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Put Some SRE in Your Shipped Software

Hard-won lessons from the world of SRE

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@postwait

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The nature of the problem:

Software Sucks.

Once you've run software at scale, you have a deep understanding of how it is all tied together with **loose string** and **hope**.

We spend massive effort to operationalize our stacks.

The burning question:

Why Ship Software?

The trends are there.
You can choose to see them or not.

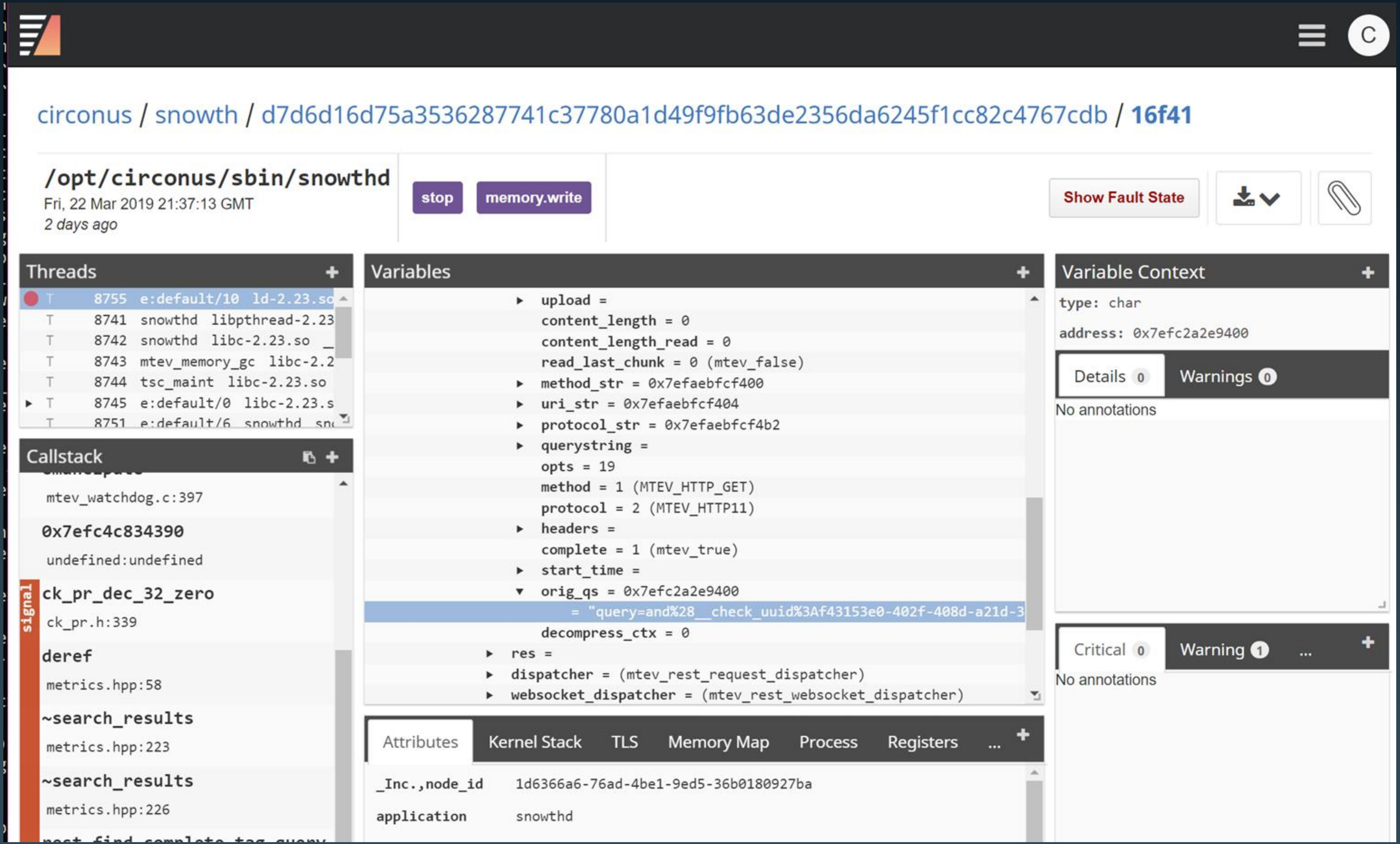
Rules.

1. Crash landings should be both fast and controlled.
2. Post-mortems are fundamental.
3. Use circuit breakers.
4. Behavior is complex. Understand it.
5. Have a failure budget.
6. Instrumentation & observability have no equals.

Build upon the right layers

Crash Analysis

If you don't know why it failed,
you dont' know anything at all.


circonus / snowth / d7d6d16d75a3536287741c37780a1d49f9fb63de2356da6245f1cc82c4767cdb / **16f41**

```
/opt/circonus/sbin/snowthd
```
Fri, 22 Mar 2019 21:37:13 GMT
2 days ago

Threads

```
● T  8755  e:default/10  ld-2.23.so
  T  8741  snowthd  libpthread-2.23
  T  8742  snowthd  libc-2.23.so  _
  T  8743  mtev_memory_gc  libc-2.2
  T  8744  tsc_maint  libc-2.23.so
▸ T  8745  e:default/0  libc-2.23.s
  T  8751  e:default/6  snowthd  sn
```

Callstack

```
mtev_watchdog.c:397
0x7efc4c834390
undefined:undefined
signal
ck_pr_dec_32_zero
ck_pr.h:339
deref
metrics.hpp:58
~search_results
metrics.hpp:223
~search_results
metrics.hpp:226
```

Variables

```
    ▸ upload =
      content_length = 0
      content_length_read = 0
      read_last_chunk = 0 (mtev_false)
    ▸ method_str = 0x7efaebfcf400
    ▸ uri_str = 0x7efaebfcf404
    ▸ protocol_str = 0x7efaebfcf4b2
    ▸ querystring =
      opts = 19
      method = 1 (MTEV_HTTP_GET)
      protocol = 2 (MTEV_HTTP11)
    ▸ headers =
      complete = 1 (mtev_true)
    ▸ start_time =
    ▾ orig_qs = 0x7efc2a2e9400
          = "query=and%28__check_uuid%3Af43153e0-402f-408d-a21d-3
      decompress_ctx = 0
  ▸ res =
  ▸ dispatcher = (mtev_rest_request_dispatcher)
  ▸ websocket_dispatcher = (mtev_rest_websocket_dispatcher)
```

```
_Inc.,node_id    1d6366a6-76ad-4be1-9ed5-36b0180927ba
application      snowthd
```

Variable Context

```
type: char
address: 0x7efc2a2e9400
```

No annotations

No annotations

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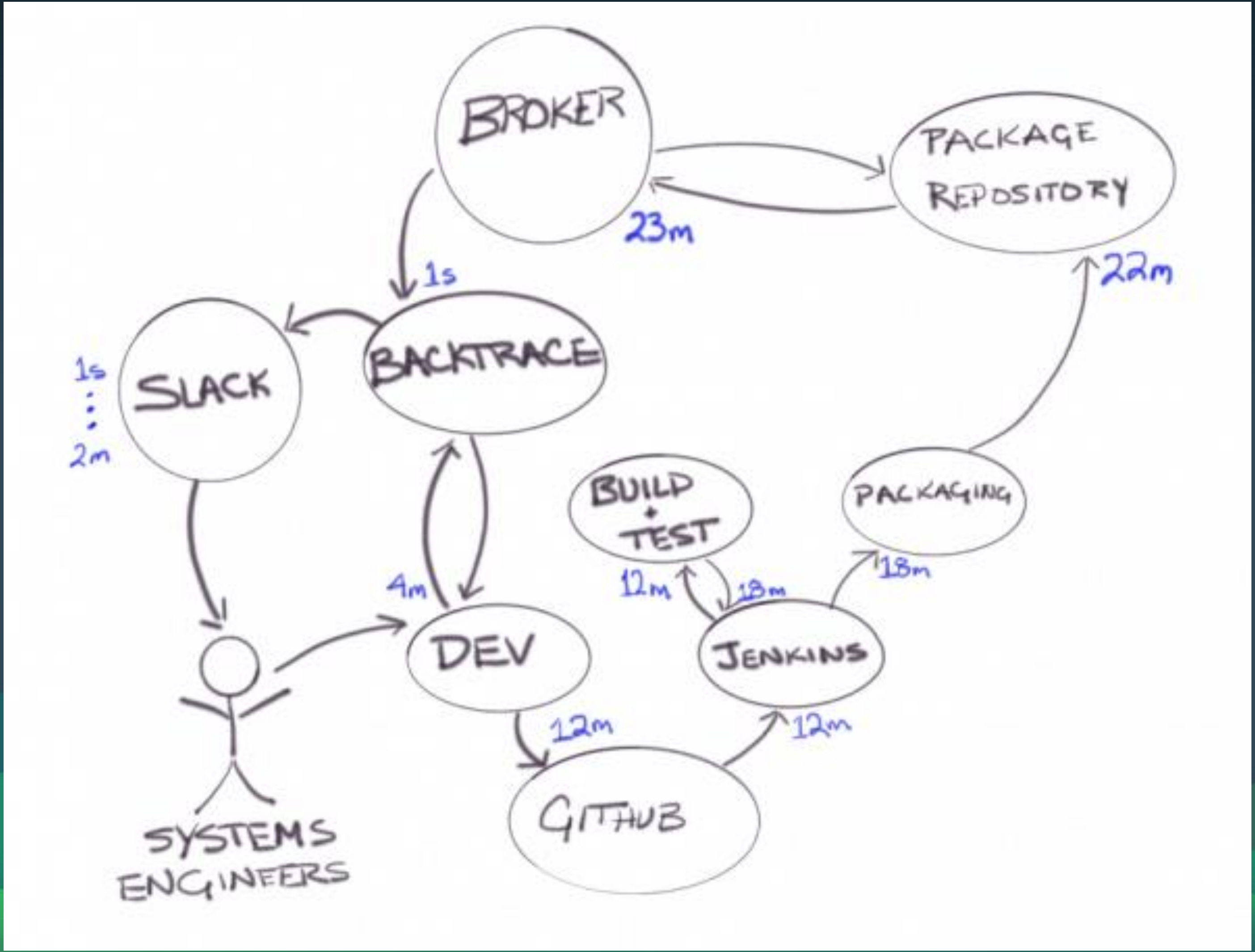
BROKER
PACKAGE REPOSITORY
23m
22m
1s
BACKTRACE
SLACK
1s
⋮
2m
4m
BUILD + TEST
PACKAGING
12m
18m
18m
DEV
JENKINS
12m
12m
GITHUB
SYSTEMS ENGINEERS

When in doubt or even curious

Expose Telemetry

Ideally, any question you would ask of a production system can be done so nondisruptively.

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libcircmetrics

- C library; BSD license, fast, thread-safe, largely lockless.
    - Text metrics (version numbers, statuses, etc.)
    - Numeric gauges, counters (w/ CPU fanout)
    - Histograms (log-linear quantized) (9ns recording)
    - Simultaneous hierarchical (graphite-style) and tagged annotation support
    - JSON output

Code Sample

```
stats_recorder_t *rec = stats_recorder_alloc();
stats_ns_t *ns = stats_register_ns(rec, NULL, "db");
stats_handle_t *h;

ns = stats_register_ns(rec, ns, "raw");
stats_ns_add_tag(nomns, "db-type", "raw");
stats_ns_add_tag(nomns, "db-impl", "nom");

h = stats.put_calls = stats_register(nomns, "put.calls", STATS_TYPE_COUNTER);
stats_handle_tagged_name(h, "calls");
stats_handle_add_tag(h, "operation", "put");
stats_handle_units(h, STATS_UNITS_REQUESTS);

h = stats.get_calls = stats_register(nomns, "get.calls", STATS_TYPE_COUNTER);
stats_handle_tagged_name(h, "calls");
stats_handle_add_tag(h, "operation", "get");
stats_handle_units(h, STATS_UNITS_REQUESTS);

h = stats.writes = stats_register(nomns, "put.tuples", STATS_TYPE_COUNTER);
stats_handle_tagged_name(h, "count");
stats_handle_add_tag(h, "operation", "put");
stats_handle_units(h, STATS_UNITS_TUPLES);

h = stats.write_latency = stats_register(nomns, "put.latency", STATS_TYPE_HISTOGRAM);
stats_handle_tagged_name(h, "latency");
stats_handle_add_tag(h, "operation", "put");
stats_handle_units(h, STATS_UNITS_SECONDS);

h = stats.write_batch = stats_register(nomns, "put.batchsize", STATS_TYPE_HISTOGRAM);
stats_handle_tagged_name(h, "batchsize");
stats_handle_add_tag(h, "operation", "put");
stats_handle_units(h, STATS_UNITS_TUPLES);
```

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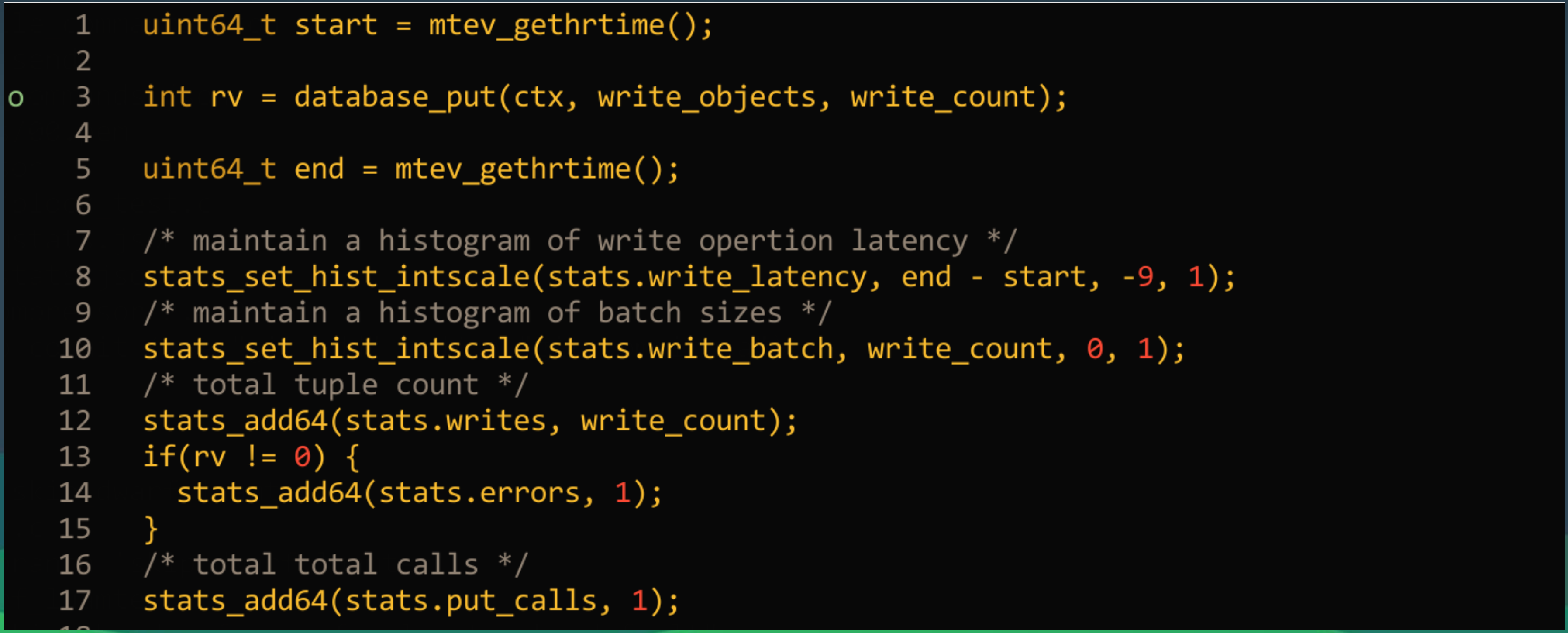
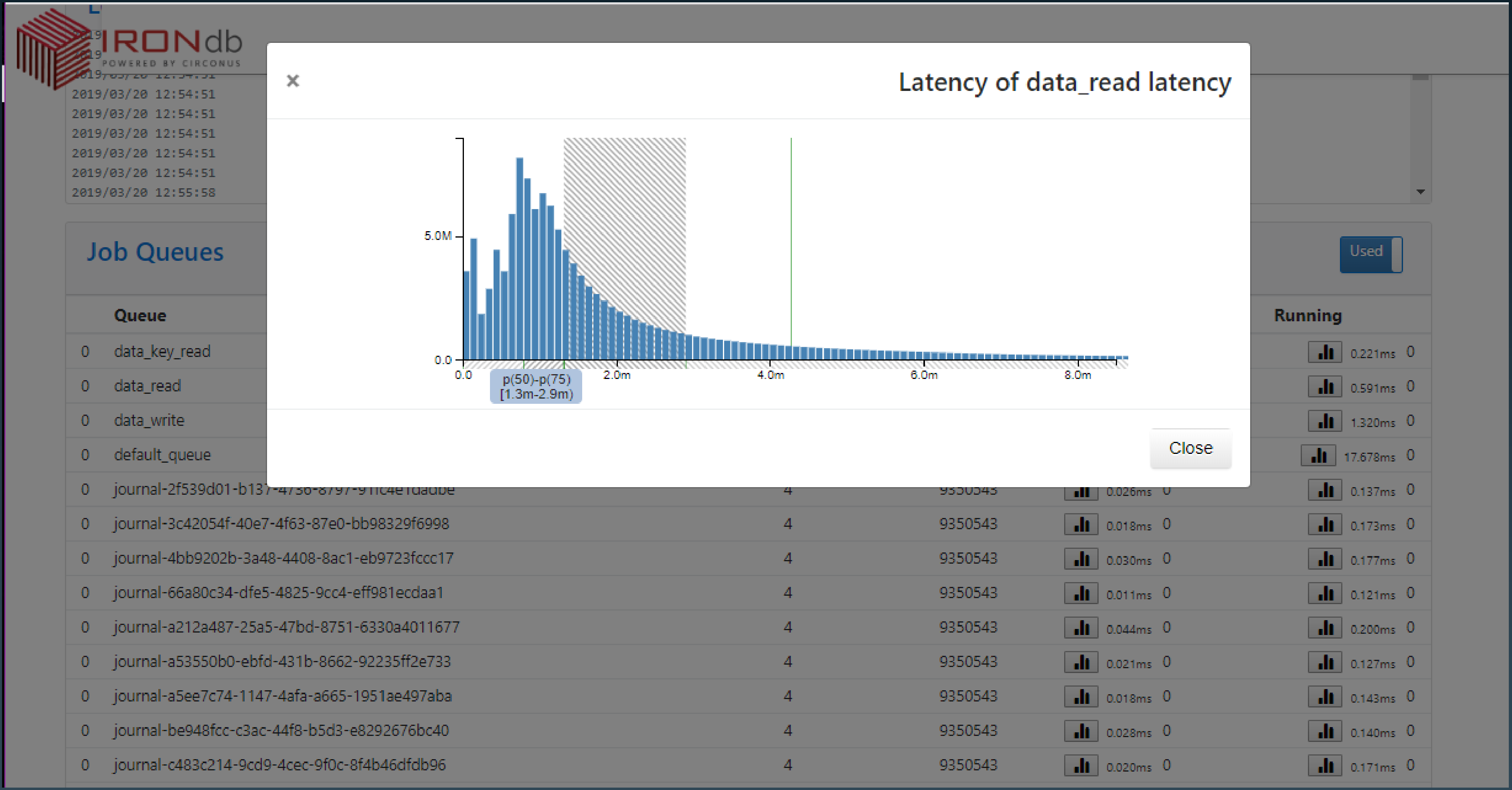
Code Sample

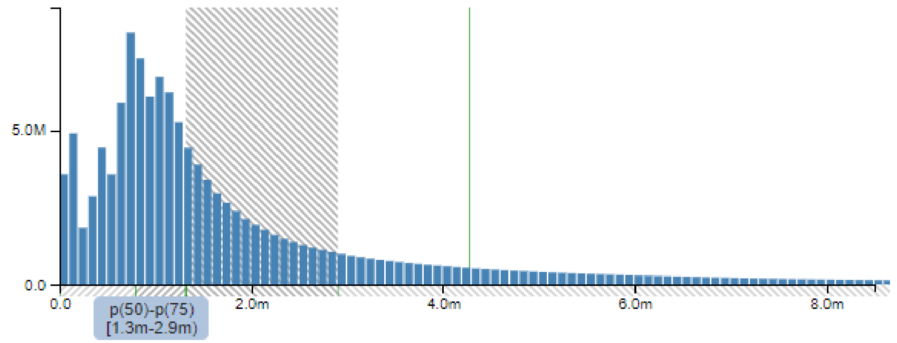


```c
uint64_t start = mtev_gethrtime();

int rv = database_put(ctx, write_objects, write_count);

uint64_t end = mtev_gethrtime();

/* maintain a histogram of write opertion latency */
stats_set_hist_intscale(stats.write_latency, end - start, -9, 1);
/* maintain a histogram of batch sizes */
stats_set_hist_intscale(stats.write_batch, write_count, 0, 1);
/* total tuple count */
stats_add64(stats.writes, write_count);
if(rv != 0) {
  stats_add64(stats.errors, 1);
}
/* total total calls */
stats_add64(stats.put_calls, 1);
```



```
2019/03/20 12:54:51
2019/03/20 12:54:51
2019/03/20 12:54:51
2019/03/20 12:54:51
2019/03/20 12:54:51
2019/03/20 12:55:58
```

Latency of data_read latency



Close

Job Queues

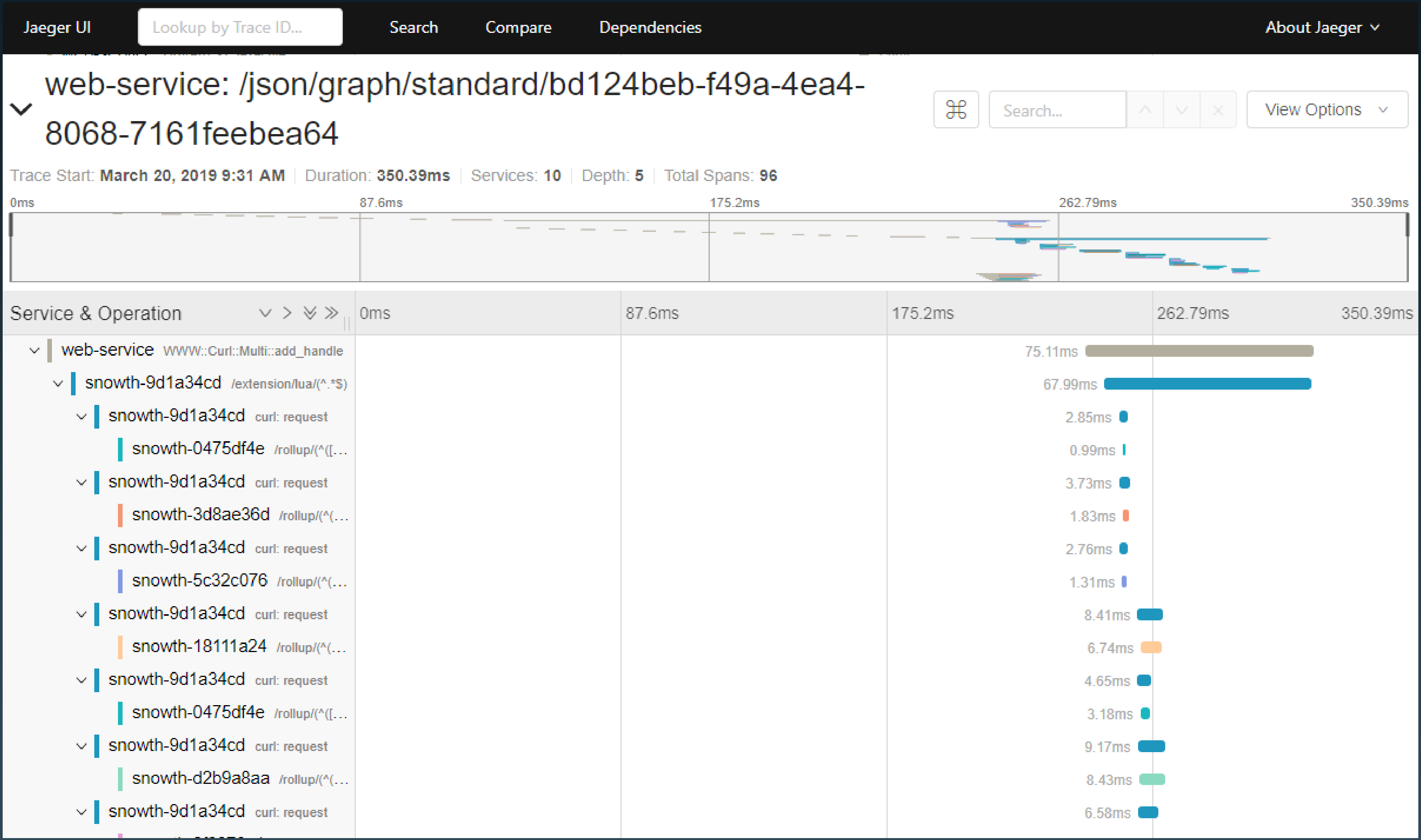
Used

	Queue					Running	
0	data_key_read					0.221ms	0
0	data_read					0.591ms	0
0	data_write					1.320ms	0
0	default_queue					17.678ms	0
0	journal-2f539d01-b137-4736-8797-911c4e1daube	4	9350543	0.026ms	0	0.137ms	0
0	journal-3c42054f-40e7-4f63-87e0-bb98329f6998	4	9350543	0.018ms	0	0.173ms	0
0	journal-4bb9202b-3a48-4408-8ac1-eb9723fccc17	4	9350543	0.030ms	0	0.177ms	0
0	journal-66a80c34-dfe5-4825-9cc4-eff981ecdaa1	4	9350543	0.011ms	0	0.121ms	0
0	journal-a212a487-25a5-47bd-8751-6330a4011677	4	9350543	0.044ms	0	0.200ms	0
0	journal-a53550b0-ebfd-431b-8662-92235ff2e733	4	9350543	0.021ms	0	0.127ms	0
0	journal-a5ee7c74-1147-4afa-a665-1951ae497aba	4	9350543	0.018ms	0	0.143ms	0
0	journal-be948fcc-c3ac-44f8-b5d3-e8292676bc40	4	9350543	0.028ms	0	0.140ms	0
0	journal-c483c214-9cd9-4cec-9f0c-8f4b46dfdb96	4	9350543	0.020ms	0	0.171ms	0

Known unknowns

Events & Distributed Tracing

A clearer story of what just happened.



Jaeger UI | Lookup by Trace ID... | Search | Compare | Dependencies | About Jaeger

web-service: /json/graph/standard/bd124beb-f49a-4ea4-8068-7161feebea64

Trace Start: **March 20, 2019 9:31 AM** | Duration: **350.39ms** | Services: **10** | Depth: **5** | Total Spans: **96**

Service & Operation	Duration
web-service WWW::Curl::Multi::add_handle	75.11ms
snowth-9d1a34cd /extension/lua/(^.*$)	67.99ms
snowth-9d1a34cd curl: request	2.85ms
snowth-0475df4e /rollup/(^([…	0.99ms
snowth-9d1a34cd curl: request	3.73ms
snowth-3d8ae36d /rollup/(^(…	1.83ms
snowth-9d1a34cd curl: request	2.76ms
snowth-5c32c076 /rollup/(^(…	1.31ms
snowth-9d1a34cd curl: request	8.41ms
snowth-18111a24 /rollup/(^(…	6.74ms
snowth-9d1a34cd curl: request	4.65ms
snowth-0475df4e /rollup/(^([…	3.18ms
snowth-9d1a34cd curl: request	9.17ms
snowth-d2b9a8aa /rollup/(^(…	8.43ms
snowth-9d1a34cd curl: request	6.58ms

Some stats...

- We only retain traces for a short period of time (up to about 3 days)
- We don’t trace with all detail on due to overhead
    - Full debugging on in a trace can produce up to 4Gb of trace data for a single user request
    - We do this sometimes via manual triggering as a debugging action
- Typically, between 10 and 2000 traces per request
- We use this as a debugging observability tool

During failure reconstruction, logs hold truth

Logging for humans

Computers talking to computers have better ways than logs. Logs are for computers talking to humans.

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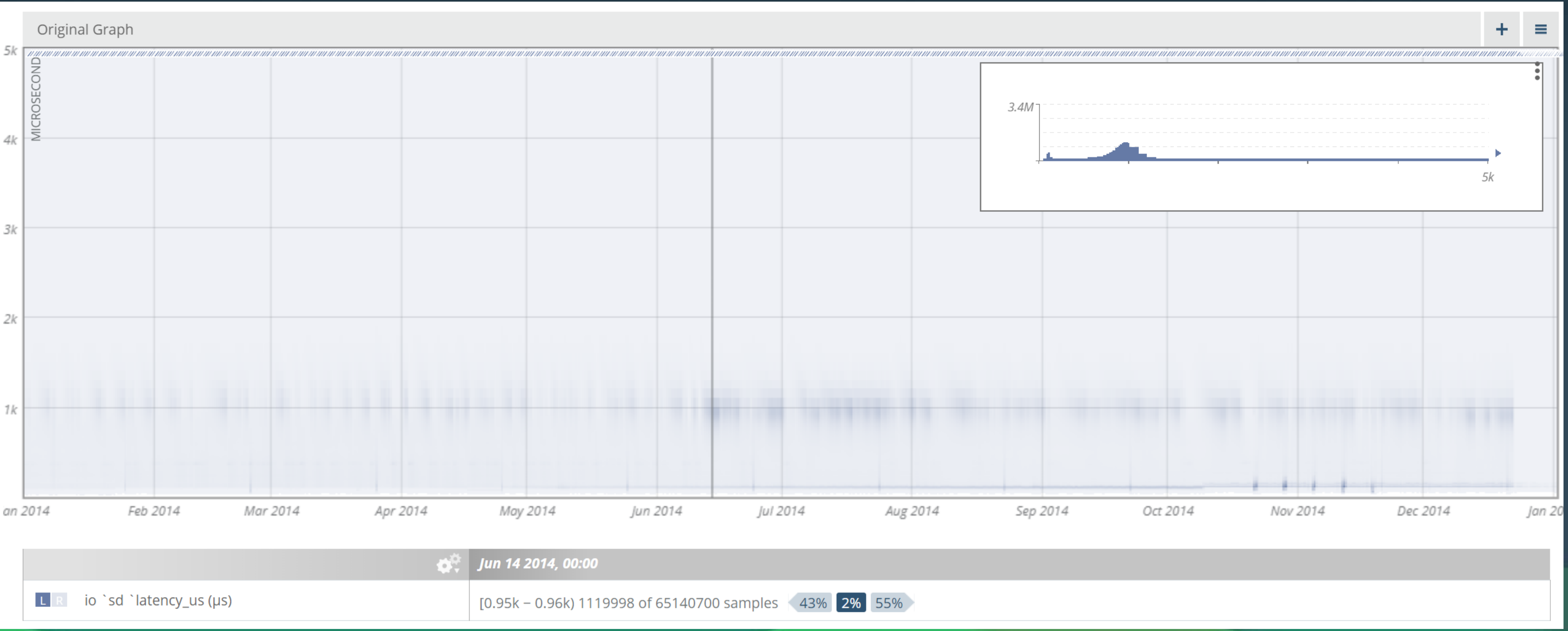
Real unknown unknowns are solved by:

Dynamic Tracing

eBPF / bpftrace
DTrace

IO Latency… single node… 2014



Jun 14 2014, 00:00

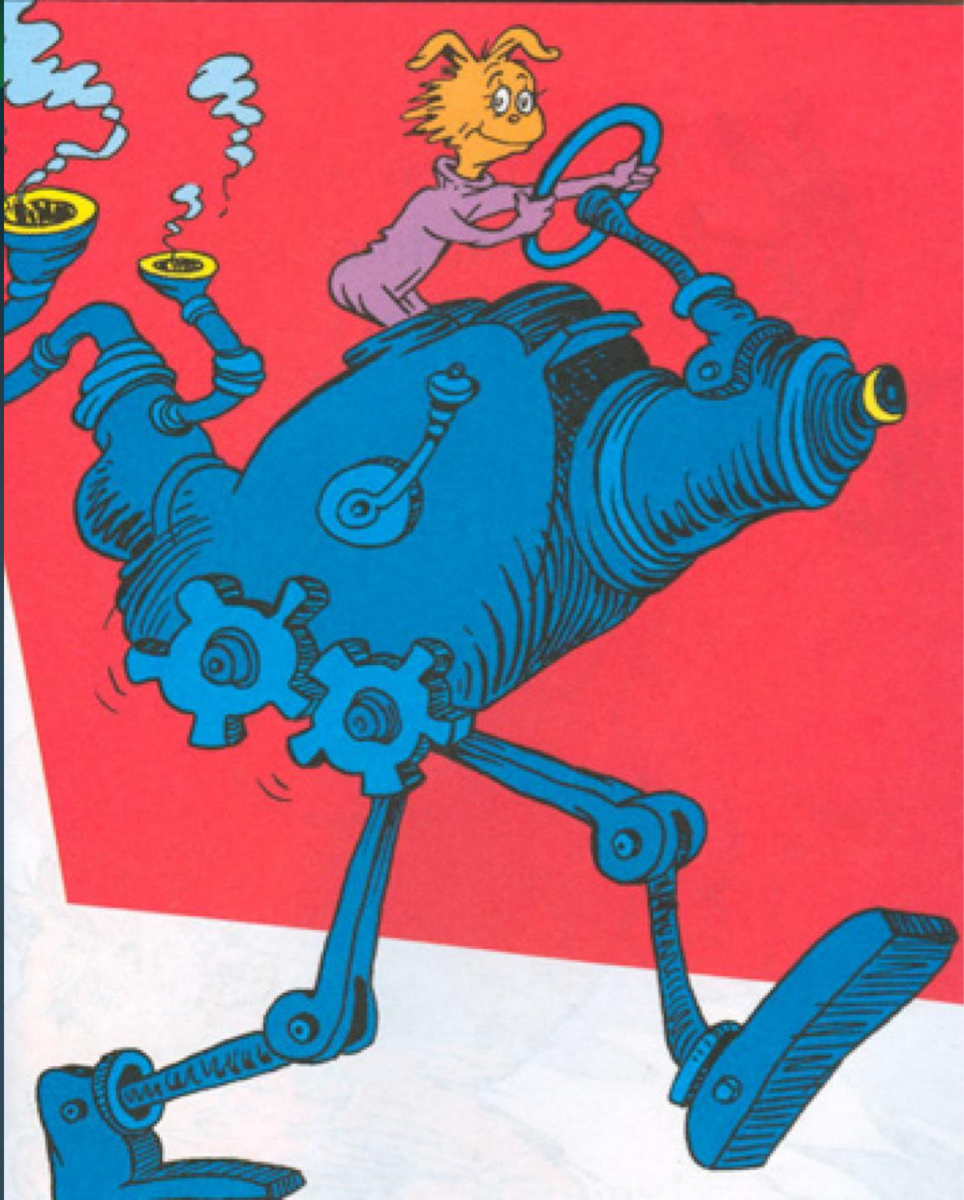
L R io `sd `latency_us (μs)

[0.95k – 0.96k) 1119998 of 65140700 samples 43% 2% 55%

Your m8g, o11y need to be accessible

Internalized MVP

No additional apparatus. No additional deployment constraints



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Shipping software means more operators

Codify Operational Assessment & Procedures

More operators, less average knowledge. Ensure procedures are repeatable.
Tools -> Solutions

Every effort to bring SRE techniques to software engineering makes SRE more accessible and useful in Cloud/SaaS engineering.

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Thank You.

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