Lenovo Global Technology
ThinkSystem ST50
(3.60 GHz, Intel Xeon E-2234)

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

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 core
Other: None
Memory: 64 GB (4 x 16 GB 2Rx8 PC4-2666V-E)
Storage: 1 x 960 GB SATA SSD
Other: None

Software
OS: Red Hat Enterprise Linux 8.1 (Ootpa)
Kernel 4.18.0-147.el8.x86_64
Compiler: C/C++: Version 19.1.1.217 of Intel C/C++
Compiler for Linux;
Fortran: Version 19.1.1.217 of Intel Fortran
Compiler for Linux
Parallel: Yes
Firmware: Lenovo BIOS Version ITE109B 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
## Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
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<tbody>
<tr>
<td>600.perlbench_s</td>
<td>8</td>
<td>235</td>
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<td>197</td>
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<td>602.gcc_s</td>
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<td>605.mcf_s</td>
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<td>23.6</td>
<td>202</td>
<td>23.3</td>
<td>200</td>
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<td>23.6</td>
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<tr>
<td>620.omnetpp_s</td>
<td>8</td>
<td>191</td>
<td>8.53</td>
<td>193</td>
<td>8.44</td>
<td>191</td>
<td>8.52</td>
<td>8</td>
<td>191</td>
<td>8.53</td>
<td>193</td>
<td>8.44</td>
<td>191</td>
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<td>623.xalancmk_s</td>
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<td>84.5</td>
<td>16.8</td>
<td>85.2</td>
<td>16.6</td>
<td>84.4</td>
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<td>8</td>
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<td>16.8</td>
<td>85.2</td>
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<td>84.4</td>
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<tr>
<td>625.x264_s</td>
<td>8</td>
<td>88.3</td>
<td>20.9</td>
<td>88.5</td>
<td>19.9</td>
<td>88.5</td>
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<td>8</td>
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<td>85.5</td>
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<td>85.4</td>
</tr>
<tr>
<td>631.deepsjeng_s</td>
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<td>641.leela_s</td>
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<td>5.88</td>
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<td>5.87</td>
<td>290</td>
<td>5.88</td>
<td>290</td>
</tr>
<tr>
<td>648.exchange2_s</td>
<td>8</td>
<td>143</td>
<td>20.5</td>
<td>144</td>
<td>20.5</td>
<td>142</td>
<td>20.8</td>
<td>8</td>
<td>143</td>
<td>20.5</td>
<td>144</td>
<td>20.5</td>
<td>142</td>
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<tr>
<td>657.xz_s</td>
<td>8</td>
<td>478</td>
<td>12.9</td>
<td>477</td>
<td>12.9</td>
<td>477</td>
<td>12.9</td>
<td>8</td>
<td>478</td>
<td>12.9</td>
<td>477</td>
<td>12.9</td>
<td>477</td>
</tr>
</tbody>
</table>

---

## 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

---

## 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,scatter"
- LD_LIBRARY_PATH = "/home/cpu2017-1.1.0-ic19.1.1/lib/intel64:/home/cpu2017-1.1.0-ic19.1.1/jee5.0.1-64"
- MALLOC_CONF = "retain:true"
- OMP_STACKSIZE = "192M"

---

## 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:

(Continued on next page)

---
General Notes (Continued)

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.

Platform Notes

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.


Sysinfo program /home/cpu2017-1.1.0-ic19.1.1/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7ed1bde646a485a0011
running on localhost.localdomain Tue Jun  9 10:34:21 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
Byte Order: Little Endian
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

(Continued on next page)
## Lenovo Global Technology

**ThinkSystem ST50**  
(3.60 GHz, Intel Xeon E-2234)

<table>
<thead>
<tr>
<th>SPECspeed®2017_int_base</th>
<th>12.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECspeed®2017_int_peak</td>
<td>12.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CPU2017 License:</th>
<th>9017</th>
<th>Test Date:</th>
<th>Jun-2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Sponsor:</td>
<td>Lenovo Global Technology</td>
<td>Hardware Availability:</td>
<td>Mar-2020</td>
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<tr>
<td>Tested by:</td>
<td>Lenovo Global Technology</td>
<td>Software Availability:</td>
<td>Apr-2020</td>
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</table>

### Platform Notes (Continued)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stepping:</td>
<td>10</td>
</tr>
<tr>
<td>CPU MHz:</td>
<td>4570.220</td>
</tr>
<tr>
<td>CPU max MHz:</td>
<td>4800.0000</td>
</tr>
<tr>
<td>CPU min MHz:</td>
<td>800.0000</td>
</tr>
<tr>
<td>BogoMIPS:</td>
<td>7200.00</td>
</tr>
<tr>
<td>Virtualization:</td>
<td>VT-x</td>
</tr>
<tr>
<td>L1d cache:</td>
<td>32K</td>
</tr>
<tr>
<td>L1i cache:</td>
<td>32K</td>
</tr>
<tr>
<td>L2 cache:</td>
<td>256K</td>
</tr>
<tr>
<td>L3 cache:</td>
<td>8192K</td>
</tr>
<tr>
<td>NUMA node0 CPU(s):</td>
<td>0-7</td>
</tr>
</tbody>
</table>
| 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 rdtsc
|                               | 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
|                               | bmi1 hle avx2 smep bmi2 ets invpcid rtm mpx rdseed adx smap clflushopt intel_pt
|                               | xsaveopt xsavec xgetbv1 xsave dtherm ida arat pni pts hwp hwp_notify hwp_act_window
|                               | hwp_epp md_clear 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.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>available:</td>
<td>1 nodes (0)</td>
</tr>
<tr>
<td>node 0 cpus:</td>
<td>0 1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>node 0 size:</td>
<td>64295 MB</td>
</tr>
<tr>
<td>node 0 free:</td>
<td>63620 MB</td>
</tr>
<tr>
<td>node distances:</td>
<td></td>
</tr>
<tr>
<td>node 0</td>
<td>0: 10</td>
</tr>
</tbody>
</table>

From `/proc/meminfo`

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MemTotal:</td>
<td>65838504 kB</td>
</tr>
<tr>
<td>HugePages_Total:</td>
<td>0</td>
</tr>
<tr>
<td>Hugepagesize:</td>
<td>2048 kB</td>
</tr>
</tbody>
</table>

From `/etc/*release*`  
`/etc/*version*`

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
</table>
| os-release:                   | NAME="Red Hat Enterprise Linux" Version="8.1 (Ootpa)"
|                               | ID="rhel1"      |
|                               | ID_LIKE="fedora"
|                               | VERSION_ID="8.1" |

(Continued on next page)
**Lenovo Global Technology**  
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<table>
<thead>
<tr>
<th>CPU2017 License: 9017</th>
<th>SPECspeed\textsuperscript{\textregistered}2017\textsubscript{\textregistered}\textsubscript{int}_\textsubscript{peak} = 12.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Sponsor: Lenovo Global Technology</td>
<td>Test Date: Jun-2020</td>
</tr>
<tr>
<td>Tested by: Lenovo Global Technology</td>
<td>Hardware Availability: Mar-2020</td>
</tr>
<tr>
<td>Software Availability: Apr-2020</td>
<td></td>
</tr>
</tbody>
</table>

**Platform Notes (Continued)**

```plaintext
PLATFORM_ID="platform:el8"
PRETTY_NAME="Red Hat Enterprise Linux 8.1 (Ootpa)"
ANSI_COLOR="0;31"
redhat-release: Red Hat Enterprise Linux release 8.1 (Ootpa)
system-release: Red Hat Enterprise Linux release 8.1 (Ootpa)
system-release-cpe: cpe:/o:redhat:enterprise_linux:8.1:ga

uname -a:
Linux localhost.localdomain 4.18.0-147.el8.x86_64 #1 SMP Thu Sep 26 15:52:44 UTC 2019
x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2018-3620 (L1 Terminal Fault): Mitigation: PTE Inversion; VMX: conditional cache flushes, SMT vulnerable
Microarchitectural Data Sampling: Mitigation: Clear CPU buffers; SMT vulnerable
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

run-level 3 Jun 9 10:32

SPEC is set to: /home/cpu2017-1.1.0-ic19.1.1
Filesystem Type Size Used Avail Use% Mounted on
/dev/sda3 xfs 812G 66G 747G 9% /home

From /sys/devices/virtual/dmi/id
BIOS: LENOVO ITE109B 04/24/2020
Vendor: LENOVO
Product: INVALID
Product Family: Lenovo Product
Serial: INVALID

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 HMA82GU7CJR8N-VK 16 GB 2 rank 2666

(End of data from sysinfo program)
Lenovo Global Technology  
ThinkSystem ST50  
(3.60 GHz, Intel Xeon E-2234)  

CPU2017 License: 9017  
Test Date: Jun-2020  
Test Sponsor: Lenovo Global Technology  
Tested by: Lenovo Global Technology  

Compiler Version Notes

==============================================================================
C       | 600.perlbench_s(base) 602.gcc_s(base, peak) 605.mcf_s(base, peak) 625.x264_s(base, peak) 657.xz_s(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       | 600.perlbench_s(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.
==============================================================================

==============================================================================
C       | 600.perlbench_s(base) 602.gcc_s(base, peak) 605.mcf_s(base, peak) 625.x264_s(base, peak) 657.xz_s(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       | 600.perlbench_s(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.
==============================================================================

==============================================================================
C++     | 620.omnetpp_s(base, peak) 623.xalancbmk_s(base, peak) 631.deepsjeng_s(base, peak) 641.leela_s(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.
==============================================================================

==============================================================================
Fortran | 648.exchange2_s(base, peak)
------------------------------------------------------------------------------
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
(Continued on next page)
Lenovo Global Technology
ThinkSystem ST50
(3.60 GHz, Intel Xeon E-2234)

Compiler Version Notes (Continued)

64, Version 19.1.1.217 Build 20200306
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

Base Compiler Invocation

C benchmarks:
ic

C++ benchmarks:
icpc

Fortran benchmarks:
ifort

Base Portability Flags

600.perlbench_s: -DSPEC_LP64 -DSPEC_LINUX_X64
602.gcc_s: -DSPEC_LP64
605.mcf_s: -DSPEC_LP64
620.omnetpp_s: -DSPEC_LP64
623.xalancbmk_s: -DSPEC_LP64 -DSPEC_LINUX
625.x264_s: -DSPEC_LP64
631.deepsjeng_s: -DSPEC_LP64
641.leela_s: -DSPEC_LP64
648.exchange2_s: -DSPEC_LP64
657.xz_s: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-m64 -qnextgen -std=c11
- Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
-xCORE-AVX2 -O3 -ffast-math -flto -mfpmath=sse -funroll-loops
-fuse-ld=gold -qopt-mem-layout-trans=4 -fopenmp -DSPEC_OPENMP
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

C++ benchmarks:
-m64 -qnextgen -Wl,-plugin-opt=-x86-branches-within-32B-boundaries
-Wl,-z,muldefs -xCORE-AVX2 -O3 -ffast-math -flto -mfpmath=sse
-funroll-loops -fuse-ld=gold -qopt-mem-layout-trans=4

(Continued on next page)
## Lenovo Global Technology

### ThinkSystem ST50

(3.60 GHz, Intel Xeon E-2234)

| SPECspeed®2017_int_base = 12.2 |
| SPECspeed®2017_int_peak = 12.5 |

| Test Sponsor: Lenovo Global Technology |
| Tested by: Lenovo Global Technology |

---

### Base Optimization Flags (Continued)

**C++ benchmarks** (continued):

```
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
-lqkmalloc
```

**Fortran benchmarks**:

```
-m64 -Wl,-plugin-opt=-x86-branches-within-32B-boundaries -xCORE-AVX2
-O3 -ipo -no-prec-div -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte
-mbranches-within-32B-boundaries
```

### Peak Compiler Invocation

**C benchmarks**:

```
icc
```

**C++ benchmarks**:

```
icpc
```

**Fortran benchmarks**:

```
ifort
```

---

### Peak Portability Flags

```
600.perlbench_s: -DSPEC_LP64 -DSPEC_LINUX_X64
602.gcc_s: -DSPEC_LP64(*) -DSPEC_LP64
605.mcf_s: -DSPEC_LP64
620.omnetpp_s: -DSPEC_LP64
623.xalancbmk_s: -DSPEC_LP64 -DSPEC_LINUX
625.x264_s: -DSPEC_LP64
631.deepsjeng_s: -DSPEC_LP64
641.leela_s: -DSPEC_LP64
648.exchange2_s: -DSPEC_LP64
657.xz_s: -DSPEC_LP64
```

(*) Indicates a portability flag that was found in a non-portability variable.

---

### Peak Optimization Flags

**C benchmarks**:

(Continued on next page)
## Lenovo Global Technology

**ThinkSystem ST50**  
(3.60 GHz, Intel Xeon E-2234)

### SPEC CPU®2017 Integer Speed Result

**Lenovo Global Technology**  
**TEST DATE:** Jun-2020  
**HARDWARE AVAILABILITY:** Mar-2020  
**SOFTWARE AVAILABILITY:** Apr-2020

### SPECspeed®2017_int_base = 12.2

### SPECspeed®2017_int_peak = 12.5

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

---

### Peak Optimization Flags (Continued)

600.perlbench_s: -Wl, -z, muldefs -prof-gen(pass 1) -prof-use(pass 2)  
-xCORE-AVX2 -ipo -O3 -no-prec-div  
-qopt-mem-layout-trans=4 -fno-strict-overflow  
-mbranches-within-32B-boundaries  
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

602.gcc_s: -m64 -qnextgen -std=c11 -fuse-ld=gold  
-We, -plugin-opt=-x86-branches-within-32B-boundaries  
-We, -z, muldefs -fprofile-generate(pass 1)  
-fprofile-use=default.profdata(pass 2) -xCORE-AVX2 -flto  
-Ofast(pass 1) -O3 -ffast-math -qopt-mem-layout-trans=4  
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

605.mcf_s: basepeak = yes

625.x264_s: -m64 -qnextgen -std=c11  
-We, -plugin-opt=-x86-branches-within-32B-boundaries  
-We, -z, muldefs -xCORE-AVX2 -flto -O3 -ffast-math  
-fuse-ld=gold -qopt-mem-layout-trans=4 -fno-alias  
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

657.xz_s: basepeak = yes

C++ benchmarks:

620.omnetpp_s: basepeak = yes

623.xalancbmk_s: basepeak = yes

631.deepsjeng_s: basepeak = yes

641.leela_s: basepeak = yes

Fortran benchmarks:

648.exchange2_s: 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-CFL-B.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-CFL-B.xml

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Standard Performance Evaluation Corporation (info@spec.org)  
https://www.spec.org/
### Lenovo Global Technology

**ThinkSystem ST50**  
**(3.60 GHz, Intel Xeon E-2234)**

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

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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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