SPEC CPU®2017 Integer Rate Result

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Lenovo Global Technology

ThinkSystem SR650 V3
(2.10 GHz, Intel Xeon Gold 5512U)

SPECrate®2017_int_base =   245

SPECrate®2017_int_peak = Not Run

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

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

Copies | 0 30.0 60.0 90.0 120 150 180 210 240 270 300 330 360 390 420 450 480 510 550

- 500.perlbench_r 56 — 179
- 502.gcc_r 56 — 202
- 505.mcf_r 56 — 387
- 520.omnetpp_r 56 — 171
- 523.xalancbmk_r 56 — 329
- 525.x264_r 56 — 493
- 531.deepsjeng_r 56 — 177
- 541.leela_r 56 — 174
- 548.exchange2_r 56 — 540
- 557.xz_r 56 — 122

SPECrate®2017_int_base (245)

Hardware

CPU Name: Intel Xeon Gold 5512U
  Max MHz: 3700
  Nominal: 2100
Enabled: 28 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: 52.5 MB I+D on chip per chip
  Other: None
Memory: 512 GB (8 x 64 GB 2Rx4 PC5-5600B-R, running at 4800)
Storage: 1 x 960 GB SATA SSD
Other: CPU Cooling: CLC

Software

OS: Red Hat Enterprise Linux 9.2 (Plow)
  Kernel 5.14.0-284.11.1.el9_2.x86_64
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;
Parallel: No
Firmware: Lenovo BIOS Version ESE123C 3.12 released Feb-2024
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

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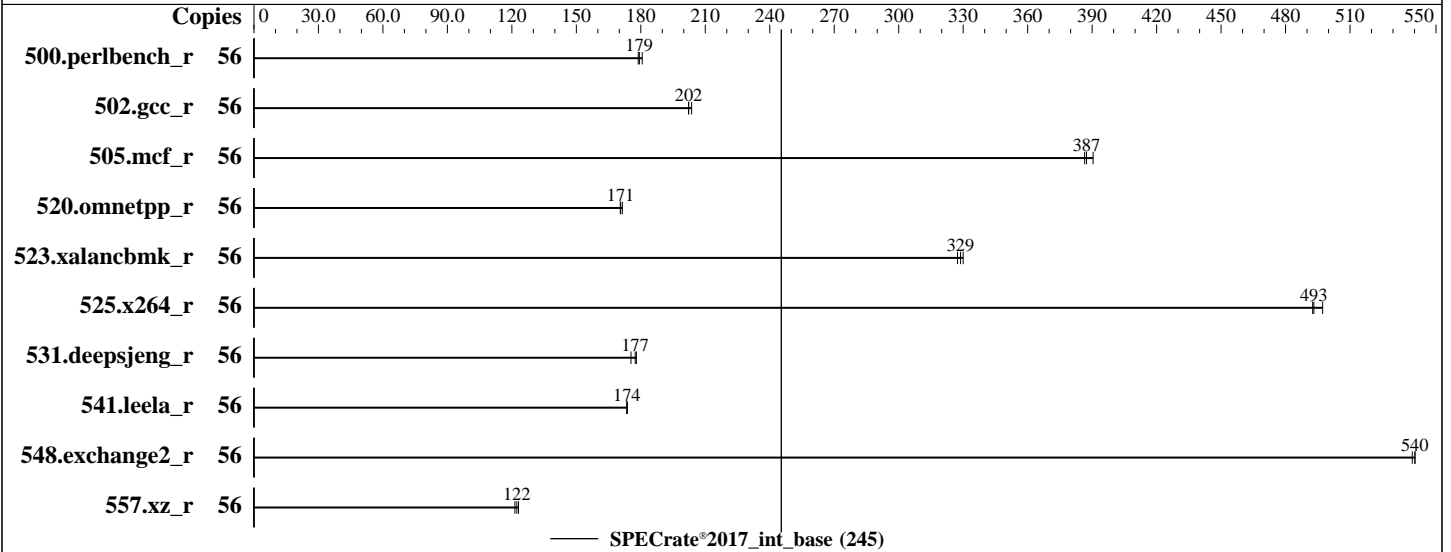
CPU2017 License: 9017	**Test Date:** Apr-2024
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Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
500.perlbench_r	56	493	181	**497**	**179**	499	179							
502.gcc_r	56	389	204	392	202	**392**	**202**							
505.mcf_r	56	232	390	**234**	**387**	234	387							
520.omnetpp_r	56	429	171	**431**	**171**	431	170							
523.xalancbmk_r	56	179	330	**180**	**329**	181	327							
525.x264_r	56	197	497	**199**	**493**	199	493							
531.deepsjeng_r	56	361	178	366	175	**362**	**177**							
541.leela_r	56	535	173	**534**	**174**	534	174							
548.exchange2_r	56	**272**	**540**	272	540	272	539							
557.xz_r	56	491	123	498	121	**494**	**122**							
SPECrate®2017_int_base =	**245**													
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.
```

(Continued on next page)

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Hardware Availability: Feb-2024
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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

```
BIOS configuration:
Choose Operating Mode set to Maximum Performance and then set it to Custom Mode
C-States set to Legacy
LLC Prefetch set to Disabled
SNC set to SNC2

 Sysinfo program /home/cpu2017-1.1.9-ic2024.0.2/bin/sysinfo
 Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
 running on localhost.localdomain Tue Apr  2 02:58:56 2024

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

 ------------------------------------------------------------
 Table of contents
 ------------------------------------------------------------
  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 252 (252-13.el9_2)
 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/khugepaged
 19. OS release
 20. Disk information
 21. /sys/devices/virtual/dmi/id
 22. dmidecode
 23. BIOS
 ------------------------------------------------------------


 ------------------------------------------------------------
 1. uname -a
   Linux localhost.localdomain 5.14.0-284.11.1.el9_2.x86_64 #1 SMP PREEMPT_DYNAMIC Wed Apr 12 10:45:03 EDT
   2023 x86_64 x86_64 x86_64 GNU/Linux


 ------------------------------------------------------------
 2. w
    02:58:56 up 1 min,  1 user,  load average: 0.19, 0.12, 0.05
   USER     TTY        LOGIN@   IDLE   JCPU   PCPU WHAT
   root     tty1       02:57   16.00s  0.86s  0.01s -bash


 ------------------------------------------------------------
 3. Username
   From environment variable $USER:  root
```

(Continued on next page)

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Platform Notes (Continued)

```
          ---------------------------------------------------------
          4. ulimit -a
            real-time non-blocking time  (microseconds, -R) unlimited
            core file size              (blocks, -c) 0
            data seg size               (kbytes, -d) unlimited
            scheduling priority             (-e) 0
            file size                   (blocks, -f) unlimited
            pending signals                 (-i) 2062643
            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) 2062643
            virtual memory              (kbytes, -v) unlimited
            file locks                      (-x) unlimited


          ---------------------------------------------------------
          5. sysinfo process ancestry
           /usr/lib/systemd/systemd rhgb --switched-root --system --deserialize 31
           login -- root
           -bash
           -bash
           runcpu --nobuild --action validate --define default-platform-flags --define numcopies=56 -c
             ic2024.0.2-lin-sapphirerapids-rate-20231213.cfg --define smt-on --define cores=28 --define physicalfirst
             --define invoke_with_interleave --define drop_caches --tune base -o all intrate
           runcpu --nobuild --action validate --define default-platform-flags --define numcopies=56 --configfile
             ic2024.0.2-lin-sapphirerapids-rate-20231213.cfg --define smt-on --define cores=28 --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/CPU2017.057/templogs/preenv.intrate.057.0.log --lognum 057.0 --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) GOLD 5512U
              vendor_id       : GenuineIntel
              cpu family      : 6
              model           : 207
              stepping        : 2
              microcode       : 0x21000200
              bugs            : spectre_v1 spectre_v2 spec_store_bypass swapgs eibrs_pbrsb
              cpu cores       : 28
              siblings        : 56
              1 physical ids (chips)
              56 processors (hardware threads)
              physical id 0: core ids 0-27
              physical id 0: apicids 0-55
            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:
```

(Continued on next page)

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Platform Notes (Continued)

```
  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):                            56
  On-line CPU(s) list:               0-55
  Vendor ID:                         GenuineIntel
  BIOS Vendor ID:                    Intel(R) Corporation
  Model name:                        INTEL(R) XEON(R) GOLD 5512U
  BIOS Model name:                   INTEL(R) XEON(R) GOLD 5512U
  CPU family:                        6
  Model:                             207
  Thread(s) per core:                2
  Core(s) per socket:                28
  Socket(s):                         1
  Stepping:                          2
  BogoMIPS:                          4200.00
  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 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 xtpr pdcm pcid dca sse4_1
                                     sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand
                                     lahf_lm abm 3dnowprefetch cpuid_fault epb cat_l3 cat_l2 cdp_l3
                                     invpcid_single cdp_l2 ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow
                                     vnmi flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmi1 avx2 smep bmi2
                                     erms invpcid cqm rdt_a avx512f avx512dq rdseed adx smap avx512ifma
                                     clflushopt clwb intel_pt avx512cd sha_ni avx512bw avx512vl xsaveopt xsavec
                                     xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local avx_vnni
                                     avx512_bf16 wbnoinvd dtherm ida arat pln pts avx512vbmi umip pku ospke
                                     waitpkg avx512_vbmi2 gfni vaes vpclmulqdq avx512_vnni avx512_bitalg tme
                                     avx512_vpopcntdq la57 rdpid bus_lock_detect cldemote movdiri movdir64b
                                     enqcmd fsrm md_clear serialize tsxldtrk pconfig arch_lbr ibt amx_bf16
                                     avx512_fp16 amx_tile amx_int8 flush_l1d arch_capabilities
  Virtualization:                    VT-x
  L1d cache:                         1.3 MiB (28 instances)
  L1i cache:                         896 KiB (28 instances)
  L2 cache:                          56 MiB (28 instances)
  L3 cache:                          52.5 MiB (1 instance)
  NUMA node(s):                      2
  NUMA node0 CPU(s):                 0-13,28-41
  NUMA node1 CPU(s):                 14-27,42-55
  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
  Vulnerability Spectre v1:          Mitigation; usercopy/swapgs barriers and __user pointer sanitization
  Vulnerability Spectre v2:          Mitigation; Enhanced IBRS, IBPB conditional, RSB filling, PBRSB-eIBRS SW
                                     sequence
  Vulnerability Srbds:               Not affected
  Vulnerability Tsx async abort:     Not affected

 From lscpu --cache:
     NAME ONE-SIZE ALL-SIZE WAYS TYPE        LEVEL  SETS PHY-LINE COHERENCY-SIZE
     L1d       48K     1.3M   12 Data            1    64        1             64
     L1i       32K     896K    8 Instruction     1    64        1             64
     L2         2M      56M   16 Unified         2  2048        1             64
```

(Continued on next page)

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Platform Notes (Continued)

```
     L3       52.5M    52.5M   15 Unified        3 57344        1             64


           --------------------------------------------------------------
8. numactl --hardware
NOTE: a numactl 'node' might or might not correspond to a physical chip.
  available: 2 nodes (0-1)
  node 0 cpus: 0-13,28-41
  node 0 size: 257666 MB
  node 0 free: 256892 MB
  node 1 cpus: 14-27,42-55
  node 1 size: 258036 MB
  node 1 free: 257361 MB
  node distances:
  node   0   1
    0:  10  12
    1:  12  10


           --------------------------------------------------------------
9. /proc/meminfo
   MemTotal:       528079972 kB


           --------------------------------------------------------------
10. who -r
   run-level 3 Apr 2 02:57


           --------------------------------------------------------------
11. Systemd service manager version: systemd 252 (252-13.el9_2)
   Default Target  Status
   multi-user      running


           --------------------------------------------------------------
12. Services, from systemctl list-unit-files
   STATE             UNIT FILES
   enabled           NetworkManager NetworkManager-dispatcher NetworkManager-wait-online atd auditd bluetooth
                     chronyd crond dbus-broker firewalld getty@ insights-client-boot irqbalance iscsi
                     iscsi-onboot kdump libstoragemgmt low-memory-monitor lvm2-monitor mcelog mdmonitor
                     microcode multipathd nis-domainname nvmefc-boot-connections rhsmcertd rsyslog rtkit-daemon
                     selinux-autorelabel-mark smartd sshd sssd systemd-boot-update systemd-network-generator
                     tuned udisks2 upower
   enabled-runtime   systemd-remount-fs
   disabled          arp-ethers blk-availability canberra-system-bootup canberra-system-shutdown
                     canberra-system-shutdown-reboot chrony-wait console-getty cpupower debug-shell
                     dnf-system-upgrade iprdump iprinit iprupdate iscsid iscsiuio kpatch kvm_stat ledmon
                     man-db-restart-cache-update nftables nvmf-autoconnect pesign psacct rdisc rhcd rhsm
                     rhsm-facts rpmdb-rebuild selinux-check-proper-disable serial-getty@ sshd-keygen@
                     systemd-boot-check-no-failures systemd-pstore systemd-sysext
   indirect          sssd-autofs sssd-kcm sssd-nss sssd-pac sssd-pam sssd-ssh sssd-sudo systemd-sysupdate
                     systemd-sysupdate-reboot


           --------------------------------------------------------------
13. Linux kernel boot-time arguments, from /proc/cmdline
   BOOT_IMAGE=(hd3,gpt2)/vmlinuz-5.14.0-284.11.1.el9_2.x86_64
   root=/dev/mapper/rhel-root
   ro
   resume=/dev/mapper/rhel-swap
   rd.lvm.lv=rhel/root
   rd.lvm.lv=rhel/swap
   rhgb
   quiet
```

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Platform Notes (Continued)

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


   ----------------------------------------------------------
15. tuned-adm active
   Current active profile: throughput-performance


   ----------------------------------------------------------
16. sysctl
   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                    40
   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                     10
   vm.watermark_boost_factor      15000
   vm.watermark_scale_factor         10
   vm.zone_reclaim_mode               0


   ----------------------------------------------------------
17. /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


   ----------------------------------------------------------
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     Red Hat Enterprise Linux 9.2 (Plow)
   redhat-release Red Hat Enterprise Linux release 9.2 (Plow)
   system-release Red Hat Enterprise Linux release 9.2 (Plow)


   ----------------------------------------------------------
20. Disk information
```

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Platform Notes (Continued)

```
 SPEC is set to: /home/cpu2017-1.1.9-ic2024.0.2
   Filesystem             Type  Size  Used Avail Use% Mounted on
  /dev/mapper/rhel-home xfs   819G   69G  750G   9% /home


  -----------------------------------------------------------
 21. /sys/devices/virtual/dmi/id
     Vendor:          Lenovo
     Product:         ThinkSystem SR650 V3 MB,EGS,DDR5,SH,2U
     Product Family:  ThinkSystem
     Serial:          1234567890


  -----------------------------------------------------------
 22. dmidecode
   Additional information from dmidecode 3.3 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:
       2x Samsung M321R8GA0PB0-CWMKH 64 GB 2 rank 5600, configured at 4800
       6x Samsung M321R8GA0PB0-CWMXH 64 GB 2 rank 5600, configured at 4800



  -----------------------------------------------------------
 23. BIOS
 (This section combines info from /sys/devices and dmidecode.)
     BIOS Vendor:      Lenovo
     BIOS Version:     ESE123C-3.12
     BIOS Date:        02/22/2024
     BIOS Revision:    3.12
     Firmware Revision: 3.90
```

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`

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 -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`

Standard Performance Evaluation Corporation (info@spec.org)   https://www.spec.org/

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ThinkSystem SR650 V3
(2.10 GHz, Intel Xeon Gold 5512U)

SPECrate®2017_int_base =   245

SPECrate®2017_int_peak = Not Run

CPU2017 License: 9017   **Test Date:**   Apr-2024
Test Sponsor: Lenovo Global Technology   **Hardware Availability:** Feb-2024
Tested by: Lenovo Global Technology   **Software Availability:** Mar-2024

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
```

For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

Tested with SPEC CPU®2017 v1.1.9 on 2024-04-02 02:58:55-0400.
Report generated on 2024-04-24 14:33:39 by CPU2017 PDF formatter v6716.
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