SPEC CPU®2017 Integer Rate Result

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Lenovo Global Technology

ThinkSystem ST650 V3
(2.00 GHz, Intel Xeon Silver 4510T)

$SPECrate^{®}2017\_int\_base = 200$

$SPECrate^{®}2017_int_peak = $ Not Run

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

Test Date: May-2024
Hardware Availability: Jun-2024
Software Availability: Apr-2024

Copies		Value
500.perlbench_r	48	145
502.gcc_r	48	177
505.mcf_r	48	327
520.omnetpp_r	48	153
523.xalancbmk_r	48	270
525.x264_r	48	369
531.deepsjeng_r	48	140
541.leela_r	48	138
548.exchange2_r	48	424
557.xz_r	48	100

Scale: 0 20.0 40.0 60.0 80.0 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 430

—— SPECrate®2017_int_base (200)

Hardware

CPU Name: Intel Xeon Silver 4510T
Max MHz: 3700
Nominal: 2000
Enabled: 24 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: 30 MB I+D on chip per chip
Other: None
Memory: 1 TB (16 x 64 GB 2Rx4 PC5-5600B-R, running at 4400)
Storage: 1 x 480 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;
Parallel: No
Firmware: Lenovo BIOS Version USE127C 4.20 released Apr-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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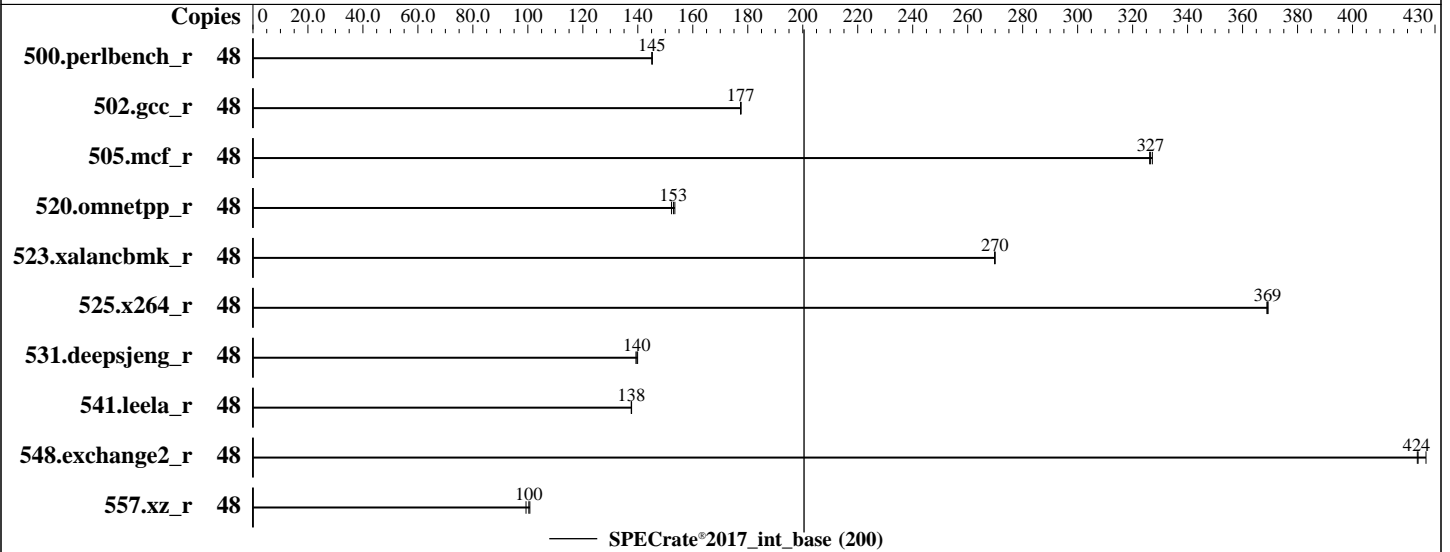
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Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
500.perlbench_r	48	**526**	**145**	526	145	526	145							
502.gcc_r	48	383	178	383	177	**383**	**177**							
505.mcf_r	48	237	327	**238**	**327**	238	326							
520.omnetpp_r	48	410	153	414	152	**412**	**153**							
523.xalancbmk_r	48	188	270	**188**	**270**	188	270							
525.x264_r	48	228	369	**228**	**369**	228	369							
531.deepsjeng_r	48	395	139	393	140	**394**	**140**							
541.leela_r	48	**577**	**138**	577	138	578	138							
548.exchange2_r	48	**297**	**424**	295	427	297	424							
557.xz_r	48	515	101	**517**	**100**	522	99.3							
SPECrate®2017_int_base =		**200**												
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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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
SNC set to SNC2
LLC Prefetch set to Disabled
UPI Link Disable set to Minimum Number of Links Enabled

 Sysinfo program /home/cpu2017-1.1.9-ic2024.0.2/bin/sysinfo
 Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
 running on localhost Thu May 23 09:01:16 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 249 (249.16+suse.171.gdad0071f15)
 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
    09:01:16 up 4 min,  1 user,  load average: 0.09, 0.02, 0.01
   USER     TTY       FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
   root     tty1      -                08:59   44.00s  1.12s  0.01s sh
   Run502-compliant-ic2024.0.2-lin-sapphirerapids-rateint-base-smt-on-20231213.sh


 ------------------------------------------------------------
 3. Username
```

(Continued on next page)

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Platform Notes (Continued)

```
  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                 (-i) 4127074
  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) 4127074
  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_ST650V3_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 numcopies=48 -c
   ic2024.0.2-lin-sapphirerapids-rate-20231213.cfg --define smt-on --define cores=24 --define physicalfirst
   --define invoke_with_interleave --define drop_caches --tune base -o all intrate
 runcpu --nobuild --action validate --define default-platform-flags --define numcopies=48 --configfile
   ic2024.0.2-lin-sapphirerapids-rate-20231213.cfg --define smt-on --define cores=24 --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/CPU2017.046/templogs/preenv.intrate.046.0.log --lognum 046.0 --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) SILVER 4510T
    vendor_id         : GenuineIntel
    cpu family        : 6
    model             : 143
    stepping          : 8
    microcode         : 0x2b0005c0
    bugs              : spectre_v1 spectre_v2 spec_store_bypass swapgs eibrs_pbrsb
    cpu cores         : 12
    siblings          : 24
    2 physical ids (chips)
    48 processors (hardware threads)
    physical id 0: core ids 0-11
    physical id 1: core ids 0-11
    physical id 0: apicids 0-23
    physical id 1: apicids 64-87
  Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for
  virtualized systems.  Use the above data carefully.

  -----------------------------------------------------------
```

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Platform Notes (Continued)

```
7. lscpu

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):                   48
  On-line CPU(s) list:      0-47
  Vendor ID:                GenuineIntel
  Model name:               INTEL(R) XEON(R) SILVER 4510T
  CPU family:               6
  Model:                    143
  Thread(s) per core:       2
  Core(s) per socket:       12
  Socket(s):                2
  Stepping:                 8
  CPU max MHz:              3700.0000
  CPU min MHz:              800.0000
  BogoMIPS:                 4000.00
  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 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
                            intel_ppin cdp_l2 ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi
                            flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2
                            erms invpcid rtm 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
                            split_lock_detect avx_vnni avx512_bf16 wbnoinvd dtherm ida arat pln pts
                            hfi 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 avx512_fp16 amx_tile flush_l1d arch_capabilities
  Virtualization:           VT-x
  L1d cache:                1.1 MiB (24 instances)
  L1i cache:                768 KiB (24 instances)
  L2 cache:                 48 MiB (24 instances)
  L3 cache:                 60 MiB (2 instances)
  NUMA node(s):             2
  NUMA node0 CPU(s):        0-11,24-35
  NUMA node1 CPU(s):        12-23,36-47
  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, 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
```

(Continued on next page)

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Platform Notes (Continued)

```
    L1d      48K    1.1M  12 Data          1    64    1        64
    L1i      32K    768K   8 Instruction   1    64    1        64
    L2        2M     48M  16 Unified       2  2048    1        64
    L3       30M     60M  15 Unified       3 32768    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: 0-11,24-35
    node 0 size: 515755 MB
    node 0 free: 514680 MB
    node 1 cpus: 12-23,36-47
    node 1 size: 516043 MB
    node 1 free: 515252 MB
    node distances:
    node   0   1
      0:  10  21
      1:  21  10


    --------------------------------------------------------------
  9. /proc/meminfo
    MemTotal:       1056561688 kB


    --------------------------------------------------------------
  10. who -r
    run-level 3 May 23 08:57


    --------------------------------------------------------------
  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 nscd postfix purge-kernels rollback rsyslog smartd sshd
                    systemd-pstore wicked wickedd-auto4 wickedd-dhcp4 wickedd-dhcp6 wickedd-nanny
    enabled-runtime systemd-remount-fs
    disabled        autofs autoyast-initscripts blk-availability boot-sysctl ca-certificates chrony-wait
                    chronyd console-getty cups cups-browsed debug-shell ebtables exchange-bmc-os-info
                    firewalld gpm grub2-once haveged haveged-switch-root hwloc-dump-hwdata ipmi ipmievd
                    issue-add-ssh-keys kexec-load lunmask man-db-create multipathd nfs nfs-blkmap rpcbind
                    rpmconfigcheck rsyncd 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=d1343b23-a61e-463a-96fe-4b32a83e08cb
    splash=silent
    mitigations=auto
    quiet
    security=apparmor


    --------------------------------------------------------------
  14. cpupower frequency-info
```

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Platform Notes (Continued)

```
     analyzing CPU 0:
       current policy: frequency should be within 800 MHz and 3.70 GHz.
                       The governor "powersave" may decide which speed to use
                       within this range.
       boost state support:
         Supported: yes
         Active: yes


    ----------------------------------------------------------
    15. 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                  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
      Filesystem     Type  Size  Used Avail Use% Mounted on
      /dev/sda3      xfs   445G   30G  416G   7% /


    ----------------------------------------------------------
    20. /sys/devices/virtual/dmi/id
```

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Platform Notes (Continued)

```
      Vendor:         Lenovo
      Product:        ThinkSystem ST650 V3
      Product Family: ThinkSystem
      Serial:         MDSN00110D


    ------------------------------------------------------------
 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:
     12x Samsung M321R8GA0PB0-CWMKH 64 GB 2 rank 5600, configured at 4400
     4x Samsung M321R8GA0PB0-CWMXH 64 GB 2 rank 5600, configured at 4400


    ------------------------------------------------------------
 22. BIOS
 (This section combines info from /sys/devices and dmidecode.)
    BIOS Vendor:      Lenovo
    BIOS Version:     USE127C-4.20
    BIOS Date:        04/10/2024
    BIOS Revision:    4.20
    Firmware Revision: 5.10
```

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.
------------------------------------------------------------------------------
```

Base Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

(Continued on next page)

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Base Compiler Invocation (Continued)

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
```

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

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

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SPECrate®2017_int_base =   200

SPECrate®2017_int_peak = Not Run

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

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.

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