## Lenovo Global Technology  
**ThinkSystem SD550 V3**  
(2.10 GHz, Intel Xeon Platinum 8558)

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### Hardware

- **CPU Name:** Intel Xeon Platinum 8558  
- **Max MHz:** 4000  
- **Nominal:** 2100  
- **Enabled:** 96 cores, 2 chips, 2 threads/core  
- **Orderable:** 1,2 chips  
- **Cache L1:** 32 KB I + 48 KB D on chip per core  
- **L2:** 2 MB I+D on chip per core  
- **L3:** 260 MB I+D on chip per chip  
- **Other:** None  
- **Memory:** 1 TB (16 x 64 GB 2Rx4 PC5-5600B-R, running at 5200)  
- **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 2024.0.2 of Intel oneAPI DPC++/C++ Compiler for Linux;  
  Fortran: Version 2024.0.2 of Intel Fortran Compiler for Linux;  
- **Firmware:** Lenovo BIOS Version FNE113F 2.20 released Jan-2024  
- **File System:** xfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** Not Applicable  
- **Other:** None  
- **Power Management:** BIOS set to prefer performance at the cost of additional power usage
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CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Tested by: Lenovo Global Technology

SPECrate®2017_int_base = 844
SPECrate®2017_int_peak = Not Run

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:
LD_LIBRARY_PATH = "/home/cpu2017-1.1.9-ic2024.0.2/lib/intel64:/home/cpu2017-1.1.9-ic2024.0.2/lib/ia32:/home/cpu2017-1.1.9-ic2024.0.2/je5.0.1-32"
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
Filesystem page cache synced and cleared with:
sync; echo 3>/proc/sys/vm/drop_caches
runcpu command invoked through numactl i.e.: 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.
General Notes (Continued)

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

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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
13:39:32 up 22:33, 1 user, load average: 131.96, 176.60, 185.00
USER  TTY FROM LOGIN@ IDLE JCPU PCPU WHAT
root tty1 - Mon15 3:38m 0.84s 0.01s sh
Run502-compliant-ic2024.0.2-lin-sapphirerapids-rateint-base-smt-on-20231213.sh

3. Username
From environment variable $USER: root

(Continued on next page)
SPEC CPU®2017 Integer Rate Result

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Test Date: Apr-2024
Hardware Availability: Mar-2024
Software Availability: Mar-2024

Platform Notes (Continued)

4. ulimit
   core file size  (blocks, -c) unlimited
   data seg size   (kbytes, -d) unlimited
   scheduling priority  (-e) 0
   file size      (blocks, -f) unlimited
   pending signals (-i) 4126816
   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) 4126816
   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
   /bin/bash ./run_SD550V3_EMR_new.sh
   sh Run502-compliant-ic2024.0.2-lin-sapphirerapids-rateint-base-smt-on-20231213.sh
   runcpu --nobuild --action validate --define default-platform-flags --define nucopies=192 -c
   ic2024.0.2-lin-sapphirerapids-rate-20231213.cfg --define smt-on --define cores=96 --define physicalfirst
   --define invoke_with_interleave --define drop_caches --tune base -o all intrate
   runcpu --nobuild --action validate --define default-platform-flags --define nucopies=192 --configfile
   ic2024.0.2-lin-sapphirerapids-rate-20231213.cfg --define smt-on --define cores=96 --define physicalfirst
   --define invoke_with_interleave --define drop_caches --tune base --output_format all --nopower --runmode
   rate --tune base --sizefrate intrate --nopreenv --note-preenv --logfile
   $SPEC/tmp/CPU2017.147/templogs/preenv.intrate.147.0.log --lognum 147.0 --from_runcpu 2
   specperl $SPEC/bin/sysinfo
   $SPEC = /home/cpu2017-1.1.9-ic2024.0.2

6. /proc/cpuinfo
   model name : INTEL(R) XEON(R) PLATINUM 8558
   vendor_id : GenuineIntel
   cpu family : 6
   model : 207
   stepping : 2
   microcode : 0x21000200
   bugs : specvre1 specvre2 spec_store_bypass swapgs eibrs_pbrsb
   cpu cores : 48
   siblings : 96
   2 physical ids (chips)
   192 processors (hardware threads)
   physical id 0: core ids 0-47
   physical id 1: core ids 0-47
   physical id 0: apicids 0-95
   physical id 1: apicids 128-223
   Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for
   virtualized systems. Use the above data carefully.

7. lscpu

(Continued on next page)
Platform Notes (Continued)

From lscpu from util-linux 2.37.4:

Architecture:                        x86_64
CPU op-mode(s):                      32-bit, 64-bit
Address sizes:                       46 bits physical, 57 bits virtual
Byte Order:                          Little Endian
CPU(s):                              192
On-line CPU(s) list:                 0-191
Vendor ID:                           GenuineIntel
Model name:                          INTEL(R) XEON(R) PLATINUM 8558
CPU family:                          6
Model:                               207
Thread(s) per core:                  2
Core(s) per socket:                  48
Socket(s):                           2
Stepping:                            2
BogoMIPS:                            4200.00

Flags:

Virtualization:                      VT-x
L1d cache:                           4.5 MiB (96 instances)
L1i cache:                           3.0 MiB (96 instances)
L2 cache:                            192 MiB (96 instances)
L3 cache:                            520 MiB (2 instances)
NUMA node(s):                        4
NUMA node0 CPU(s):                   0-23, 96-119
NUMA node1 CPU(s):                   24-47, 120-143
NUMA node2 CPU(s):                   48-71, 144-167
NUMA node3 CPU(s):                   72-95, 168-191

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/swaps barriers and __user pointer sanitization
Vulnerability Spectre v2:            Mitigation; Enhanced IBRS, IBPB conditional, RSB filling, PBRSB-eIBRS SW sequence
Vulnerability Srbsds:                Not affected
Vulnerability Tsa async abort:       Not affected

From lspsmp --cache:

NAME ONE-SIZE ALL-SIZE WAYS TYPE LEVEL SETS PHY-LINE COHERENCY-SIZE
L1d 48K 4.5M 12 Data 1 64 1 64

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Platform Notes (Continued)

L1i 32K 3M 8 Instruction 1 64 1 64
L2 2M 192M 16 Unified 2 2048 1 64
L3 260M 520M 20 Unified 3 212992 1 64

8. numactl --hardware
NOTE: a numactl 'node' might or might not correspond to a physical chip.
available: 4 nodes (0-3)
node 0 cpus: 0-23,96-119
node 0 free: 257699 MB
node 1 cpus: 24-47,120-143
node 1 free: 258001 MB
node 2 cpus: 48-71,144-167
node 2 free: 258035 MB
node 3 cpus: 72-95,168-191
node 3 free: 257997 MB
node distances:
node 0 1 2 3
0:  10  12  21  21
1:  12  10  21  21
2:  21  21  10  12
3:  21  21  12  10

9. /proc/meminfo
MemTotal: 1056495544 kB

10. who -r
run-level 3 Apr 15 15:06

11. Systemd service manager version: systemd 249 (249.16+suse.171.gdad0071f15)
Default Target: multi-user

12. Services, from systemctl list-unit-files
STATE UNIT FILES
enabled YaST2-Firstboot YaST2-Second-Stage apparmor auditd cron getty@ irqbalance issue-generator kbssettings lkm2-monitor nscd postfix purge-kernels rollback rayslog smartd ashd systemd-remount-fs
enabled-runtime syskerneld-auto4 wickedd-auto4 wickedd-dhcp4 wickedd-dhcp6 wickedd-nanny
disabled autos autoyast-initscripts blk-availability boot-sysctl ca-certificates chrony-wait chronyd console-getty cups cups-browsed debug-shell ebtables exchange-bmc-os-info firewall2 gpm grub2-getty incident load average losetup modprobe rexmd rpcbind
indirect systemctl

13. Linux kernel boot-time arguments, from /proc/cmdline
BOOT_IMAGE=/boot/vmlinuz-5.14.21-150500.53-default
root=UUID=153ce07c-609f-4750-a4b2-582e7fbcf5b1

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Platform Notes (Continued)

splash=silent
mitigations=auto
quiet
security=apparmor

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

15. sysctl
   kernel.numa_balancing  1
   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.extfrag_threshold  500
   vm.min_unmapped_ratio  1
   vm.nr_hugepages  0
   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

16. /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

17. /sys/kernel/mm/transparent_hugepage/khugepaged
   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

18. OS release
   From /etc/**-release /etc/**-version
   os-release SUSE Linux Enterprise Server 15 SP5

19. Disk information
   SPEC is set to: /home/cpu2017-1.1.9-ic2024.0.2

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Platform Notes (Continued)

Filesystem     Type  Size  Used  Avail  Use% Mounted on
/dev/sda2      xfs   894G   48G  847G   6%  /

20. /sys/devices/virtual/dmi/id
   Vendor: Lenovo
   Product: ThinkSystem SD550V3 MB
   Product Family: ThinkSystem
   Serial: 1234567890

21. dmidecode
   Additional information from dmidecode 3.4 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:
   16x Samsung M321R8GA0PB0-CWMKH 64 GB 2 rank 5600, configured at 5200

22. BIOS
   (This section combines info from /sys/devices and dmidecode.)
   BIOS Vendor: Lenovo
   BIOS Version: PNE113F-2.20
   BIOS Date: 01/02/2024
   BIOS Revision: 2.20
   Firmware Revision: 1.10

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 2024.0.2 Build 20231213
Copyright (C) 1985-2023 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 2024.0.2 Build 20231213
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------------------------------------
Fortran | 548.exchange2_r(base)
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2024.0.2 Build 20231213
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.
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Base Compiler Invocation

C benchmarks:
icx

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### Base Compiler Invocation (Continued)

- **C++ benchmarks:**
  - icpx

- **Fortran benchmarks:**
  - ifx

### Base Portability Flags

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### Base Optimization Flags

- **C benchmarks:**
  - `-w -std=c11 -m64 -Wl,-z,muldefs -xsapphirerapids -O3 -ffast-math`
  - `-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4`
  - `-L/opt/intel/oneapi/compiler/2024.0/lib -lqkmalloc`

- **C++ benchmarks:**
  - `-w -std=c++14 -m64 -Wl,-z,muldefs -xsapphirerapids -O3 -ffast-math`
  - `-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4`
  - `-L/opt/intel/oneapi/compiler/2024.0/lib -lqkmalloc`

- **Fortran benchmarks:**
  - `-w -m64 -Wl,-z,muldefs -xsapphirerapids -O3 -ffast-math -flto`
  - `-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4`
  - `-nostandard-realloc-lhs -align array32byte -auto`
  - `-L/opt/intel/oneapi/compiler/2024.0/lib -lqkmalloc`
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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-Eaglestream-AA.html
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-Eaglestream-AA.xml
http://www.spec.org/cpu2017/flags/Intel-ic2024-official-linux64.xml

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