



SPEC CPU®2017 Floating Point Speed Result

Copyright 2017-2025 Standard Performance Evaluation Corporation

Lenovo Global Technology

ThinkSystem SR650 V4
(2.60 GHz, Intel Xeon 6521P)

SPECspeed®2017_fp_base = 242

SPECspeed®2017_fp_peak = Not Run

CPU2017 License: 9017

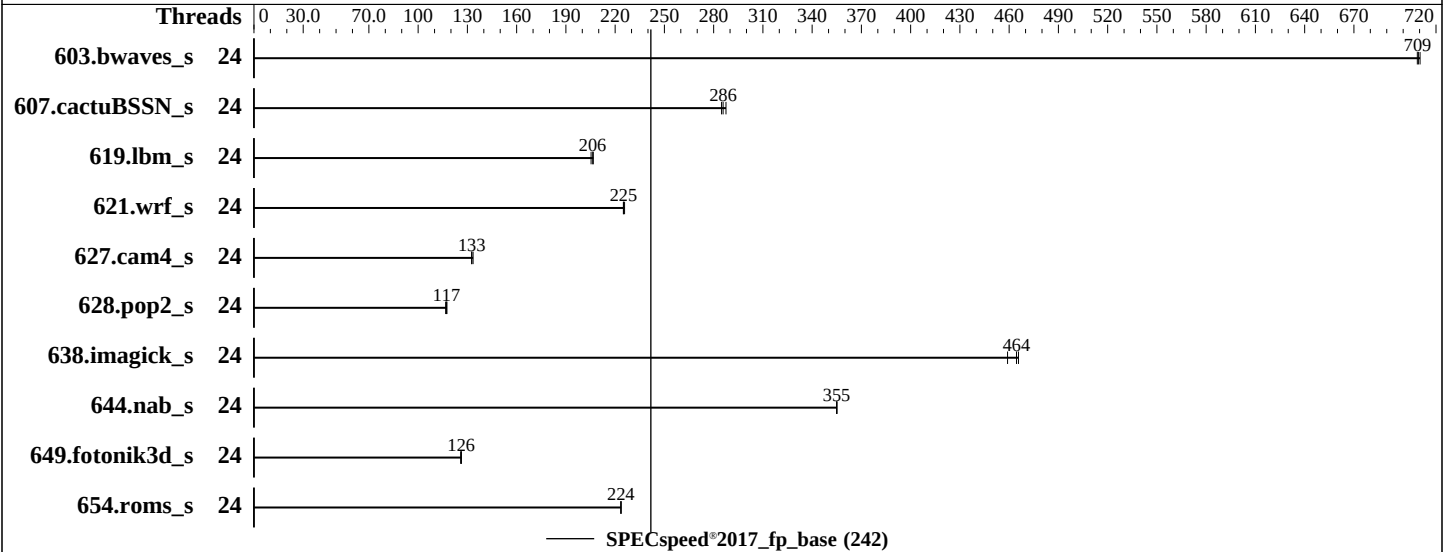
Test Sponsor: Lenovo Global Technology

Tested by: Lenovo Global Technology

Test Date: May-2025

Hardware Availability: May-2025

Software Availability: Jun-2024



Hardware

CPU Name: Intel Xeon 6521P
Max MHz: 4100
Nominal: 2600
Enabled: 24 cores, 1 chip
Orderable: 1 chip
Cache L1: 64 KB I + 48 KB D on chip per core
L2: 2 MB I+D on chip per core
L3: 144 MB I+D on chip per chip
Other: None
Memory: 256 GB (8 x 32 GB 2Rx8 PC5-6400B-R)
Storage: 1 x 960 GB NVME SSD
Other: CPU Cooling: DLC

Software

OS: SUSE Linux Enterprise Server 15 SP6
Kernel 6.4.0-150600.21-default
Compiler: C/C++: Version 2024.1 of Intel oneAPI DPC++/C++ Compiler for Linux;
Fortran: Version 2024.1 of Intel Fortran Compiler for Linux;
Parallel: Yes
Firmware: Lenovo BIOS Version IHE109U 1.20 released Mar-2025
File System: xfs
System State: Run level 3 (multi-user)
Base Pointers: 64-bit
Peak Pointers: Not Applicable
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	Base							Peak						
	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
603.bwaves_s	24	83.3	709	<u>83.2</u>	<u>709</u>	83.1	710							
607.cactuBSSN_s	24	58.5	285	<u>58.3</u>	<u>286</u>	58.0	288							
619.lbm_s	24	<u>25.4</u>	<u>206</u>	25.3	207	25.5	205							
621.wrf_s	24	58.6	226	58.8	225	<u>58.7</u>	<u>225</u>							
627.cam4_s	24	<u>66.8</u>	<u>133</u>	66.8	133	66.4	133							
628.pop2_s	24	<u>101</u>	<u>117</u>	102	117	101	118							
638.imagick_s	24	<u>31.1</u>	<u>464</u>	31.4	459	31.0	466							
644.nab_s	24	49.2	355	49.2	355	<u>49.2</u>	<u>355</u>							
649.fotonik3d_s	24	72.2	126	72.4	126	<u>72.2</u>	<u>126</u>							
654.roms_s	24	70.4	224	<u>70.4</u>	<u>224</u>	70.5	223							

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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 = "/home/cpu2017-1.1.9-ic2024.1/lib/intel64:/home/cpu2017-1.1.9-ic2024.1/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 Redhat Enterprise Linux 8.0

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>



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Platform Notes

BIOS configuration:

Workload Profile set to High Performance Computing

Hyper-Threading set to Disabled

Page Policy set to Adaptive

LLC Prefetch set to Enabled

Sysinfo program /home/cpu2017-1.1.9-ic2024.1/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost Fri May 16 16:22:45 2025

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 254 (254.10+suse.84.ge8d77af424)
12. Services, from systemctl list-unit-files
13. Linux kernel boot-time arguments, from /proc/cmdline
14. cpupower frequency-info
15. sysctl
16. /sys/kernel/mm/transparent_hugepage
17. /sys/kernel/mm/transparent_hugepage/khugepaged
18. OS release
19. Disk information
20. /sys/devices/virtual/dmi/id
21. dmidecode
22. BIOS

1. uname -a
Linux localhost 6.4.0-150600.21-default #1 SMP PREEMPT_DYNAMIC Thu May 16 11:09:22 UTC 2024 (36c1e09)
x86_64 x86_64 x86_64 GNU/Linux

2. w
16:22:45 up 1:09, 1 user, load average: 15.45, 20.94, 21.59
USER TTY FROM LOGIN@ IDLE JCPU PCPU WHAT

3. Username
From environment variable \$USER: root

4. ulimit -a
core file size (blocks, -c) unlimited
data seg size (kbytes, -d) unlimited
scheduling priority (-e) 0
file size (blocks, -f) unlimited
pending signals (-i) 1030068

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Platform Notes (Continued)

max locked memory (kbytes, -l) 8192
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) 1030068
virtual memory (kbytes, -v) unlimited
file locks (-x) unlimited

```
-----
5. sysinfo process ancestry
/usr/lib/systemd/systemd --switched-root --system --deserialize=42
sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups
sshd: root [priv]
sshd: root@notty
/bin/bash ./02.remote_local_SPEccpu_1.01.sh
sh Run553-compliant-ic2024.1-lin-sapphirerapids-speedfp-base-smt-off-20240308.sh
runcpu --nobuild --action validate --define default-platform-flags -c
ic2024.1-lin-sapphirerapids-speed-20240308.cfg --define cores=24 --tune base -o all --define drop_caches
fpspeed
runcpu --nobuild --action validate --define default-platform-flags --configfile
ic2024.1-lin-sapphirerapids-speed-20240308.cfg --define cores=24 --tune base --output_format all --define
drop_caches --nopower --runmode speed --tune base --size refspeed fpspeed --nopreenv --note-preenv
--logfile $SPEC/tmp/CPU2017.563/temlogs/preenv.fpspeed.563.0.log --lognum 563.0 --from_runcpu 2
specperl $SPEC/bin/sysinfo
$SPEC = /home/cpu2017-1.1.9-ic2024.1
```

```
-----
6. /proc/cpuinfo
model name      : Intel(R) Xeon(R) 6521P
vendor_id       : GenuineIntel
cpu family      : 6
model           : 173
stepping        : 1
microcode       : 0xa0000c0
bugs             : spectre_v1 spectre_v2 spec_store_bypass swapgs bhi
cpu cores       : 24
siblings        : 24
1 physical ids (chips)
24 processors (hardware threads)
physical id 0:  core ids 0-23
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
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 2.39.3:

Architecture:	x86_64
CPU op-mode(s):	32-bit, 64-bit
Address sizes:	52 bits physical, 57 bits virtual
Byte Order:	Little Endian
CPU(s):	24
On-line CPU(s) list:	0-23
Vendor ID:	GenuineIntel
BIOS Vendor ID:	Intel(R) Corporation

(Continued on next page)



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Platform Notes (Continued)

Model name: Intel(R) Xeon(R) 6521P
BIOS Model name: Intel(R) Xeon(R) 6521P UNKNOWN CPU @ 2.6GHz
BIOS CPU family: 179
CPU family: 6
Model: 173
Thread(s) per core: 1
Core(s) per socket: 24
Socket(s): 1
Stepping: 1
Frequency boost: enabled
CPU(s) scaling MHz: 155%
CPU max MHz: 2601.0000
CPU min MHz: 800.0000
BogoMIPS: 5200.00
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 intel_ppin cdp_l2 ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm 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 user_shstk avx_vnni avx512_bf16 wbnoinvd dtherm ida arat pln pts vnni avx512vbmi umip pku ospke waitpkg avx512_vbmi2 gfn1 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 ibt amx_bf16 avx512_fp16 amx_tile amx_int8 flush_l1d arch_capabilities
Virtualization: VT-x
L1d cache: 1.1 MiB (24 instances)
L1i cache: 1.5 MiB (24 instances)
L2 cache: 48 MiB (24 instances)
L3 cache: 144 MiB (1 instance)
NUMA node(s): 1
NUMA node0 CPU(s): 0-23
Vulnerability Gather data sampling: Not affected
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Mmio stale data: Not affected
Vulnerability Reg file data sampling: Not affected
Vulnerability Retbleed: Not affected
Vulnerability Spec rstack overflow: 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 / Automatic IBRS; IBPB conditional; RSB filling; PBRSE-eIBRS Not affected; BHI BHI_DIS_S
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	1.1M	12	Data	1	64	1	64
L1i	64K	1.5M	16	Instruction	1	64	1	64

(Continued on next page)



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Platform Notes (Continued)

L2	2M	48M	16 Unified	2	2048	1	64
L3	144M	144M	16 Unified	3	147456	1	64

8. numactl --hardware

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

available: 1 nodes (0)

node 0 cpus: 0-23

node 0 size: 257543 MB

node 0 free: 255591 MB

node distances:

node 0

0: 10

9. /proc/meminfo

MemTotal: 263724720 kB

10. who -r

run-level 3 May 16 15:14

11. Systemd service manager version: systemd 254 (254.10+suse.84.ge8d77af424)

Default Target	Status
----------------	--------

multi-user	running
------------	---------

12. Services, from systemctl list-unit-files

STATE	UNIT FILES
-------	------------

enabled	YaST2-Firstboot YaST2-Second-Stage apparmor auditd cron getty@ irqbalance issue-generator kbdsettings klog lvm2-monitor nsd nvme-fc-boot-connections nvme-fc-autoconnect postfix purge-kernels rollback rsyslog smartd sshd systemd-pstore wicked wickedd-auto4 wickedd-dhcp4 wickedd-dhcp6 wickedd-nanny
---------	---

enabled-runtime	systemd-remount-fs
-----------------	--------------------

disabled	autofs autostart-initscripts blk-availability boot-sysctl ca-certificates chrony-wait chronyd console-getty cups cups-browsed debug-shell ebttables exchange-bmc-os-info firewallld fsidd gpm grub2-once haveged ipmi ipmievd issue-add-ssh-keys kexec-load lunmask man-db-create multipathd nfs nfs-blkmap rpcbind rpmconfigcheck rsyncd serial-getty@ smartd-generate_opts snmpd snmptrapd systemd-boot-check-no-failures systemd-confext systemd-network-generator systemd-sysext systemd-time-wait-sync systemd-timesyncd
----------	---

generated	ntp_sync
-----------	----------

indirect	systemd-userdbd wickedd
----------	-------------------------

13. Linux kernel boot-time arguments, from /proc/cmdline

BOOT_IMAGE=/boot/vmlinuz-6.4.0-150600.21-default

root=UUID=8c76b9eb-7cab-4e58-a0ba-c4f6030335e5

splash=silent

mitigations=auto

quiet

security=apparmor

14. cpupower frequency-info

analyzing CPU 10:

current policy: frequency should be within 800 MHz and 2.60 GHz.

The governor "performance" may decide which speed to use within this range.

boost state support:

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Platform Notes (Continued)

Supported: yes
Active: yes

```
-----
15. sysctl
   kernel.numa_balancing      0
   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

-----
16. /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

-----
17. /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

-----
18. OS release
   From /etc/*-release /etc/*-version
   os-release SUSE Linux Enterprise Server 15 SP6

-----
19. Disk information
   SPEC is set to: /home/cpu2017-1.1.9-ic2024.1
   Filesystem      Type  Size  Used Avail Use% Mounted on
   /dev/nvme0n1p2 xfs   893G   84G  810G  10% /

-----
20. /sys/devices/virtual/dmi/id
   Vendor:      Lenovo
   Product:     ThinkSystem SR650 V4
   Product Family: ThinkSystem
   Serial:      0987654321
```

(Continued on next page)



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Platform Notes (Continued)

21. dmidecode

Additional information from dmidecode 3.4 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:

8x Samsung M321R4GA3PB2-CCPEC 32 GB 2 rank 6400

22. BIOS

(This section combines info from /sys/devices and dmidecode.)

BIOS Vendor: Lenovo
BIOS Version: IHE109U-1.20
BIOS Date: 03/15/2025
BIOS Revision: 1.20
Firmware Revision: 1.20

Compiler Version Notes

C | 619.lbm_s(base) 638.imagick_s(base) 644.nab_s(base)

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2024.1.0 Build 20240308
Copyright (C) 1985-2024 Intel Corporation. All rights reserved.

C++, C, Fortran | 607.cactuBSSN_s(base)

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2024.1.0 Build 20240308
Copyright (C) 1985-2024 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2024.1.0 Build 20240308
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Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2024.1.0 Build 20240308
Copyright (C) 1985-2024 Intel Corporation. All rights reserved.

Fortran | 603.bwaves_s(base) 649.fotonik3d_s(base) 654.roms_s(base)

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2024.1.0 Build 20240308
Copyright (C) 1985-2024 Intel Corporation. All rights reserved.

Fortran, C | 621.wrf_s(base) 627.cam4_s(base) 628.pop2_s(base)

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2024.1.0 Build 20240308
Copyright (C) 1985-2024 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2024.1.0 Build 20240308
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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:

-w -std=c11 -m64 -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:

-w -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

Benchmarks using both Fortran and C:

-w -m64 -std=c11 -Wl,-z,muldefs -xsapphirerapids -Ofast -ffast-math

(Continued on next page)



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Base Optimization Flags (Continued)

Benchmarks using both Fortran and C (continued):

```
-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++:

```
-w -std=c++14 -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 -nostandard-realloc-lhs -align array32byte  
-auto -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc
```

The flags files that were used to format this result can be browsed at

<http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Birchstream-C.html>

<http://www.spec.org/cpu2017/flags/Intel-ic2024-official-linux64.html>

You can also download the XML flags sources by saving the following links:

<http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Birchstream-C.xml>

<http://www.spec.org/cpu2017/flags/Intel-ic2024-official-linux64.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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