## Lenovo Global Technology

**ThinkSystem ST250**

(3.60 GHz, Intel Xeon E-2234)

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| Test Date: | Jun-2020 |
| Test Sponsor: | Lenovo Global Technology |
| Tested by: | Lenovo Global Technology |

### SPECrate®2017_fp_base = 33.5

| SPECrate®2017_fp_peak = 35.2 |

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### Hardware

| CPU Name: | Intel Xeon E-2234 |
| Max MHz: | 4800 |
| Nominal: | 3600 |
| Enabled: | 4 cores, 1 chip, 2 threads/core |
| 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: | 128 GB (4 x 32 GB 2Rx4 PC4-2666V-E) |
| Storage: | 1 x 960 GB SATA SSD |
| Other: | None |

### Software

| OS: | SUSE Linux Enterprise Server 12 SP5 (x86_64) |
| Compiler: | C/C++: Version 19.1.1.217 of Intel |
| Firmware: | Lenovo BIOS Version ISE115D 2.10 released Apr-2020 |
| 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 set to prefer performance at the cost of additional power usage |

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<th>507.caetuBSSN_r</th>
<th>508.namd_r</th>
<th>510.parest_r</th>
<th>511.povray_r</th>
<th>519.lbm_r</th>
<th>521.wrf_r</th>
<th>526.blender_r</th>
<th>527.cam4_r</th>
<th>538.imagick_r</th>
<th>544.nab_r</th>
<th>549.fotonik3d_r</th>
<th>554.roms_r</th>
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**Lenovo Global Technology**  
**ThinkSystem ST250**  
*(3.60 GHz, Intel Xeon E-2234)*  

**CPU2017 License:** 9017  
**Test Sponsor:** Lenovo Global Technology  
**Tested by:** Lenovo Global Technology  

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**Compiler Notes**

The inconsistent Compiler version information under Compiler Version section is due to a discrepancy in Intel Compiler. The correct version of C/C++ compiler is: Version 19.1.1.217 Build 20200306 Compiler for Linux  
The correct version of Fortran compiler is: Version 19.1.1.217 Build 20200306 Compiler for Linux

**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/cpu2017-1.1.0-ic19.1.1/lib/intel64:/home/cpu2017-1.1.0-ic19.1.1/j  
e5.0.1-64"  
MALLOCONF = "retain:true"
SPEC CPU®2017 Floating Point Rate Result

Copyright 2017-2020 Standard Performance Evaluation Corporation

Lenovo Global Technology
ThinkSystem ST250
(3.60 GHz, Intel Xeon E-2234)

SPECrate®2017_fp_base = 33.5
SPECrate®2017_fp_peak = 35.2

CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Tested by: Lenovo Global Technology

Test Date: Jun-2020
Hardware Availability: Mar-2020
Software Availability: Apr-2020

General Notes

Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB 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
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.
Yes: The test sponsor attests, as of date of publication, that CVE-2018-3640 (Spectre variant 3a)
is mitigated in the system as tested and documented.
Yes: The test sponsor attests, as of date of publication, that CVE-2018-3639 (Spectre variant 4)
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

Platform Notes

BIOS configuration:
Choose Operating Mode set to Maximum Performance

Sysinfo program /home/cpu2017-1.1.0-ic19.1.1/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7edble6e46a485a0011
running on linux-tzna Sun Jun 7 21:43:16 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-2234 CPU @ 3.60GHz
    1 "physical id"s (chips)
    8 "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 : 8
    physical 0: cores 0 1 2 3

From lscpu:
    Architecture:     x86_64
    CPU op-mode(s):  32-bit, 64-bit

(Continued on next page)
Lenovo Global Technology
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| SPECrate®2017_fp_base = 33.5 |
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**CPU2017 License:** 9017  
**Test Sponsor:** Lenovo Global Technology  
**Test Date:** Jun-2020  
**Tested by:** Lenovo Global Technology  
**Hardware Availability:** Mar-2020  
**Software Availability:** Apr-2020

### Platform Notes (Continued)

- **Byte Order:** Little Endian
- **Address sizes:** 39 bits physical, 48 bits virtual
- **CPU(s):** 8
- **On-line CPU(s) list:** 0-7
- **Thread(s) per core:** 2
- **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-2234 CPU @ 3.60GHz
- **Stepping:** 10
- **CPU MHz:** 3600.000
- **CPU max MHz:** 4800.0000
- **CPU min MHz:** 800.0000
- **BogoMIPS:** 7200.00
- **Virtualization:** VT-x
- **L1d cache:** 32K
- **L1i cache:** 32K
- **L2 cache:** 256K
- **L3 cache:** 8192K
- **NUMA node0 CPU(s):** 0-7
- **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 arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid aperfmperf tscknown_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 3nowprefetch cpuid_fault epb invpcid_single pti ssbd ibrs ibpb stibp tpr_shadow vmmv flexpriority ept vpid fsgsbase tsc_adjust bm11 hle avx2 smep bmi2 erms invpcid rtm mpx rdseed adx smap clflushopt intel_pt xsaveopt xsavecpuid xsaveprec xsave vsnmi dtherm ida arat pln pts hwp hwp_notify hwp_act_window hwp_epp mdclear 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 4 5 6 7
- node 0 size: 128866 MB
- node 0 free: 128354 MB
- node distances:
  - node 0
  - 0: 10

(Continued on next page)
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SPECrate®2017_fp_base = 33.5
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Test Date: Jun-2020
Hardware Availability: Mar-2020
Software Availability: Apr-2020

Platform Notes (Continued)

From /proc/meminfo
MemTotal: 131959308 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

From /etc/*release* /etc/*version*
SuSE-release:
SUSE Linux Enterprise Server 12 (x86_64)
VERSION = 12
PATCHLEVEL = 5
# This file is deprecated and will be removed in a future service pack or release.
# Please check /etc/os-release for details about this release.
os-release:
NAME="SLES"
VERSION="12-SP5"
VERSION_ID="12.5"
PRETTY_NAME="SUSE Linux Enterprise Server 12 SP5"
ID="sles"
ANSI_COLOR="0;32"
CPE_NAME="cpe:/o:suse:sles:12:sp5"

uname -a:
x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

itlb_multithit: KVM: Mitigation: Split huge pages
CVE-2018-3620 (L1 Terminal Fault): Mitigation: PTE Inversion; VMX: conditional
cache flushes, SMT vulnerable
Microarchitectural Data Sampling:
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: usercopy/swapgs barriers and __user
pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Full generic retpoline, IBPB:
conditional, IBRS_FW, STIBP: conditional, RSB
filling
tsx_async_abort: Mitigation: Clear CPU buffers; SMT vulnerable

run-level 3 Jun 7 21:41
SPEC is set to: /home/cpu2017-1.1.0-ic19.1.1

Filesystem Type Size Used Avail Use% Mounted on
/dev/sdb3 xfs 893G 64G 829G 8% /
Platform Notes (Continued)

From /sys/devices/virtual/dmi/id
BIOS: Lenovo -[ISE115D-2.10]- 04/24/2020
Vendor: Lenovo
Product: ThinkSystem ST250 -[7Y45CT0WW]-
Product Family: ThinkSystem
Serial: 1234567890

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:
4x SK Hynix HMAA4GU7AJR8N-VK 32767 MB 2 rank 2666

(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) C Compiler for applications running on Intel(R) 64, Version 2021.1
NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

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

Intel(R) C++ Compiler for applications running on Intel(R) 64, Version 2021.1
NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

==============================================================================
| C++, C | 511.povray_r(base) 526.blender_r(base, peak)
==============================================================================

Intel(R) C++ Compiler for applications running on Intel(R) 64, Version 2021.1
NextGen Build 20200304
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Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1
NextGen Build 20200304
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(Continued on next page)
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Software Availability: Apr-2020

Compiler Version Notes (Continued)
==============================================================================
C++, C          | 511.povray_r(peak)
==============================================================================
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
   Version 19.1.1.217 Build 20200306
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
   Version 19.1.1.217 Build 20200306
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

==============================================================================
C++, C          | 511.povray_r(base) 526.blender_r(base, peak)
==============================================================================
Intel(R) C++ Compiler for applications running on Intel(R) 64, Version 2021.1
   NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1
   NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

==============================================================================
C++, C          | 511.povray_r(peak)
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Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
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Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
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==============================================================================
C++, C, Fortran | 507.cactuBSSN_r(base, peak)
==============================================================================
Intel(R) C++ Compiler for applications running on Intel(R) 64, Version 2021.1
   NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1
   NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.1.1.217 Build 20200306
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

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Tested by: Lenovo Global Technology

Test Date: Jun-2020
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Compiler Version Notes (Continued)

==============================================================================
Fortran         | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak)
                  | 554.roms_r(base, peak)
==============================================================================
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.1.1.217 Build 20200306
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

------------------------------------------------------------------------------
Fortran, C      | 521.wrf_r(base) 527.cam4_r(base, peak)
------------------------------------------------------------------------------
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.1.1.217 Build 20200306
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Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1
NextGen Build 20200304
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------------------------------------------------------------------------------
Fortran, C      | 521.wrf_r(peak)
------------------------------------------------------------------------------
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Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
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------------------------------------------------------------------------------
Fortran, C      | 521.wrf_r(base) 527.cam4_r(base, peak)
------------------------------------------------------------------------------
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------------------------------------------------------------------------------
Fortran, C      | 521.wrf_r(peak)
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(Continued on next page)
Lenovo Global Technology
ThinkSystem ST250
(3.60 GHz, Intel Xeon E-2234)

<table>
<thead>
<tr>
<th>SPECrate®2017_fp_base = 33.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECrate®2017_fp_peak = 35.2</td>
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</table>

CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Tested by: Lenovo Global Technology
Test Date: Jun-2020
Hardware Availability: Mar-2020
Software Availability: Apr-2020

Compiler Version Notes (Continued)

Intel (R) C Intel (R) 64 Compiler for applications running on Intel (R) 64,
Version 19.1.1.217 Build 20200306

Base Compiler Invocation

C benchmarks:
icc

C++ benchmarks:
icpc

Fortran benchmarks:
ifort

Benchmarks using both Fortran and C:
ifort icc

Benchmarks using both C and C++:
icpc icc

Benchmarks using Fortran, C, and C++:
icpc icc 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
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**SPEC CPU®2017 Floating Point Rate Result**

Copyright 2017-2020 Standard Performance Evaluation Corporation

**Lenovo Global Technology**

**ThinkSystem ST250**

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**Base Optimization Flags**

**C benchmarks:**
- m64 -qnextgen -std=c11
- Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
- fuse-ld=gold -xCORE-AVX2 -Ofast -ffast-math -flto -mfpmath=sse
- funroll-loops -qopt-mem-layout-trans=4
- L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

**C++ benchmarks:**
- m64 -qnextgen -Wl,-plugin-opt=-x86-branches-within-32B-boundaries
- Wl,-z,muldefs -fuse-ld=gold -xCORE-AVX2 -Ofast -ffast-math -flto
- mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
- L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

**Fortran benchmarks:**
- m64 -Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
- fuse-ld=gold -xCORE-AVX2 -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
- L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

**Benchmarks using both Fortran and C:**
- m64 -qnextgen -std=c11
- Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
- fuse-ld=gold -xCORE-AVX2 -O3 -ipo -no-prec-div
- qopt-prefetch -ffinite-math-only
- qopt-multiple-gather-scatter-by-shuffles -nostandard-realloc-lhs
- align array32byte -auto -mbranches-within-32B-boundaries
- L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

**Benchmarks using both C and C++:**
- m64 -qnextgen -std=c11
- Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
- fuse-ld=gold -xCORE-AVX2 -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 -nostandard-realloc-lhs
- -align array32byte -auto -mbranches-within-32B-boundaries
- L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

**Benchmarks using Fortran, C, and C++:**
- m64 -qnextgen -std=c11
- Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
- fuse-ld=gold -xCORE-AVX2 -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 -nostandard-realloc-lhs
- -align array32byte -auto -mbranches-within-32B-boundaries

(Continued on next page)
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Base Optimization Flags (Continued)
Benchmarks using Fortran, C, and C++ (continued):
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Peak Compiler Invocation
C benchmarks:
icc
C++ benchmarks:
icpc
Fortran benchmarks:
ifort
Benchmarks using both Fortran and C:
ifort icc
Benchmarks using both C and C++:
icpc icc
Benchmarks using Fortran, C, and C++:
icpc icc 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: basepeak = yes
C++ benchmarks:

(Continued on next page)
Lenovo Global Technology

ThinkSystem ST250 (3.60 GHz, Intel Xeon E-2234)

LENNOVO GLOBAL TECHNOLOGY

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Lenovo Global Technology

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CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Tested by: Lenovo Global Technology

Peak Optimization Flags (Continued)

508.namd_r:basepeak = yes
510.parest_r: -m64 -qnextgen
-W1,-plugin-opt=-x86-branches-within-32B-boundaries
-W1,-z,muldefs -fuse-ld=gold -xCORE-AVX2 -Ofast
-ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -L/usr/local/jemalloc64-5.0.1/lib
-ljemalloc

Fortran benchmarks:
503.bwaves_r: -m64 -W1,-plugin-opt=-x86-branches-within-32B-boundaries
-W1,-z,muldefs -fuse-ld=gold -xCORE-AVX2 -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
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

549.fotonik3d_r:basepeak = yes
554.roms_r: Same as 503.bwaves_r

Benchmarks using both Fortran and C:
521.wrf_r: -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX2 -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
-nostandard-realloc-lhs -align array32byte -auto
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

527.cam4_r:basepeak = yes

Benchmarks using both C and C++:
511.povray_r: -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX2 -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++:

(Continued on next page)
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**SPECrate®2017_fp_peak = 35.2**

**Peak Optimization Flags (Continued)**

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-SKL-J.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/Intel-ic19.1u1-official-linux64_revA.xml
http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-SKL-J.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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