**Lenovo Global Technology**

ThinkSystem ST650 V2  
(2.30 GHz, Intel Xeon Silver 4310T)

| Copies | 0 | 15.0 | 30.0 | 45.0 | 60.0 | 75.0 | 90.0 | 105 | 120 | 135 | 150 | 165 | 180 | 195 | 210 | 225 | 240 | 255 | 270 | 285 | 300 | 315 | 330 | 345 | 360 |
|---------|---|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 500.perlbench_r | 40 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 502.gcc_r | 40 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 505.mcf_r | 40 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 520.omnetpp_r | 40 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 523.xalancbmk_r | 40 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 525.x264_r | 40 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 531.deepsjeng_r | 40 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 541.leela_r | 40 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 548.exchange2_r | 40 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 557.xz_r | 40 | | | | | | | | | | | | | | | | | | | | | | | | | |

**Hardware**

- **CPU Name**: Intel Xeon Silver 4310T  
- **Max MHz**: 3400  
- **Nominal**: 2300  
- **Enabled**: 20 cores, 2 chips, 2 threads/core  
- **Orderable**: 1.2 chips  
- **Cache L1**: 32 KB I + 48 KB D on chip per core  
- **L2**: 1.25 MB I+D on chip per core  
- **L3**: 15 MB I+D on chip per chip  
- **Other**: None  
- **Memory**: 1 TB (32 x 32 GB 2Rx8 PC4-3200AA-R, running at 2666)  
- **Storage**: 1 x 960 GB SATA SSD  
- **Other**: None

**Software**

- **OS**: Red Hat Enterprise Linux 8.3 (Ootpa)  
- **Kernel**: 4.18.0-240.el8.x86_64  
- **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  
- **Parallel**: No  
- **Firmware**: Lenovo BIOS Version U8E113E 1.10 released Aug-2021  
- **File System**: xfs  
- **System State**: Run level 3 (multi-user)  
- **Base Pointers**: 64-bit  
- **Peak Pointers**: Not Applicable  
- **Other**: None  
- **Power Management**: BIOS and OS set to prefer performance at the cost of additional power usage

**SPEC CPU®2017 Integer Rate Result**

---

Copyright 2017-2021 Standard Performance Evaluation Corporation

SPECrate®2017_int_base = 145

SPECrate®2017_int_peak = Not Run

Lenovo Global Technology  
Test Date: Sep-2021  
Hardware Availability: Jul-2021  
Software Availability: Dec-2020

CPU2017 License: 9017

Test Sponsor: Lenovo Global Technology  
Tested by: Lenovo Global Technology  
Test Date: Sep-2021  
Hardware Availability: Jul-2021  
Tested by: Lenovo Global Technology  
Software Availability: Dec-2020
**SPEC CPU®2017 Integer Rate Result**

Copyright 2017-2021 Standard Performance Evaluation Corporation

---

**Lenovo Global Technology**

ThinkSystem ST650 V2
(2.30 GHz, Intel Xeon Silver 4310T)

SPECrade®2017_int_base = 145
SPECrade®2017_int_peak = Not Run

---

**Results Table**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>664</td>
<td>95.9</td>
<td>662</td>
<td>96.1</td>
<td>663</td>
<td>96.0</td>
</tr>
<tr>
<td>502.gcc_r</td>
<td>40</td>
<td>467</td>
<td>121</td>
<td>470</td>
<td>120</td>
<td>469</td>
<td>121</td>
</tr>
<tr>
<td>505.mcf_r</td>
<td>40</td>
<td>268</td>
<td>242</td>
<td>266</td>
<td>243</td>
<td>268</td>
<td>241</td>
</tr>
<tr>
<td>520.omnetpp_r</td>
<td>40</td>
<td>518</td>
<td>101</td>
<td>516</td>
<td>102</td>
<td>520</td>
<td>101</td>
</tr>
<tr>
<td>523.xalancbmk_r</td>
<td>40</td>
<td>234</td>
<td>180</td>
<td>233</td>
<td>181</td>
<td>233</td>
<td>181</td>
</tr>
<tr>
<td>525.x264_r</td>
<td>40</td>
<td>242</td>
<td>290</td>
<td>240</td>
<td>292</td>
<td>241</td>
<td>290</td>
</tr>
<tr>
<td>531.deepsjeng_r</td>
<td>40</td>
<td>420</td>
<td>109</td>
<td>422</td>
<td>109</td>
<td>422</td>
<td>109</td>
</tr>
<tr>
<td>541.leela_r</td>
<td>40</td>
<td>627</td>
<td>106</td>
<td>628</td>
<td>106</td>
<td>628</td>
<td>106</td>
</tr>
<tr>
<td>548.exchange2_r</td>
<td>40</td>
<td>358</td>
<td>293</td>
<td>360</td>
<td>291</td>
<td>358</td>
<td>293</td>
</tr>
<tr>
<td>557.xz_r</td>
<td>40</td>
<td>540</td>
<td>80.0</td>
<td>541</td>
<td>79.9</td>
<td>541</td>
<td>79.8</td>
</tr>
</tbody>
</table>

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

---

**Submit Notes**

The numactl mechanism was used to bind copies to processors. The config file option 'submit' was used to generate numactl 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:


MALLOC_CONF = "retain:true"

---

**General Notes**

Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM
memory using Red Hat Enterprise Linux 8.1
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
runcpu command invoked through numaclt i.e.:
### Lenovo Global Technology

**ThinkSystem ST650 V2**  
*(2.30 GHz, Intel Xeon Silver 4310T)*

<table>
<thead>
<tr>
<th>CPU2017 License</th>
<th>Lenovo Global Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Sponsor</td>
<td>Lenovo Global Technology</td>
</tr>
<tr>
<td>Tested by</td>
<td>Lenovo Global Technology</td>
</tr>
</tbody>
</table>

**SPEC CPU® 2017 Integer Rate Result**

<table>
<thead>
<tr>
<th>SPECrate®2017_int_base</th>
<th>145</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECrate®2017_int_peak</td>
<td>Not Run</td>
</tr>
</tbody>
</table>

**General Notes (Continued)**

numactl --interleave=all runcpu <etc>

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.

**Platform Notes**

**BIOS configuration:**
Choose Operating Mode set to Maximum Performance and then set it to Custom Mode  
DCU Streamer Prefetcher set to Disabled  
UPI Link Disable set to Disabled 1 Link

**Sysinfo program** /home/cpu2017-1.1.8-ic2021.1-revB/bin/sysinfo  
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d  
running on localhost.localdomain Sat Sep 11 01:48:14 2021

**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) Silver 4310T CPU @ 2.30GHz  
  - 2 "physical id"s (chips)  
  - 40 "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: 10  
  - siblings: 20  
  - physical 0: cores 0 1 2 3 4 5 6 7 8 9  
  - physical 1: cores 0 1 2 3 4 5 6 7 8 9

From lscpu from util-linux 2.32.1:  
- Architecture: x86_64  
- CPU op-mode(s): 32-Bit, 64-bit  
- Byte Order: Little Endian  
- CPU(s): 40  
- On-line CPU(s) list: 0-39  
- Thread(s) per core: 2  
- Core(s) per socket: 10  
- Socket(s): 2  
- NUMA node(s): 2  
- Vendor ID: GenuineIntel  
- CPU family: 6

(Continued on next page)
Lenovo Global Technology
ThinkSystem ST650 V2
(2.30 GHz, Intel Xeon Silver 4310T)

SPEC CPU®2017 Integer Rate Result
Copyright 2017-2021 Standard Performance Evaluation Corporation

Lenovo Global Technology

SPECrate®2017_int_base = 145
SPECrate®2017_int_peak = Not Run

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

Platform Notes (Continued)

Model: 106
Model name: Intel(R) Xeon(R) Silver 4310T CPU @ 2.30GHz
Stepping: 6
CPU MHz: 2899.786
BogoMIPS: 4600.00
Virtualization: VT-x
L1d cache: 48K
L1i cache: 32K
L2 cache: 1280K
L3 cache: 15360K
NUMA node0 CPU(s): 0-9,20-29
NUMA node1 CPU(s): 10-19,30-39
Flags: fpu vme de pse tsc msr pae mce 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 pni pclmulqdq dtes64 ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtrig pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx1 f16c rdrand lahf_lm abm 3nowprefetch cpuid_fault epb cat_l3 invpcid_single intel_pni ssbd mba ibpb stibp ibrs ibrs_enabled tpr_shadow vnmi flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid cqm rdt_a avx512f avx512dq rdseed adx smap avx512ifma clflushopt clwb intel_pti avx512cd sha_ni avx512bw avx512vl xsaveopt xsavec xsaveopt xsaves cmqm_llc cmqm_occup_llc cmqm_mbb_total cmqm_mbb_local split_lock_detect wbnoiwvd dtherm ida arat pln pts avx512vmbmi umip pku ospke avx512_vmbmi2 gfnl vaes vpcmullqdq avx512_vnni avx512_bitalg tme avx512_vpopcntdq la57 rdpid md_clear pconfiq flush_l1d arch_capabilities

/proc/cpuinfo cache data
cache size : 15360 KB

From numactl --hardware
WARNING: a numactl 'node' might or might not correspond to a physical chip.
available: 2 nodes (0-1)
node 0 cpus: 0 1 2 3 4 5 6 7 8 9 20 21 22 23 24 25 26 27 28 29
node 0 size: 501645 MB
node 0 free: 515088 MB
node 1 cpus: 10 11 12 13 14 15 16 17 18 19 30 31 32 33 34 35 36 37 38 39
node 1 size: 501634 MB
node 1 free: 515334 MB
node distances:
node 0 1
 0: 10 20
 1: 20 10

From /proc/meminfo
MemTotal: 1056493928 KB
HugePages_Total: 0
Hugepagesize: 2048 KB

(Continued on next page)
Lenovo Global Technology
ThinkSystem ST650 V2
(2.30 GHz, Intel Xeon Silver 4310T)

SPEC®2017 Integer Rate Result
Copyright 2017-2021 Standard Performance Evaluation Corporation

Lenovo Global Technology

SPEC®2017_int_base = 145
SPEC®2017_int_peak = Not Run

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

Test Date: Sep-2021
Hardware Availability: Jul-2021
Software Availability: Dec-2020

Platform Notes (Continued)

/sbin/tuned-adm active
Current active profile: balanced

From /etc/*release* /etc/*version*
  os-release:
    NAME="Red Hat Enterprise Linux"
    VERSION="8.3 (Ootpa)"
    ID="rhel"
    ID_LIKE="fedora"
    VERSION_ID="8.3"
    PLATFORM_ID="platform:el8"
    PRETTY_NAME="Red Hat Enterprise Linux 8.3 (Ootpa)"
    ANSI_COLOR="0;31"
  redhat-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
  system-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
  system-release-cpe: cpe:/o:redhat:enterprise_linux:8.3:ga

uname -a:
  Linux localhost.localdomain 4.18.0-240.el8.x86_64 #1 SMP Wed Sep 23 05:13:10 EDT 2020
  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): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2017-5753 (Spectre variant 1): Mitigation: usercopy/swaps barriers and __user pointer sanitation
CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort): Not affected

run-level 3 Sep 11 01:43
SPEC is set to: /home/cpu2017-1.1.8-ic2021.1-revB
  Filesystem Type Size Used Avail Use% Mounted on
  /dev/sda4 xfs 818G 108G 710G 14% /home

From /sys/devices/virtual/dmi/id
  Vendor: Lenovo

(Continued on next page)
Lenovo Global Technology
ThinkSystem ST650 V2
(2.30 GHz, Intel Xeon Silver 4310T)

SPECrate®2017_int_base = 145
SPECrate®2017_int_peak = Not Run

<table>
<thead>
<tr>
<th>CPU2017 License:</th>
<th>9017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Sponsor:</td>
<td>Lenovo Global Technology</td>
</tr>
<tr>
<td>Tested by:</td>
<td>Lenovo Global Technology</td>
</tr>
<tr>
<td>Test Date:</td>
<td>Sep-2021</td>
</tr>
<tr>
<td>Hardware Availability:</td>
<td>Jul-2021</td>
</tr>
<tr>
<td>Software Availability:</td>
<td>Dec-2020</td>
</tr>
</tbody>
</table>

Platform Notes (Continued)

Product: ThinkSystem ST650V2
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:
32x Samsung M393A4G43AB3-CWE 32 GB 2 rank 3200, configured at 2666

BIOS:
  BIOS Vendor: Lenovo
  BIOS Version: U8E113E-1.10
  BIOS Date: 08/31/2021
  BIOS Revision: 1.10
  Firmware Revision: 1.41

(End of data from sysinfo program)

Compiler Version Notes

C  | 500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base)
   | 525.x264_r(base) 557.xz_r(base)

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++  | 520.omnetpp_r(base) 523.xalancbmk_r(base) 531.deepsjeng_r(base)
    | 541.leela_r(base)

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.

Fortran  | 548.exchange2_r(base)

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.

(Continued on next page)
Lenovo Global Technology
ThinkSystem ST650 V2
(2.30 GHz, Intel Xeon Silver 4310T)

<table>
<thead>
<tr>
<th>SPECrate®2017_int_base</th>
<th>145</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECrate®2017_int_peak</td>
<td>Not Run</td>
</tr>
</tbody>
</table>

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

Test Date: Sep-2021
Hardware Availability: Jul-2021
Software Availability: Dec-2020

### Compiler Version Notes (Continued)

#### Base Compiler Invocation

C benchmarks:
- icx

C++ benchmarks:
- icpx

Fortran benchmarks:
- ifort

#### Base Portability Flags

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>500.perlbench_r</td>
<td>-DSPEC_LP64 -DSPEC_LINUX_X64</td>
</tr>
<tr>
<td>502.gcc_r</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>505.mcf_r</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>520.omnetpp_r</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>523.xalancbmk_r</td>
<td>-DSPEC_LP64 -DSPEC_LINUX</td>
</tr>
<tr>
<td>525.x264_r</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>531.deepsjeng_r</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>541.leela_r</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>548.exchange2_r</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>557.xz_r</td>
<td>-DSPEC_LP64</td>
</tr>
</tbody>
</table>

#### Base Optimization Flags

C benchmarks:
- -w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ffast-math
- -flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
- -mbranches-within-32B-boundaries
- -L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin
- -lqkmalloc

C++ benchmarks:
- -w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ffast-math -flto
- -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
- -mbranches-within-32B-boundaries
- -L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin
- -lqkmalloc

(Continued on next page)
Lenovo Global Technology

ThinkSystem ST650 V2
(2.30 GHz, Intel Xeon Silver 4310T)

SPECrate®2017_int_base = 145
SPECrate®2017_int_peak = Not Run

Fortran benchmarks:
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ipo -no-prec-div
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte
-auto -mbranches-within-32B-boundaries
-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin
-lqkmalloc

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-ICElake-F.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-ICElake-F.xml
http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64_revA.xml