# SPEC CPU®2017 Integer Rate Result

## Lenovo Global Technology

**ThinkSystem SR650 V3 (2.00 GHz, Intel Xeon Silver 4410Y)**

<table>
<thead>
<tr>
<th>Test Sponsor:</th>
<th>Lenovo Global Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tested by:</td>
<td>Lenovo Global Technology</td>
</tr>
<tr>
<td>CPU2017 License:</td>
<td>9017</td>
</tr>
<tr>
<td>Test Date:</td>
<td>Mar-2023</td>
</tr>
<tr>
<td>Hardware Availability:</td>
<td>Feb-2023</td>
</tr>
<tr>
<td>Software Availability:</td>
<td>Dec-2022</td>
</tr>
</tbody>
</table>

### Copies

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>500.perlbench_r</td>
<td>48</td>
</tr>
<tr>
<td>502.gcc_r</td>
<td>48</td>
</tr>
<tr>
<td>505.mcf_r</td>
<td>48</td>
</tr>
<tr>
<td>520.omnetpp_r</td>
<td>48</td>
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<tr>
<td>523.xalancbmk_r</td>
<td>48</td>
</tr>
<tr>
<td>525.x264_r</td>
<td>48</td>
</tr>
<tr>
<td>531.deepsjeng_r</td>
<td>48</td>
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<tr>
<td>541.leela_r</td>
<td>48</td>
</tr>
<tr>
<td>548.exchange2_r</td>
<td>48</td>
</tr>
<tr>
<td>557.xz_r</td>
<td>48</td>
</tr>
</tbody>
</table>

### Hardware

- **CPU Name:** Intel Xeon Silver 4410Y
- **Max MHz:** 3900
- **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
- **Cache L2:** 2 MB I+D on chip per core
- **Cache L3:** 30 MB I+D on chip per chip
- **Memory:** 512 GB (16 x 32 GB 2Rx8 PC5-4800B-R, running at 4000)
- **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
  C/C++: Version 2023.0 of Intel oneAPI DPC++/C++ Compiler for Linux;
  Fortran: Version 2023.0 of Intel Fortran Compiler for Linux;
- **Compiler:**
- **Firmware:** Lenovo BIOS Version ESE109L 1.10 released Jan-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

### SPECrate®2017_int_base = 217

### SPECrate®2017_int_peak = Not Run
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SPECrade®2017_int_base = 217
SPECrade®2017_int_peak = Not Run

Results Table

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<tr>
<td>548.exchange2_r</td>
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<td>98.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.xalanchmk_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/jes5.0.1-32"

MALLOC_CONF = "retain:true"
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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:
Operating Mode set to Maximum Performance and then set it to Custom Mode
MONITOR/MAWAIT set to Enabled
SNC set to SNC2
LLC Prefetch set to Disabled
UPI Link Disable set to Disabled 1 Link

Sysinfo program /home/cpu2017-1.1.9-ic2023.0/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36e2c92cc097bec197
running on localhost Wed Mar 22 20:30:38 2023

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

(Continued on next page)
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SPECrate®2017_int_base = 217
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Platform Notes (Continued)

1. `uname -a`
   
   Linux localhost 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`
   
   20:30:38 up 1 min,  1 user,  load average: 2.94, 1.44, 0.54
   USER    TTY     FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
   root    tty1     -                20:30   10.00s  1.10s  0.00s -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) 2062672
   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) 2062672
   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=48 -c
   ic2023.0-lin-sapphirerapids-rate-20221201.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 intrate --nopreenv --note-preenv --logfile
   $SPEC/tmp/CPUP2017.152/templogs/preenv.intrate.152.0.log --lognum 152.0 --from_runcpu 2
   specperl $SPEC/bin/sysinfo
   $SPEC = /home/cpu2017-1.1.9-ic2023.0

6. `/proc/cpuinfo`
   
   model name      : Intel(R) Xeon(R) Silver 4410Y
   vendor_id       : GenuineIntel
   cpu family      : 6
   model           : 143
   stepping        : 8
   microcode       : 0x2b000161
   bugs            : spectre_v1 spectre_v2 spec_store_bypass swapgs

(Continued on next page)
Platform Notes (Continued)

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 128-151
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 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 128-151
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):                          48
On-line CPU(s) list:             0-47
Vendor ID:                       GenuineIntel
Model name:                      Intel(R) Xeon(R) Silver 4410Y
CPU family:                      6
Model:                           143
Thread(s) per core:              2
Core(s) per socket:              12
Socket(s):                       2
Stepping:                        8
BogoMIPS:                        4000.00
NUMA node(s):                    4
NUMA node0 CPU(s):               0-5,24-29
NUMA node1 CPU(s):               6-11,30-35
NUMA node2 CPU(s):               12-17,36-41
NUMA node3 CPU(s):               18-23,42-47
Vulnerability Itlb multihit:     Not affected
Vulnerability L1f:               Not affected
Vulnerability Mds:               Not affected
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 (24 instances)
NUMA node(s):                    4
NUMA node0 CPU(s):               0-5,24-29
NUMA node1 CPU(s):               6-11,30-35
NUMA node2 CPU(s):               12-17,36-41
NUMA node3 CPU(s):               18-23,42-47
Vulnerability Itlb multihit:     Not affected
Vulnerability L1f:               Not affected
Vulnerability Mds:               Not affected

(Continued on next page)
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(2.00 GHz, Intel Xeon Silver 4410Y)

---

### CPU2017 License: 9017

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

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### Platform Notes (Continued)

<table>
<thead>
<tr>
<th>Vulnerability Meltdown:</th>
<th>Not affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vulnerability Spec store bypass:</td>
<td>Mitigation; Speculative Store Bypass disabled via prctl and seccomp</td>
</tr>
<tr>
<td>Vulnerability Spectre v1:</td>
<td>Mitigation; usercopy/swapgs barriers and __user pointer sanitization</td>
</tr>
<tr>
<td>Vulnerability Spectre v2:</td>
<td>Mitigation; Enhanced IBRS, IBPB conditional, RSB filling</td>
</tr>
<tr>
<td>Vulnerability Srdbd:</td>
<td>Not affected</td>
</tr>
<tr>
<td>Vulnerability Tsx async abort:</td>
<td>Not affected</td>
</tr>
</tbody>
</table>

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>
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<tr>
<td></td>
<td>48K</td>
<td>1.1M</td>
<td>12</td>
<td>Data</td>
<td></td>
<td>64</td>
<td>1</td>
<td>64</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1i</td>
<td>32K</td>
<td>768K</td>
<td>8</td>
<td>Instruction</td>
<td>1</td>
<td>64</td>
<td>1</td>
<td>64</td>
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<tr>
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<td>2M</td>
<td>48M</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>30M</td>
<td>60M</td>
<td>15</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: 4 nodes (0-3)

node 0 cpus: 0-5,24-29
node 0 size: 128683 MB
node 0 free: 128011 MB
node 1 cpus: 6-11,30-35
node 1 size: 129020 MB
node 1 free: 128649 MB
node 2 cpus: 12-17,36-41
node 2 size: 128986 MB
node 2 free: 128595 MB
node 3 cpus: 18-23,42-47
node 3 size: 129001 MB
node 3 free: 128624 MB

node distances:

<table>
<thead>
<tr>
<th>node</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
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</thead>
<tbody>
<tr>
<td>0:</td>
<td>10</td>
<td>12</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>1:</td>
<td>12</td>
<td>10</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>2:</td>
<td>21</td>
<td>21</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>3:</td>
<td>21</td>
<td>21</td>
<td>12</td>
<td>10</td>
</tr>
</tbody>
</table>

---

9. /proc/meminfo

| MemTotal: | 528068704 kB |

---

10. who -r

run-level 3 Mar 22 20:29

---

11. Systemd service manager version: systemd 249 (249.11+suse.124.g2bc0b2c447)

Default Target: running

---

12. Services, from systemctl list-unit-files

<table>
<thead>
<tr>
<th>STATE</th>
<th>UNIT FILES</th>
</tr>
</thead>
<tbody>
<tr>
<td>enabled</td>
<td>YaST2-Firstboot YaST2-Second-Stage apparmor auditd cron getty@ haveged irqbalance issue-generator kbdsettings klog lvm2-monitor nscd postfix purge-kernels rollback rsyslog systemd-remount-fs systemd-rollback-fs systemd-udevd systemd-udevd-fs</td>
</tr>
</tbody>
</table>

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**Platform Notes (Continued)**

- lunmask man-db-create multipathd nfs nfs-blkmap rdisc rpcbind rpmconfigcheck rsyncd
  sapconf serial-getty8 smartd_generate_opts snmpd snmptrapd sysstat
  systemd-boot-check-no-failures systemd-network-generator systemd-sysext
  systemd-time-wait-sync systemd-timesyncd tuned

  indirect uidd wickedd

---

13. Linux kernel boot-time arguments, from /proc/cmdline

   BOOT_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default
   root=UUID=461ffbd6-8da0-4c20-adb7-d9d3143b6aa5
   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: virtual-guest

---

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 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

---

17. /sys/kernel/mm/transparent_hugepage

   defrag always defer defer+madvise [madvise] never
   enabled [always] madvise never
   hpage_pmd_size 2097152
   shm_mmap 0  
   enabled always within_size advise [never] deny force

---

18. /sys/kernel/mm/transparent_hugepage/kwargs

   alloc_sleep_millisecs 60000

---

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Software Availability: Dec-2022

Platform Notes (Continued)

defrag                      1
max_ptes_none             511
max_ptes_shared           256
max_ptes_swap              64
pages_to_scan            4096
scan_sleep_milliseconds  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  112G  777G  13% /

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 3.2 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:
16x Samsung M321R4GA3BB0-CQKVG 32 GB 2 rank 4800, configured at 4000

23. BIOS
(This section combines info from /sys/devices and dmidecode.)
BIOS Vendor:       Lenovo
BIOS Version:      ESE109L-1.10
BIOS Date:         01/07/2023
BIOS Revision:     1.10
Firmware Revision: 1.0

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 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
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**SPEC CPU®2017 Integer Rate Result**

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<tbody>
<tr>
<td>SPECrate®2017_int_peak = Not Run</td>
</tr>
</tbody>
</table>

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

Test Date: Mar-2023
Hardware Availability: Feb-2023
Software Availability: Dec-2022

Compiler Version Notes (Continued)

Fortran | 548.exchange2_r(base)
-----------------------------------------------------------------------------------
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.0.0 Build 20221201
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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/usr/local/intel/compiler/2023.0.0/linux/compiler/lib/intel64_lin
-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

(Continued on next page)
Lenovo Global Technology
ThinkSystem SR650 V3
(2.00 GHz, Intel Xeon Silver 4410Y)

SPECrate®2017_int_base = 217
SPECrate®2017_int_peak = Not Run

Base Optimization Flags (Continued)

C++ benchmarks (continued):
-L/usr/local/intel/compiler/2023.0.0/linux/compiler/lib/intel64_lin
-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/usr/local/intel/compiler/2023.0.0/linux/compiler/lib/intel64_lin
-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-O.html
http://www.spec.org/cpu2017/flags/Intel-ic2023-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-O.xml
http://www.spec.org/cpu2017/flags/Intel-ic2023-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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