## SPEC CPU®2017 Floating Point Rate Result

### Hewlett Packard Enterprise

**License:** SPEC®2017 License: 3

**Test Sponsor:** Test Sponsor: HPE

**Hardware Availability:** Hardware Availability: Feb-2020

**Tested by:** Tested by: HPE

**Software Availability:** Software Availability: Jun-2019

**Test Date:** Test Date: Mar-2020

---

### SPECrate®2017_fp_base = 227

### SPECrate®2017_fp_peak = 244

---

### Hardware

- **CPU Name:** Intel Xeon Gold 5220R
- **Max MHz:** 4000
- **Nominal:** 2200
- **Enabled:** 48 cores, 2 chips, 2 threads/core
- **Orderable:** 1, 2 chip(s)
- **Cache L1:** 32 KB I + 32 KB D on chip per core
- **L2:** 1 MB I+D on chip per core
- **L3:** 35.75 MB I+D on chip per chip
- **Memory:** 384 GB (24 x 16 GB 2Rx8 PC4-2933Y-R, running at 2666)
- **Storage:** 1 x 400 GB SAS SSD, RAID 0
- **Other:** None
- **OS:** SUSE Linux Enterprise Server 15 SP1 (x86_64)
- **Kernel:** 4.12.14-195-default

### Software

- **Compiler:** C/C++: Version 19.0.4.227 of Intel C/C++ Compiler Build 20190416 for Linux;
  Fortran: Version 19.0.4.227 of Intel Fortran Compiler Build 20190416 for Linux;
- **Parallel:** No
- **Firmware:** HPE BIOS Version I42 v2.22 (11/13/2019) released Feb-2020
- **File System:** btrfs
- **System State:** Run level 3 (multi-user)
- **Base Pointers:** 64-bit
- **Peak Pointers:** 64-bit
- **Other:** None
- **Power Management:** BIOS set to prefer performance at the cost of additional power usage

---

### Performance Results

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>SPECrate®2017_fp_base</th>
<th>SPECrate®2017_fp_peak</th>
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<tbody>
<tr>
<td>503.bwaves_r</td>
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<tr>
<td>507.caactuBSSN_r</td>
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<tr>
<td>508.namd_r</td>
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<tr>
<td>554.roms_r</td>
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**Footnote:**

HPE SYNERGY 480 GEN10,
SPEC CPU®2017 Floating Point Rate Result
Copyright 2017-2020 Standard Performance Evaluation Corporation

Test Date: Mar-2020

Hardware Availability: Feb-2020

Tested by: HPE

Software Availability: Jun-2019

Test Sponsor: HPE

Hardware

- CPU2017 License: 3
- Test Sponsor: HPE
- Tested by: HPE
- **Specrate®2017_fp_base = 227**
- **Specrate®2017_fp_peak = 244**

---

**Software**

- OS: SUSE Linux Enterprise Server 15 SP1 (x86_64)
- Compiler: C/C++: Version 19.0.4.227 of Intel C/C++ Compiler Build 20190416 for Linux;
  Fortran: Version 19.0.4.227 of Intel Fortran Compiler Build 20190416 for Linux;
- Parallel: No
- Firmware: HPE BIOS Version I42 v2.22 (11/13/2019) released Feb-2020
- File System: btrfs
- System State: Run level 3 (multi-user)
- Base Pointers: 64-bit
- Peak Pointers: 64-bit
- Other: None
- Power Management: BIOS set to prefer performance at the cost of additional power usage
SPEC CPU®2017 Floating Point Rate Result

Hewlett Packard Enterprise
(Test Sponsor: HPE)
Synergy 480 Gen10
(2.20 GHz, Intel Xeon Gold 5220R)

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Hewlett Packard Enterprise
(Test Sponsor: HPE)
Synergy 480 Gen10
(2.20 GHz, Intel Xeon Gold 5220R)

SPECrate®2017_fp_base = 227
SPECrate®2017_fp_peak = 244

Results Table

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

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"
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

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
    LD_LIBRARY_PATH = "~/home/cpu2017/lib/intel64"

General Notes

Binaries compiled on a system with 1x Intel Core i9-7900X CPU + 32GB RAM
memory using Redhat Enterprise Linux 7.5

(Continued on next page)
Hewlett Packard Enterprise
(Test Sponsor: HPE)
Synergy 480 Gen10
(2.20 GHz, Intel Xeon Gold 5220R)

| SPECrate®2017_fp_base = 227 |
| SPECrate®2017_fp_peak = 244 |

**CPU2017 License:** 3
**Test Sponsor:** HPE
**Tested by:** HPE
**Test Date:** Mar-2020
**Hardware Availability:** Feb-2020
**Software Availability:** Jun-2019

---

**General Notes (Continued)**

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:
- Thermal Configuration set to Maximum Cooling
- Memory Patrol Scrubbing set to Disabled
- LLC Prefetch set to Enabled
- LLC Dead Line Allocation set to Disabled
- Enhanced Processor Performance set to Enabled
- Workload Profile set to General Throughput Compute
- Workload Profile set to Custom
- Energy/Performance Bias set to Balanced Performance

Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f88fa3d7ed166e4a485a0911
running on sy480-sys2 Tue Mar 10 07:18:05 2020

SUT (System Under Test) info as seen by some common utilities.
For more information on this section, see https://www.spec.org/cpu2017/Docs/config.html#sysinfo

From /proc/cpuinfo
- model name: Intel(R) Xeon(R) Gold 5220R CPU @ 2.20GHz
  - 2 "physical id"s (chips)
  - 96 "processors"
- cores, siblings (Caution: counting these is hw and system dependent. The following excerpts from /proc/cpuinfo might not be reliable. Use with caution.)
  - cpu cores: 24
  - siblings: 48
  - physical 0: cores 0 1 2 3 9 10 11 12 13 16 17 18 19 20 21 24 25 26 27 28 29
  - physical 1: cores 0 1 2 3 4 8 9 10 11 12 13 16 17 18 19 20 21 25 26 27 28 29

From lscpu:
- Architecture: x86_64
- CPU op-mode(s): 32-bit, 64-bit
- Byte Order: Little Endian
- Address sizes: 46 bits physical, 48 bits virtual
- CPU(s): 96
- On-line CPU(s) list: 0-95
- Thread(s) per core: 2

(Continued on next page)
Hewlett Packard Enterprise
Synergy 480 Gen10
(2.20 GHz, Intel Xeon Gold 5220R)

**SPECrate®2017_fp_base = 227**
**SPECrate®2017_fp_peak = 244**

**CPU2017 License:** 3
**Test Sponsor:** HPE
**Tested by:** HPE

**Platform Notes (Continued)**

Core(s) per socket: 24
Socket(s): 2
NUMA node(s): 4
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Gold 5220R CPU @ 2.20GHz
Stepping: 7
CPU MHz: 2200.000
BogoMIPS: 4400.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 36608K
NUMA node0 CPU(s): 0-11,48-59
NUMA node1 CPU(s): 12-23,60-71
NUMA node2 CPU(s): 24-35,72-83
NUMA node3 CPU(s): 36-47,84-95

Flags:

```
  fpu   vme  de  pse  msr  mtrr  pae  mce  cmov
  pat   pse36 clflush dtc 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 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 cdp_l3
  invpcid_single intel_pni ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi
  flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm
cqm mpx rdt_a_avx512f avx512fd rdseed adx smap clflushopt clwb intel_pt avx512cd
  avx512bw avx512vl xsaveopt xsaves xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc
  cqm_mbm_total cqm_mbm_local dtherm ida arat pfn pts pkup ospke avx512_vnni md_clear
  flush_lld arch_capabilities
```

/proc/cpuinfo cache data
cache size : 36608 KB

From numactl --hardware WARNING: a numactl 'node' might or might not correspond to a
physical chip.

```
available: 4 nodes (0-3)
node 0 cpus: 0 1 2 3 4 5 6 7 8 9 10 11 48 49 50 51 52 53 54 55 56 57 58 59
node 0 size: 96285 MB
node 0 free: 95809 MB
node 1 cpus: 12 13 14 15 16 17 18 19 20 21 22 23 60 61 62 63 64 65 66 67 68 69 70 71
node 1 size: 96733 MB
node 1 free: 96441 MB
node 2 cpus: 24 25 26 27 28 29 30 31 32 33 34 35 72 73 74 75 76 77 78 79 80 81 82 83
node 2 size: 96763 MB
node 2 free: 96563 MB
```

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

 node 3 cpus: 36 37 38 39 40 41 42 43 44 45 46 47 84 85 86 87 88 89 90 91 92 93 94 95
 node 3 size: 96564 MB
 node 3 free: 96357 MB
 node distances:
   node 0 1 2 3
   0:  10  21  31  31
   1:  21  10  31  31
   2:  31  31  10  21
   3:  31  31  21  10

From /proc/meminfo
  MemTotal:       395620352 kB
  HugePages_Total:       0
  Hugepagesize:       2048 kB

From /etc/*release*/etc/*version*
  os-release:
    NAME="SLES"
    VERSION="15-SP1"
    VERSION_ID="15.1"
    PRETTY_NAME="SUSE Linux Enterprise Server 15 SP1"
    ID="sles"
    ID_LIKE="suse"
    ANSI_COLOR="0;32"
    CPE_NAME="cpe:/o:suse:sles:15:sp1"

  uname -a:
    Linux sy480-sys2 4.12.14-195-default #1 SMP Tue May 7 10:55:11 UTC 2019 (8fba516)
    x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2018-3620 (L1 Terminal Fault): Not affected
Microarchitectural Data Sampling: Not affected
CVE-2017-5754 (Meltdown): Not affected
CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2017-5753 (Spectre variant 1): Mitigation: __user pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling

run-level 3 Mar 10 07:15

SPEC is set to: /home/cpu2017
  Filesystem Type Size Used Avail Use% Mounted on
  /dev/sda2 btrfs 371G 115G 255G 32% /home

(Continued on next page)
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CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Platform Notes (Continued)
From /sys/devices/virtual/dmi/id
BIOS:    HPE I42 11/13/2019
Vendor:  HPE
Product: Synergy 480 Gen10
Product Family: Synergy
Serial:  MXQ72204FC

Additional information from dmidecode 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:
    24x UNKNOWN NOT AVAILABLE 16 GB 2 rank 2933

(End of data from sysinfo program)

Compiler Version Notes

C
    519.lbm_r(base, peak) 538.imagick_r(base, peak)
    544.nab_r(base, peak)

Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

C++
    508.namd_r(base, peak) 510.parest_r(base, peak)

Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

C++, C
    511.povray_r(base, peak) 526.blender_r(base, peak)

Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

(Continued on next page)
## Compiler Version Notes (Continued)

C++, C, Fortran | 507.cactuBSSN_r(base, peak)

Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

Fortran | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak)
554.roms_r(base, peak)

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

Fortran, C | 521.wrf_r(base, peak) 527.cam4_r(base, peak)

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

### Base Compiler Invocation

C benchmarks:
```
icc -m64 -std=c11
```

C++ benchmarks:
```
icpc -m64
```

Fortran benchmarks:
```
ifort -m64
```
**SPEC CPU®2017 Floating Point Rate Result**

Hewlett Packard Enterprise  
(Test Sponsor: HPE)  
Synergy 480 Gen10  
(2.20 GHz, Intel Xeon Gold 5220R)

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<td>244</td>
<td>227</td>
</tr>
</tbody>
</table>

CPU2017 License: 3  
Test Sponsor: HPE  
Tested by: HPE

**Base Compiler Invocation (Continued)**

Benchmarks using both Fortran and C:
```bash
ifort -m64 icc -m64 -std=c11
```

Benchmarks using both C and C++:
```bash
icpc -m64 icc -m64 -std=c11
```

Benchmarks using Fortran, C, and C++:
```bash
icpc -m64 icc -m64 -std=c11 ifort -m64
```

**Base Portability Flags**

503.bwaves_r: -DSPEC_LP64  
507.cactuBSSN_r: -DSPEC_LP64  
508.namd_r: -DSPEC_LP64  
510.parest_r: -DSPEC_LP64  
511.povray_r: -DSPEC_LP64  
519.lbm_r: -DSPEC_LP64  
521.wrf_r: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian  
526.blender_r: -DSPEC_LP64 -DSPEC_LINUX -funsigned-char  
527.cam4_r: -DSPEC_LP64 -DSPEC_CASE_FLAG  
538.imagick_r: -DSPEC_LP64  
544.nab_r: -DSPEC_LP64  
549.fotonik3d_r: -DSPEC_LP64  
554.roms_r: -DSPEC_LP64

**Base Optimization Flags**

C benchmarks:
```bash
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only  
-qopt-mem-layout-trans=4
```

C++ benchmarks:
```bash
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only  
-qopt-mem-layout-trans=4
```

Fortran benchmarks:
```bash
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only  
-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs  
-align array32byte
```

Benchmarks using both Fortran and C:
```bash
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
```

(Continued on next page)
Hewlett Packard Enterprise
(Test Sponsor: HPE)
Synergy 480 Gen10
(2.20 GHz, Intel Xeon Gold 5220R)

SPECrate®2017_fp_base = 227
SPECrate®2017_fp_peak = 244

<table>
<thead>
<tr>
<th>CPU2017 License: 3</th>
<th>Test Date:</th>
<th>Mar-2020</th>
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<td>Software Availability:</td>
<td>Jun-2019</td>
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</table>

### Base Optimization Flags (Continued)

Benchmarks using both Fortran and C (continued):
- `-qopt-mem-layout-trans=4`  `-auto`  `-nostandard-realloc-lhs`
- `-align array32byte`

Benchmarks using both C and C++:
- `-xCORE-AVX2`  `-ipo`  `-O3`  `-no-prec-div`  `-qopt-prefetch`  `-ffinite-math-only`
- `-qopt-mem-layout-trans=4`

Benchmarks using Fortran, C, and C++:
- `-xCORE-AVX2`  `-ipo`  `-O3`  `-no-prec-div`  `-qopt-prefetch`  `-ffinite-math-only`
- `-qopt-mem-layout-trans=4`  `-auto`  `-nostandard-realloc-lhs`
- `-align array32byte`

### Peak Compiler Invocation

C benchmarks:
- `icc -m64 -std=c11`

C++ benchmarks:
- `icpc -m64`

Fortran benchmarks:
- `ifort -m64`

Benchmarks using both Fortran and C:
- `ifort -m64 icc -m64 -std=c11`

Benchmarks using both C and C++:
- `icpc -m64 icc -m64 -std=c11`

Benchmarks using Fortran, C, and C++:
- `icpc -m64 icc -m64 -std=c11 ifort -m64`

### Peak Portability Flags

Same as Base Portability Flags
Hewlett Packard Enterprise
(Test Sponsor: HPE)
Synergy 480 Gen10
(2.20 GHz, Intel Xeon Gold 5220R)

SPECrata®2017_fp_base = 227
SPECrata®2017_fp_peak = 244

CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Test Date: Mar-2020
Hardware Availability: Feb-2020
Software Availability: Jun-2019

Peak Optimization Flags

C benchmarks:

519.1bm_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4

538.imagick_r: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4

544.nab_r: Same as 538.imagick_r

C++ benchmarks:

508.namd_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4

510.parest_r: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4

Fortran benchmarks:

503.bwaves_r: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -auto
-nostandard-realloc-lhs -align array32byte

549.fotonik3d_r: Same as 503.bwaves_r

554.roms_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
-align array32byte

Benchmarks using both Fortran and C:

-prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
-align array32byte

Benchmarks using both C and C++:

511.povray_r: -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4

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

Hewlett Packard Enterprise
(Test Sponsor: HPE)
Synergy 480 Gen10
(2.20 GHz, Intel Xeon Gold 5220R)

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**Peak Optimization Flags (Continued)**

526.blender_r: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4

Benchmarks using Fortran, C, and C++:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -auto -nostandard-realloc-lhs
-align array32byte

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.2-CLX-revB.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.2-CLX-revB.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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