Restoring Confidence in Microservices: Tracing That's More Than Traces

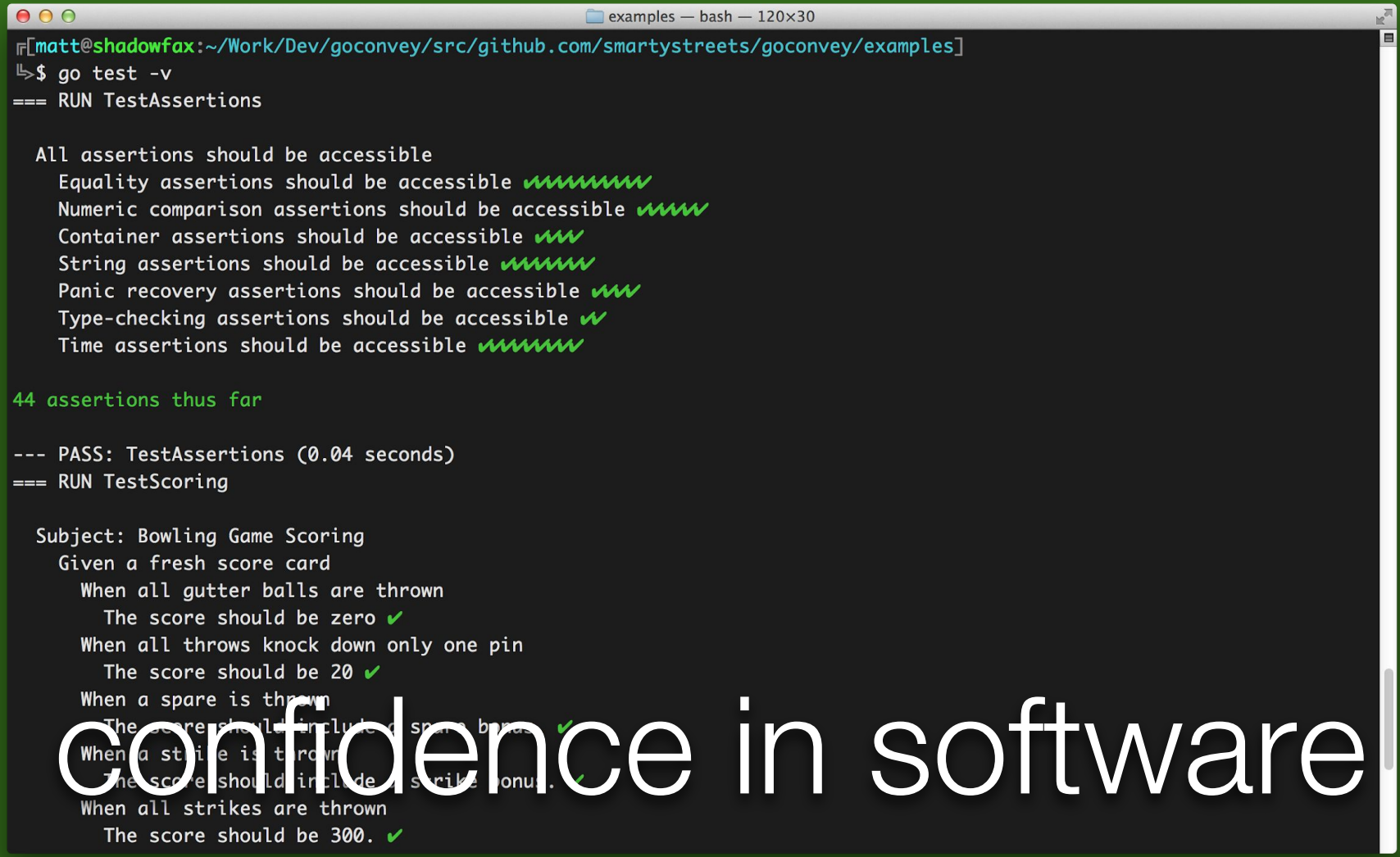
Ben Sigelman (LightStep co-founder, OpenTracing co-creator)

QCon London, March 6, 2019

LIGHTSTEP

confidence

confidence

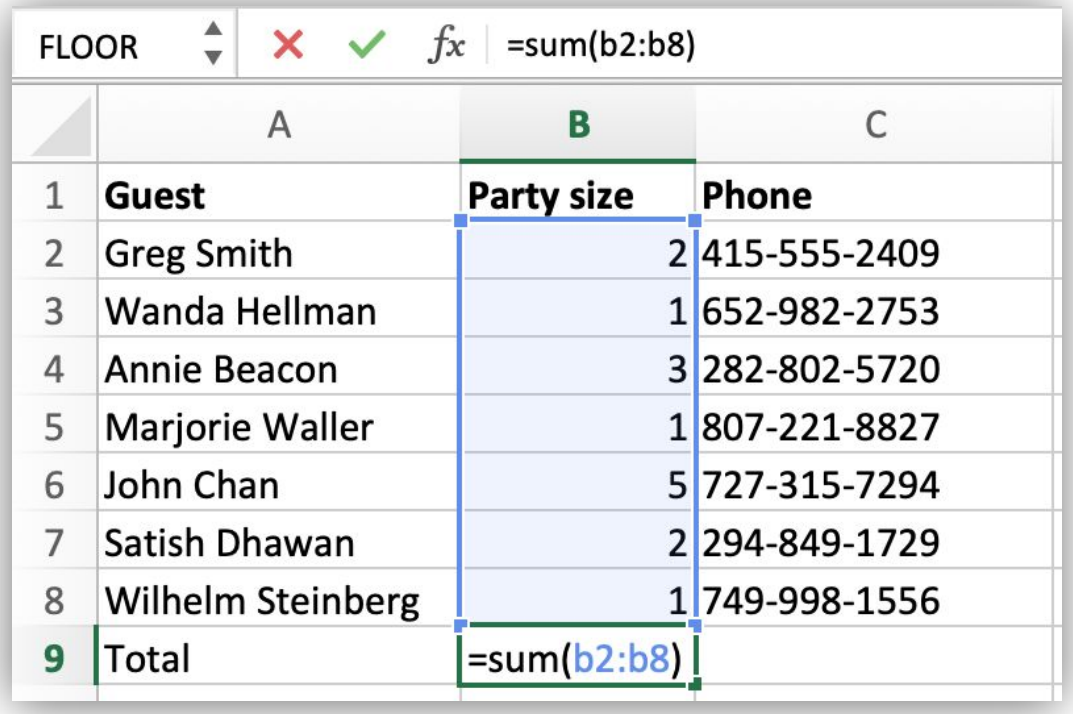

examples — bash — 120×30
[matt@shadowfax:~/Work/Dev/goconvey/src/github.com/smartystreets/goconvey/examples]
$ go test -v
=== RUN TestAssertions
All assertions should be accessible
Equality assertions should be accessible ✔✔✔✔✔✔✔✔✔
Numeric comparison assertions should be accessible ✔✔✔✔✔
Container assertions should be accessible ✔✔✔
String assertions should be accessible ✔✔✔✔✔✔✔
Panic recovery assertions should be accessible ✔✔✔
Type-checking assertions should be accessible ✔✔
Time assertions should be accessible ✔✔✔✔✔✔✔
44 assertions thus far
--- PASS: TestAssertions (0.04 seconds)
=== RUN TestScoring
Subject: Bowling Game Scoring
Given a fresh score card
When all gutter balls are thrown
The score should be zero ✔
When all throws knock down only one pin
The score should be 20 ✔
When a spare is thrown
When a strike is thrown
When all strikes are thrown
The score should be 300. ✔
confidence in software

Cluster Health
Cluster Pod Usage
7.00%
Cluster CPU Usage
68.2%
Cluster Memory Usage
17.68%
Cluster Disk Usage
27.0%
Cluster Pod Capacity
1.5 K
1.0 K
500
0
pods
23:00
23:10
23:20
allocatable
capacity
requested
Cluster CPU Capacity
11
10
9
8
7
6
cores
23:00
23:10
23:20
allocatable
capacity
requested
Cluster Mem Capacity
40 GB
30 GB
20 GB
10 GB
0 B
23:00
23:10
23:20
allocatable
capacity
requested
Cluster Disk Capacity
4.0 TB
3.0 TB
2.0 TB
1.0 TB
0 B
23:00
23:10
23:20
usage
limit
Deployments
Deployment Replicas - Up To Date
Time
Metric
Value
2019-01-09 23:24:57
1
2019-01-09 23:24:57
1
2019-01-09 23:24:57
1
2019-01-09 23:24:57
1
Deployment Replicas
24
Deployment Replicas - Updated
24
Deployment Replicas - Unavailable
1
Node
Number Of Nodes
Nodes Out of Disk
0
Nodes Unavailable
confidence in software

Leverage and Complexity

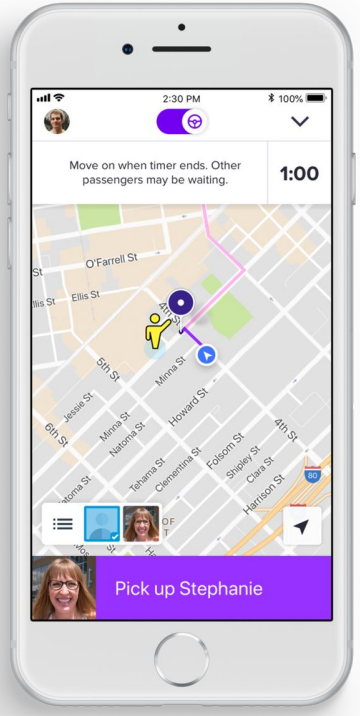
LIGHTSTEP

Software with small leverage



LIGHTSTEP

Software with large leverage



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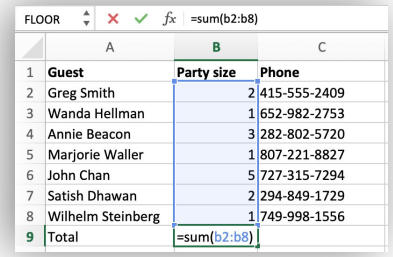
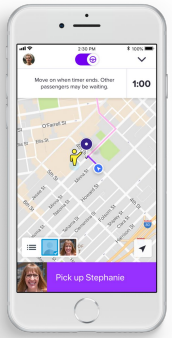
Software: a continuum





Small leverage

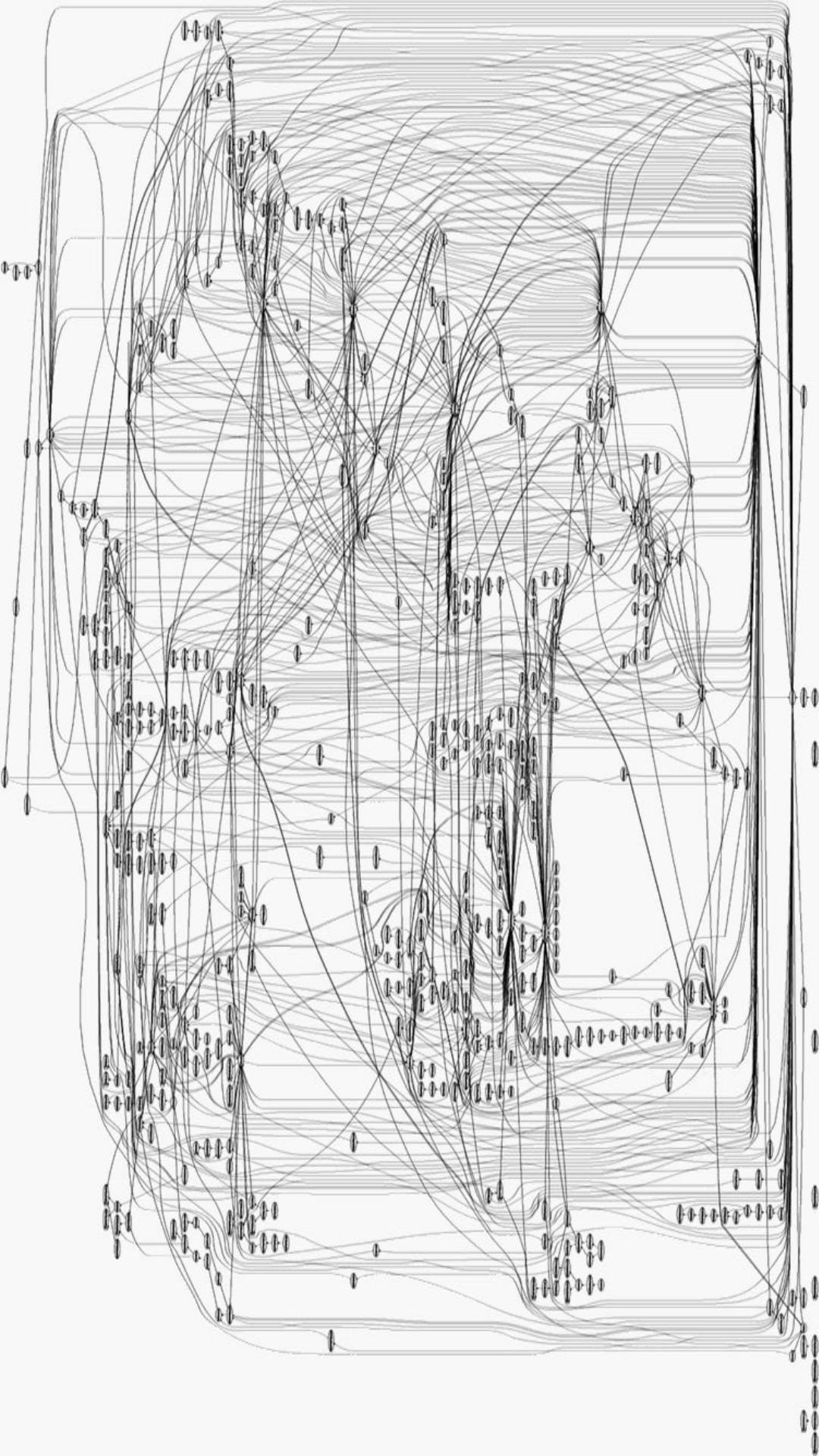
Clumsy UX

Developers:

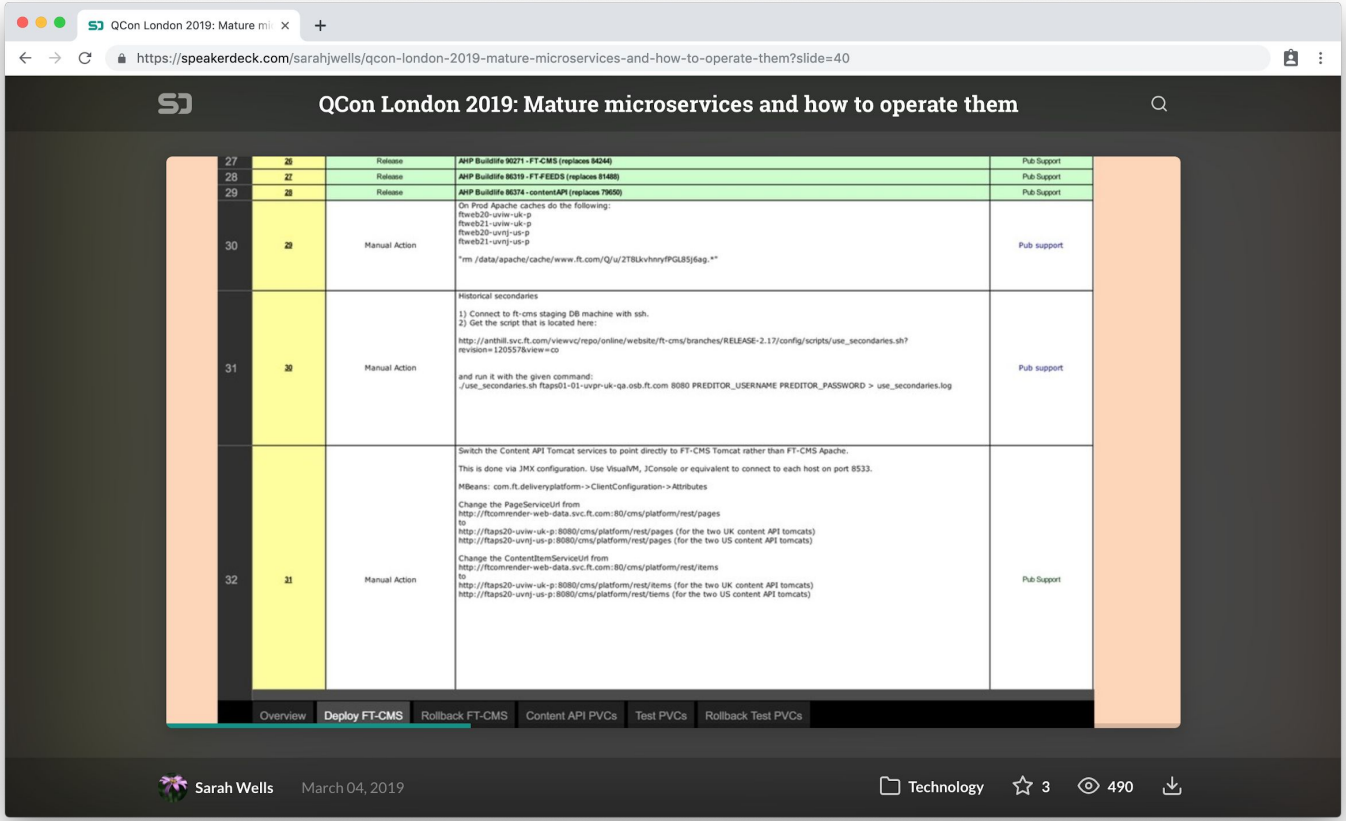
Large leverage

💯 UX

LIGHTSTEP



Monthly Release Spreadsheets (via Sarah Wells)

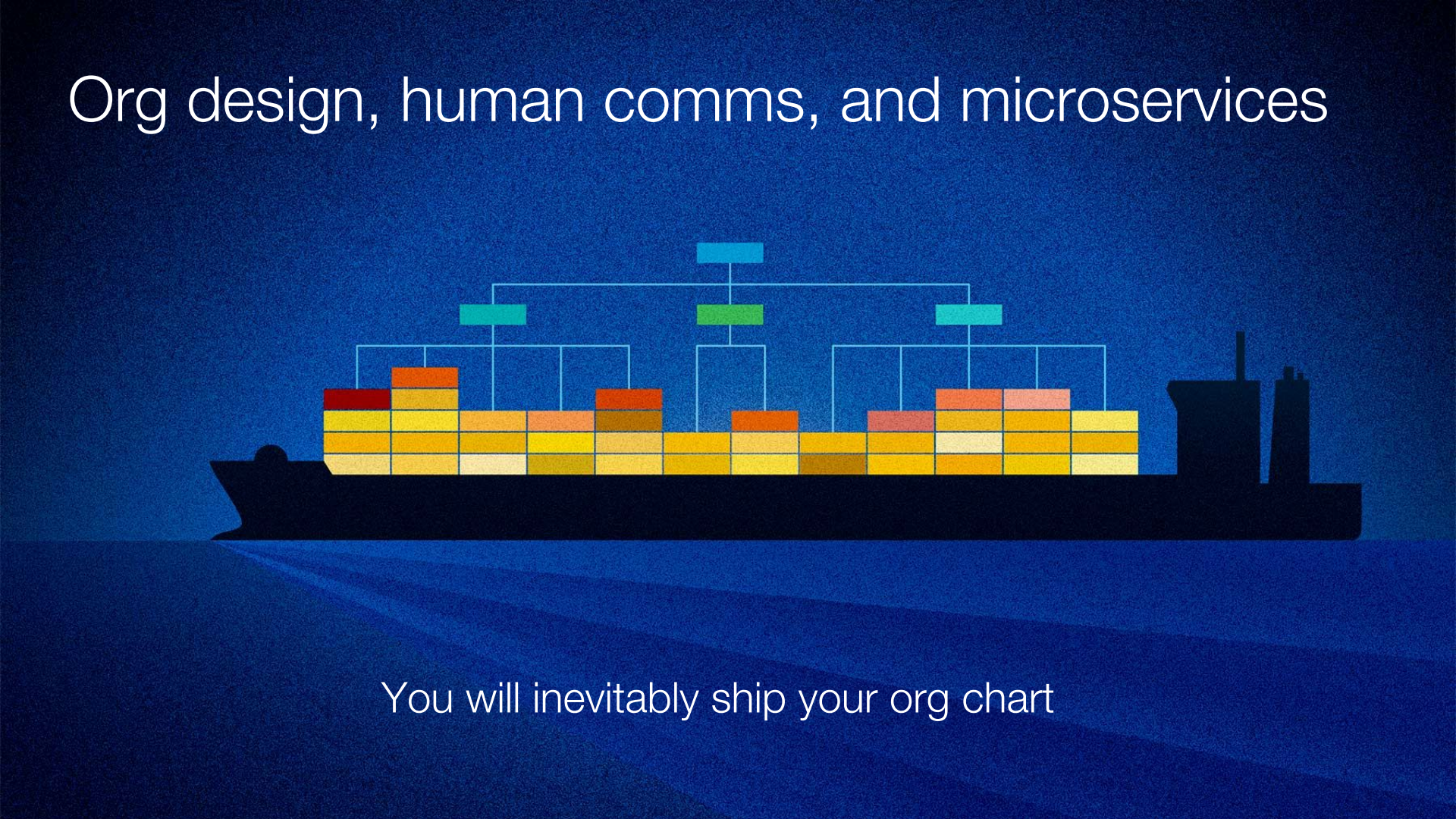


Crisis of Confidence #1

Velocity (or lack thereof)

LIGHTSTEP

Org design, human comms, and microservices



You will inevitably ship your org chart

Déjà vu…

Crystal Hirschorn
@cfhirschorn

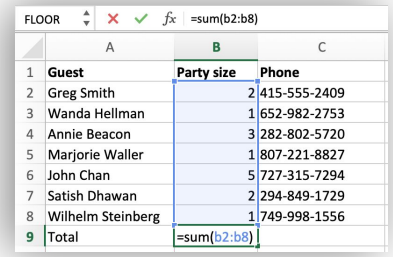
"You will inevitably ship your org chart" aka Conway's Law. Love this illustration from .@el_bhs #QConLondon

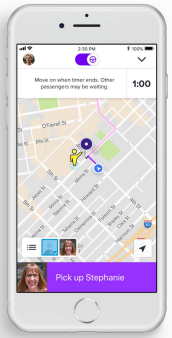
♡ 7 3:21 PM - Mar 4, 2019

See Crystal Hirschorn's other Tweets

LIGHTSTEP

Regaining confidence in velocity





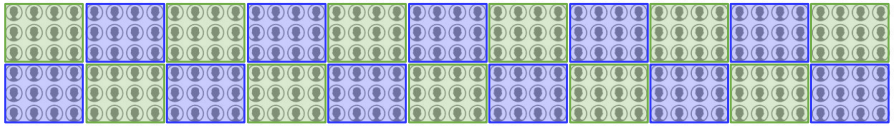
Modest impact

Small software scope

Developers:

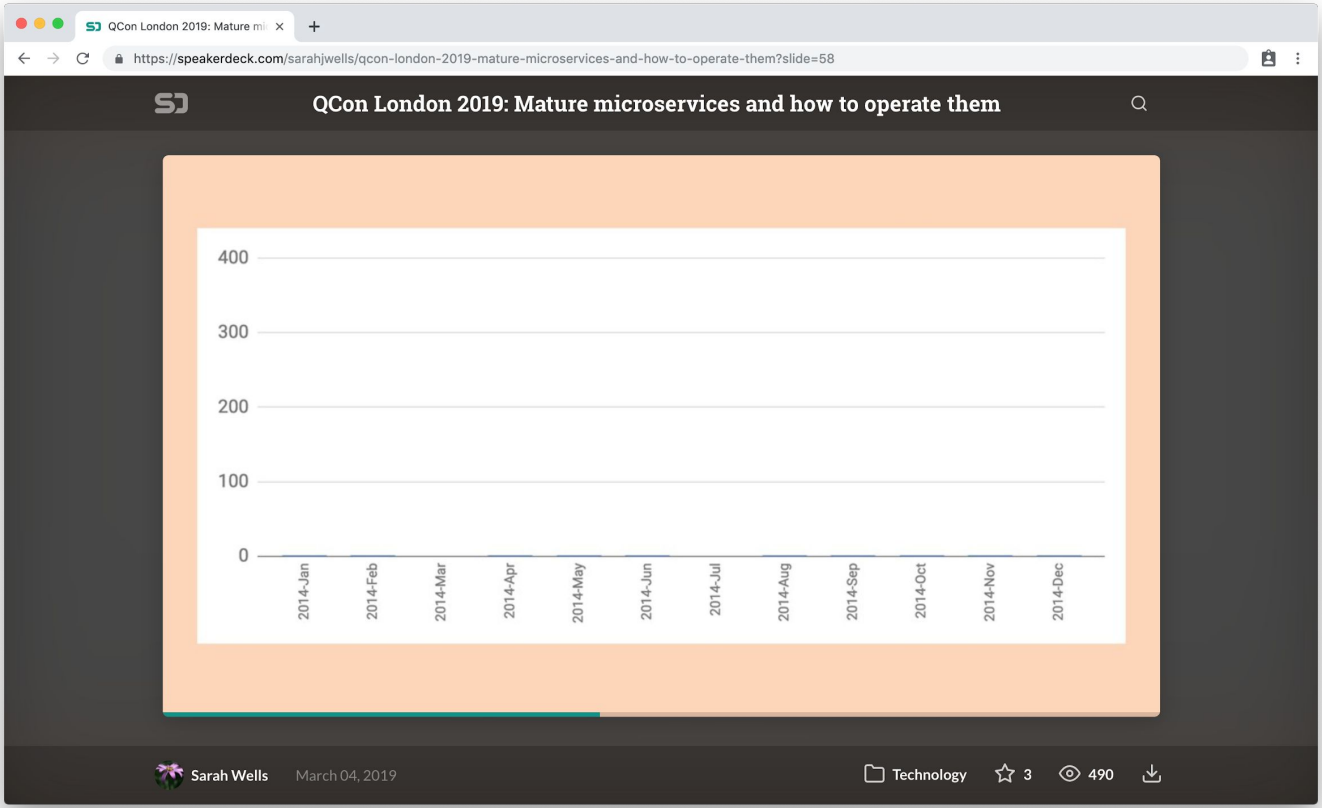
Massive impact

Large software scope



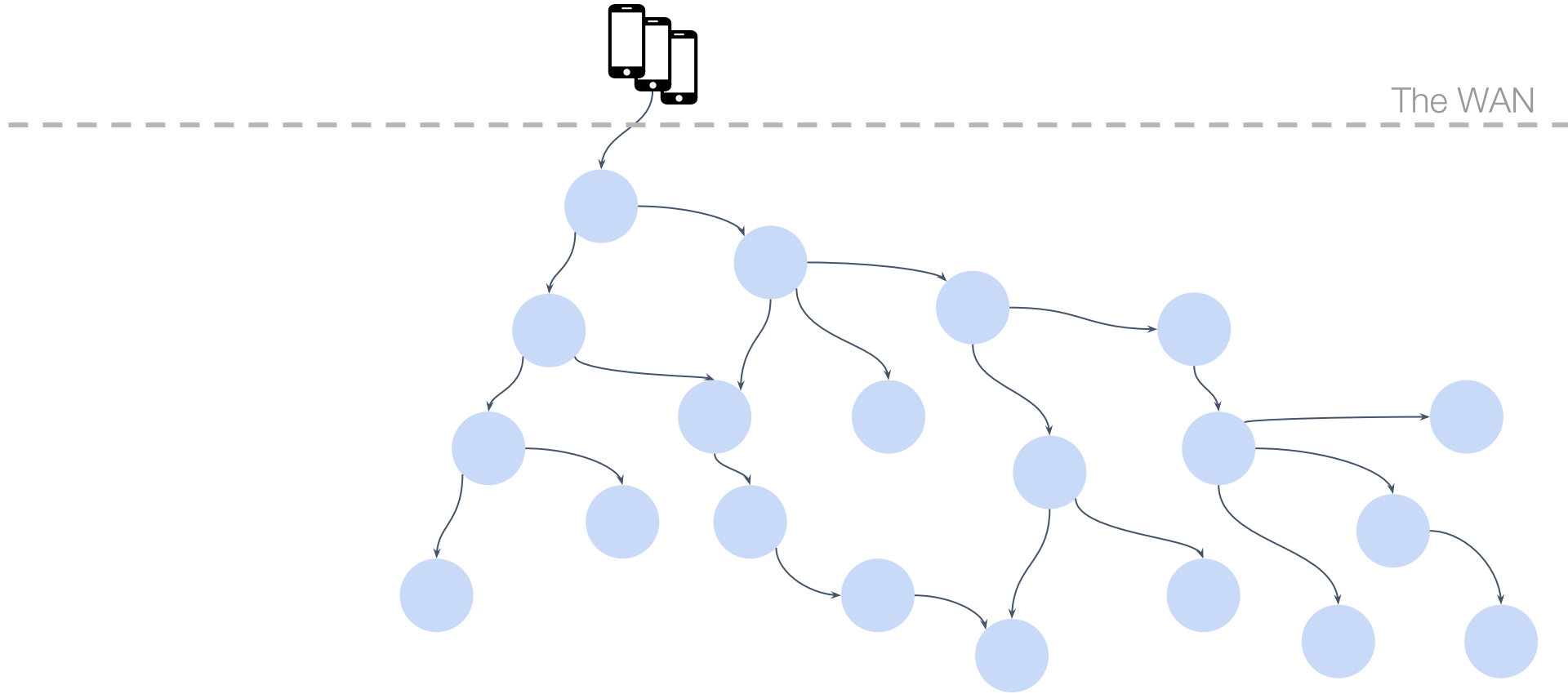
LIGHTSTEP

@sarahwells: monthly release count with a monolith

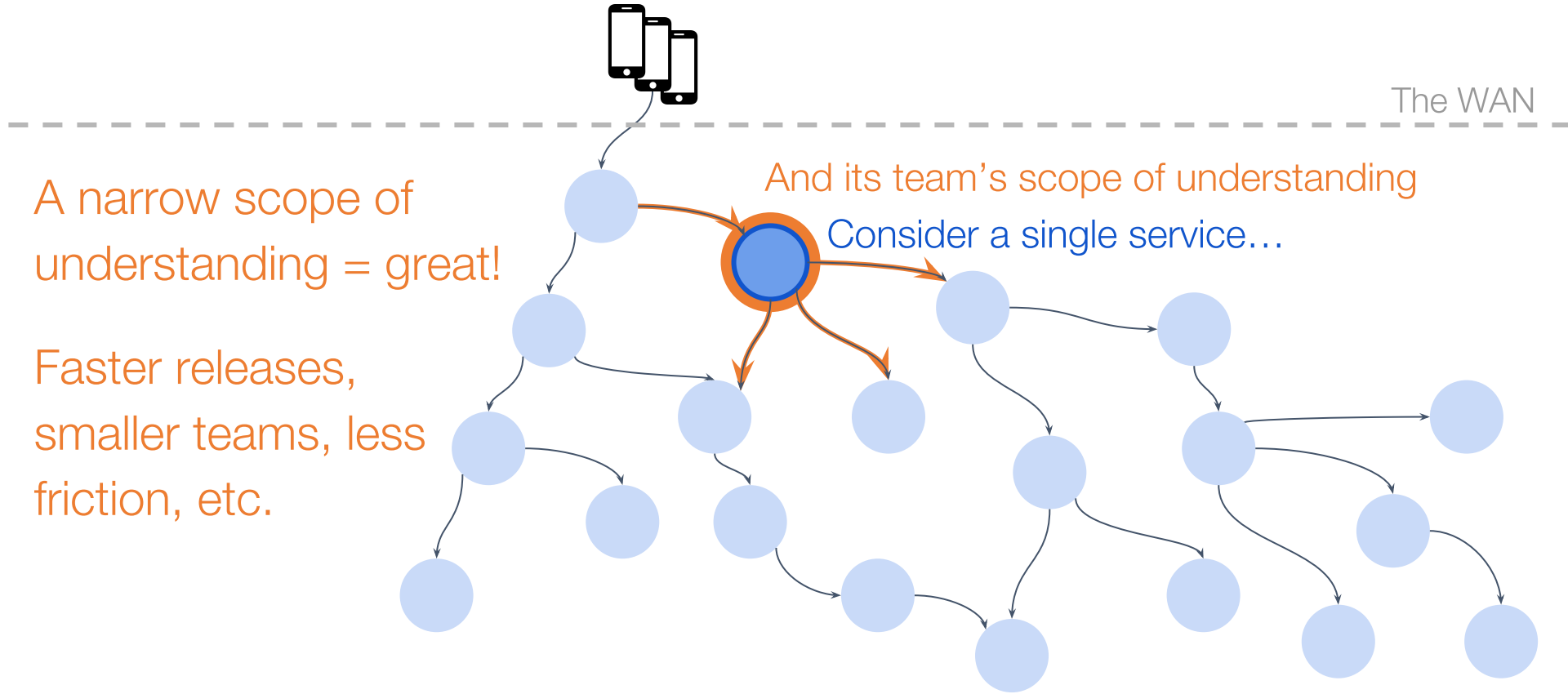


@sarahwells: monthly release count with microservices

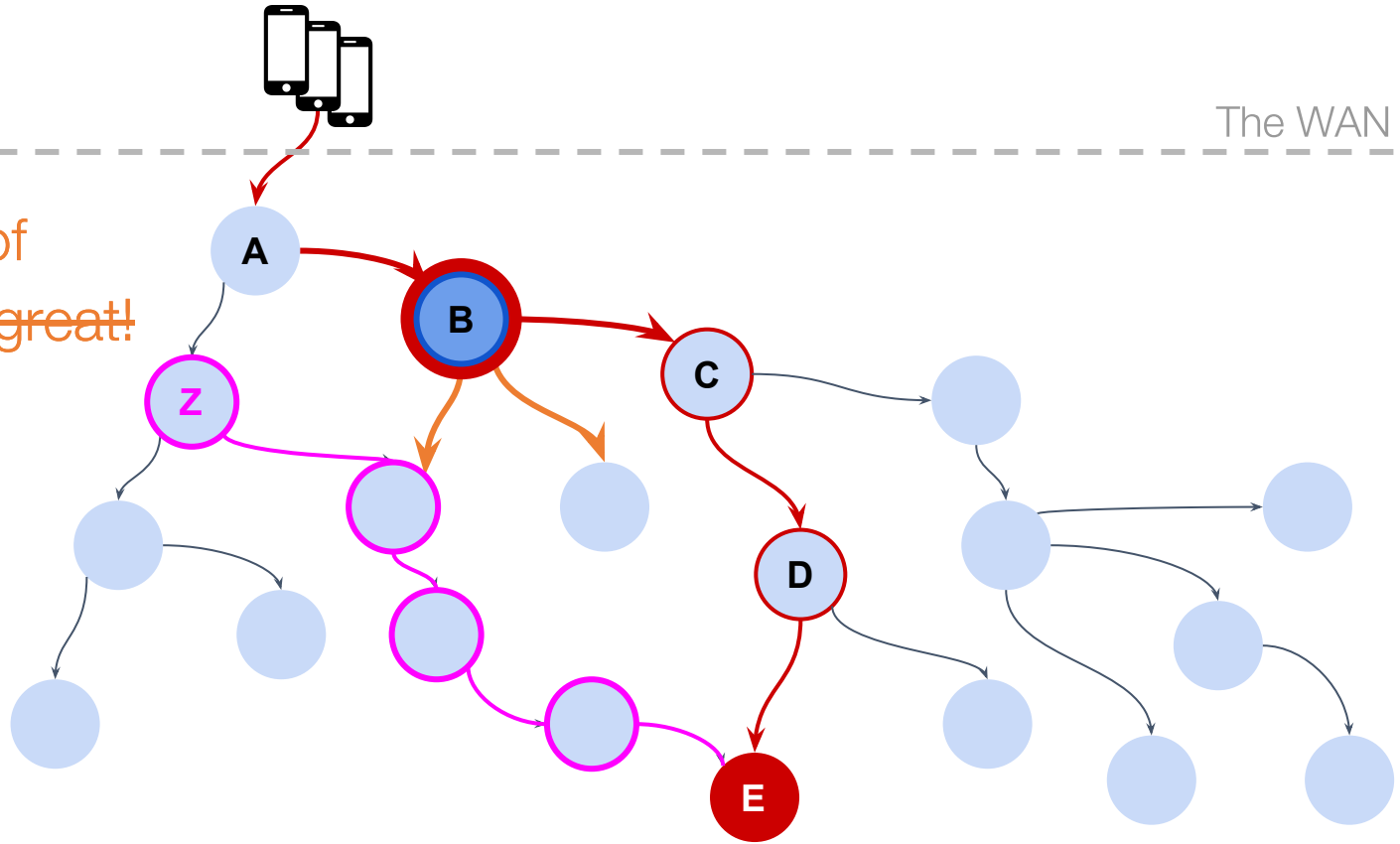
A microservices architecture



A microservices architecture



A microservices architecture (with a slowdown)



A narrow scope of understanding = ~~great!~~

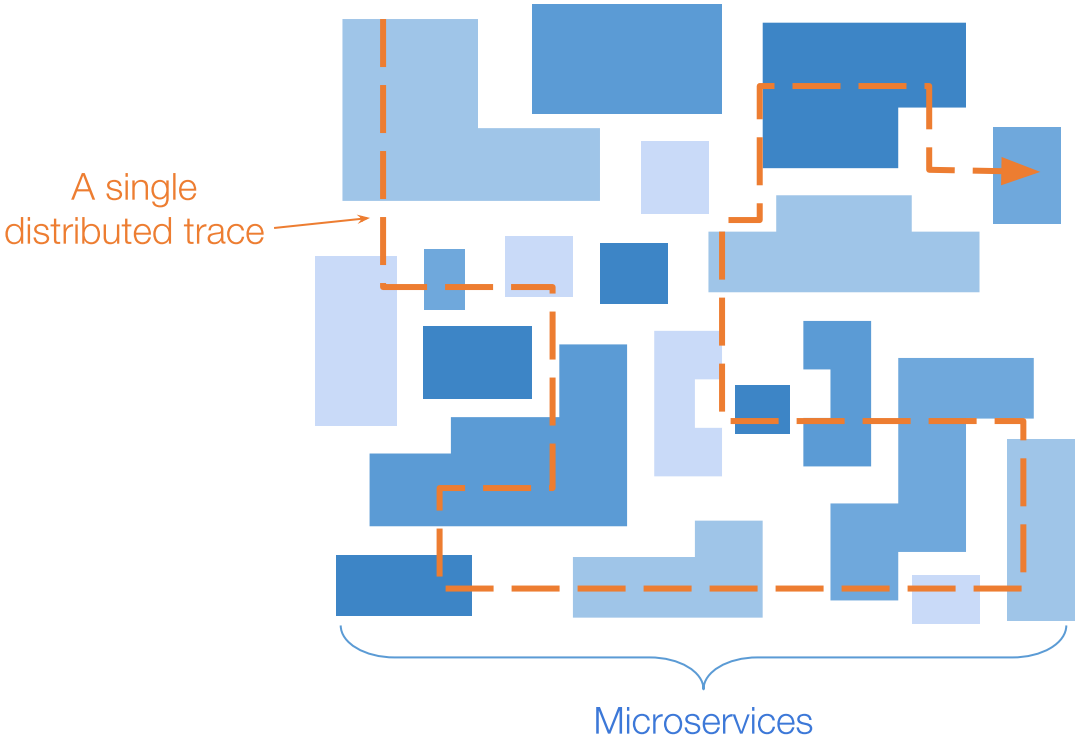
… problematic.

Decoupling cuts both ways.

Crisis of Confidence #2

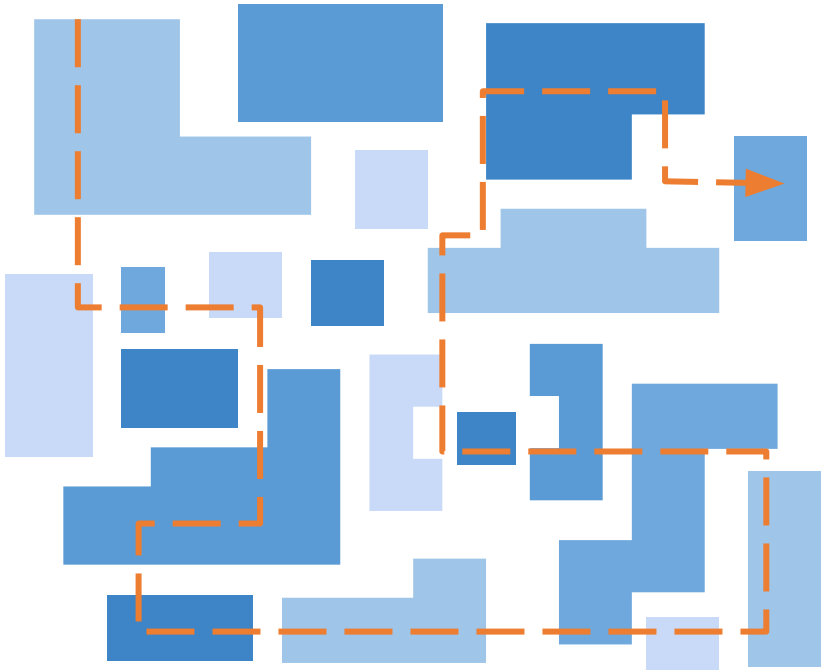
Hypothesis Overload

LIGHTSTEP



LIGHTSTEP

Tracing Conundrum: Data Volume



```
   app transaction rate
x    # of microservices
x  cost of net+storage
x   weeks of retention

-----------------------

      way too much $$$$
```

LIGHTSTEP

The Life of Trace Data: Dapper

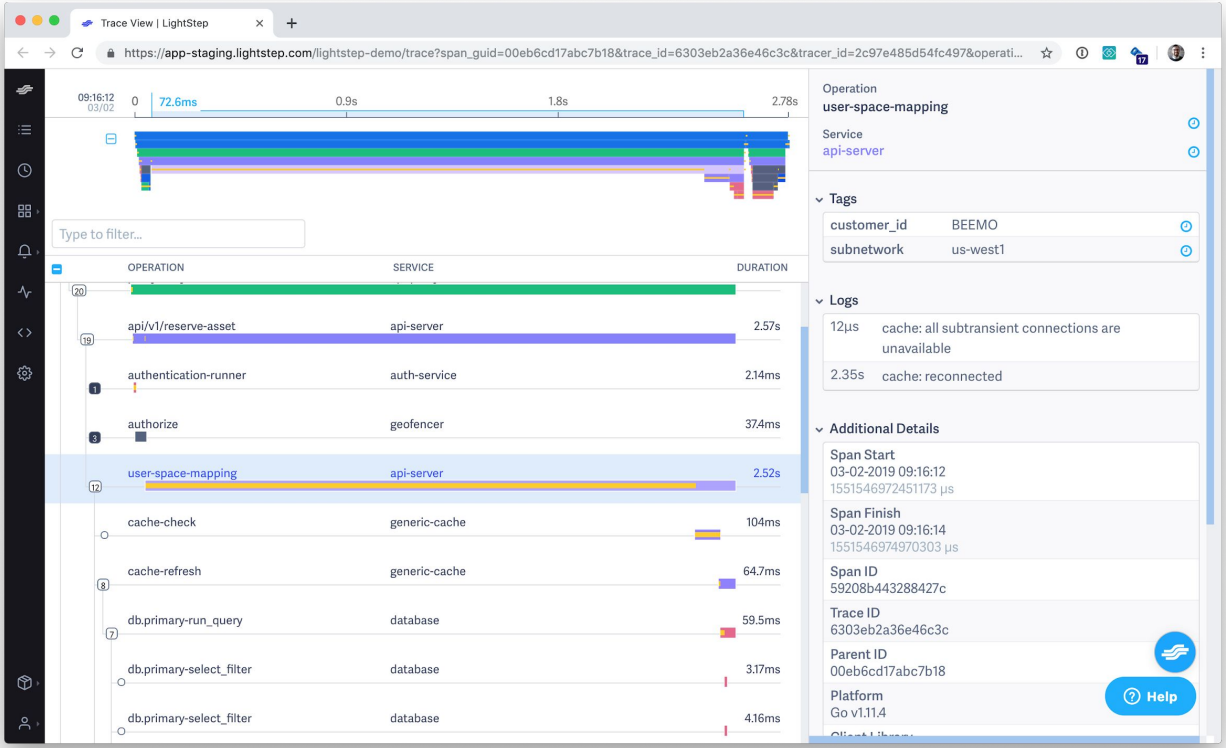
Stage	Overhead affects…	Retained
Instrumentation Executed	App	100.00%
Buffered within app process	App	000.10%
Flushed out of process	App	000.10%
Centralized regionally	Regional network + storage	000.10%
Centralized globally	WAN + storage	000.01%

The Life of Trace Data: ~~Dapper~~ "Other Approaches"

Stage	Overhead affects…	Retained
Instrumentation Executed	App	100.00%
Buffered within app process	App	100.00%
Flushed out of process	App	100.00%
Centralized regionally	Regional network + storage	100.00%
Centralized globally	WAN + storage	on-demand

LIGHTSTEP

Tracing Conundrum: “Too Much Signal”



Raw distributed traces, in summary

- One distributed trace per transaction
- Crosses microservice boundaries
- They are **necessary** if we want to understand the relationships between distant actors in our architecture …

… and yet:

- traces are too big for our brains
- there are too many of them to centralize durably

“Traces” vs. “Tracing”

Distributed *traces*: basically just `structs`

Distributed *tracing*: **the art and science of making distributed traces valuable**

So… how *do* we make distributed traces valuable?

We use them to restore confidence.

Traces, Tracing, and Confidence

Quick Vocab Refresher: **SLIs**

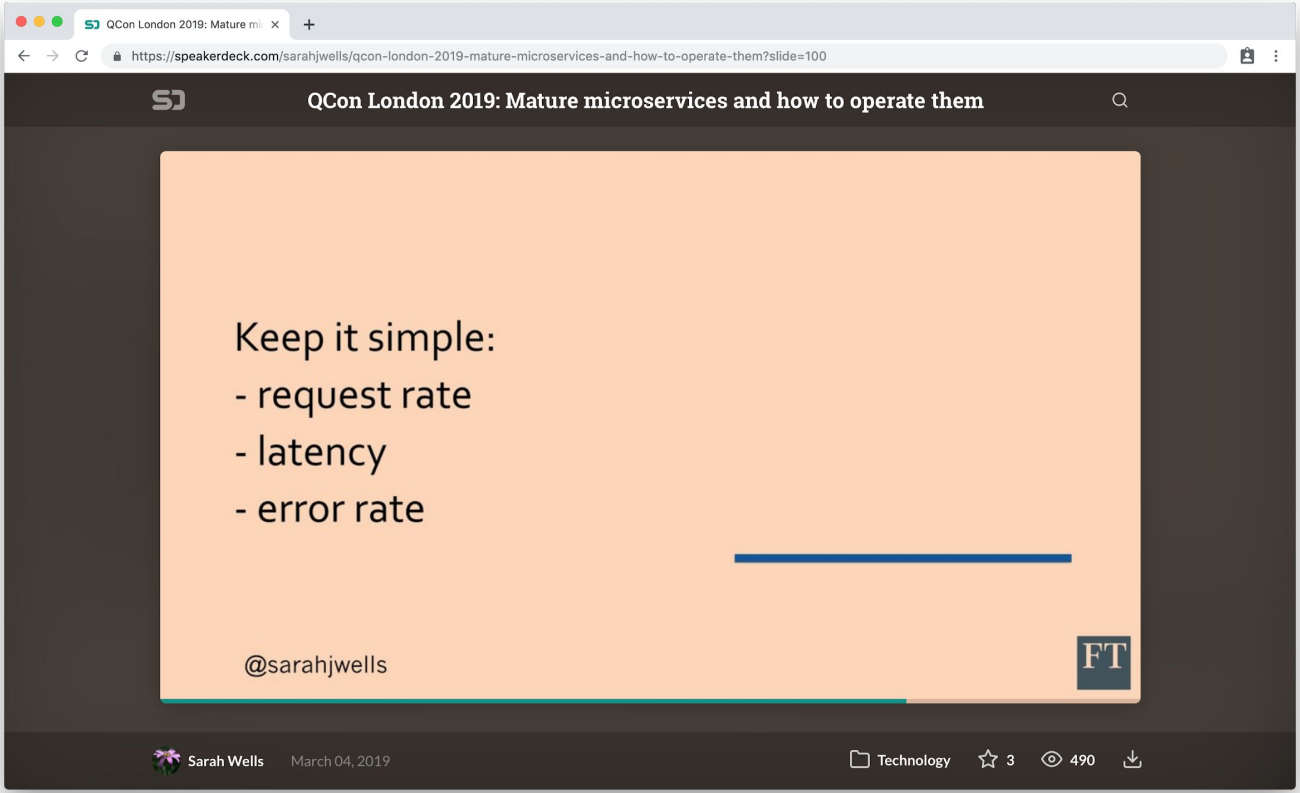
"SLI" = "Service Level Indicator"

TL;DR: An SLI is **an indicator of health** that a service's **consumers** would care about.

… *not* an indicator of its inner workings

A blast from the past…
Keep it simple:
- request rate
- latency
- error rate
QCon
QCon
SLI advice from earlier t

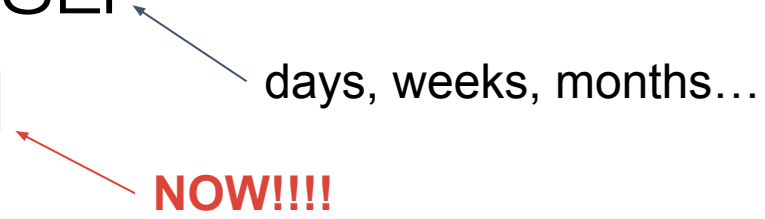
Sarah’s actual slide, about SLIs



“Confidence” is controlling your SLIs

Two fundamental goals:

- Gradually **improving** an SLI
- Rapidly **restoring** an SLI

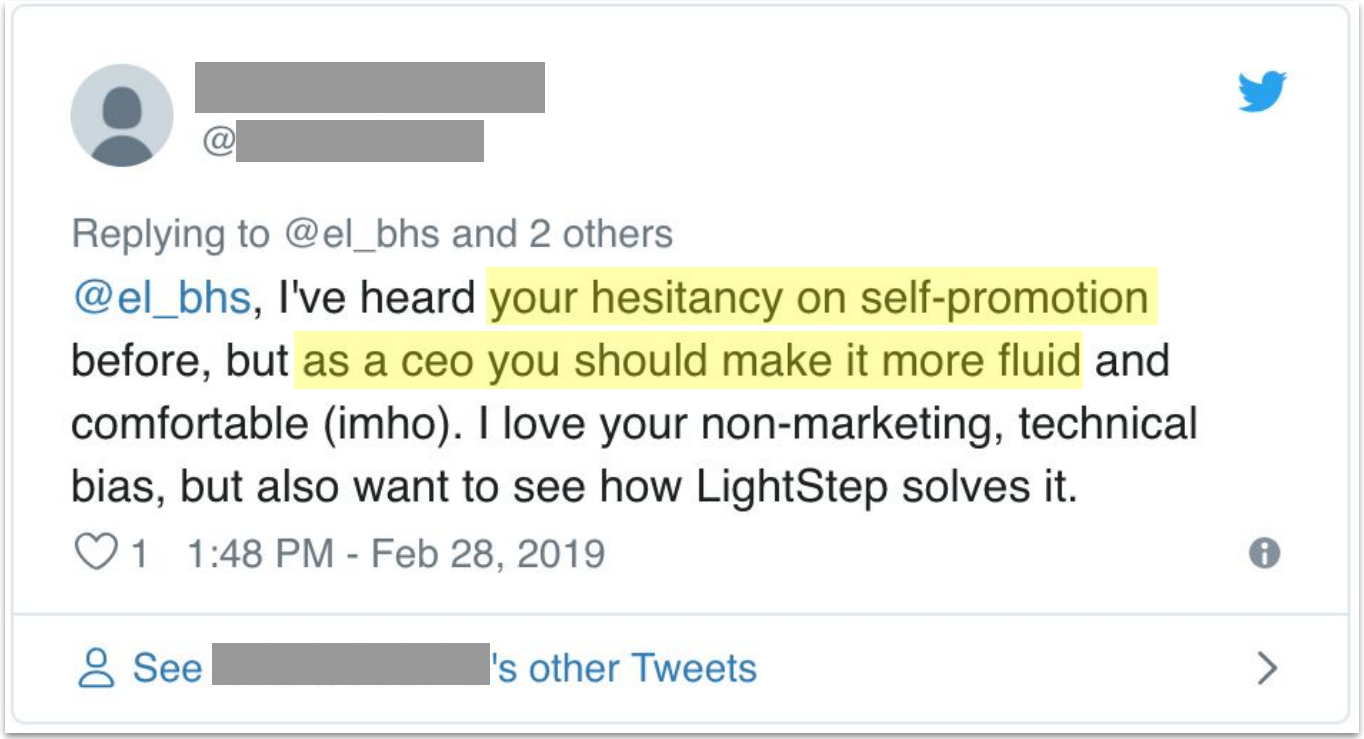


Reminder: “SLI” = “Service Level Indicator”

Two Fundamental **Activities**

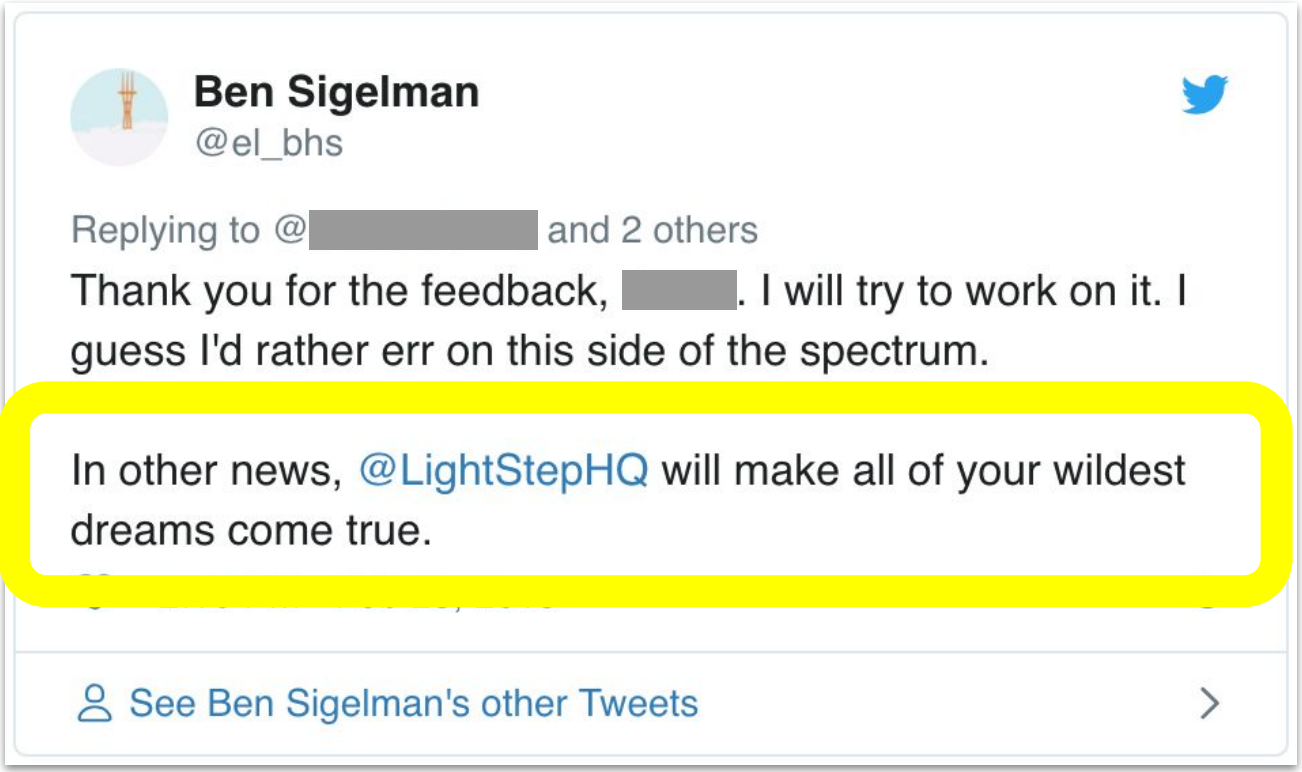
1. **Detection:** measuring SLIs precisely
2. **Explaining variance:** recognizing and explaining variance, often iteratively

An aside…



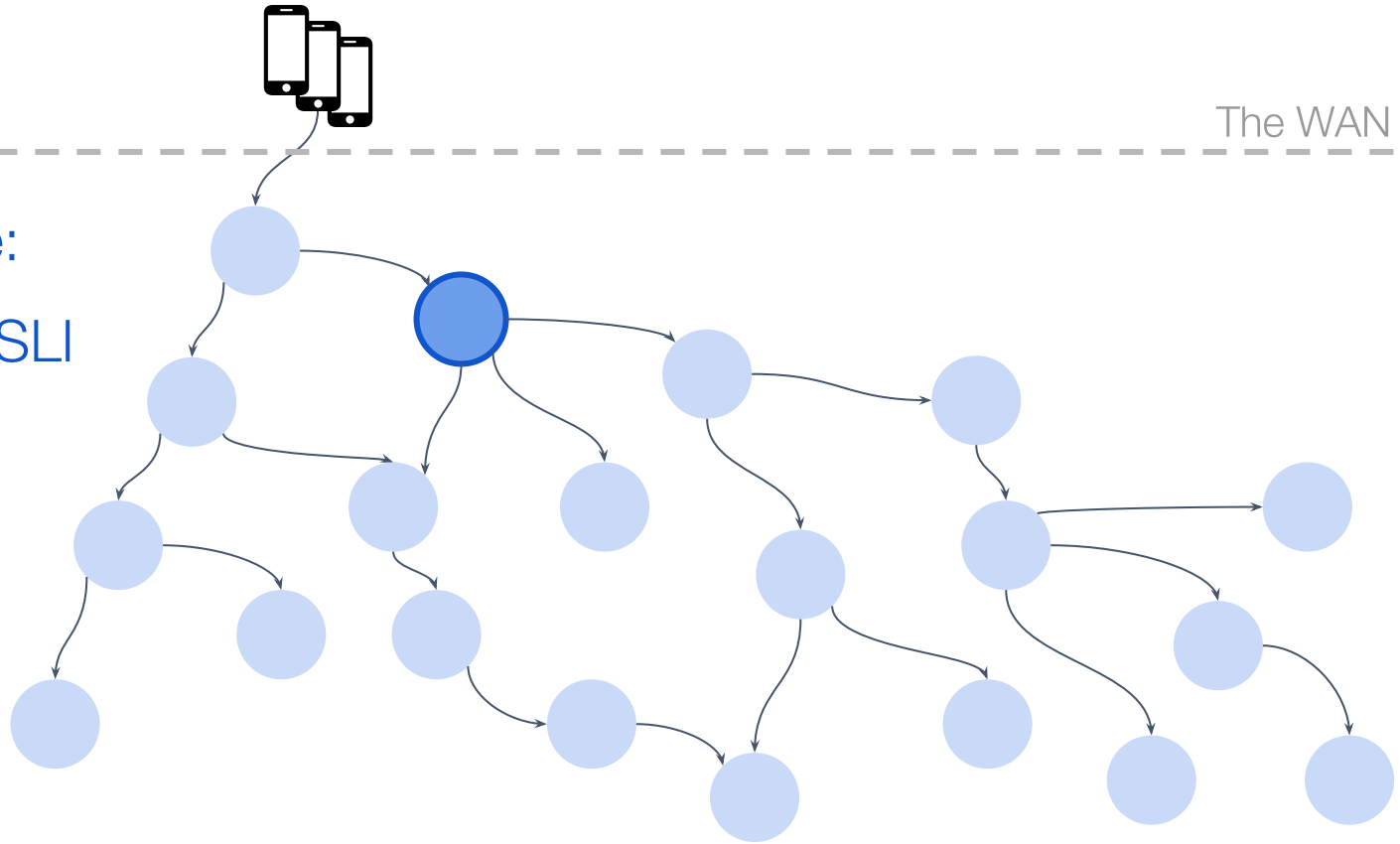
LIGHTSTEP

An aside…



LIGHTSTEP

A Service-Centric Approach



Given any service:

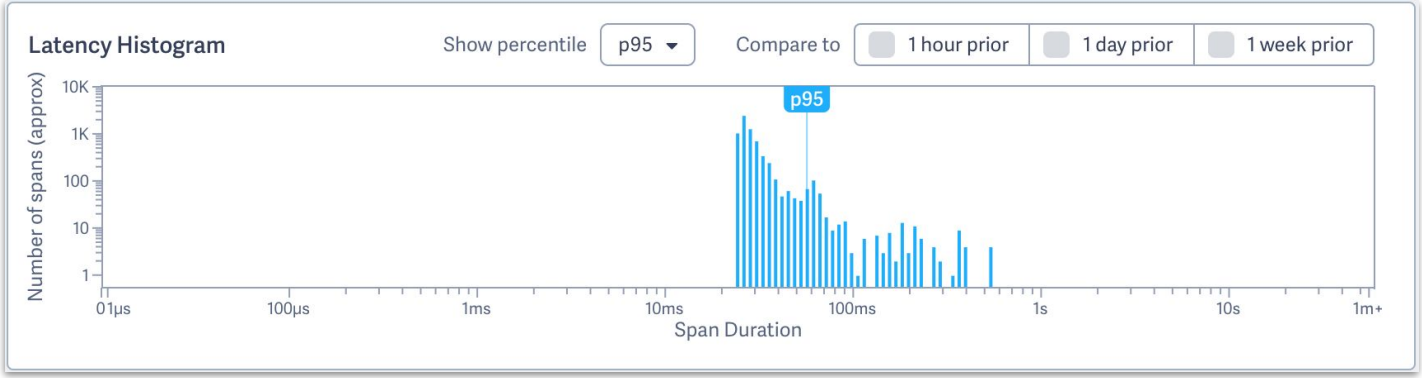
1. Start with an SLI
2. Find variance
3. Explain it

Confidence about *variance*

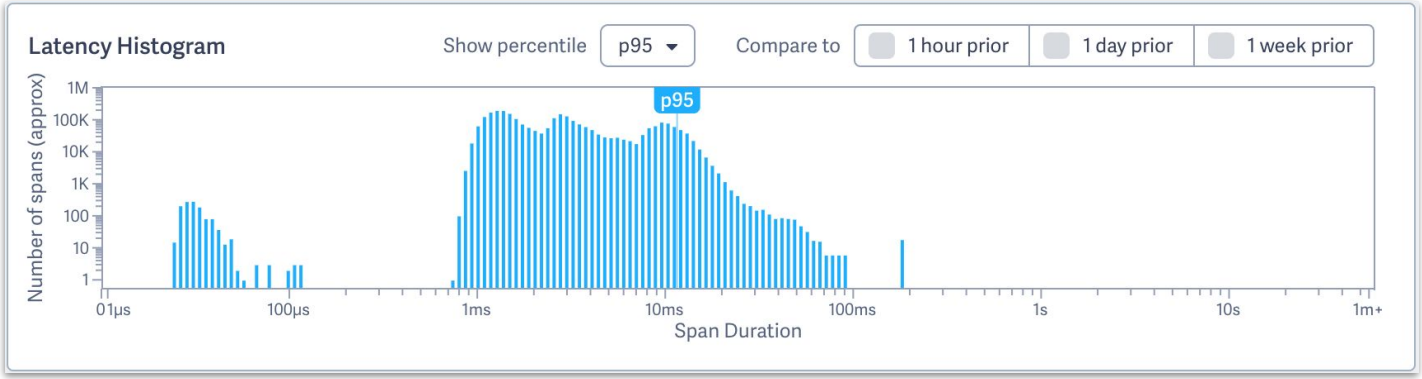
Percentile	Latency for A	Latency for B
p50	30ms	3ms
p90	42ms	11ms
p95	66ms	13ms
p99	180ms	17ms

Confidence about *variance*

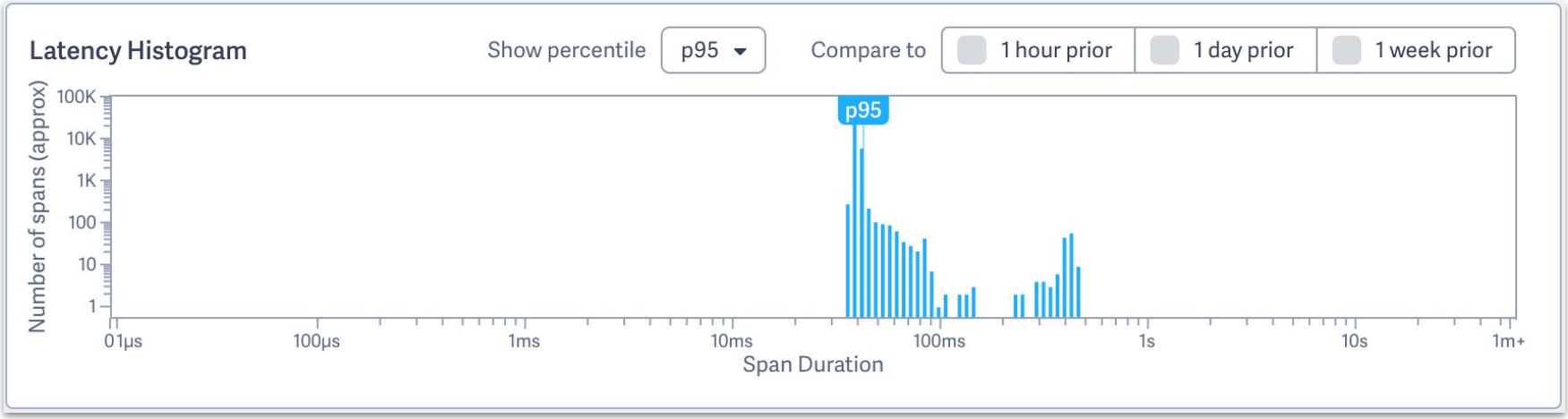
A



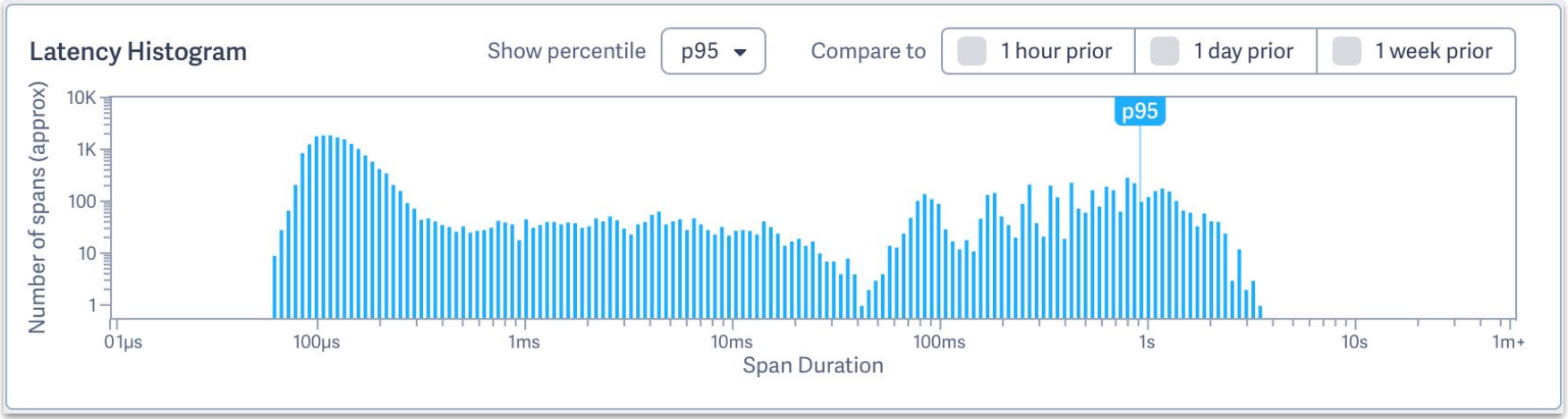
B



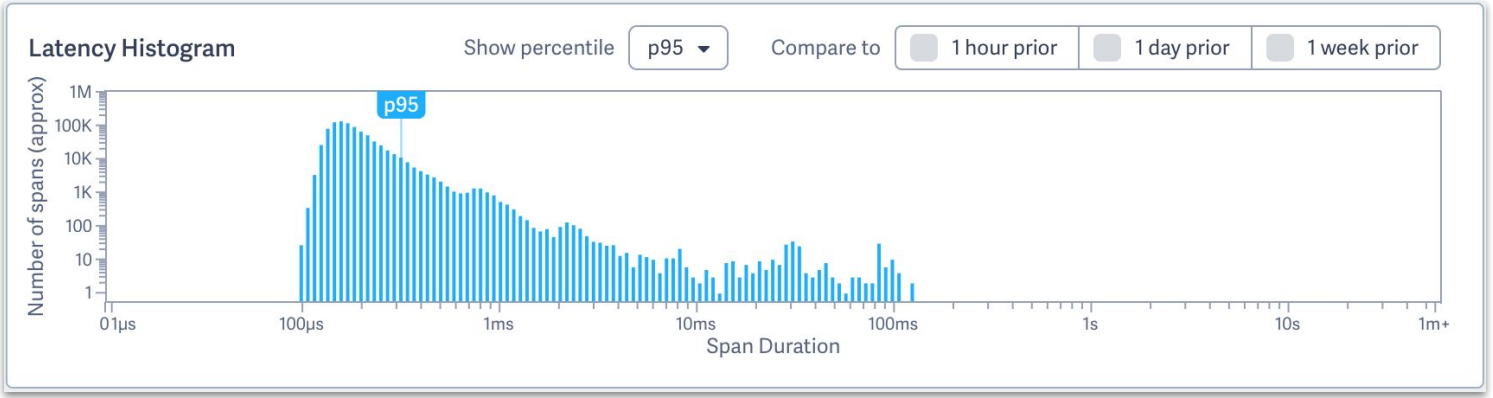
Confidence about *variance*

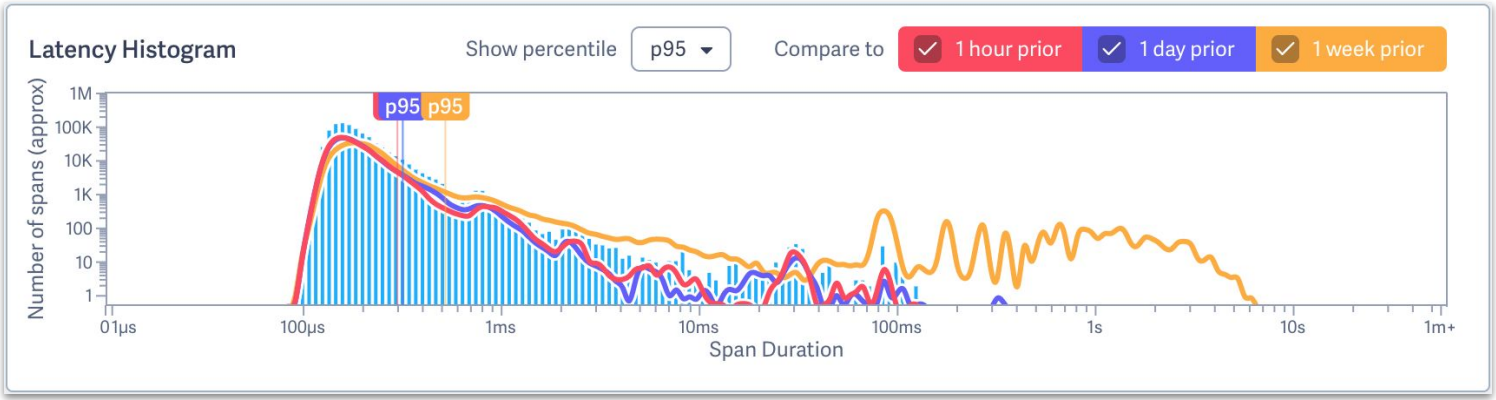


Confidence about *variance*



Latency variance vs temporal variance



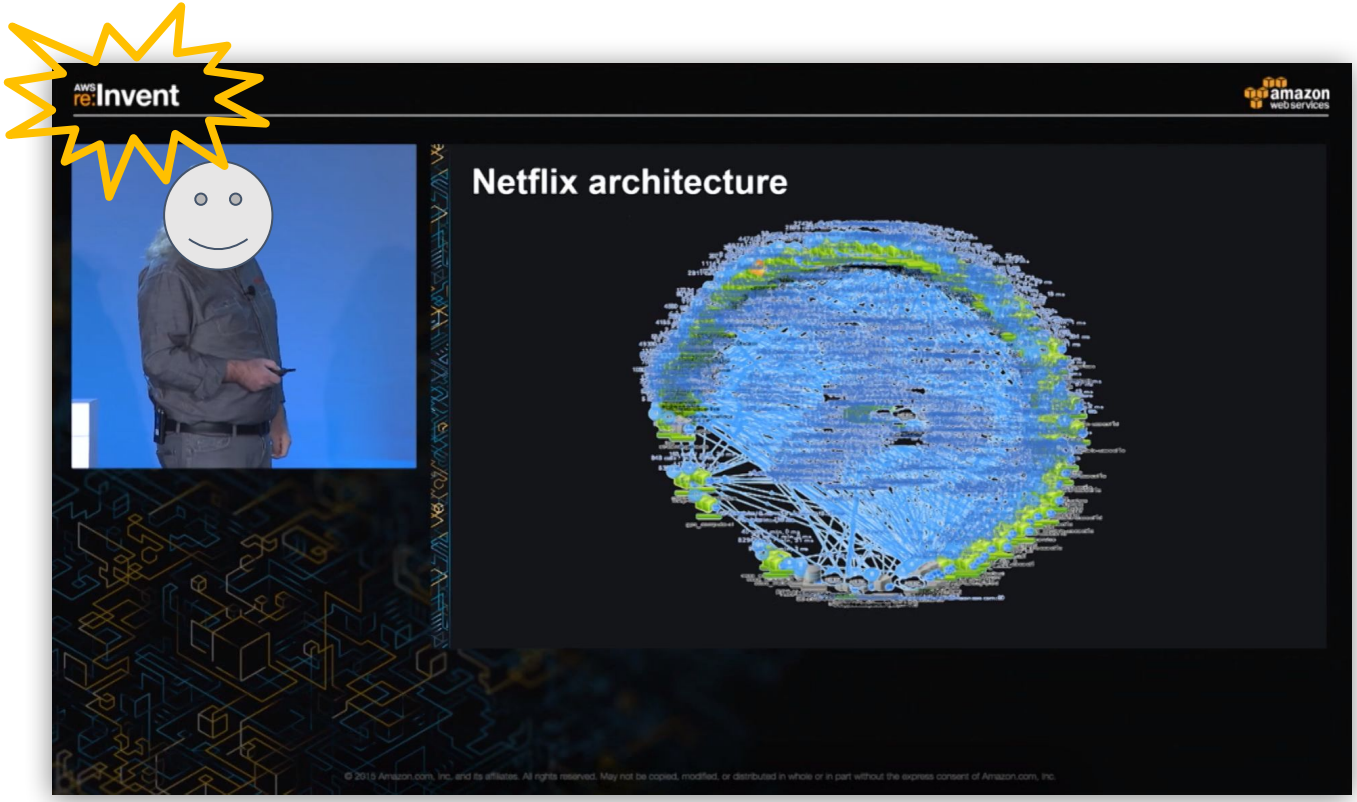


“Variance over *what* exactly?”

just trace span latencies,

filtered by (high-cardinality) tag values

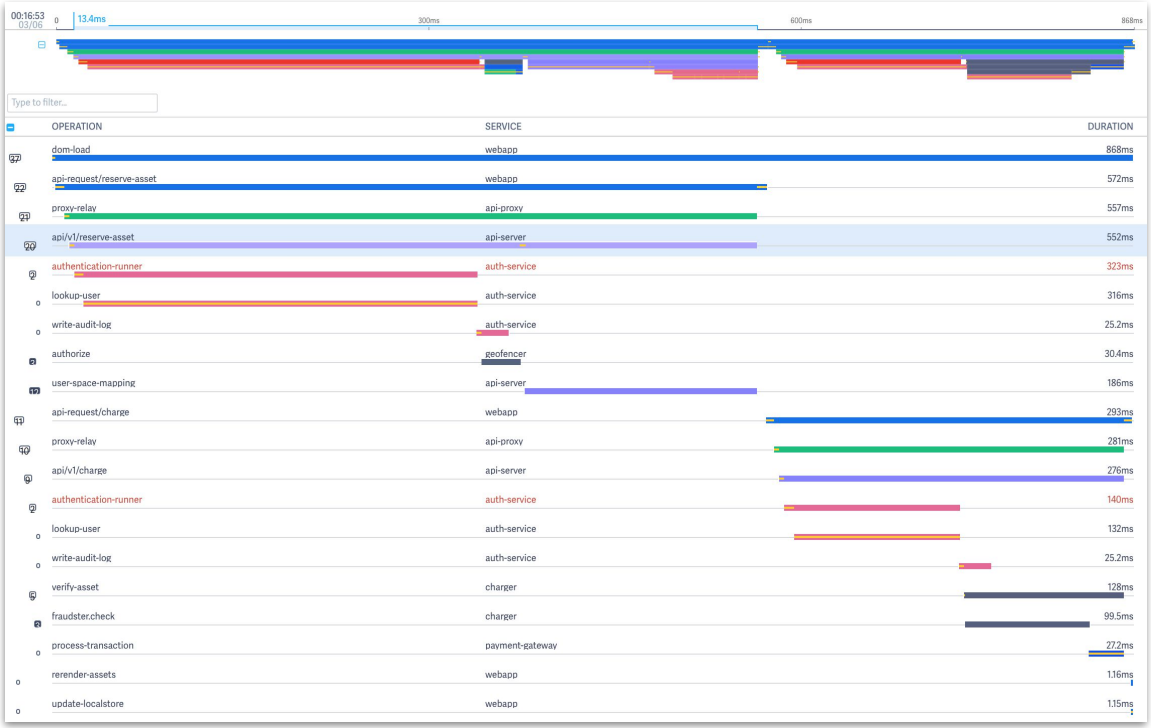
Confidence about *bottlenecks*



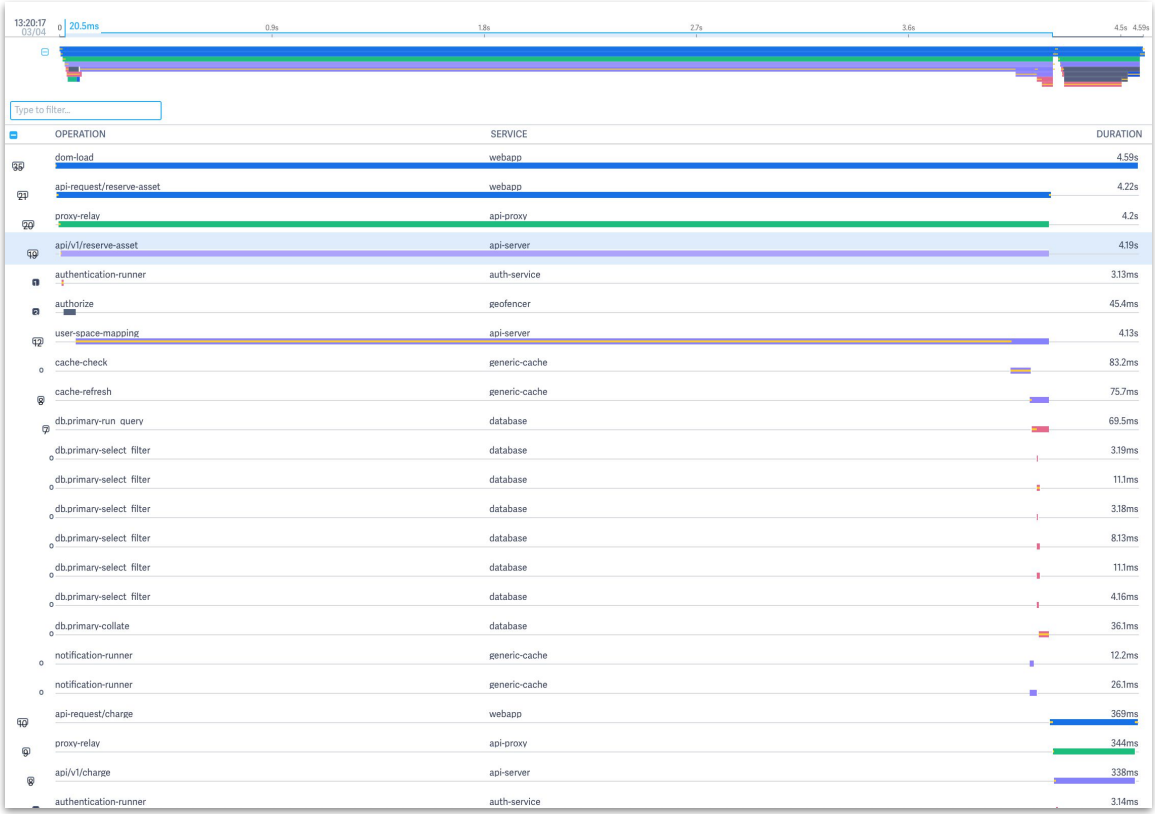
Confidence about *bottlenecks*

(link)

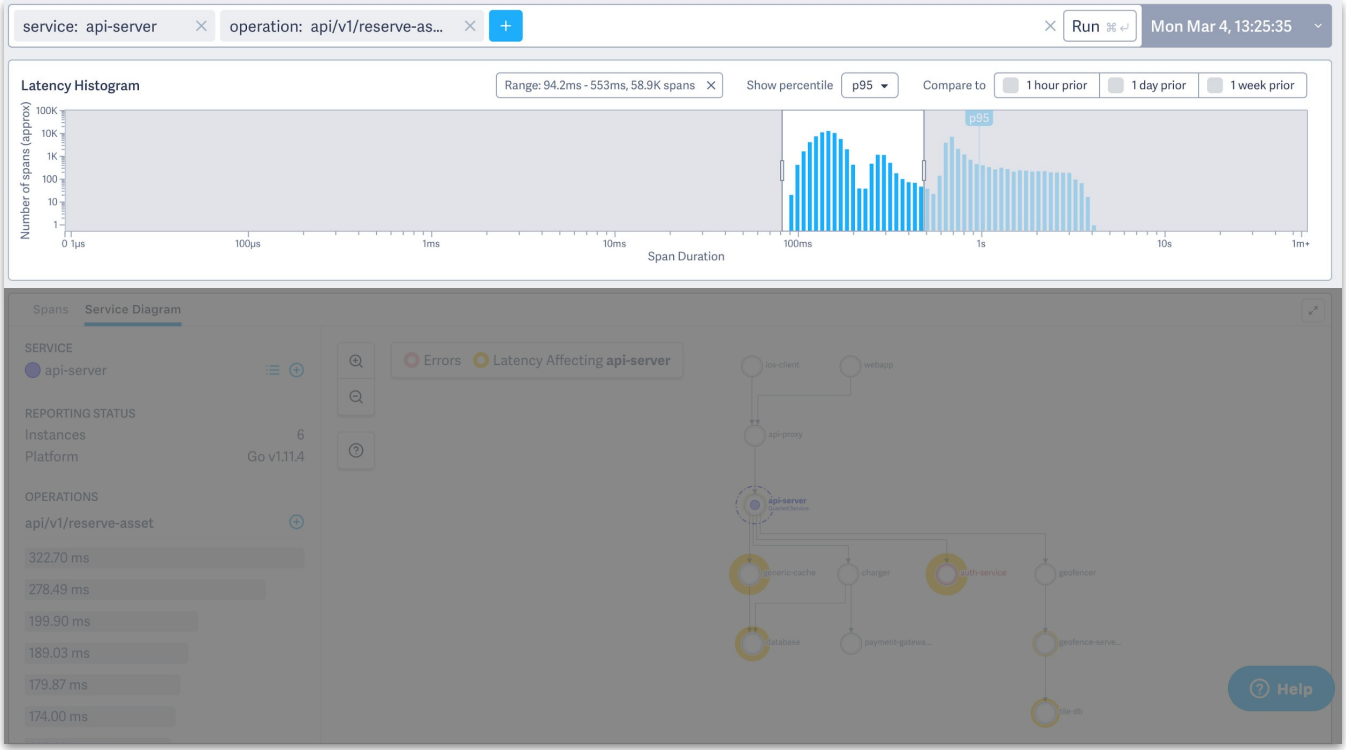
Common case traces



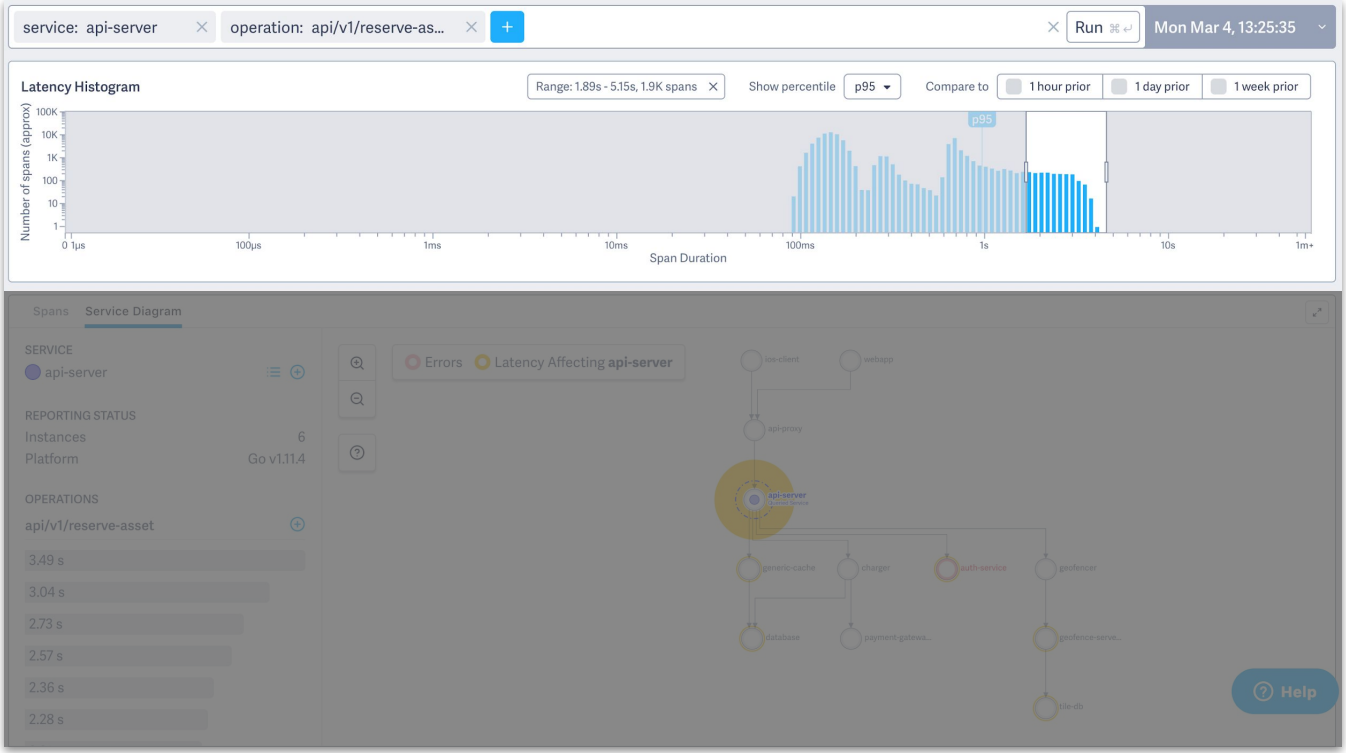
Common case traces



Confidence about *bottlenecks*: common case



Confidence about *bottlenecks*: outliers

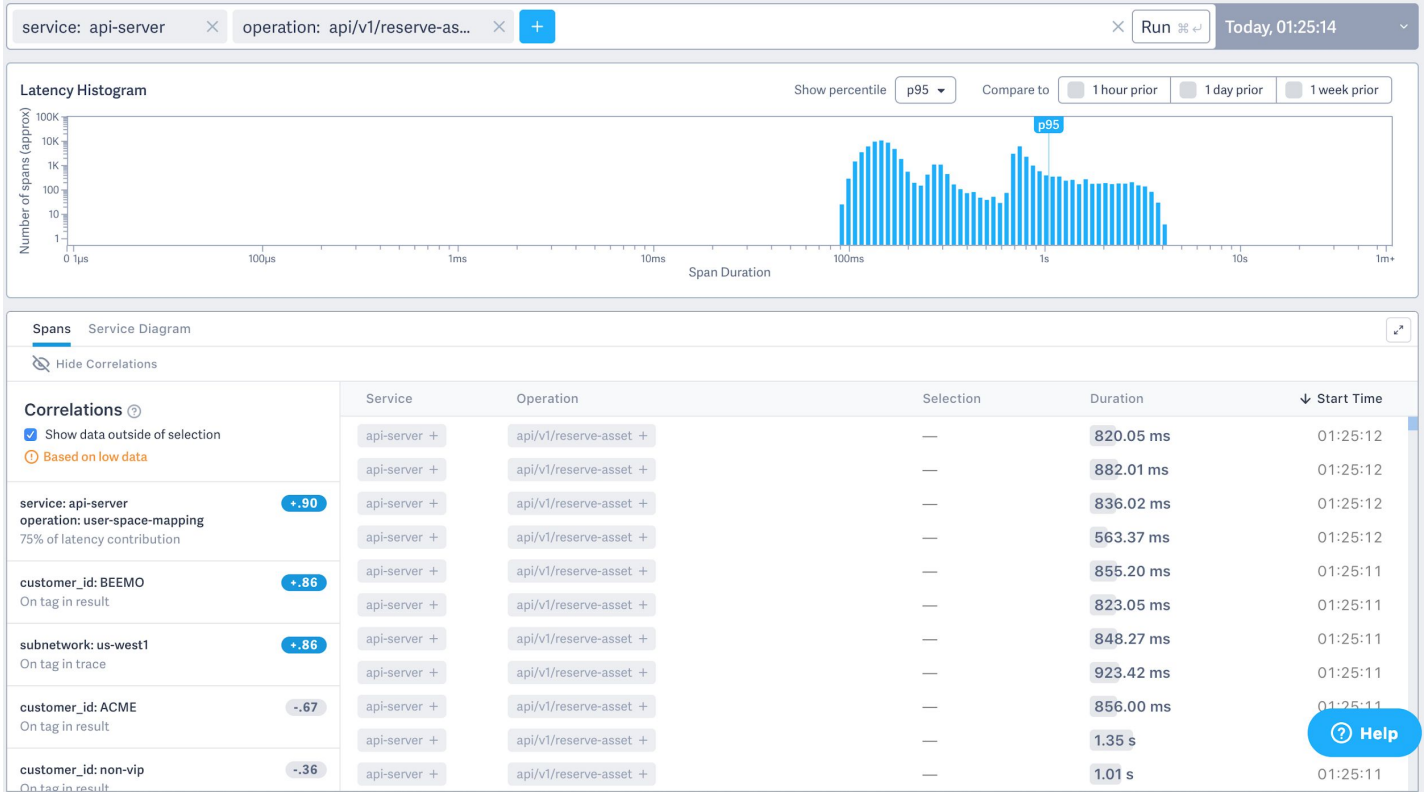


Confidence about *hypotheses*

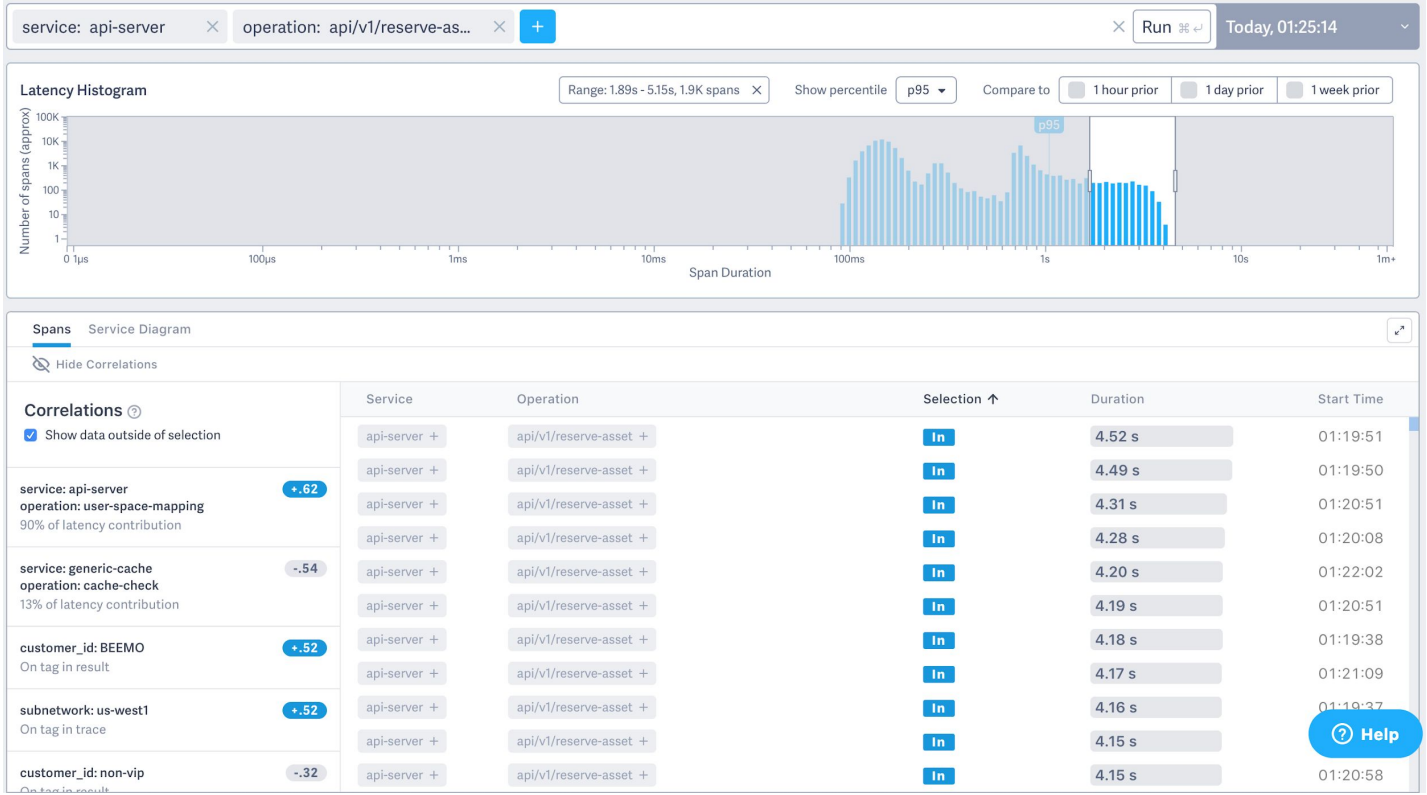
(link)

(Relevant)

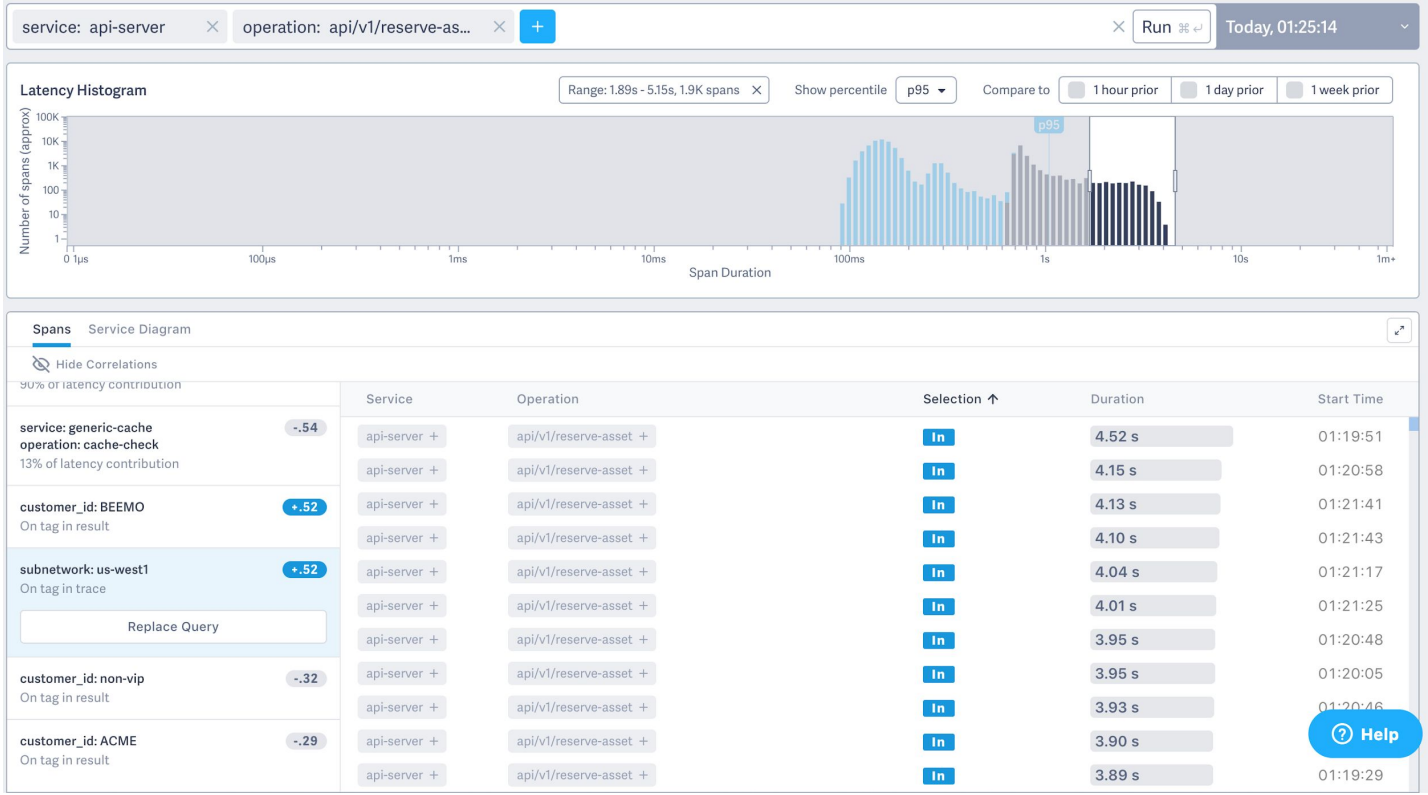
Confidence about *hypotheses*



Isolating variance



Considering a hypothesis



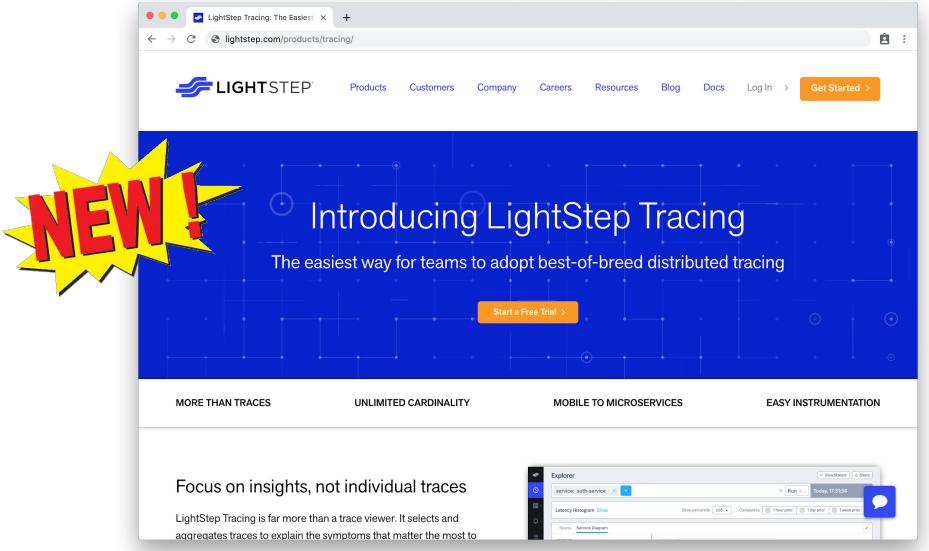
Wrapping up…

confidence

Thank you!

Ben Sigelman, Co-founder and CEO
twitter: @el_bhs
email: bhs@lightstep.com

PS: LightStep launched self-serve tracing at QCon London!



I am friendly and would love to chat… please say hello, I don't make it to Europe often!