## Lenovo Global Technology
ThinkSystem ST50 V3
(3.40 GHz, Intel Xeon E-2434)

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

<table>
<thead>
<tr>
<th>Copies</th>
<th>SPECrate\textsuperscript{2017\textunderscore int_base}</th>
<th>SPECrate\textsuperscript{2017\textunderscore int_peak}</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>37.3</td>
<td>41.7</td>
</tr>
<tr>
<td>8</td>
<td>45.6</td>
<td>54.3</td>
</tr>
<tr>
<td>8</td>
<td>30.9</td>
<td>86.8</td>
</tr>
<tr>
<td>8</td>
<td>72.0</td>
<td>101</td>
</tr>
<tr>
<td>8</td>
<td>37.1</td>
<td>107</td>
</tr>
<tr>
<td>8</td>
<td>35.4</td>
<td></td>
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<tr>
<td>8</td>
<td>72.0</td>
<td>108</td>
</tr>
<tr>
<td>8</td>
<td>22.8</td>
<td></td>
</tr>
</tbody>
</table>

### Hardware
- **CPU Name:** Intel Xeon E-2434  
- **Max MHz:** 5000  
- **Nominal:** 3400  
- **Enabled:** 4 cores, 1 chip, 2 threads/core  
- **Orderable:** 1 chip  
- **Cache L1:** 32 KB I + 48 KB D on chip per core  
- **L2:** 2 MB 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 PC5-4800B-E, running at 4400)  
- **Storage:** 1 x 960 GB SATA SSD  
- **Other:** CPU Cooling: Air

### Software
- **OS:** SUSE Linux Enterprise Server 15 SP5  
  Kernel 5.14.21-150500.53-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:** No  
- **Firmware:** Lenovo BIOS Version CTE105H 1.10 released Mar-2024  
- **File System:** xfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 32/64-bit  
- **Other:** jemalloc memory allocator V5.0.1  
- **Power Management:** BIOS set to prefer performance at the cost of additional power usage

**Test Date:** Jun-2024  
**Hardware Availability:** May-2024  
**Software Availability:** Mar-2024
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SPECrate®2017_int_base = 50.4
SPECrate®2017_int_peak = 52.2

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>perlbench_r</td>
<td>8</td>
<td>341</td>
<td>37.3</td>
<td>341</td>
<td>37.3</td>
<td>384</td>
<td>33.2</td>
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<td>gcc_r</td>
<td>8</td>
<td>248</td>
<td>45.7</td>
<td>249</td>
<td>45.6</td>
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<td>mcf_r</td>
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<td>86.9</td>
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<td>omnetpp_r</td>
<td>8</td>
<td>340</td>
<td>30.9</td>
<td>340</td>
<td>30.9</td>
<td>340</td>
<td>30.9</td>
</tr>
<tr>
<td>xalancbmk_r</td>
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<td>117</td>
<td>72.1</td>
<td>117</td>
<td>72.0</td>
<td>118</td>
<td>71.9</td>
</tr>
<tr>
<td>x264_r</td>
<td>8</td>
<td>139</td>
<td>100</td>
<td>139</td>
<td>101</td>
<td>139</td>
<td>101</td>
</tr>
<tr>
<td>deepsjeng_r</td>
<td>8</td>
<td>247</td>
<td>37.1</td>
<td>247</td>
<td>37.2</td>
<td>247</td>
<td>37.1</td>
</tr>
<tr>
<td>leela_r</td>
<td>8</td>
<td>374</td>
<td>35.4</td>
<td>374</td>
<td>35.5</td>
<td>374</td>
<td>35.4</td>
</tr>
<tr>
<td>exchange2_r</td>
<td>8</td>
<td>195</td>
<td>108</td>
<td>195</td>
<td>108</td>
<td>195</td>
<td>108</td>
</tr>
<tr>
<td>xz_r</td>
<td>8</td>
<td>383</td>
<td>22.6</td>
<td>373</td>
<td>23.2</td>
<td>378</td>
<td>22.8</td>
</tr>
</tbody>
</table>

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

Submit Notes

The 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/cpu2017-1.1.9-ic2024.1/lib/intel64:/home/cpu2017-1.1.9-ic2024.1/lib/ia32:/home/cpu2017-1.1.9-ic2024.1/jemalloc-5.0.1-32"
MALLOC_CONF = "retain:true"

General Notes

Binaries compiled on a system with 2x Intel Xeon Platinum 8280M CPU + 384GB RAM
memory using Red Hat Enterprise Linux 8.4
Transparent Huge Pages enabled by default
Prior to runcpu invocation
Files system 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

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General Notes (Continued)

built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5

Platform Notes

Sysinfo program /home/cpu2017-1.1.9-lc2024.1/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost Thu Jun 6 03:15:11 2024

SUT (System Under Test) info as seen by some common utilities.

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 249 (249.16+suse.171.gdad0071f1f15)
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 5.14.21-150500.53-default #1 SMP PREEMPT_DYNAMIC Wed May 10 07:56:26 UTC 2023 (b630043)
   x86_64 x86_64 x86_64 GNU/Linux

2. w
   03:15:11 up 7:40, 1 user, load average: 6.01, 7.51, 7.79
   USER TTY FROM LOGIN@ IDLE JCPU PCPU WHAT
   root tty1 - 19:35 4:19m 0.99s 0.01s -bash

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

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Platform Notes (Continued)

file size (blocks, -f) unlimited
pending signals (-l) 256784
max locked memory (kbytes, -l) 64
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) 256784
virtual memory (kbytes, -v) unlimited
file locks (-x) unlimited

5./sysinfo process ancestry
/usr/lib/systemd/systemd --switched-root --system --deserialize 30
login -- root
-bash
-bash
-bash
runcpu --nobuild --action validate --define default-platform-flags --define numcopies=8 -c
ic2024.1-lin-sierraforest-rate-20240308.cfg --define smt-on --define cores=8 --define physicallogical
--define no numa --reportable --tune base,peak -o all --define drop_caches intrate
runcpu --nobuild --action validate --define default-platform-flags --define numcopies=8 --configfile
ic2024.1-lin-sierraforest-rate-20240308.cfg --define smt-on --define cores=8 --define physicallogical
--define no numa --reportable --tune base,peak --output_format all --define drop_caches --nopower
--runmode rate --tune base:peak --size refrate intrate --nopreenv --note-preenv --logfile
$SPEC/tmp/CPU2017.064/templogs/preenv.intrate.064.0.log --lognum 064.0 --from_runcpu 2
specperl $SPEC/bin/sysinfo
$SPEC = /home/cpu2017-1.1.9-ic2024.1

6. /proc/cpuinfo
model name : Intel(R) Xeon(R) E E-2434
vendor_id : GenuineIntel
cpu family : 6
model : 183
stepping : 1
microcode : 0x11f
bugs : spectre_v1 spectre_v2 spec_store_bypass swapgs eibrs_pbrsb
cpu cores : 4
siblings : 8
1 physical ids (chips)
8 processors (hardware threads)
physical id 0: core ids 0-3
physical id 0: apic ids 0-7
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 2.37.4:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Address sizes: 42 bits physical, 48 bits virtual
Byte Order: Little Endian
CPU(s): 8
On-line CPU(s) list: 0-7

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Vendor ID: GenuineIntel
Model name: Intel(R) Xeon(R) E E-2434
CPU family: 6
Model: 183
Thread(s) per core: 2
Core(s) per socket: 4
Stepping: 1
BogoMIPS: 6835.20

**Platform Notes (Continued)**

Virtualization: VT-x

L1d cache: 192 KiB (4 instances)
L1i cache: 128 KiB (4 instances)
L2 cache: 8 MiB (4 instances)
L3 cache: 12 MiB (1 instance)

NUMA node(s): 1
NUMA node0 CPU(s): 0-7

Vulnerability ITlb multihit: Not affected
Vulnerability L1tf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Mmio stale data: Not affected
Vulnerability Retbleed: 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, RB filling, PBRUSB-eIBRS SW sequence
Vulnerability Srbd: Not affected
Vulnerability Tax async abort: Not affected

From lscpu --cache:

<table>
<thead>
<tr>
<th>NAME</th>
<th>ONE-SIZE</th>
<th>ALL-SIZE</th>
<th>WAYS</th>
<th>TYPE</th>
<th>LEVEL</th>
<th>SETS</th>
<th>PHY-LINE</th>
<th>COHERENCY-SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1d</td>
<td>48K</td>
<td>192K</td>
<td>12</td>
<td>Data</td>
<td>1</td>
<td>64</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L1i</td>
<td>32K</td>
<td>128K</td>
<td>8</td>
<td>Instruction</td>
<td>1</td>
<td>64</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L2</td>
<td>2M</td>
<td>8M</td>
<td>16</td>
<td>Unified</td>
<td>2</td>
<td>2048</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L3</td>
<td>12M</td>
<td>12M</td>
<td>6</td>
<td>Unified</td>
<td>3</td>
<td>32768</td>
<td>1</td>
<td>64</td>
</tr>
</tbody>
</table>

8. numactl --hardware
NOTE: a numactl 'node' might or might not correspond to a physical chip.
Available: 1 nodes (0)
node 0 cpus: 0-7
node 0 size: 64226 MB
node 0 free: 61829 MB
node distances:
node   0
0: 10

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Platform Notes (Continued)

9. /proc/meminfo
   MemTotal: 65767568 kB

10. who -r
    run-level 3 Jun 5 19:34

11. Systemd service manager version: systemd 249 (249.16+suse.171.gdad0071f15)
    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 postfix purge-kernels rollback rayslog smartd sshd
    systemd-pstore wicked wicked-autop4 wicked-dhcp6 wicked-dhcpp6 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 ebtokens exchange-bmc-os-info
    firewallld gpm grub2-_once havedeg-switch-root ipmi ipmi@dev issue-add-ssh-keys
    kexec-load lnumask man-db-create multipathd nfs nfs-blkmap rpcbind rpmconfigcheck systemd
    serial-getty@ smartd_generate_opts snmpd snmptrapd systemd-boot-check-no-failures
    systemd-network-generator systemd-sysext systemd-time-wait-sync systemd-timesyncd
    indirect wickedd

13. Linux kernel boot-time arguments, from /proc/cmdline
    BOOT_IMAGE=/boot/vmlinuz-5.14.21-150500.53-default
    root=UUID=178ca5f7-ae8d-49cb-88b7-ce796ad62ec9
    splash=silent
    quiet
    security=apparmor
    mitigations=auto

14. cpupower frequency-info
    analyzing CPU 0:
    Unable to determine current policy
    boost state support:
    Supported: yes
    Active: yes

15. sysctl
    kernel.numa_balancing 0
    kernel.randomize_va_space 2
    vm.compartment_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.extrfrag_threshold 500
    vm.min_unmapped_ratio 1
    vm.nr_hugepages 0

(Continued on next page)
Platform Notes (Continued)

- System Configuration:
  - 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

- Transparent Huge Page Configuration:
  - dir: /sys/kernel/mm/transparent_hugepage
  - defrag: always defer defer+madvise [madvise] never
  - enabled: [always] madvise never
  - hpage_pmd_size: 2097152
  - shmem_enabled: always within_size advise [never] deny force

- Transparent Huge Page/khugepaged Configuration:
  - 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

- OS Information:
  - From /etc/*-release /etc/*-version
  - os-release: SUSE Linux Enterprise Server 15 SP5

- Disk Information:
  - SPEC is set to: /home/cpu2017-1.1.9-ic2024.1
  - Filesystem: /dev/sda3
    - Type: xfs
    - Size: 893G
    - Used: 41G
    - Avail: 852G
    - Use%: 5%
    - Mounted on: /

- System Diagnostics:
  - BIOS:
    - Vendor: Lenovo
    - BIOS Version: CTE105H-1.10
    - BIOS Date: 03/28/2024
    - BIOS Revision: 1.10

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Platform Notes (Continued)

Firmware Revision: 1.20

Compiler Version Notes

Base Compiler Invocation

C benchmarks:
icx

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Base Compiler Invocation (Continued)

C++ benchmarks:
icpx

Fortran benchmarks:
ifx

Base Portability Flags

500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
502.gcc_r: -DSPEC_LP64
505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
523.xalancbmk_r: -DSPEC_LP64 -DSPEC_LINUX
525.x264_r: -DSPEC_LP64
531.deepsjeng_r: -DSPEC_LP64
541.leela_r: -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-w -std=c11 -m64 -Wl,-z,muldefs -xsierraforest -O3 -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-L/opt/intel/oneapi/compiler/2024.1/lib -lqkmalloc

C++ benchmarks:
-w -std=c++14 -m64 -Wl,-z,muldefs -xsierraforest -O3 -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-L/opt/intel/oneapi/compiler/2024.1/lib -lqkmalloc

Fortran benchmarks:
-w -m64 -Wl,-z,muldefs -xsierraforest -O3 -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte -auto
-L/opt/intel/oneapi/compiler/2024.1/lib -lqkmalloc
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Peak Compiler Invocation

C benchmarks:
  icx

C++ benchmarks:
  icpx

Fortran benchmarks:
  ifx

Peak Portability Flags

500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
502.gcc_r: -D_FILE_OFFSET_BITS=64
505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
523.xalancbmk_r: -DSPEC_LP64 -DSPEC_LINUX
525.x264_r: -DSPEC_LP64
531.deepsjeng_r: -DSPEC_LP64 -DSPEC_LINUX
541.leea_r: -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64

Peak Optimization Flags

C benchmarks:

500.perlbench_r: -w -std=c11 -m64 -Wl,-z,muldefs
-fprofile-generate(pass 1)
-fprofile-use=default.profdatalpass 2)-xCORE-AVX2 -flto
-Ofast -ffast-math -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -fno-strict-overflow
-L/opt/intel/oneapi/compiler/2024.1/lib -lqm_malloc

502.gcc_r: -m32 -L/opt/intel/oneapi/compiler/2024.1/lib32 -std=gnu89
-Wl,-z,muldefs -fprofile-generate(pass 1)
-fprofile-use=default.profdatalpass 2)-xCORE-AVX2 -flto
-Ofast -ffast-math -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -L/usr/local/jemalloc32-5.0.1/lib
-ljemalloc

505.mcf_r: basepeak = yes

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Software Availability: Mar-2024

Peak Optimization Flags (Continued)

525.x264_r: \(-w\) \(-\text{std}=\text{c11} \ -m64 \ -Wl,-z,muldefs \ -xsirenaforest \ -O\text{fast} \ -ffast-math \ -flto \ -mfpmath=sse \ -funroll-loops \ -qopt-mem-layout-trans=4 \ -fno-alias \ -L/opt/intel/oneapi/compiler/2024.1/lib \ -lqkmalloc

557.xz_r: basepeak = yes

C++ benchmarks:

520.omnetpp_r: basepeak = yes
523.xalancbmk_r: basepeak = yes
531.deepsjeng_r: basepeak = yes
541.leela_r: basepeak = yes

Fortran benchmarks:

548.exchange2_r: basepeak = yes

The flags files that were used to format this result can be browsed at
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-Catlow-A.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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