Whooo’s calling Whooo?

Jodi Spacek

Hootsuite

March 11, 2016

Part 1: Microservice Migration

How we adjust to our ever-changing environment leading to reasons **why microservice calls are hard to track**

Part 2: Microservice Mystery

Take a look at a case study and come up with some techniques to diagnose problems

Hootsuite **collects**, **organizes** and **interacts** with social network data
10+ million users 5000+ requests / sec

Lots of interesting Distributed Systems problems!

Business Uses: customer support, data analytics, predictions

One of our largest concerns today is dealing with legacy code and outdated infrastructure

The Lounge in HQ 2

#chillax

Part 1: Microservice Migration

The Code

Legacy Code: older code we've inherited that is 4-5 years old

Is it a good idea to remove and replace legacy code all at once?

- No, we need to consider how **drastic changes affect 10 million users currently in the system**
- We need to get all of the developers on board with the changes gradually

#hootdogs Baby Monty!!

#hootdogs Wise Monty

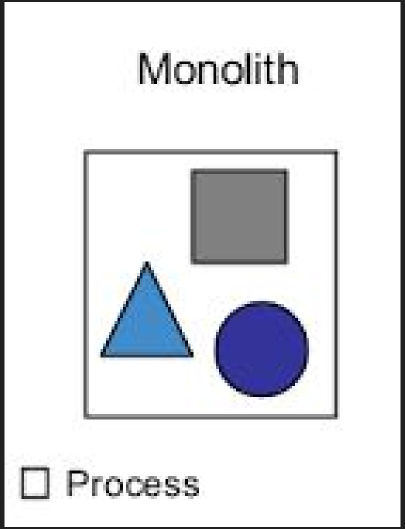
#YodaPug
and the ragtag team of HootDogs

How did Hootsuite adjust to hyper-growth?

Hacking together a solution in the monolith to keep up with this drastic growth in the user base

Why are we getting rid of the Monolith?

- PHP monolith doesn't scale well and is ill-suited for enterprise use
- it's difficult to keep code neat and tidy, it allows for bad coding behaviour



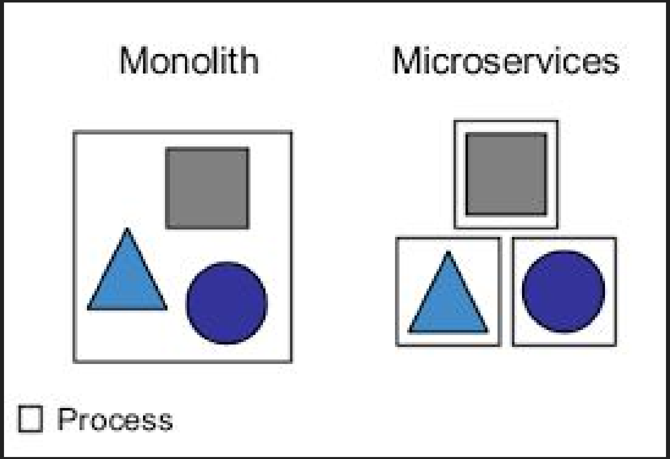
#hypergrowth

How have we addressed **consistent growth** in our user base?

- We can take the time now to move away from the PHP monolith code to Service Oriented Architecture
- Microservices fall under the umbrella of SOA

These isolated components help us to (1) distribute network traffic (2) replace legacy code incrementally and (3) distribute work in our team

We have **5000+ user calls per second**. How many **microservice** calls per user call? 5000+ requests/s multiplied by the complexity of the type of call



#soaftw

- **monolith**: these ingredients (components) are baked into one big pie
- **microservices**: pick and choose your ingredients individually

How easy is it to remove the apple and replace with raspberries?

- Should we remove the apple completely so that there’s a moment of time where nothing is on the plate?
- Should we put all of the raspberries on the plate and then after a certain amount of time remove the apple?
- Should we put one raspberry on the plate at a time? Remove parts of the apple that match the weight of the raspberry so that the weight is the same?

Apple Pie Monolith

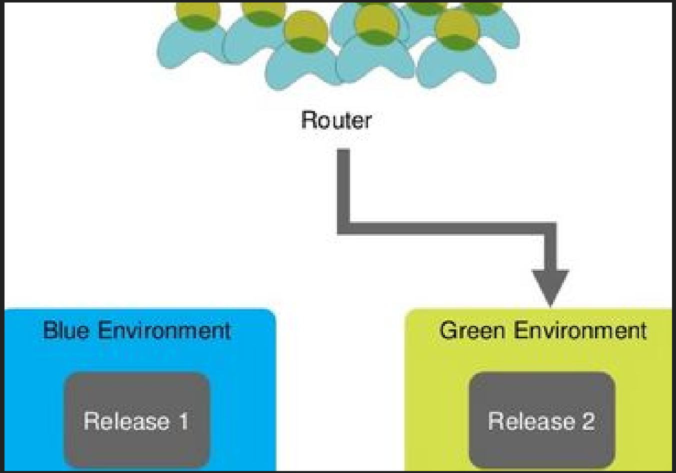
Apple Pie Deconstructed

blue-green deployments: switch from old to new (blue to green)

What happens if we have problems with the green environment?

- switching environments is a quick change that is less complex than performing rollbacks ~ faster than a full redeployment of code which must be thoroughly tested before going to production
- the state in the green (new) environment may be corrupted and unusable even if we replace the new code with the old code version

Blue-green Deployment



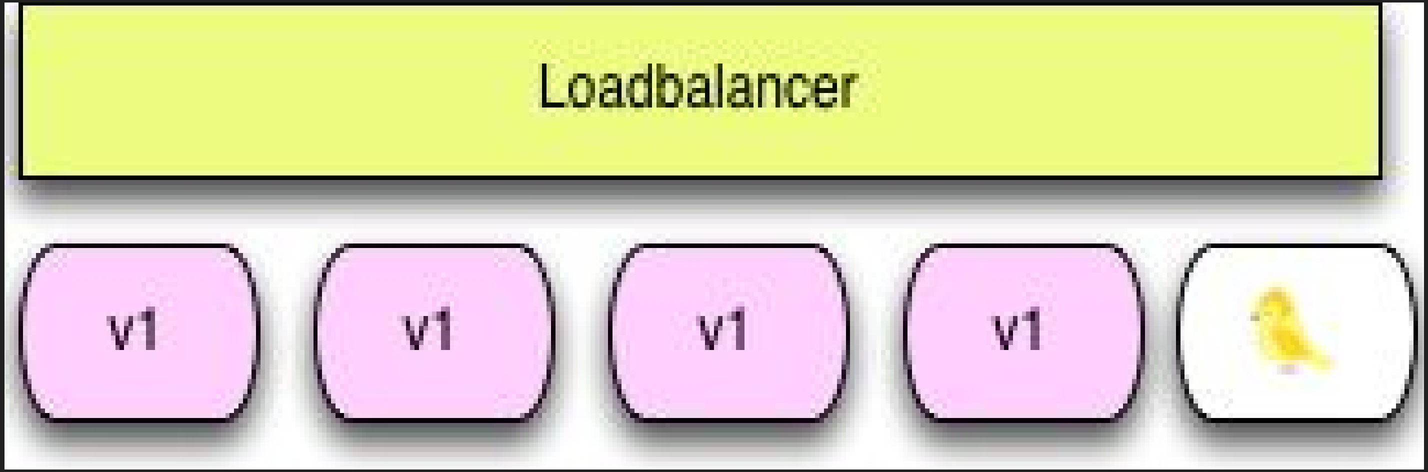
#greenmeansgo

canary deployment: Riskier changes where we want to discover the behaviour on production

What happens to the canary server if it starts failing?

- stop routing any requests to the canary
- swap out the canary server with the old version of the service

Canary Deployment



#goodlucklittlecanary

Part 1: Microservice Migration

Infrastructure

Where the Code Lives

Infrastructure Redesign Motivation

Volume of retweets causes an outage of our entire system

this guy >>>

#supnotyourapps

Microservice Architecture

Brokers: queue and transform messages

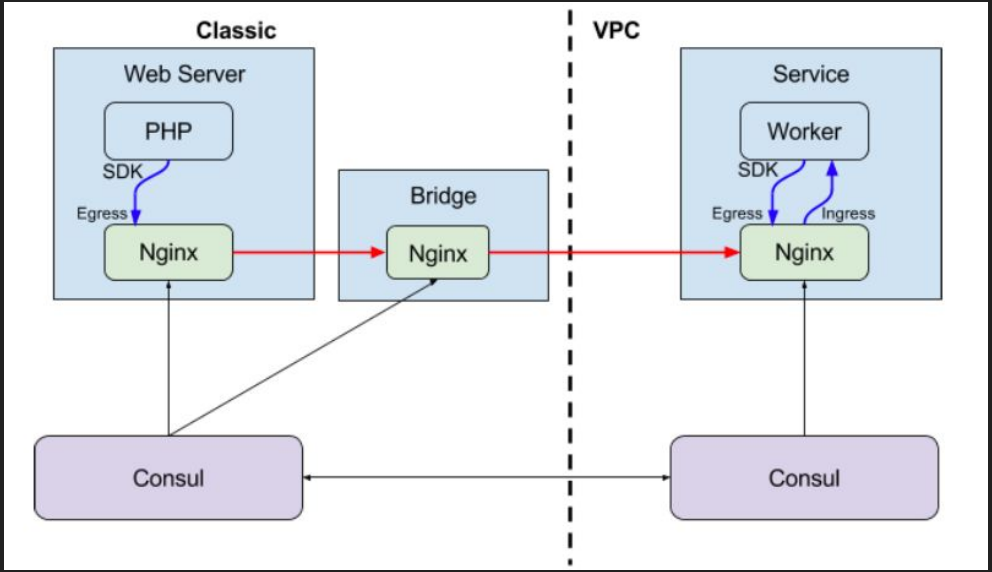
Routers: determine best location to send messages

Service Discovery: automatically detect the location of a microservice

Workers: microservice nodes in a cluster

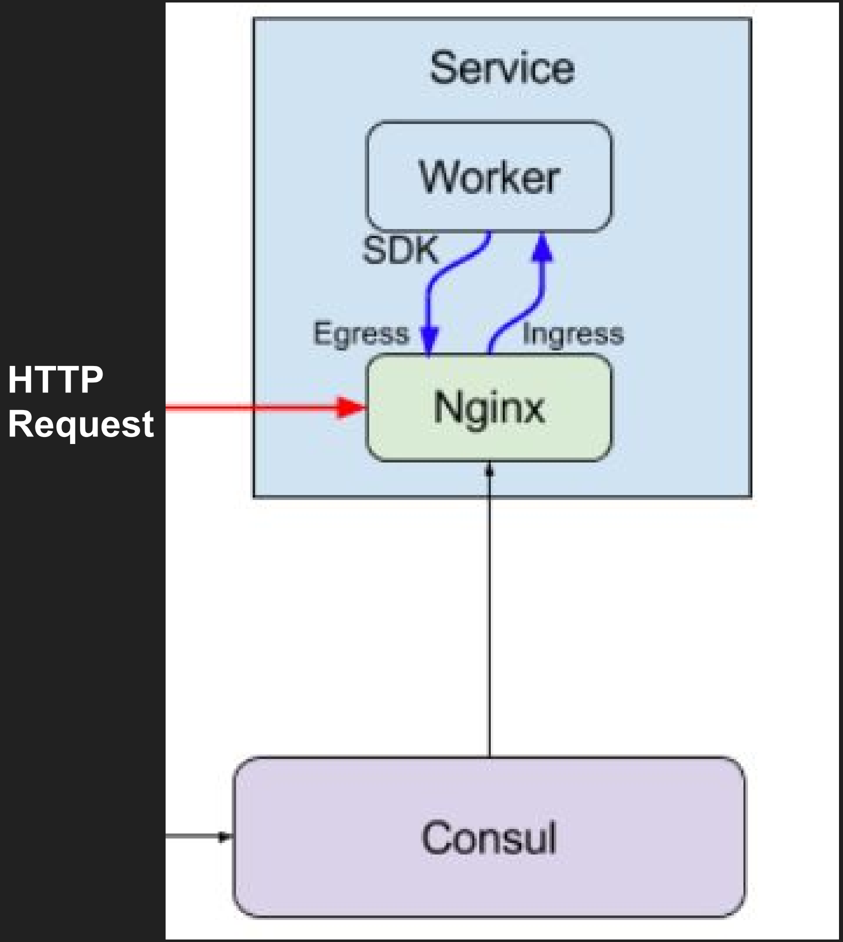
Fault Tolerance: operates correctly even when component fails

Monolith Infrastructure Migration



- most of our older services & THE MONOLITH live in EC2 Classic
- use a bridge to direct traffic to our new services in VPC (Virtual Private Cloud)
- ASG (auto scaling group) lives in VPC and it helps us to deal with changes in the volume of requests
- How? ASG can scale up by adding new nodes in the cluster, and scale down when traffic is lower to save $$

#evenmoremigrations



Code Name “Back to the Future”

- HTTP is an oldie but a goodie
- service discovery & load balancing with Nginx & Consul
- **Nginx**: HTTP proxy with caching
- **Consul**: Distributed (K, V) store

If one of the nodes goes down, but the request was already sent (in-flight), nginx can redispatch it to another node

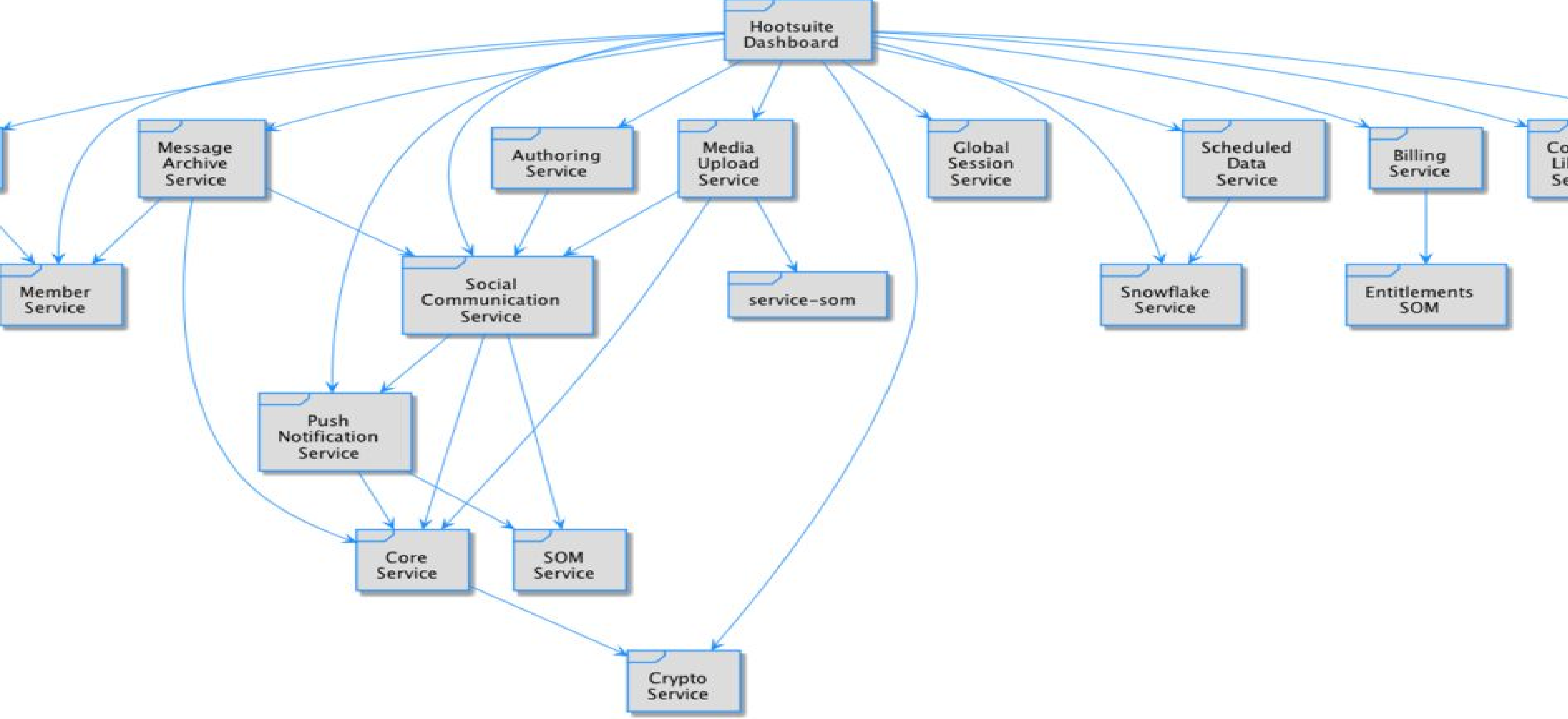
Can any request ever be dropped?

- If the number of requests sent to a downed node exceeds the Nginx buffer storage size, requests will be dropped

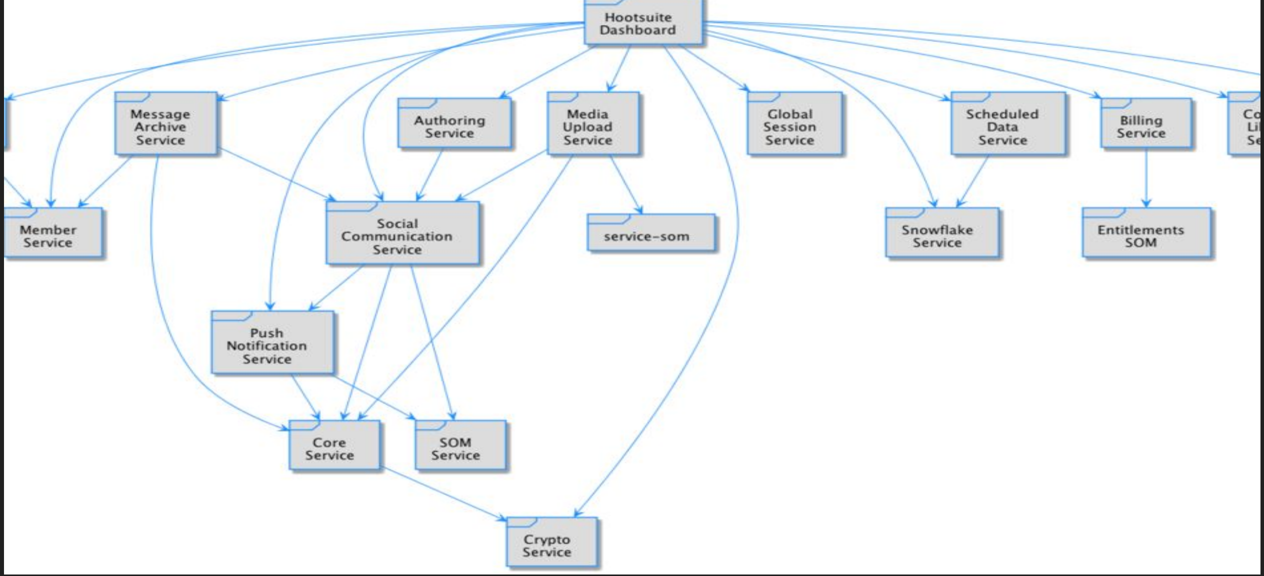
#backtothefuture

Part 2: Microservice Mystery

What do we know?



#somanycalls



How micro is micro? Microservices are of varying size & complexity, they handle small pieces of logical functionality that make microservices easier to distribute and replace

How micro is too micro? You don't want to make your microservices so tiny that the advantages of this design are overshadowed by having to make so many calls that it's a networking nightmare

#micromicromicro

Part 2: Microservice Mystery

What can we see?

logstash: centralizes log data and standardizes them for elastic search

elasticsearch: real time data analytics

kibana: visualization tool for elasticsearch

elastic
elasticsearch.
logstash
kibana

#elkstack

What kinds of problems are caused by decentralization of our logs?

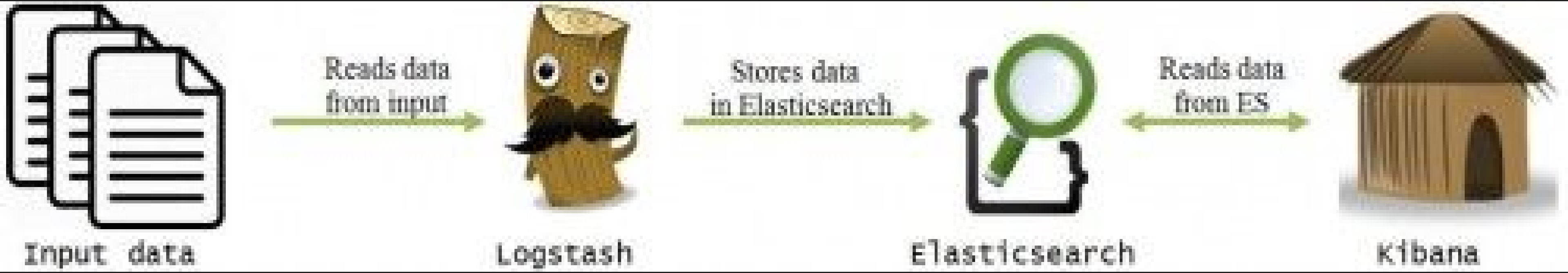
Logs are spread all over our servers and are hard to track

What kinds of features does the ELK stack provide?

Functionality to coordinate different log formats, regardless of the tag placement and format

What can everyone understand in the ELK stack?

Kibana’s visual clues for behaviour changes in graphs



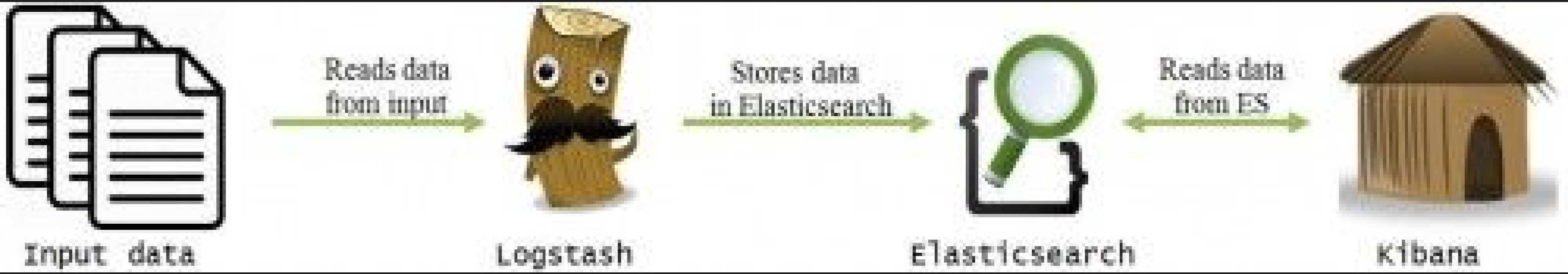
#elkstack

How do we make connections between calls that are logged?

- **W**e need to make the logical connections between microservice calls ourselves by searching for keywords to view logs in a list

Is this an easy thing to do?

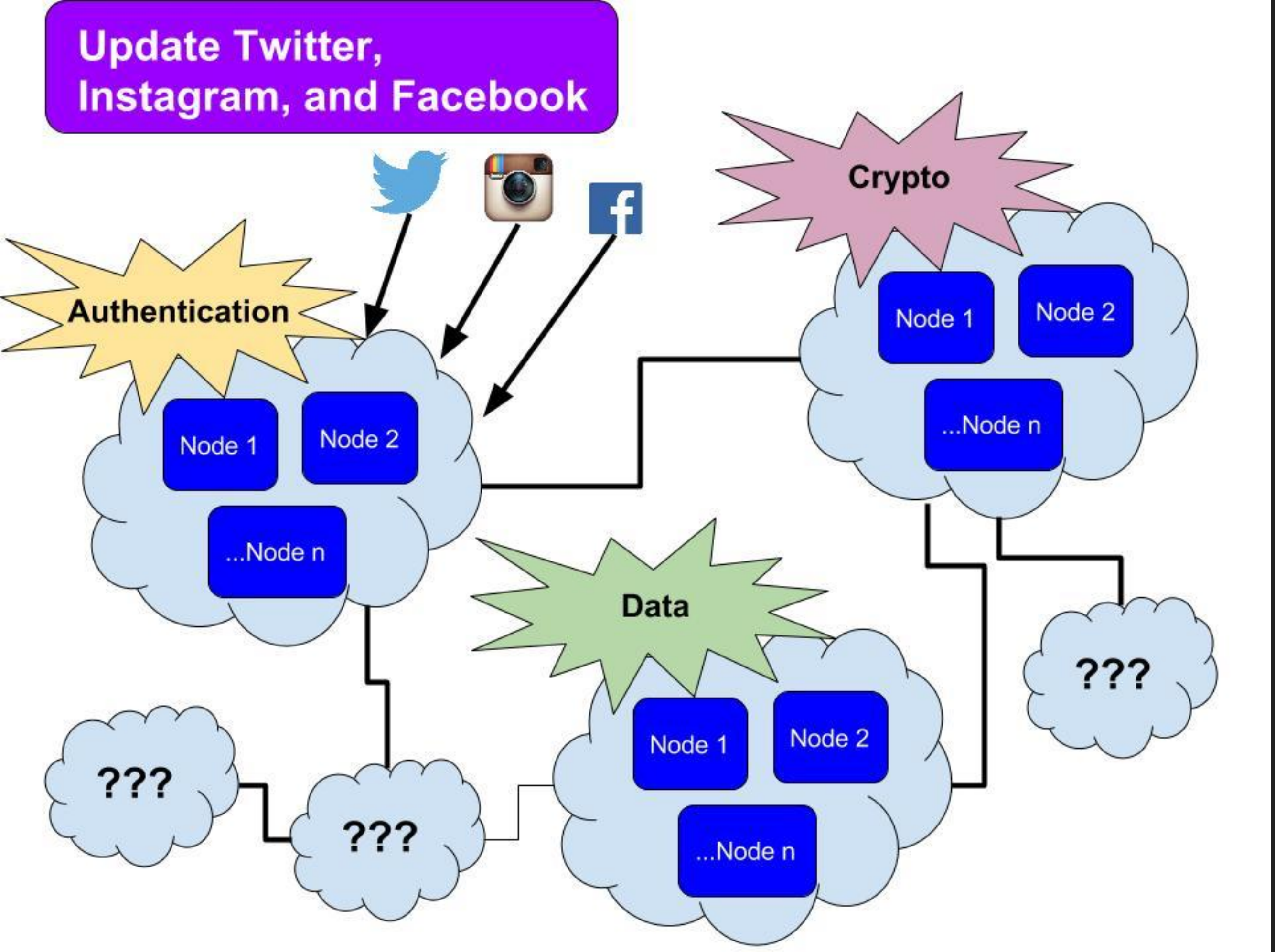
- This could be an easy task if the microservice calls are simple
- But simple calls don't usually cause complex issues that are difficult to track!



#elkstack

Part 2: Microservice Mystery

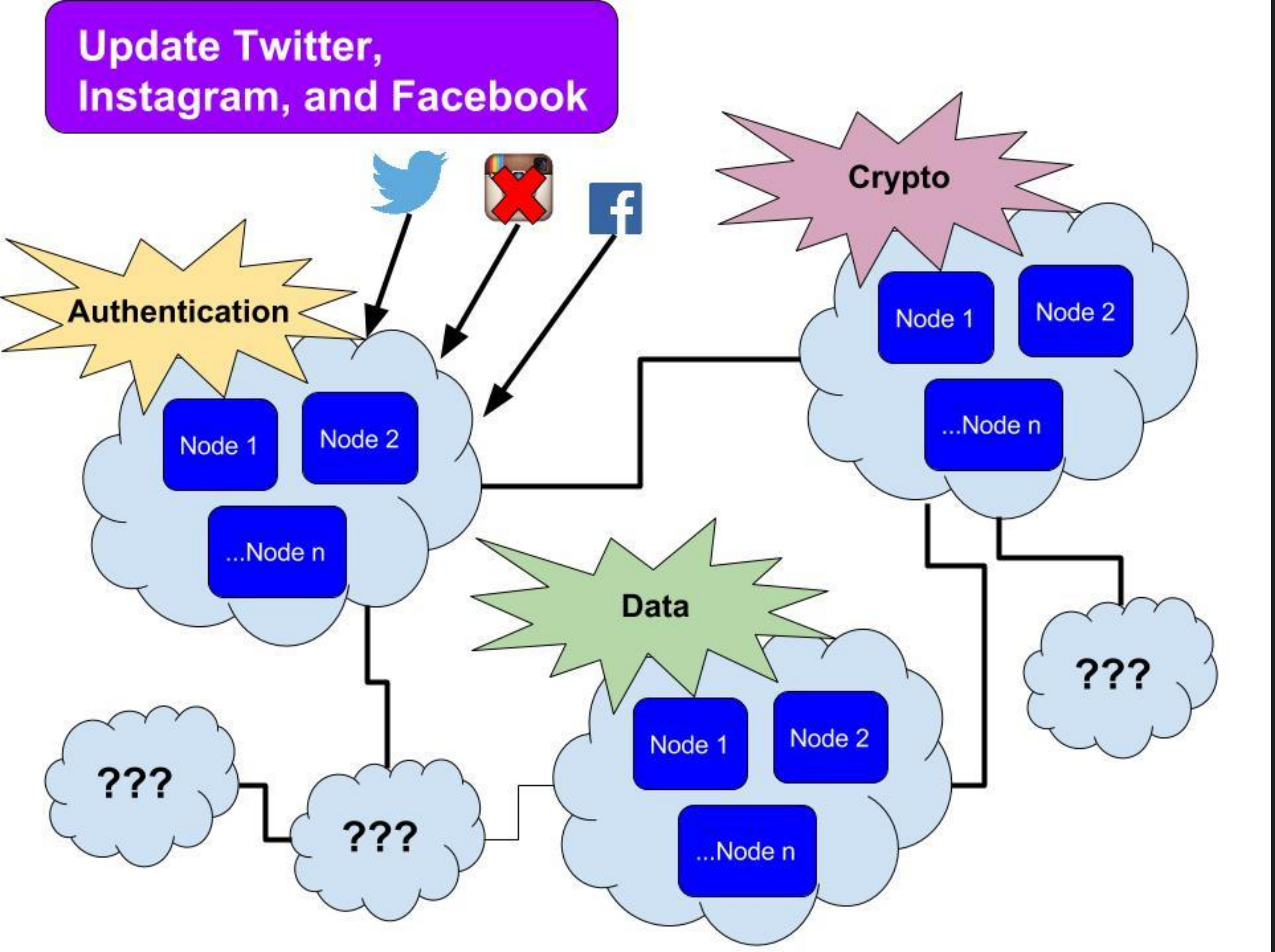
The Case



Send a request to update Twitter, Instagram, and Facebook

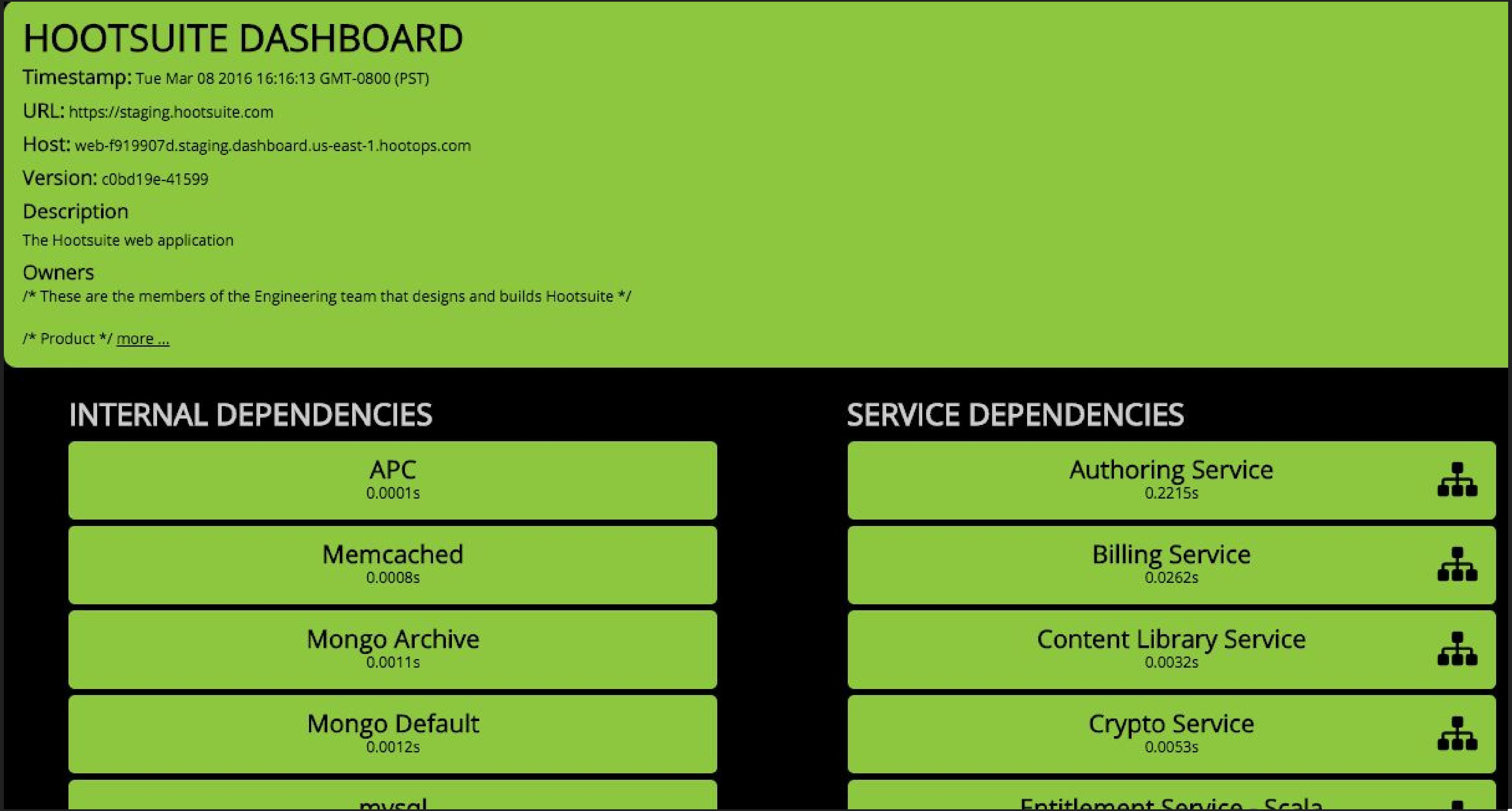
What happens after the first few calls from the first microservice?

#sofarsogood



Where would you start your investigation?

#whatwouldsherlockdo



HOOTSUITE DASHBOARD

Timestamp: Tue Mar 08 2016 16:16:13 GMT-0800 (PST)

URL: https://staging.hootsuite.com

Host: web-f919907d.staging.dashboard.us-east-1.hootops.com

Version: c0bd19e-41599

Description

The Hootsuite web application

Owners

/* These are the members of the Engineering team that designs and builds Hootsuite */

/* Product */ more ...

INTERNAL DEPENDENCIES

APC
0.0001s

Memcached
0.0008s

Mongo Archive
0.0011s

Mongo Default
0.0012s

mysql

SERVICE DEPENDENCIES

Authoring Service
0.2215s

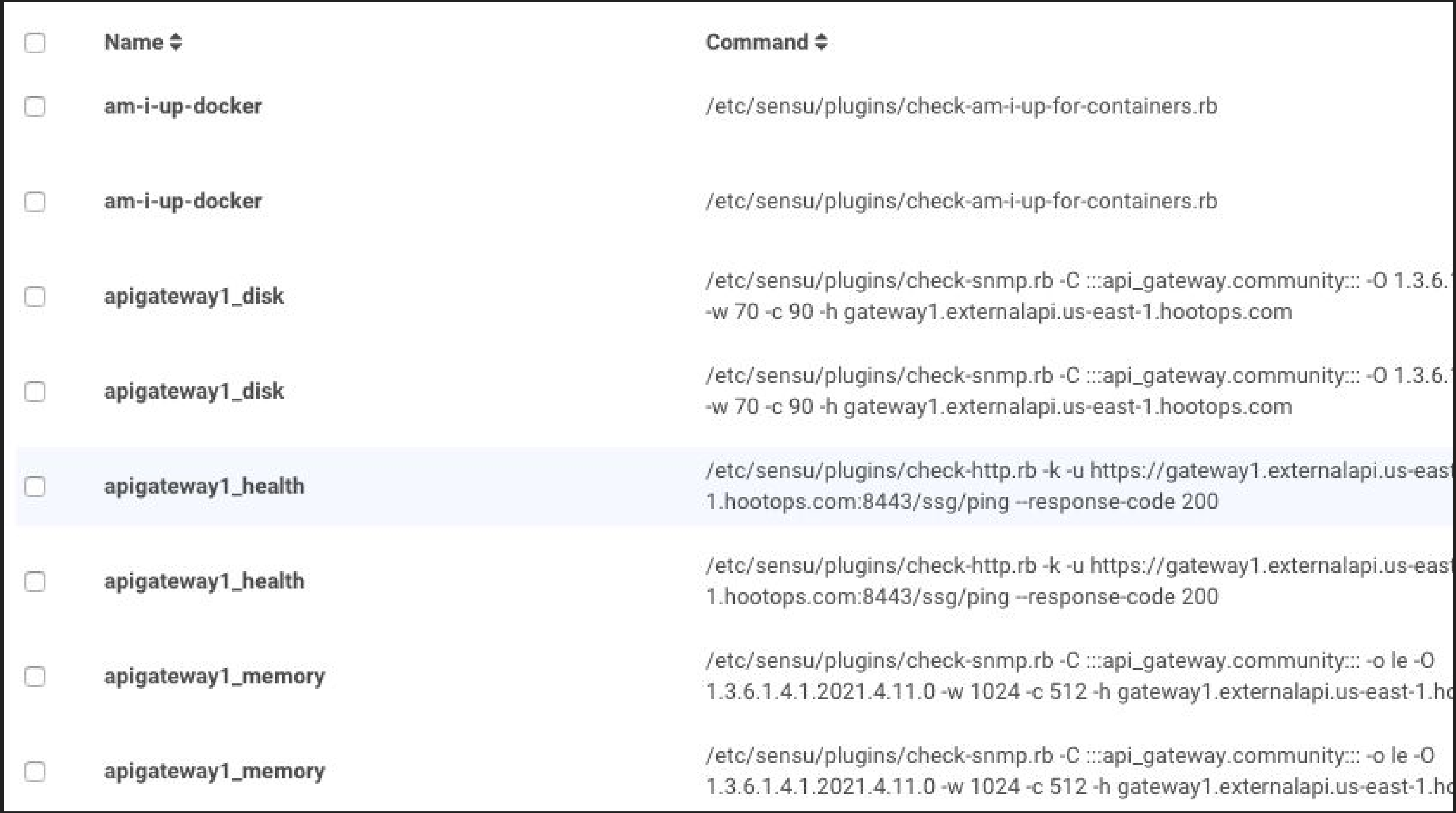
Billing Service
0.0262s

Content Library Service
0.0032s

Crypto Service
0.0053s

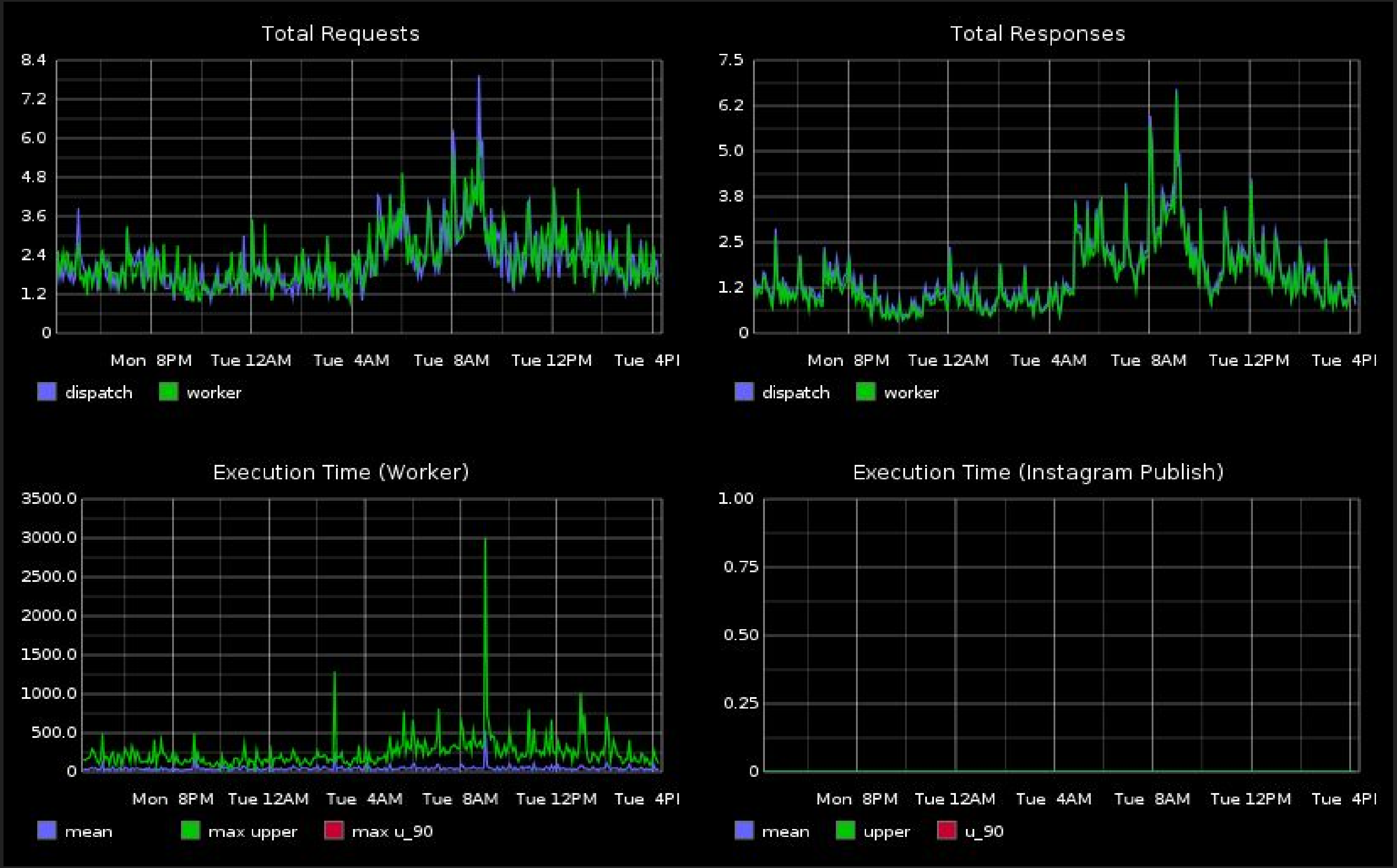
Entitlement Service - Scala

#nodehealth

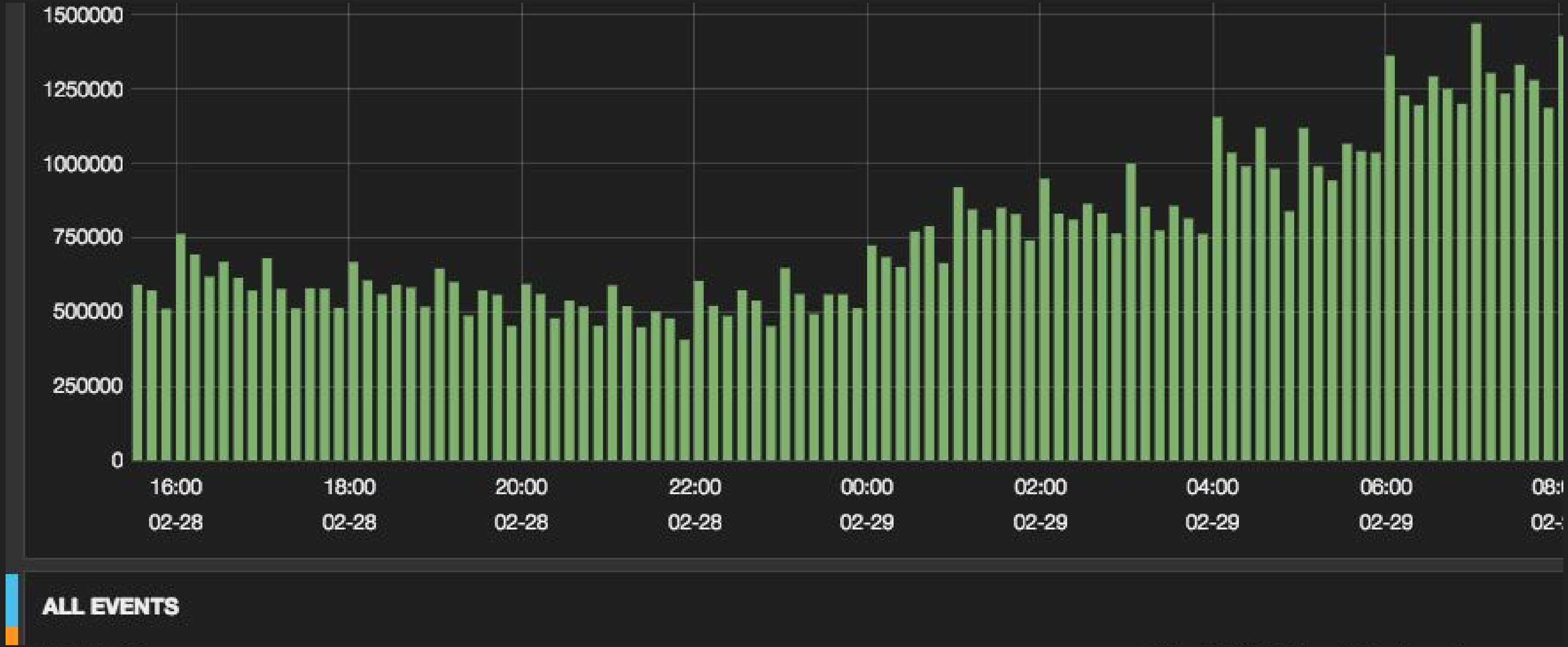


	Name	Command
☐	am-i-up-docker	/etc/sensu/plugins/check-am-i-up-for-containers.rb
☐	am-i-up-docker	/etc/sensu/plugins/check-am-i-up-for-containers.rb
☐	apigateway1_disk	/etc/sensu/plugins/check-snmp.rb -C :::api_gateway.community::: -O 1.3.6. -w 70 -c 90 -h gateway1.externalapi.us-east-1.hootops.com
☐	apigateway1_disk	/etc/sensu/plugins/check-snmp.rb -C :::api_gateway.community::: -O 1.3.6. -w 70 -c 90 -h gateway1.externalapi.us-east-1.hootops.com
☐	apigateway1_health	/etc/sensu/plugins/check-http.rb -k -u https://gateway1.externalapi.us-eas 1.hootops.com:8443/ssg/ping --response-code 200
☐	apigateway1_health	/etc/sensu/plugins/check-http.rb -k -u https://gateway1.externalapi.us-eas 1.hootops.com:8443/ssg/ping --response-code 200
☐	apigateway1_memory	/etc/sensu/plugins/check-snmp.rb -C :::api_gateway.community::: -o le -O 1.3.6.1.4.1.2021.4.11.0 -w 1024 -c 512 -h gateway1.externalapi.us-east-1.ho
☐	apigateway1_memory	/etc/sensu/plugins/check-snmp.rb -C :::api_gateway.community::: -o le -O 1.3.6.1.4.1.2021.4.11.0 -w 1024 -c 512 -h gateway1.externalapi.us-east-1.ho

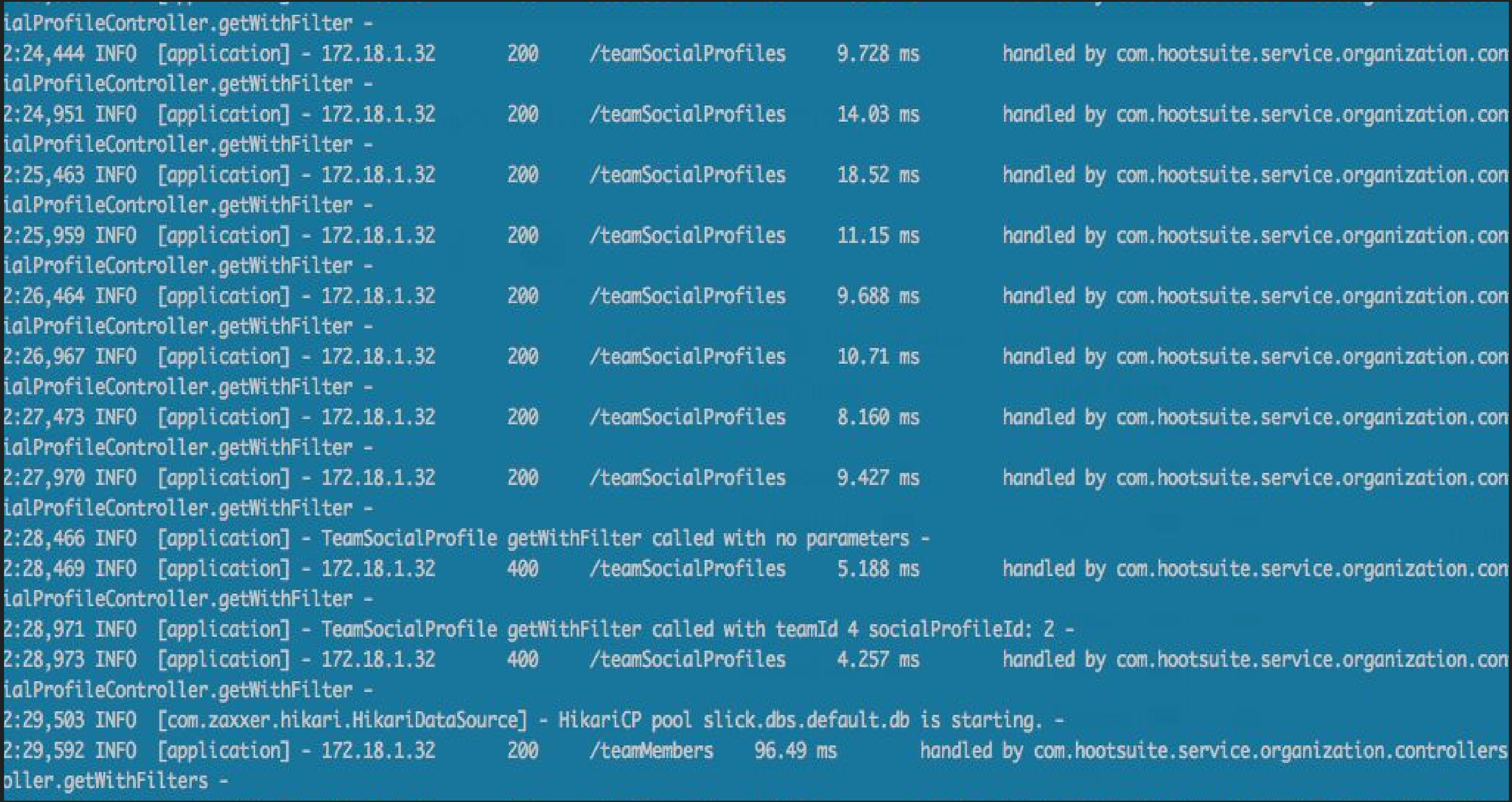
#sensuhealth


Total Requests
8.4
7.2
6.0
4.8
3.6
2.4
1.2
0
Mon 8PM
Tue 12AM
Tue 4AM
Tue 8AM
Tue 12PM
Tue 4PI
🟦 dispatch
🟩 worker
Total Responses
7.5
6.2
5.0
3.8
2.5
1.2
0
Mon 8PM
Tue 12AM
Tue 4AM
Tue 8AM
Tue 12PM
Tue 4PI
🟦 dispatch
🟩 worker
Execution Time (Worker)
3500.0
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0
Mon 8PM
Tue 12AM
Tue 4AM
Tue 8AM
Tue 12PM
Tue 4PI
🟦 mean
🟩 max upper
🟥 max u_90
Execution Time (Instagram Publish)
1.00
0.75
0.50
0.25
0
Mon 8PM
Tue 12AM
Tue 4AM
Tue 8AM
Tue 12PM
Tue 4PI
🟦 mean
🟩 upper
🟥 u_90

#graphite


1500000
1250000
1000000
750000
500000
250000
0
16:00 02-28
18:00 02-28
20:00 02-28
22:00 02-28
00:00 02-29
02:00 02-29
04:00 02-29
06:00 02-29
08:0
02-
ALL EVENTS

#kibana



```
ialProfileController.getWithFilter -
2:24,444 INFO  [application] - 172.18.1.32      200    /teamSocialProfiles    9.728 ms       handled by com.hootsuite.service.organization.con
ialProfileController.getWithFilter -
2:24,951 INFO  [application] - 172.18.1.32      200    /teamSocialProfiles    14.03 ms       handled by com.hootsuite.service.organization.con
ialProfileController.getWithFilter -
2:25,463 INFO  [application] - 172.18.1.32      200    /teamSocialProfiles    18.52 ms       handled by com.hootsuite.service.organization.con
ialProfileController.getWithFilter -
2:25,959 INFO  [application] - 172.18.1.32      200    /teamSocialProfiles    11.15 ms       handled by com.hootsuite.service.organization.con
ialProfileController.getWithFilter -
2:26,464 INFO  [application] - 172.18.1.32      200    /teamSocialProfiles    9.688 ms       handled by com.hootsuite.service.organization.con
ialProfileController.getWithFilter -
2:26,967 INFO  [application] - 172.18.1.32      200    /teamSocialProfiles    10.71 ms       handled by com.hootsuite.service.organization.con
ialProfileController.getWithFilter -
2:27,473 INFO  [application] - 172.18.1.32      200    /teamSocialProfiles    8.160 ms       handled by com.hootsuite.service.organization.con
ialProfileController.getWithFilter -
2:27,970 INFO  [application] - 172.18.1.32      200    /teamSocialProfiles    9.427 ms       handled by com.hootsuite.service.organization.con
ialProfileController.getWithFilter -
2:28,466 INFO  [application] - TeamSocialProfile getWithFilter called with no parameters -
2:28,469 INFO  [application] - 172.18.1.32      400    /teamSocialProfiles    5.188 ms       handled by com.hootsuite.service.organization.con
ialProfileController.getWithFilter -
2:28,971 INFO  [application] - TeamSocialProfile getWithFilter called with teamId 4 socialProfileId: 2 -
2:28,973 INFO  [application] - 172.18.1.32      400    /teamSocialProfiles    4.257 ms       handled by com.hootsuite.service.organization.con
ialProfileController.getWithFilter -
2:29,503 INFO  [com.zaxxer.hikari.HikariDataSource] - HikariCP pool slick.dbs.default.db is starting. -
2:29,592 INFO  [application] - 172.18.1.32      200    /teamMembers    96.49 ms       handled by com.hootsuite.service.organization.controllers
oller.getWithFilters -
```

#lastditcheffort

How many different places do we need to check?

How many developers would need to do this?

How would we coordinate their efforts to put together a hypothesis?

Can we get rid of some of the stress points in this process?

Can these clues be connected in some way to help our analysis?

Can we do any better than this?

#whatwouldsherlockdo

Activity: Sherlock & Watson

Connect the Clues

Can these microservice clues be connected in some way to help our analysis?

Let’s take a couple of minutes to work in pairs and brainstorm on a solution!

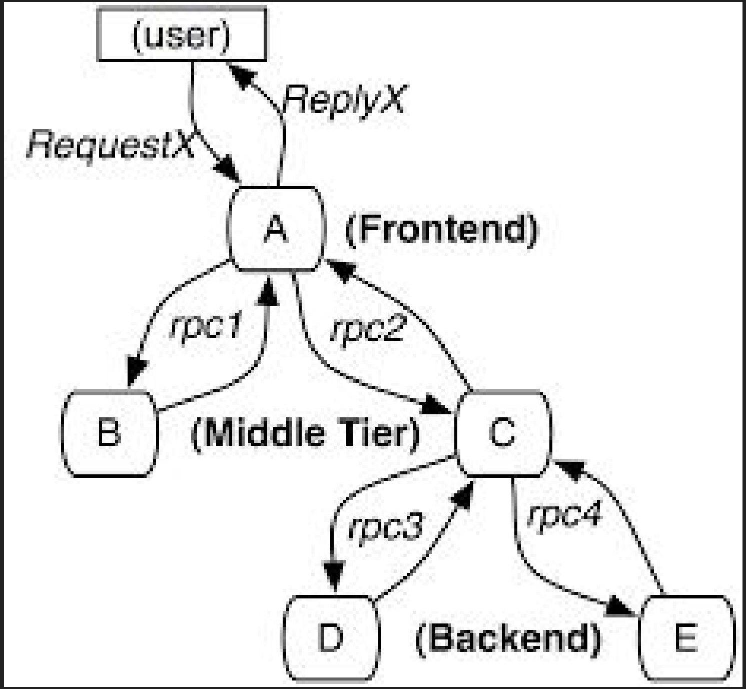
Microservice Inspiration

What would Sherlock do?

RESEARCH

What are other companies doing?

- Inspiration from Google's Dapper
- constant deployments means we need a dynamic solution
- can understand real-time system behaviour
- helps to understand exceptions



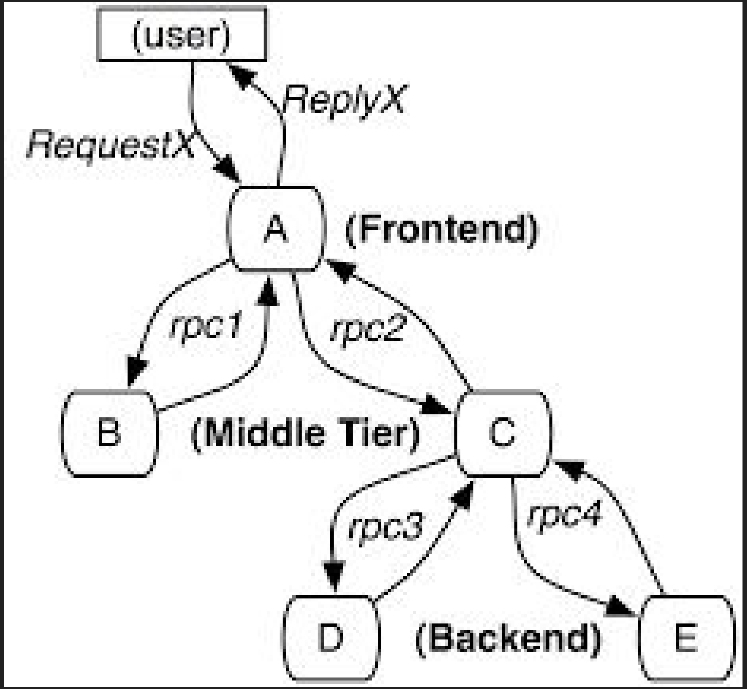
Google's Dapper Call Tree

#ohsogoogley

Bright Idea: what if we link our microservice calls?

This will help to:

- Troubleshoot issues
- Find points of stress in the system
- Allocate resources (people and systems)



Google's Dapper Call Tree

#brightidea

Hootsuite’s Feather Finder	Google’s Dapper
● UUID List in the request header ● **in-band:** trace is inside of the request itself ● **2 points of contact with duration**	● Instrument RPC code ● **out-of-band**: trace is outside of the request tree ● **4 points of contact** ● **more accurate timing data**

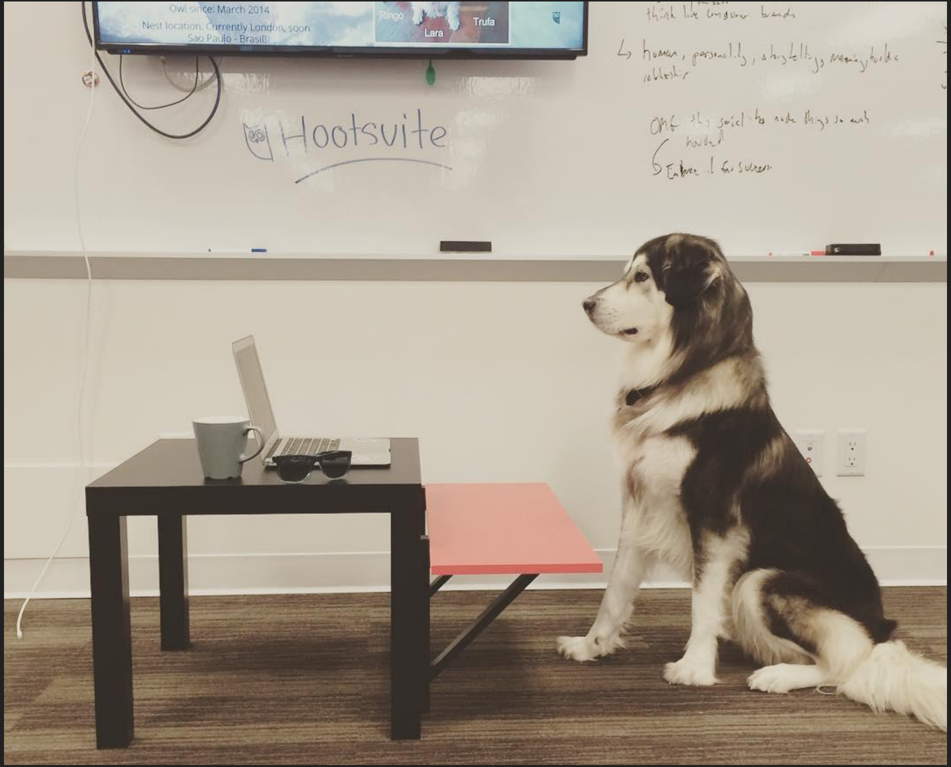
Is this enough information for us to deduce, Sherlock style?

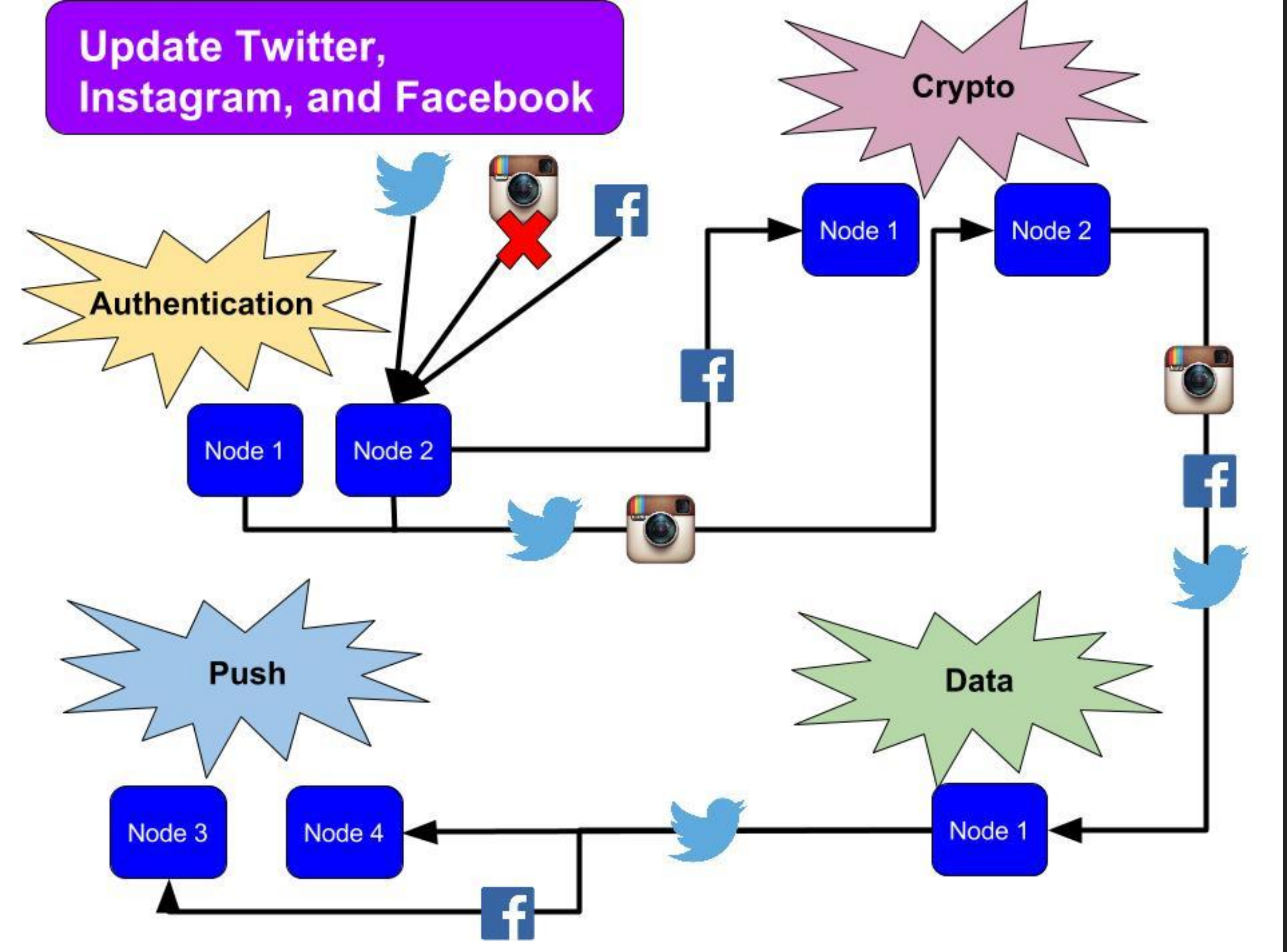
Yes, the **duration** of each call and the complete list of microservices in a call is helpful for most cases.

#featherfinderlite

Microservice Mystery

Back to the Case: Let's try out our Call Tree





Can you spot the microservice call that failed?

The call from Data to Push has failed for Instagram.

What are the implications of this problem?

This is a very difficult problem to solve, and can result in a dangling reference

#featherfindercalltree

Project Feather Finder?

This is a great idea! Let’s code it up!

#socloseyetsofar

How can we show the usefulness of this tool to all developers?

- 2-day company wide hackathon
- Integrate a tracing system by reusing ELK stack
- Embed information in our requests
- Reuse the existing logging mechanisms in PHP and Scala

Project Feather Finder Growth

Resources

http://code.hootsuite.com/elk-stack-101/

http://code.hootsuite.com/my-first-week-in-hypergrowth/

http://twitter.github.io/zipkin/

The Verification of a Distributed System (short overview from Twitter)

No compromises: distributed transactions with consistency, availability, and performance (RDMA)

Thank you! Questions?

#hazquestions?