



SPEC CPU®2017 Floating Point Rate Result

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Lenovo Global Technology

SPECrate®2017_fp_base = 457

ThinkSystem SR860 V2
(2.80 GHz, Intel Xeon Gold 6328H)

SPECrate®2017_fp_peak = Not Run

CPU2017 License: 9017

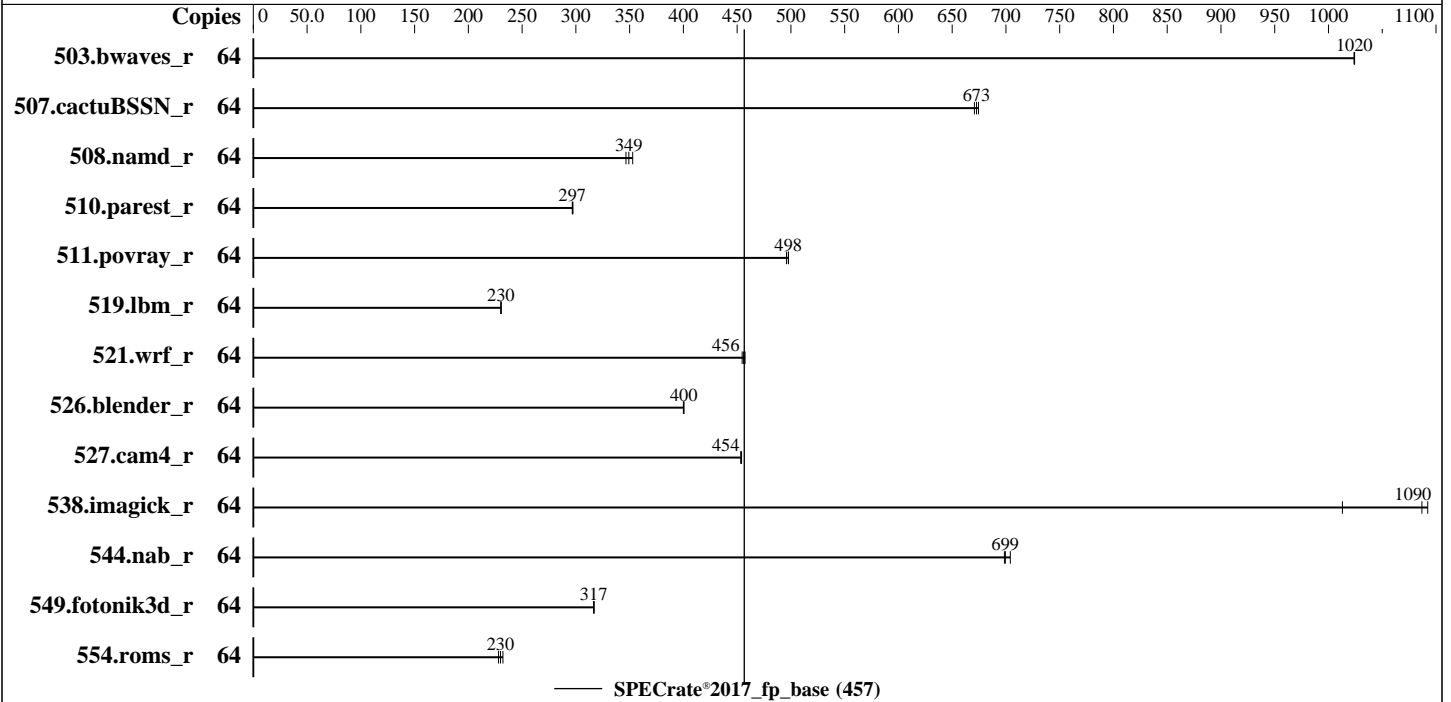
Test Date: Nov-2020

Test Sponsor: Lenovo Global Technology

Hardware Availability: Nov-2020

Tested by: Lenovo Global Technology

Software Availability: Aug-2020



Hardware

CPU Name: Intel Xeon Gold 6328H
 Max MHz: 4300
 Nominal: 2800
 Enabled: 64 cores, 4 chips
 Orderable: 2,4 chips
 Cache L1: 32 KB I + 32 KB D on chip per core
 L2: 1 MB I+D on chip per core
 L3: 22 MB I+D on chip per chip
 Other: None
 Memory: 768 GB (48 x 16 GB 2Rx8 PC4-3200AA-R, running at 2933)
 Storage: 1 x 960 GB SATA SSD
 Other: None

Software

OS: Red Hat Enterprise Linux 8.2 (Ootpa)
 Kernel 4.18.0-193.el8.x86_64
 Compiler: C/C++: Version 19.1.2.275 of Intel C/C++ Compiler for Linux;
 Fortran: Version 19.1.2.275 of Intel Fortran Compiler for Linux
 Parallel: No
 Firmware: Lenovo BIOS Version MSE107H 1.00 released Oct-2020
 File System: xfs
 System State: Run level 3 (multi-user)
 Base Pointers: 64-bit
 Peak Pointers: Not Applicable
 Other: jemalloc memory allocator V5.0.1
 Power Management: BIOS set to prefer performance at the cost of additional power usage



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Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
503.bwaves_r	64	627	1020	<u>627</u>	<u>1020</u>	627	1020							
507.cactuBSSN_r	64	<u>120</u>	<u>673</u>	120	674	121	671							
508.namd_r	64	172	353	175	347	<u>174</u>	<u>349</u>							
510.parest_r	64	563	297	564	297	<u>564</u>	<u>297</u>							
511.povray_r	64	300	498	301	496	<u>300</u>	<u>498</u>							
519.lbm_r	64	293	230	293	230	<u>293</u>	<u>230</u>							
521.wrf_r	64	<u>315</u>	<u>456</u>	315	455	313	457							
526.blender_r	64	<u>243</u>	<u>400</u>	244	400	243	400							
527.cam4_r	64	247	453	<u>247</u>	<u>454</u>	246	454							
538.imagick_r	64	157	1010	146	1090	<u>146</u>	<u>1090</u>							
544.nab_r	64	154	699	<u>154</u>	<u>699</u>	153	704							
549.fotonik3d_r	64	787	317	<u>788</u>	<u>317</u>	788	317							
554.roms_r	64	<u>442</u>	<u>230</u>	446	228	438	232							

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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/cpu2017-1.1.0-ic19.lu2/lib/intel64:/home/cpu2017-1.1.0-ic19.lu2/j
e5.0.1-64"
MALLOC_CONF = "retain:true"

General Notes

Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM
memory using Redhat Enterprise Linux 8.0
Transparent Huge Pages enabled by default

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General Notes (Continued)

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.

jemalloc, a general purpose malloc implementation
built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5
sources available from jemalloc.net or <https://github.com/jemalloc/jemalloc/releases>

Platform Notes

BIOS configuration:

Choose Operating Mode set to Maximum Performance and then set it to Custom Mode
MONITOR/MWAIT set to Enabled
Hyper-Threading set to Disabled
SNC set to Enabled
Stale Atos set to Enable

Sysinfo program /home/cpu2017-1.1.0-ic19.lu2/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7edble6e46a485a0011
running on localhost.localdomain Mon Nov 30 00:24:09 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 6328H CPU @ 2.80GHz
 4 "physical id"s (chips)
 64 "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 : 16
siblings  : 16
physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
physical 2: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
physical 3: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
```

From lscpu:

(Continued on next page)



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Platform Notes (Continued)

```

Architecture:          x86_64
CPU op-mode(s):        32-bit, 64-bit
Byte Order:            Little Endian
CPU(s):                64
On-line CPU(s) list:   0-63
Thread(s) per core:    1
Core(s) per socket:    16
Socket(s):             4
NUMA node(s):          8
Vendor ID:             GenuineIntel
CPU family:            6
Model:                 85
Model name:            Intel(R) Xeon(R) Gold 6328H CPU @ 2.80GHz
Stepping:              11
CPU MHz:               3508.064
CPU max MHz:           4300.0000
CPU min MHz:           1000.0000
BogoMIPS:              5600.00
Virtualization:        VT-x
L1d cache:             32K
L1i cache:             32K
L2 cache:              1024K
L3 cache:              22528K
NUMA node0 CPU(s):    0-3,8-11
NUMA node1 CPU(s):    4-7,12-15
NUMA node2 CPU(s):    16-19,24-27
NUMA node3 CPU(s):    20-23,28-31
NUMA node4 CPU(s):    32-35,40-43
NUMA node5 CPU(s):    36-39,44-47
NUMA node6 CPU(s):    48-51,56-59
NUMA node7 CPU(s):    52-55,60-63
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
aperfmpperf 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 fl6c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb cat_l3 cdp_l3
invpcid_single intel_ppin 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 avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd
avx512bw avx512vl xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbm_total
cqm_mbm_local avx512_bf16 dtherm ida arat pln pts pku ospke avx512_vnni md_clear
flush_lld arch_capabilities

```

```

/proc/cpuinfo cache data
cache size : 22528 KB

```

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Platform Notes (Continued)

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

```

available: 8 nodes (0-7)
node 0 cpus: 0 1 2 3 8 9 10 11
node 0 size: 96355 MB
node 0 free: 96222 MB
node 1 cpus: 4 5 6 7 12 13 14 15
node 1 size: 96765 MB
node 1 free: 96599 MB
node 2 cpus: 16 17 18 19 24 25 26 27
node 2 size: 96765 MB
node 2 free: 96550 MB
node 3 cpus: 20 21 22 23 28 29 30 31
node 3 size: 96765 MB
node 3 free: 96622 MB
node 4 cpus: 32 33 34 35 40 41 42 43
node 4 size: 96765 MB
node 4 free: 96656 MB
node 5 cpus: 36 37 38 39 44 45 46 47
node 5 size: 96765 MB
node 5 free: 96656 MB
node 6 cpus: 48 49 50 51 56 57 58 59
node 6 size: 96765 MB
node 6 free: 96613 MB
node 7 cpus: 52 53 54 55 60 61 62 63
node 7 size: 96737 MB
node 7 free: 96547 MB

```

```

node distances:
node  0  1  2  3  4  5  6  7
  0:  10 11 20 20 20 20 20 20
  1:  11 10 20 20 20 20 20 20
  2:  20 20 10 11 20 20 20 20
  3:  20 20 11 10 20 20 20 20
  4:  20 20 20 20 10 11 20 20
  5:  20 20 20 20 11 10 20 20
  6:  20 20 20 20 20 20 10 11
  7:  20 20 20 20 20 20 11 10

```

```

From /proc/meminfo
MemTotal:      792257500 kB
HugePages_Total:      0
Hugepagesize:    2048 kB

```

```

/usr/bin/lsb_release -d
Red Hat Enterprise Linux release 8.2 (Ootpa)

```

From /etc/*release* /etc/*version*

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Platform Notes (Continued)

```
os-release:
  NAME="Red Hat Enterprise Linux"
  VERSION="8.2 (Ootpa)"
  ID="rhel"
  ID_LIKE="fedora"
  VERSION_ID="8.2"
  PLATFORM_ID="platform:el8"
  PRETTY_NAME="Red Hat Enterprise Linux 8.2 (Ootpa)"
  ANSI_COLOR="0;31"
```

```
redhat-release: Red Hat Enterprise Linux release 8.2 (Ootpa)
system-release: Red Hat Enterprise Linux release 8.2 (Ootpa)
system-release-cpe: cpe:/o:redhat:enterprise_linux:8.2:ga
```

```
uname -a:
Linux localhost.localdomain 4.18.0-193.el8.x86_64 #1 SMP Fri Mar 27 14:35:58 UTC 2020
x86_64 x86_64 x86_64 GNU/Linux
```

Kernel self-reported vulnerability status:

```
itlb_multihit: Not affected
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: usercopy/swaps barriers and __user
pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB: conditional,
RSB filling
tsx_async_abort: Not affected
```

run-level 3 Nov 30 00:17

```
SPEC is set to: /home/cpu2017-1.1.0-ic19.1u2
Filesystem      Type  Size  Used Avail Use% Mounted on
/dev/sda3       xfs   892G   36G  856G   5% /
```

```
From /sys/devices/virtual/dmi/id
BIOS:      Lenovo M5E107H-1.00 10/18/2020
Vendor:    Lenovo
Product:   ThinkSystem SR860 V2
Product Family: ThinkSystem
Serial:    none
```

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

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Platform Notes (Continued)

frequent changes to hardware, firmware, and the "DMTF SMBIOS" standard.

Memory:

48x SK Hynix HMA82GR7CJR8N-XN 16 GB 2 rank 3200

(End of data from sysinfo program)

Memory on this system run at 2933 MHz due to CPU limitation.

Compiler Version Notes

=====
C | 519.lbm_r(base) 538.imagick_r(base) 544.nab_r(base)

Intel(R) C Compiler for applications running on Intel(R) 64, Version

19.1.2.275 Build 20200604

Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

=====
C++ | 508.namd_r(base) 510.parest_r(base)

Intel(R) C++ Compiler for applications running on Intel(R) 64, Version

19.1.2.275 Build 20200604

Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

=====
C++, C | 511.povray_r(base) 526.blender_r(base)

Intel(R) C++ Compiler for applications running on Intel(R) 64, Version

19.1.2.275 Build 20200604

Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

Intel(R) C Compiler for applications running on Intel(R) 64, Version

19.1.2.275 Build 20200604

Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

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

Intel(R) C++ Compiler for applications running on Intel(R) 64, Version

19.1.2.275 Build 20200604

Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

Intel(R) C Compiler for applications running on Intel(R) 64, Version

19.1.2.275 Build 20200604

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Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)

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Compiler Version Notes (Continued)

64, Version 19.1.2.275 Build 20200623
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

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

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.1.2.275 Build 20200623
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

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

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.1.2.275 Build 20200623
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) C Compiler for applications running on Intel(R) 64, Version
19.1.2.275 Build 20200604
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Base Compiler Invocation

C benchmarks:

icc

C++ benchmarks:

icpc

Fortran benchmarks:

ifort

Benchmarks using both Fortran and C:

ifort icc

Benchmarks using both C and C++:

icpc icc

Benchmarks using Fortran, C, and C++:

icpc icc ifort



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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:

```

-m64 -qnextgen -std=c11
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
-xCORE-AVX512 -Ofast -ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

```

C++ benchmarks:

```

-m64 -qnextgen -Wl,-plugin-opt=-x86-branches-within-32B-boundaries
-Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math -flto -mfpmath=sse
-funroll-loops -qopt-mem-layout-trans=4
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

```

Fortran benchmarks:

```

-m64 -Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
-xCORE-AVX512 -O3 -ipo -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-multiple-gather-scatter-by-shuffles
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte
-auto -mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

```

Benchmarks using both Fortran and C:

```

-m64 -qnextgen -std=c11
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
-xCORE-AVX512 -Ofast -ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -O3 -ipo -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-multiple-gather-scatter-by-shuffles
-nostandard-realloc-lhs -align array32byte -auto
-mbranches-within-32B-boundaries -L/usr/local/jemalloc64-5.0.1/lib

```

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Base Optimization Flags (Continued)

Benchmarks using both Fortran and C (continued):

-ljemalloc

Benchmarks using both C and C++:

```
-m64 -qnextgen -std=c11
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
-xCORE-AVX512 -Ofast -ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc
```

Benchmarks using Fortran, C, and C++:

```
-m64 -qnextgen -std=c11
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
-xCORE-AVX512 -Ofast -ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -O3 -ipo -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-multiple-gather-scatter-by-shuffles
-nostandard-realloc-lhs -align array32byte -auto
-mbranches-within-32B-boundaries -L/usr/local/jemalloc64-5.0.1/lib
-ljemalloc
```

The flags files that were used to format this result can be browsed at

http://www.spec.org/cpu2017/flags/Intel-ic19.1ul-official-linux64_revA.html

<http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Cooperlake-A.html>

You can also download the XML flags sources by saving the following links:

http://www.spec.org/cpu2017/flags/Intel-ic19.1ul-official-linux64_revA.xml

<http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Cooperlake-A.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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