



SPEC CPU®2017 Floating Point Rate Result

Copyright 2017-2022 Standard Performance Evaluation Corporation

Lenovo Global Technology

ThinkSystem ST250 V2
(3.20 GHz, Intel Xeon E-2356G)

SPECrate®2017_fp_base = 51.3

SPECrate®2017_fp_peak = 51.9

CPU2017 License: 9017

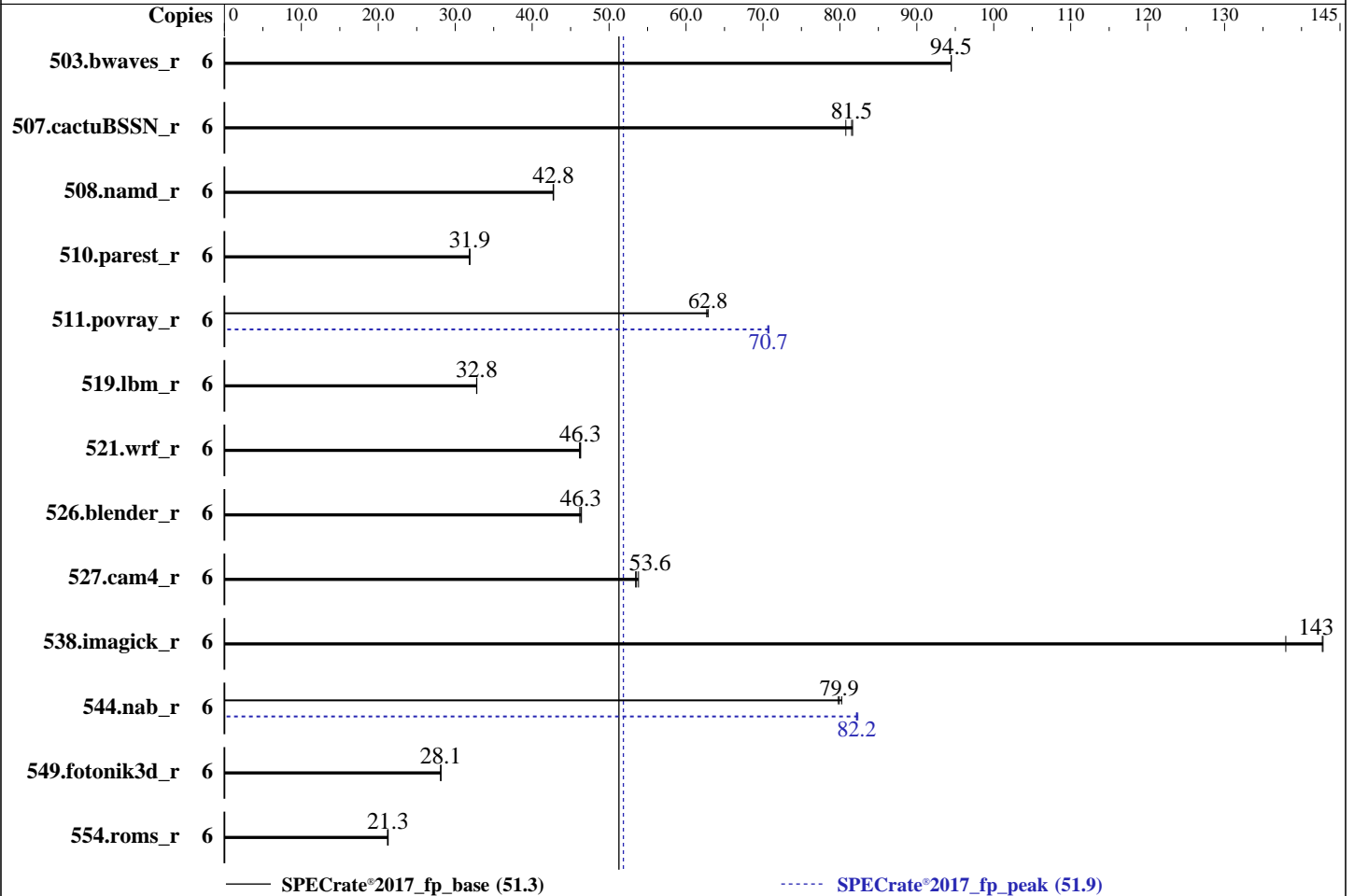
Test Sponsor: Lenovo Global Technology

Tested by: Lenovo Global Technology

Test Date: Jun-2022

Hardware Availability: Apr-2022

Software Availability: Jun-2021



Hardware

CPU Name: Intel Xeon E-2356G
 Max MHz: 5000
 Nominal: 3200
 Enabled: 6 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: 12 MB I+D on chip per chip
 Other: None
 Memory: 64 GB (2 x 32 GB 2Rx8 PC4-3200AA-E)
 Storage: 1 x 960 GB SATA SSD
 Other: None

Software

OS: SUSE Linux Enterprise Server 15 SP3 (x86_64)
 Kernel 5.3.18-57-default
 Compiler: C/C++: Version 2021.1 of Intel oneAPI DPC++/C++ Compiler Build 20201113 for Linux;
 Fortran: Version 2021.1 of Intel Fortran Compiler Classic Build 20201112 for Linux;
 C/C++: Version 2021.1 of Intel C/C++ Compiler Classic Build 20201112 for Linux
 Parallel: No
 Firmware: Lenovo BIOS Version TQE104H 1.01 released Jun-2022 tested as TQE103G 1.01 Apr-2022
 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	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
503.bwaves_r	6	637	94.5	<u>637</u>	<u>94.5</u>	637	94.5	6	637	94.5	<u>637</u>	<u>94.5</u>	637	94.5
507.cactuBSSN_r	6	<u>93.2</u>	<u>81.5</u>	93.0	81.7	94.0	80.8	6	<u>93.2</u>	<u>81.5</u>	93.0	81.7	94.0	80.8
508.namd_r	6	133	42.7	<u>133</u>	<u>42.8</u>	133	42.8	6	133	42.7	<u>133</u>	<u>42.8</u>	133	42.8
510.parest_r	6	493	31.8	492	31.9	<u>492</u>	<u>31.9</u>	6	493	31.8	492	31.9	<u>492</u>	<u>31.9</u>
511.povray_r	6	<u>223</u>	<u>62.8</u>	224	62.7	223	62.9	6	198	70.8	198	70.6	<u>198</u>	<u>70.7</u>
519.lbm_r	6	<u>193</u>	<u>32.8</u>	193	32.8	193	32.8	6	<u>193</u>	<u>32.8</u>	193	32.8	193	32.8
521.wrf_r	6	<u>291</u>	<u>46.3</u>	290	46.3	291	46.2	6	<u>291</u>	<u>46.3</u>	290	46.3	291	46.2
526.blender_r	6	197	46.4	<u>197</u>	<u>46.3</u>	198	46.2	6	197	46.4	<u>197</u>	<u>46.3</u>	198	46.2
527.cam4_r	6	<u>196</u>	<u>53.6</u>	195	53.8	196	53.4	6	<u>196</u>	<u>53.6</u>	195	53.8	196	53.4
538.imagick_r	6	104	143	108	138	<u>105</u>	<u>143</u>	6	104	143	108	138	<u>105</u>	<u>143</u>
544.nab_r	6	<u>126</u>	<u>79.9</u>	127	79.8	126	80.2	6	<u>123</u>	<u>82.2</u>	123	82.1	123	82.3
549.fotonik3d_r	6	832	28.1	<u>832</u>	<u>28.1</u>	831	28.1	6	832	28.1	<u>832</u>	<u>28.1</u>	831	28.1
554.roms_r	6	450	21.2	<u>448</u>	<u>21.3</u>	448	21.3	6	450	21.2	<u>448</u>	<u>21.3</u>	448	21.3

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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"

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH =
"/home/cpu2017-1.1.8-ic2021.1-revA-updatel/lib/intel64:/home/cpu2017-1.1.8-ic2021.1-revA-updatel/je5.0.1-64"
MALLOC_CONF = "retain:true"

General Notes

Binaries compiled on a system with 1x Intel Core i9-7940X CPU + 64GB RAM memory using openSUSE Leap 15.2
Transparent Huge Pages disabled by default
echo never > /sys/kernel/mm/transparent_hugepage/enabled

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General Notes (Continued)

```
echo never > /sys/kernel/mm/transparent_hugepage/defrag
```

```
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:

Choose Operating Mode set to Maximum Performance and then set it to Custom Mode

Hyper-Threading set to Disabled

```
Sysinfo program /home/cpu2017-1.1.8-ic2021.1-revA-updatel/bin/sysinfo
```

```
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
```

```
running on node1 Wed Jun 1 16:29:35 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-2356G CPU @ 3.20GHz
```

```
1 "physical id"s (chips)
```

```
6 "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 : 6
```

```
siblings : 6
```

```
physical 0: cores 0 1 2 3 4 5
```

From lscpu from util-linux 2.36.2:

```
Architecture: x86_64
```

```
CPU op-mode(s): 32-bit, 64-bit
```

```
Byte Order: Little Endian
```

```
Address sizes: 39 bits physical, 48 bits virtual
```

```
CPU(s): 6
```

```
On-line CPU(s) list: 0-5
```

```
Thread(s) per core: 1
```

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Platform Notes (Continued)

```

Core(s) per socket:          6
Socket(s):                   1
NUMA node(s):               1
Vendor ID:                   GenuineIntel
CPU family:                  6
Model:                       167
Model name:                  Intel(R) Xeon(R) E-2356G CPU @ 3.20GHz
Stepping:                    1
CPU MHz:                     4800.000
BogoMIPS:                    6384.00
Virtualization:              VT-x
L1d cache:                   288 KiB
L1i cache:                   192 KiB
L2 cache:                    3 MiB
L3 cache:                    12 MiB
NUMA node0 CPU(s):          0-5
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 and seccomp
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
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 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 fsrm md_clear flush_lld arch_capabilities

```

From `lscpu --cache:`

NAME	ONE-SIZE	ALL-SIZE	WAYS	TYPE	LEVEL	SETS	PHY-LINE	COHERENCY-SIZE
L1d	48K	288K	12	Data	1	64	1	64
L1i	32K	192K	8	Instruction	1	64	1	64
L2	512K	3M	8	Unified	2	1024	1	64
L3	12M	12M	16	Unified	3	12288	1	64

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Platform Notes (Continued)

```
/proc/cpuinfo cache data
cache size : 12288 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 4 5
node 0 size: 64233 MB
node 0 free: 63782 MB
node distances:
node    0
0:     10
```

```
From /proc/meminfo
MemTotal:      65775564 kB
HugePages_Total:      0
Hugepagesize:    2048 kB
```

```
From /etc/*release* /etc/*version*
os-release:
NAME="SLES"
VERSION="15-SP3"
VERSION_ID="15.3"
PRETTY_NAME="SUSE Linux Enterprise Server 15 SP3"
ID="sles"
ID_LIKE="suse"
ANSI_COLOR="0;32"
CPE_NAME="cpe:/o:suse:sles:15:sp3"
```

```
uname -a:
Linux node1 5.3.18-57-default #1 SMP Wed Apr 28 10:54:41 UTC 2021 (ba3c2e9) 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:

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Platform Notes (Continued)

	conditional, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling):	Not affected
CVE-2019-11135 (TSX Asynchronous Abort):	Not affected

run-level 3 Jun 1 16:28

SPEC is set to: /home/cpu2017-1.1.8-ic2021.1-revA-update1

Filesystem	Type	Size	Used	Avail	Use%	Mounted on
/dev/sda2	xfs	894G	118G	777G	14%	/

From /sys/devices/virtual/dmi/id

Vendor:	Lenovo
Product:	ThinkSystem ST250 V2
Product Family:	ThinkSystem
Serial:	1234567890

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 Technology 18ASF4G72AZ-3G2B1 32 GB 2 rank 3200

BIOS:

BIOS Vendor:	Lenovo
BIOS Version:	TQE103G-1.01
BIOS Date:	04/19/2022
BIOS Revision:	1.1
Firmware Revision:	1.96

(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 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
-----
```

```
=====
C++       | 508.namd_r(base, peak) 510.parest_r(base, peak)
-----
```

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Compiler Version Notes (Continued)

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Version 2021.1 Build 20201113
Copyright (C) 1985-2020 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 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R)
64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 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 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
Version 2021.1 Build 20201113
Copyright (C) 1985-2020 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 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R)
64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 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,
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Compiler Version Notes (Continued)

=====
C++, C, Fortran | 507.cactuBSSN_r(base, peak)
=====

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
Version 2021.1 Build 20201113
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on
Intel(R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 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 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 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
Intel(R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,
Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

Base Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:
ifort

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Base Compiler Invocation (Continued)

Benchmarks using both Fortran and C:

ifort icx

Benchmarks using both C and C++:

icpx icx

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

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Base Optimization Flags (Continued)

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
```

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

(Continued on next page)



SPEC CPU®2017 Floating Point Rate Result

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Lenovo Global Technology

SPECrate®2017_fp_base = 51.3

ThinkSystem ST250 V2
(3.20 GHz, Intel Xeon E-2356G)

SPECrate®2017_fp_peak = 51.9

CPU2017 License: 9017

Test Date: Jun-2022

Test Sponsor: Lenovo Global Technology

Hardware Availability: Apr-2022

Tested by: Lenovo Global Technology

Software Availability: Jun-2021

Peak Compiler Invocation (Continued)

Benchmarks using both C and C++:

511.povray_r: icpc icc

526.blender_r: icpx icx

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: -w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -flto
-Ofast -qopt-mem-layout-trans=4
-fimf-accuracy-bits=14:sqrt
-mbranches-within-32B-boundaries -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

(Continued on next page)



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Peak Optimization Flags (Continued)

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  
-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/Lenovo-Platform-SPECcpu2017-Flags-V1.2-RocketB-A.html>
http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64_revA.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-RocketB-A.xml>
http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64_revA.xml

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