## Lenovo Global Technology

**ThinkSystem SD650 V3**  
(2.10 GHz, Intel Xeon Max 9468)

### CPU2017 License: 9017

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

**Hardware**

- **CPU Name:** Intel Xeon Max 9468  
- **Max MHz:** 3500  
- **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:** 105 MB I+D on chip per chip  
- **Other:** None  
- **Memory:** 640 GB (16 x 32 GB 2Rx8 PC5-4800B-R + 2 x 64 GB HBM)  
- **Storage:** 1 x 960 GB SATA SSD  
- **Other:** None

### Software

- **OS:** SUSE Linux Enterprise Server 15 SP4 (x86_64)  
  Kernel 5.14.21-150400.22-default  
- **Compiler:** C/C++: Version 2023.0 of Intel oneAPI DPC++/C++ Compiler for Linux;  
  Fortran: Version 2023.0 of Intel Fortran Compiler for Linux;  
- **Parallel:** No  
- **Firmware:** Lenovo BIOS Version USE117T 3.10 released Apr-2023  
- **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

**SPECrate®2017_int_base = 751**  
**SPECrate®2017_int_peak = Not Run**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
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<tbody>
<tr>
<td>500.perlbench_r</td>
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<tr>
<td>502.gcc_r</td>
<td>192</td>
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<td>505.mcf_r</td>
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<tr>
<td>520.omnetpp_r</td>
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<tr>
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<td>531.deepsjeng_r</td>
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<td>541.leela_r</td>
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<td>557.xz_r</td>
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**Notes:** Lenovo Global Technology  
**Test Date:** May-2023  
**Hardware Availability:** May-2023  
**Software Availability:** Dec-2022
Lenovo Global Technology
ThinkSystem SD650 V3
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Results Table

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</tr>
</tbody>
</table>

SPECrate®2017_int_base = 751
SPECrate®2017_int_peak = Not Run

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

Compiler Notes

SPEC has ruled that the compiler used for this result was performing a compilation that specifically improves the performance of the 523.xalancbmk_r / 623.xalancbmk_s benchmarks using a priori knowledge of the SPEC code and dataset to perform a transformation that has narrow applicability.

In order to encourage optimizations that have wide applicability (see rule 1.4 https://www.spec.org/cpu2017/Docs/runrules.html#rule_1.4), SPEC will no longer publish results using this optimization.

This result is left in the SPEC results database for historical reference.

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-ic2023.0/lib/intel64:/home/cpu2017-1.1.9-ic2023.0/lib/ia32:/home/cpu2017-1.1.9-ic2023.0/je5.0.1-32"
MALLOC_CONF = "retain:true"
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SPECrates
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Test Date: May-2023
Hardware Availability: May-2023
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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.
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 Custom Mode
DCU Streamer Prefetcher set to Disabled
UPI Link Disable set to Disabled 1 Link
SNC set to SNC4
LLC Prefetch set to Disabled
Sysinfo program /home/cpu2017-1.1.9-ic2023.0/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on Perf-Seoul2-L Mon May 15 09:54:30 2023

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

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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 (249.11+suse.124.g2bc0b2c447)
12. Services, from systemctl list-unit-files
13. Linux kernel boot-time arguments, from /proc/cmdline
14. cpupower frequency-info
15. tuned-adm active
16. sysctl
17. /sys/kernel/mm/transparent_hugepage
18. /sys/kernel/mm/transparent_hugepage/transparent
19. OS release
20. Disk information
21. /sys/devices/virtual/dmi/id
22. dmidecode
23. BIOS

(Continued on next page)
### Platform Notes (Continued)

1. `uname -a`
   
   Linux Perf-Seoul2-L 5.14.21-150400.22-default #1 SMP PREEMPT_DYNAMIC Wed May 11 06:57:18 UTC 2022 (49db222)
   
   x86_64 x86_64 x86_64 GNU/Linux

   └──-----------------------------------------------

2. `w`

   09:54:30 up 15 min, 1 user, load average: 0.07, 0.02, 0.00

   USER   TTY      FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
   root   tty1     -                09:54   14.00s  2.13s  0.07s -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
   file size               (blocks, -f) unlimited
   pending signals         (-l) 2062415
   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) 2062415
   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=192 -c
   ic2023.0-lin-sapphirerapids-rate-20221201.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 --size refrate intrate --nopreenv --note-preenv --logfile
   $SPEC/tmp/CPU2017.108/templogs/preenv.intrate.108.0.log --lognum 108.0 --from_runcpu 2
   specperl $SPEC/bin/sysinfo
   $SPEC = /home/cpu2017-1.1.9-ic2023.0

   └──-----------------------------------------------

6. `/proc/cpuinfo`

   model name : Intel (R) Xeon (R) CPU Max 9468
   vendor_id : GenuineIntel
   cpu family : 6
   model : 143
   stepping : 8
   microcode : 0x2c0001d1
   bugs : spectre_v1 spectre_v2 spec_store_bypass swapped

   (Continued on next page)
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<table>
<thead>
<tr>
<th>SPECrate®2017_int_base</th>
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<tr>
<td>SPECrate®2017_int_peak</td>
<td>Not Run</td>
</tr>
</tbody>
</table>

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**Platform Notes (Continued)**

```plaintext
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

From lscpu from util-linux 2.37.2:

```
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) CPU Max 9468
CPU family: 6
Model: 143
Thread(s) per core: 2
Core(s) per socket: 48
Stepping: 8
BogoMIPS: 4200.00

Flags:
fupe 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 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 xtrpx pdm pclid dca ssse3 l1e
lahf_lm abm 3dnowprefetch cpuid_fault epb cat_l3 cat_12 cpdp_13
invpcid_single intel_pmm cdpr_12 sbbf mba ibrs ibpb ibrs-enhanced
ptr_shadow vnumi fpxpriority ept vpid ept_ad fsdepth tsc_adjunct bmon hle
avx2 smep bmi2 erms invpcid rtm cqm rdt_a avx512f avx512dq rdseed adx
avx512ifma cflushopt clwb intel_pt avx512cd sha ni avx512bw avx512vl
xsavesopt xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mmm_total
cmo_mmm_local split_lock_detect avx_vnni avx512_bf16 vmbndv dtmrdm ida
rat plot pts avx512vbmi umip ppu ospe waitpkg avx512_vbmi2 gfnv vaes
vpcm16qcd avx512_vnni avx512_bitalg tme avx512_vpopcntdq ia57 rdpdi
bus_lock_detect cldemote movdiri movdir64b enqcmd form md_clear serialize
tsxidtrk pconfig arch_lbr avx512_fp16 smw_tile flush_l1d arch_capabilities

Virtualization:
VT-x
L1d cache: 4.5 MiB (96 instances)
L1i cache: 3 MiB (96 instances)
L2 cache: 192 MiB (96 instances)
L3 cache: 210 MiB (2 instances)
NUMA node(s): 8
NUMA node0 CPU(s): 0-11,96-107
NUMA node1 CPU(s): 12-23,108-119
NUMA node2 CPU(s): 24-35,120-131
NUMA node3 CPU(s): 36-47,132-143
NUMA node4 CPU(s): 48-59,144-155
NUMA node5 CPU(s): 60-71,156-167
NUMA node6 CPU(s): 72-83,168-179
```

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SPEC CPU®2017 Integer Rate Result

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Platform Notes (Continued)

NUMA node7 CPU(s): 84-95,180-191
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: 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, RSB filling
Vulnerability Srbds: Not affected
Vulnerability Tx async abort: Not affected

From lscpu --cache:

<table>
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<tr>
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<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>
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<td>4.5M</td>
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<td>64</td>
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<tr>
<td>L1i</td>
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<td>3M</td>
<td>8</td>
<td>Instruction</td>
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<td>2M</td>
<td>192M</td>
<td>16</td>
<td>Unified</td>
<td>2</td>
<td>2048</td>
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<td>105M</td>
<td>210M</td>
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<td>3</td>
<td>114688</td>
<td>1</td>
<td>64</td>
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</table>

8. numactl --hardware

NOTE: a numactl 'node' might or might not correspond to a physical chip.

available: 8 nodes (0-7)
node 0 cpus: 0-11,96-107
node 0 size: 64134 MB
node 0 free: 63097 MB
node 1 cpus: 12-23,108-119
node 1 size: 64505 MB
node 1 free: 63959 MB
node 2 cpus: 24-35,120-131
node 2 size: 64505 MB
node 2 free: 63948 MB
node 3 cpus: 36-47,132-143
node 3 size: 64505 MB
node 3 free: 64012 MB
node 4 cpus: 48-59,144-155
node 4 size: 64505 MB
node 4 free: 63999 MB
node 5 cpus: 60-71,156-167
node 5 size: 64505 MB
node 5 free: 64032 MB
node 6 cpus: 72-83,168-179
node 6 size: 64505 MB
node 6 free: 63643 MB
node 7 cpus: 84-95,180-191
node 7 size: 64457 MB
node 7 free: 63943 MB

node distances:

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<th>0</th>
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<th>2</th>
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<th>4</th>
<th>5</th>
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</table>

9. /proc/meminfo

MemTotal: 528002976 kB

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Platform Notes (Continued)

10. who -r
    run-level 3 May 15 09:40

11. systemd service manager version: systemd 249 (249.11+suse.124.g2bc0b2c447)
    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 display-manager getty@ haveged
        irqbalance issue-generator kbdsettings llog vm2-monitor nscd postfix purge-kernels
        rollback rsyslog smartd sshd wicked wickeddd-auto4 wickeddd-dhcp4 wickeddd-dhcp6
        wickedd-nanny
    enabled-runtime systemd-remount-fs
    disabled autofs autoyast-initscripts blk-availability boot-syact1 ca-certificates chrony-wait
cron console-getty cups cups-browsed debug-shell ebtables exchange-bmc-os-info
        emacs iptables ipfw ipmi ipmievalue ipmiext auditd add-ssh-keys kexec-load
        lvm2-monitor man-db-create multipathd nfs nfs-blkmap rdisc rpcbind rmcconfigcheck rsyncd
        serial-getty@ smartd_generate_opts snmpd snmptrapd systemd-boot-check-no-failures
        systemd-network-generator systemd-sysext systemd-time-sync systemd-time-wait-sync systemd-timesyncd
        tuned
    indirect wicked

13. Linux kernel boot-time arguments, from /proc/cmdline
    BOOT_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default
    root=UUID=5f8bfd2f-a83f-41d5-8917-33e974e2f5bd
    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. tuned-adm active
    It seems that tuned daemon is not running, preset profile is not activated.
    Preset profile: powersave

16. sysct1
    kernel.numa_balancing 1
    kernel.randomize_va_space 2
    vm.compaction_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

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

Lenovo Global Technology
ThinkSystem SD650 V3
(2.10 GHz, Intel Xeon Max 9468)

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

SPECrater®2017_int_base = 751
SPECrater®2017_int_peak = Not Run

Test Date: May-2023
Hardware Availability: May-2023
Software Availability: Dec-2022

Platform Notes (Continued)

---

17. /sys/kernel/mm/transparent_hugepage
defrag        always defer defer+advise [madvise] never
enabled       [always] madvise never
hpags_pmd_size 2097152
shmem_enabled always within_size advise [never] deny force
---

18. /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
---

19. OS release
From /etc/*-release /etc/*-version
os-release SUSE Linux Enterprise Server 15 SP4
---

20. Disk information
SPEC is set to: /home/cpu2017-1.1.9-ic2023.0
Filesystem     Type  Size  Used Avail Use% Mounted on
/dev/sda3      xfs   889G   42G  848G   5% /
---

21. /sys/devices/virtual/dmi/id
Vendor:       Lenovo
Product:     ThinkSystem SD650 V3
Product Family: ThinkSystem
Serial:     9999999999
---

22. dmidecode
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:
  8x Intel 16 GB 1 rank 3200
  16x Samsung M321R4GA3B0-CQKVG 32 GB 2 rank 4800
---

23. BIOS
This section combines info from /sys/devices and dmidecode.
BIOS Vendor: Lenovo

(Continued on next page)
Lenovo Global Technology

ThinkSystem SD650 V3
(2.10 GHz, Intel Xeon Max 9468)

SPECRate®2017_int_base = 751
SPECRate®2017_int_peak = Not Run

Platform Notes (Continued)

BIOS Version: USE117T-3.10
BIOS Date: 04/17/2023
BIOS Revision: 3.10
Firmware Revision: 2.10

Each Intel Xeon CPU Max processor is configured with 64 GB of High Bandwidth Memory (HBM) in-package. `dmidecode` is additionally reporting the capacity of the CPU in-package HBM stack as: '8x Intel 16 GB 1 rank 3200'

Compiler Version Notes

```
C       | 500.perlb ench_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 2023.0.0 Build 20221201
Copyright (C) 1985-2022 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 2023.0.0 Build 20221201
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
```

```
Fortran | 548.exchange2_r(base)
-----------------------------------------------
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
```

Base Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:
ifx

Base Portability Flags

```
500.perlb ench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
502.gcc_r: -DSPEC_LP64
505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
```

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Lenovo Global Technology
ThinkSystem SD650 V3
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