
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -fiopenmp  
-DSPEC_OPENMP -Wno-implicit-int -mprefer-vector-width=512  
-nostandard-realloc-lhs -align array32byte -auto  
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc
```

Benchmarks using Fortran, C, and C++:

```
-m64 -std=c++14 -std=c11 -Wl,-z,muldefs -xsaphirerapids -Ofast  
-ffast-math -flto -mfpmath=sse -funroll-loops  
-qopt-mem-layout-trans=4 -fiopenmp -DSPEC_OPENMP -Wno-implicit-int  
-mprefer-vector-width=512 -nostandard-realloc-lhs -align array32byte  
-auto -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc
```

Peak Compiler Invocation

C benchmarks:
icx

Fortran benchmarks:
ifx

Benchmarks using both Fortran and C:
ifx icx

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

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

(Continued on next page)



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Tested by: xFusion

Test Date: Jun-2023
Hardware Availability: Jan-2023
Software Availability: Dec-2022

Peak Optimization Flags (Continued)

619.lbm_s: basepeak = yes

638.imagick_s: basepeak = yes

644.nab_s: basepeak = yes

Fortran benchmarks:

```
603.bwaves_s: -m64 -Wl,-z,muldefs -DSPEC_OPENMP -xsapphirerapids
-Ofast -ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -fiopenmp -nostandard-realloc-lhs
-align array32byte -auto -L/usr/local/jemalloc64-5.0.1/lib
-ljemalloc
```

649.fotonik3d_s: basepeak = yes

654.roms_s: basepeak = yes

Benchmarks using both Fortran and C:

621.wrf_s: basepeak = yes

627.cam4_s: basepeak = yes

628.pop2_s: basepeak = yes

Benchmarks using Fortran, C, and C++:

607.cactuBSSN_s: 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-SPR-V1.1-revC.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-SPR-V1.1-revC.xml>

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