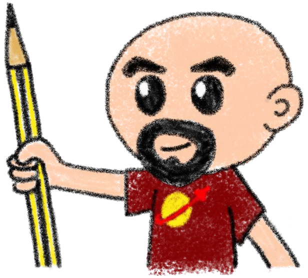
GDG Le Mans

2020-04-15

Monitoring OVH: 350k servers, 30 DCs... and one Metrics platform

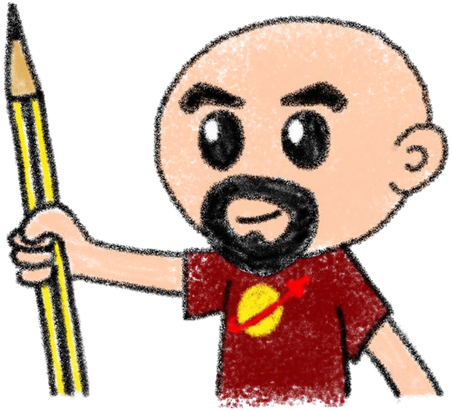
Horacio Gonzalez

@LostInBrittany



Who are we?

Introducing myself and introducing ~~OVH~~ OVHcloud



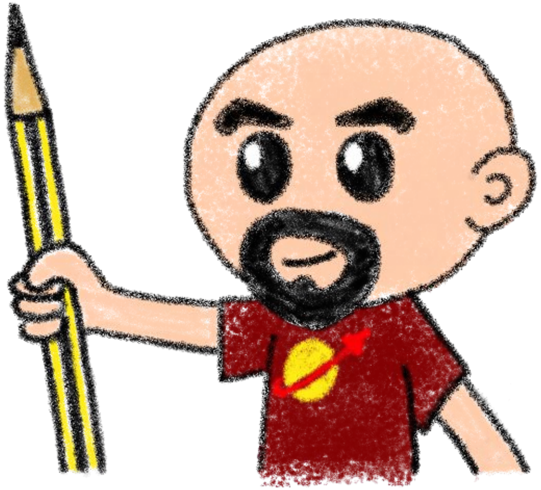
Horacio Gonzalez

@LostInBrittany

Spaniard lost in Brittany, developer, dreamer and all-around geek

OVHcloud

Team DevRel



DevFest du Bout du Monde

Finist Devs

Google Developers Experts 2019

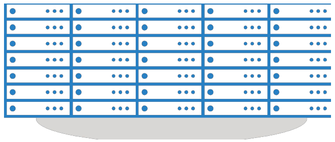
Web Technologies GDE

Flutter

OVHcloud: A Global Leader

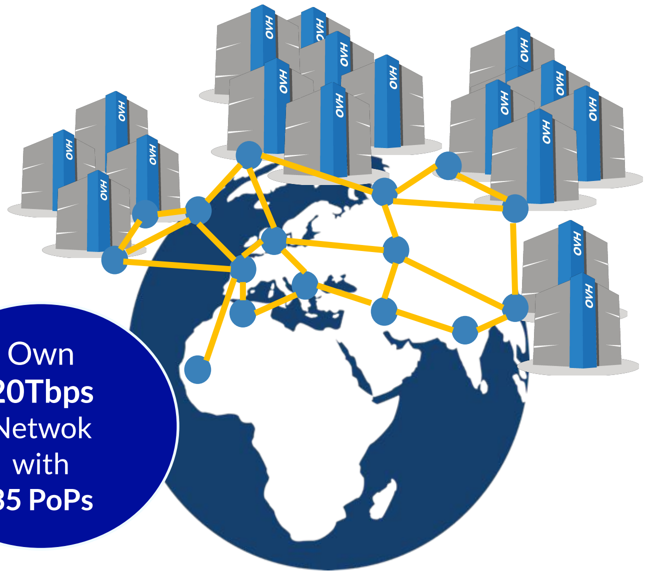
250k Private cloud VMs running

1 Dedicated IaaS Europe



Hosting capacity : **1.3M** Physical Servers

360k Servers already deployed



Own **20Tbps** Netwok with **35 PoPs**

30 Datacenters

> **1.3M** Customers in **138** Countries

OVHcloud: Our solutions

Cloud

VPS

Public Cloud

Private Cloud

Serveur dédié

Cloud Desktop

Hybrid Cloud

Mobile Hosting

Containers

Compute

Database

Object Storage

Securities

Messaging

Web Hosting

Domain names

Email

CDN

Web hosting

MS Office

MS solutions

Telecom

VoIP

SMS/Fax

Virtual desktop

Cloud HubiC

Over theBox

Once upon a time...

Because I love telling tales

This talk is about a tale...

A true one nevertheless

And as in most tales

It begins with a mission

And a band of heroes

Engulfed into the adventure

They fight against mishaps

And all kind of foes

They build mighty fortresses

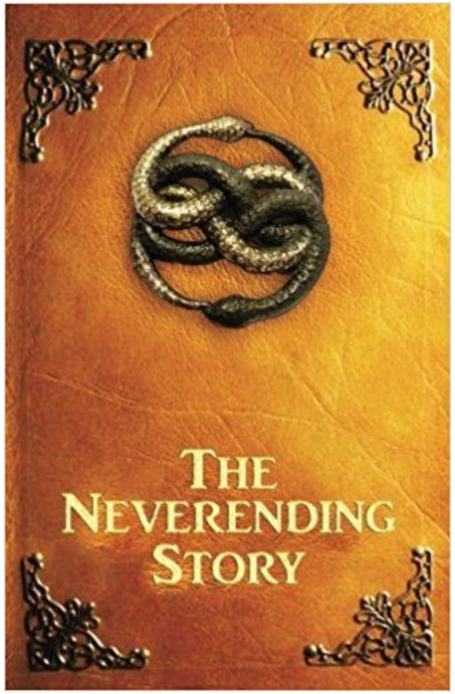
Pushing the limits of possible

And defend them day after day

www.desktopextreme.com | Lord of the Rings - Return of the King

Against all odds

But we don't know yet the end

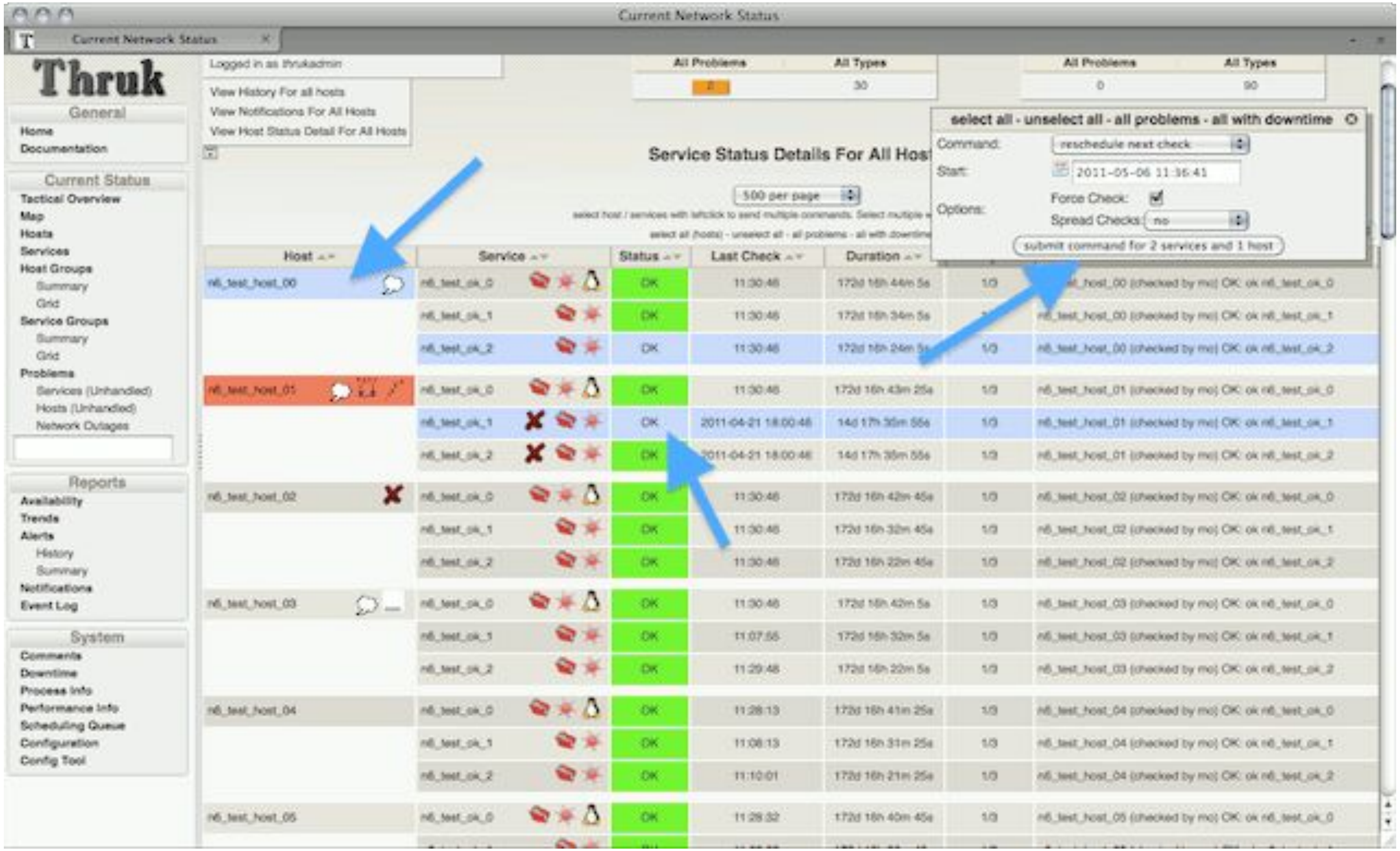


Because this tale isn't finished yet

It begins with a mission

Build a metrics platform for OVH

A long time ago...



Current Network Status

Thruk

Logged in as thrukadmin

View History For all hosts
View Notifications For All Hosts
View Host Status Detail For All Hosts

General
- Home
- Documentation

Current Status
- Tactical Overview
- Map
- Hosts
- Services
- Host Groups
  - Summary
  - Grid
- Service Groups
  - Summary
  - Grid
- Problems
  - Services (Unhandled)
  - Hosts (Unhandled)
  - Network Outages

Reports
- Availability
- Trends
- Alerts
  - History
  - Summary
- Notifications
- Event Log

System
- Comments
- Downtime
- Process Info
- Performance Info
- Scheduling Queue
- Configuration
- Config Tool

All Problems	All Types
2	30

All Problems	All Types
0	90

Service Status Details For All Host

500 per page

select host / services with leftclick to send multiple commands. Select multiple

select all (hosts) - unselect all - all problems - all with downtime

select all - unselect all - all problems - all with downtime

Command: reschedule next check

Start: 2011-05-06 11:36:41

Options: Force Check: ☑
Spread Checks: no

Host	Service	Status	Last Check	Duration		
n6_test_host_00	n6_test_ok_0	OK	11:30:46	172d 16h 44m 5s	1/3	_host_00 (checked by me) OK: ok n6_test_ok_0
	n6_test_ok_1	OK	11:30:46	172d 16h 34m 5s	1/3	n6_test_host_00 (checked by me) OK: ok n6_test_ok_1
	n6_test_ok_2	OK	11:30:46	172d 16h 24m 5s	1/3	n6_test_host_00 (checked by me) OK: ok n6_test_ok_2
n6_test_host_01	n6_test_ok_0	OK	11:30:46	172d 16h 43m 25s	1/3	n6_test_host_01 (checked by me) OK: ok n6_test_ok_0
	n6_test_ok_1	OK	2011-04-21 18:00:46	14d 17h 35m 55s	1/3	n6_test_host_01 (checked by me) OK: ok n6_test_ok_1
	n6_test_ok_2	OK	2011-04-21 18:00:46	14d 17h 35m 55s	1/3	n6_test_host_01 (checked by me) OK: ok n6_test_ok_2
n6_test_host_02	n6_test_ok_0	OK	11:30:46	172d 16h 42m 45s	1/3	n6_test_host_02 (checked by me) OK: ok n6_test_ok_0
	n6_test_ok_1	OK	11:30:46	172d 16h 32m 45s	1/3	n6_test_host_02 (checked by me) OK: ok n6_test_ok_1
	n6_test_ok_2	OK	11:30:46	172d 16h 22m 45s	1/3	n6_test_host_02 (checked by me) OK: ok n6_test_ok_2
n6_test_host_03	n6_test_ok_0	OK	11:30:46	172d 16h 42m 5s	1/3	n6_test_host_03 (checked by me) OK: ok n6_test_ok_0
	n6_test_ok_1	OK	11:07:55	172d 16h 32m 5s	1/3	n6_test_host_03 (checked by me) OK: ok n6_test_ok_1
	n6_test_ok_2	OK	11:29:48	172d 16h 22m 5s	1/3	n6_test_host_03 (checked by me) OK: ok n6_test_ok_2
n6_test_host_04	n6_test_ok_0	OK	11:28:13	172d 16h 41m 25s	1/3	n6_test_host_04 (checked by me) OK: ok n6_test_ok_0
	n6_test_ok_1	OK	11:08:13	172d 16h 31m 25s	1/3	n6_test_host_04 (checked by me) OK: ok n6_test_ok_1
	n6_test_ok_2	OK	11:10:01	172d 16h 21m 25s	1/3	n6_test_host_04 (checked by me) OK: ok n6_test_ok_2
n6_test_host_05	n6_test_ok_0	OK	11:28:32	172d 16h 40m 45s	1/3	n6_test_host_05 (checked by me) OK: ok n6_test_ok_0

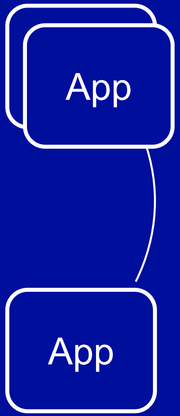
A long time ago...

Monitoring: **Does** the system works?

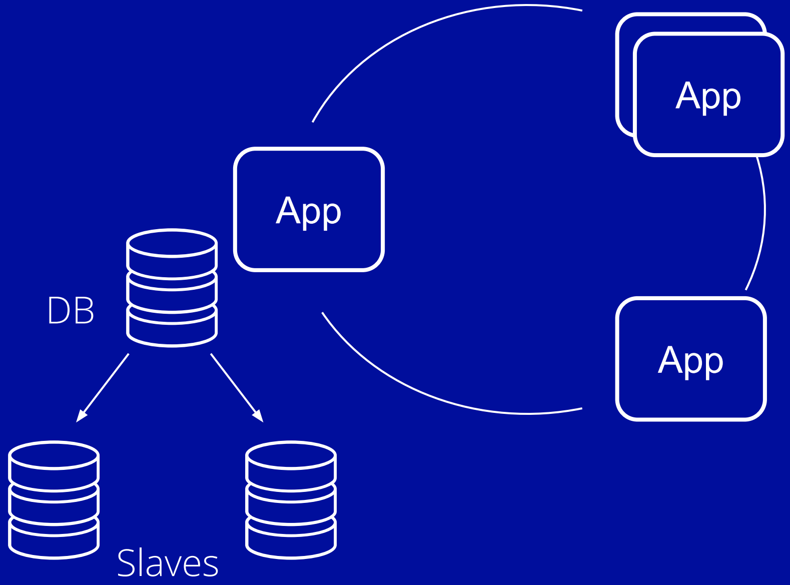
Moving from monolith to µservices

App

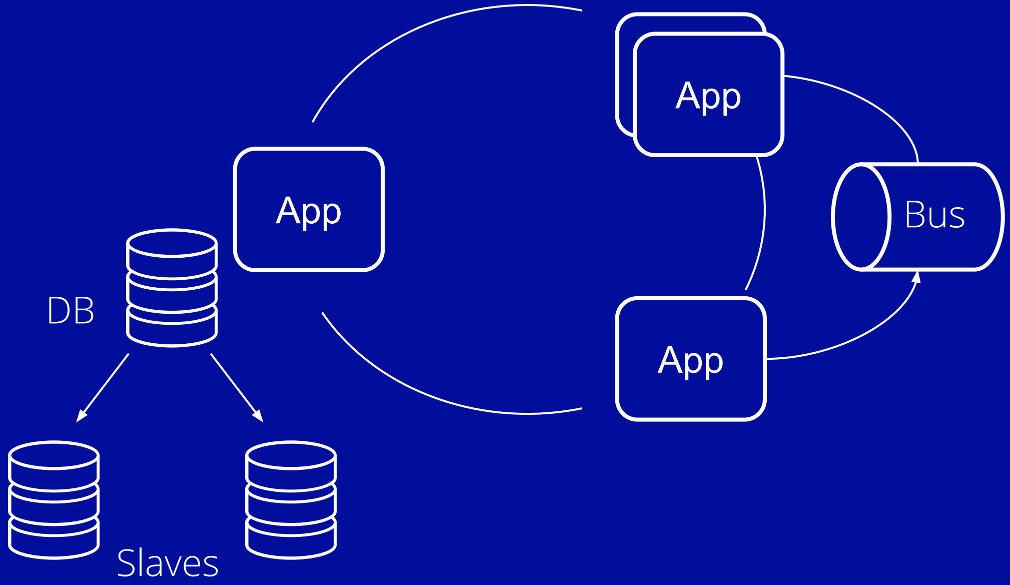
Moving from monolith to µservices



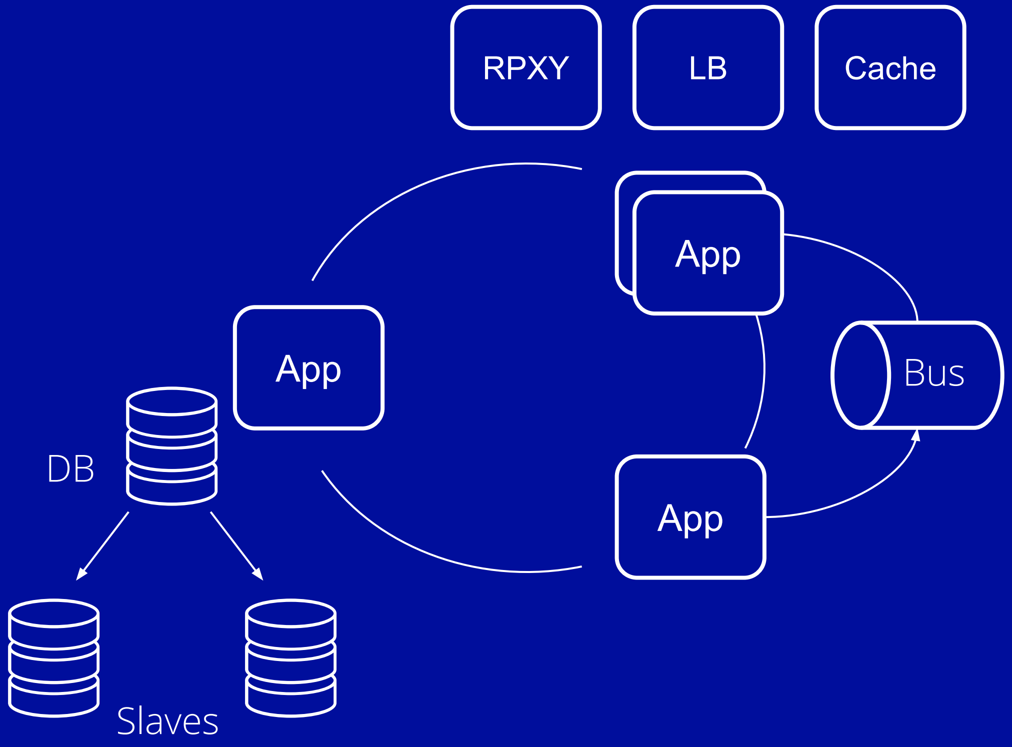
Moving from monolith to µservices



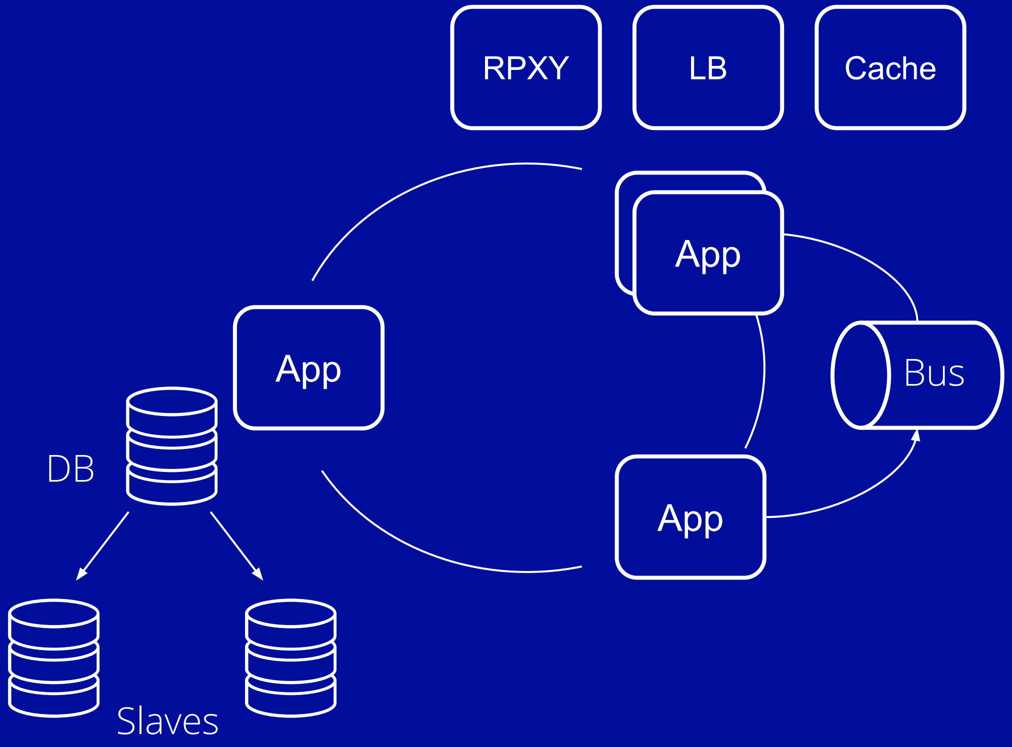
Moving from monolith to µservices



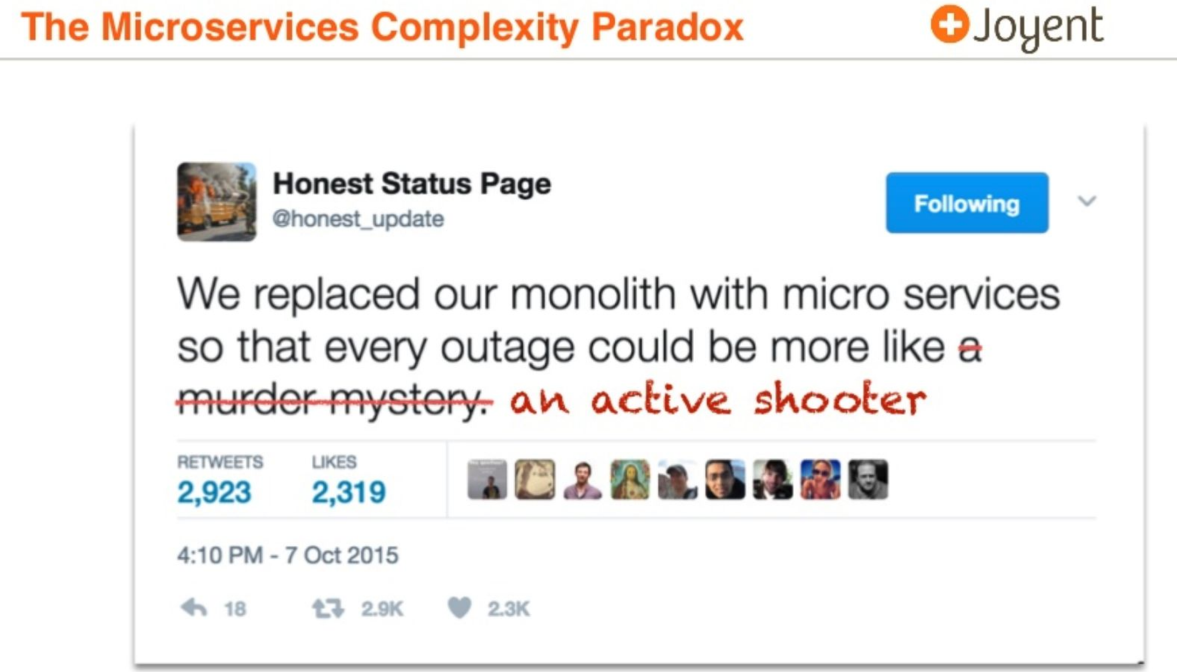
Moving from monolith to µservices



What could go wrong?



Microservices are a distributed system



The Microservices Complexity Paradox

Joyent

Honest Status Page
@honest_update

We replaced our monolith with micro services so that every outage could be more like ~~a murder mystery.~~ an active shooter

RETWEETS 2,923 LIKES 2,319

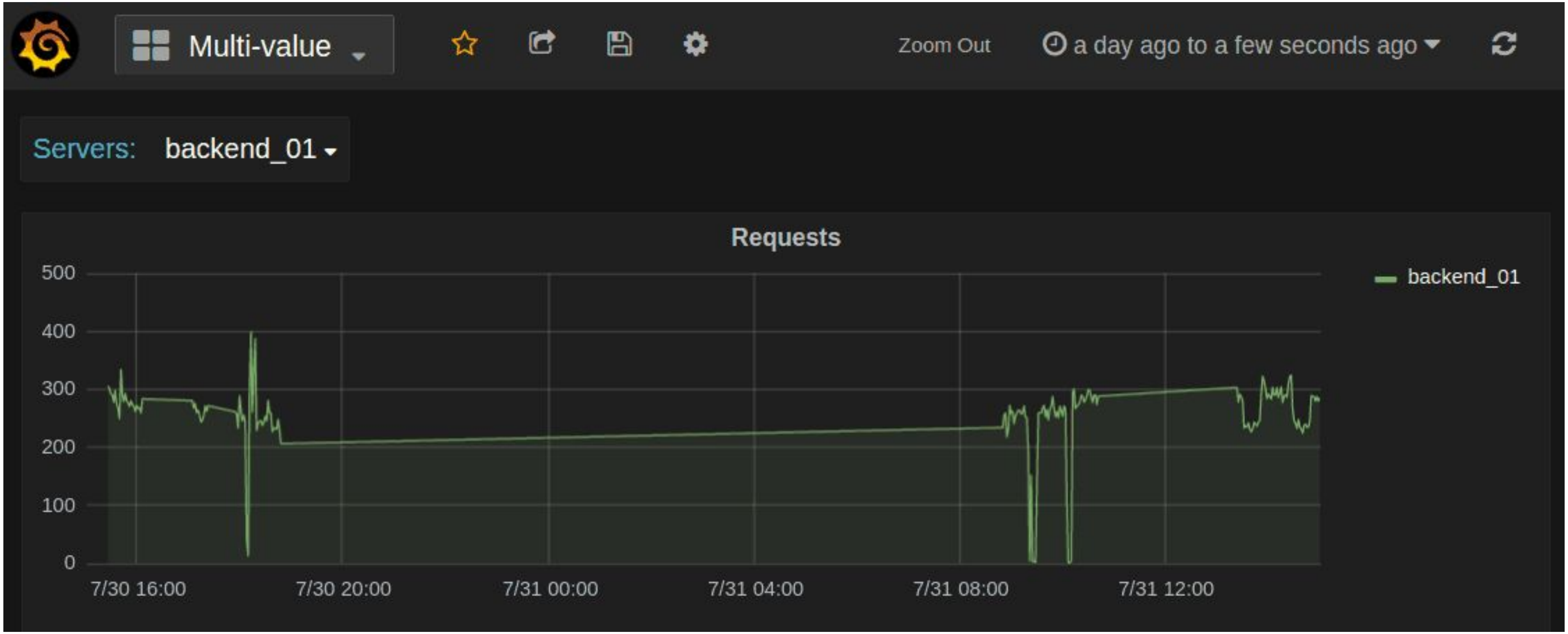
4:10 PM - 7 Oct 2015

GOTO 2017 • Debugging Under Fire: Keep your Head when Systems have Lost their Mind • Bryan Cantrill

We need to have insights

Observability: **How** the system works?

OVH decided go metrics-oriented



A metrics platform for OVH

For **all** OVH

Building OVH Metrics

One Platform to unify them all,
One Platform to find them,
One Platform to bring them all
and in the Metrics monitor them

What is OVH Metrics?

Managed Cloud Platform
for Time Series

OVH monitoring story

We had lots of partial solutions...

OpenTSDB

mongoDB®

graphite

influxdb

OVH monitoring story

One Platform to unify them all

What should we build it on?

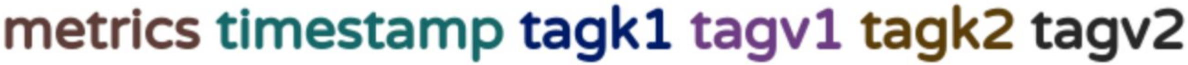
OVH monitoring story

Including a really big

OPENTSDB

OpenTSDB drawbacks

OpenTSDB RowKey Design



metrics timestamp tagk1 tagv1 tagk2 tagv2

!

OpenTSDB Rowkey design flaws

- .*regex.* => full table scans
- High cardinality issues (Query latencies)

↓

We needed something able to manage **hundreds of millions** time series

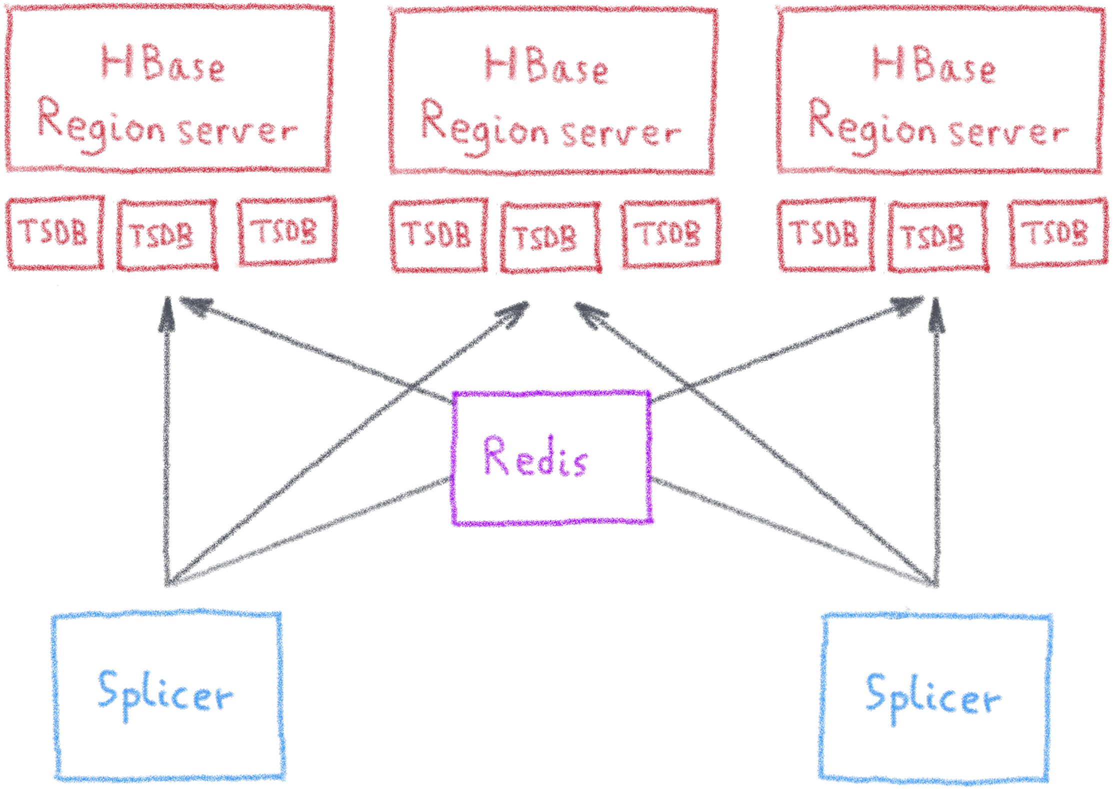
↓

OpenTSBD didn't **scale** for us

OpenTSDB other flaws

- Compaction (or append writes)
- /api/query : 1 endpoint per function?
- Asynchronous
- Unauthenticated
- ...

Scaling OpenTSDB



Metrics needs

First **need**:

To be **massively** scalable

Analytics is the key to success

Fetching data is only the tip of the iceberg

Analysing metrics data

To be scalable, analysis must be done in the database, not in user's computer

Metrics needs

Second **need**:

To have **rich query** capabilities

Enter Warp 10...

Open-source
Time series
Database

More than a Time Series DB

Warp 10 is a software platform that

- Ingests and stores time series
- Manipulates and analyzes time series

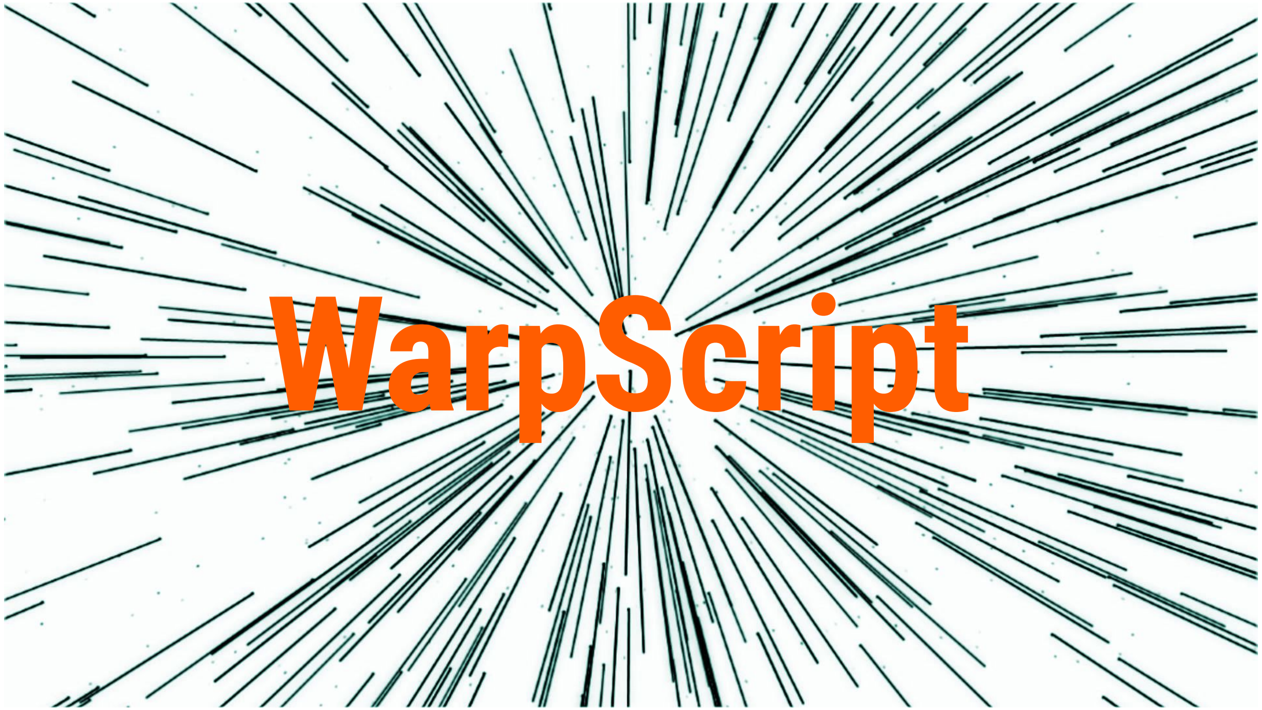
Manipulating Time Series with Warp 10

A true Time Series analysis toolbox

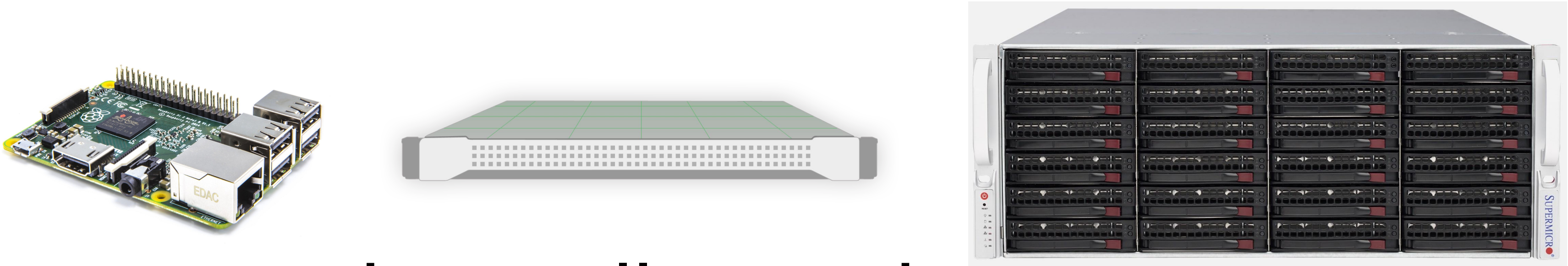
- Hundreds of functions
- Manipulation frameworks
- Analysis workflow

Manipulating Time Series with Warp 10

A Time Series manipulation language



Did you say scalability?



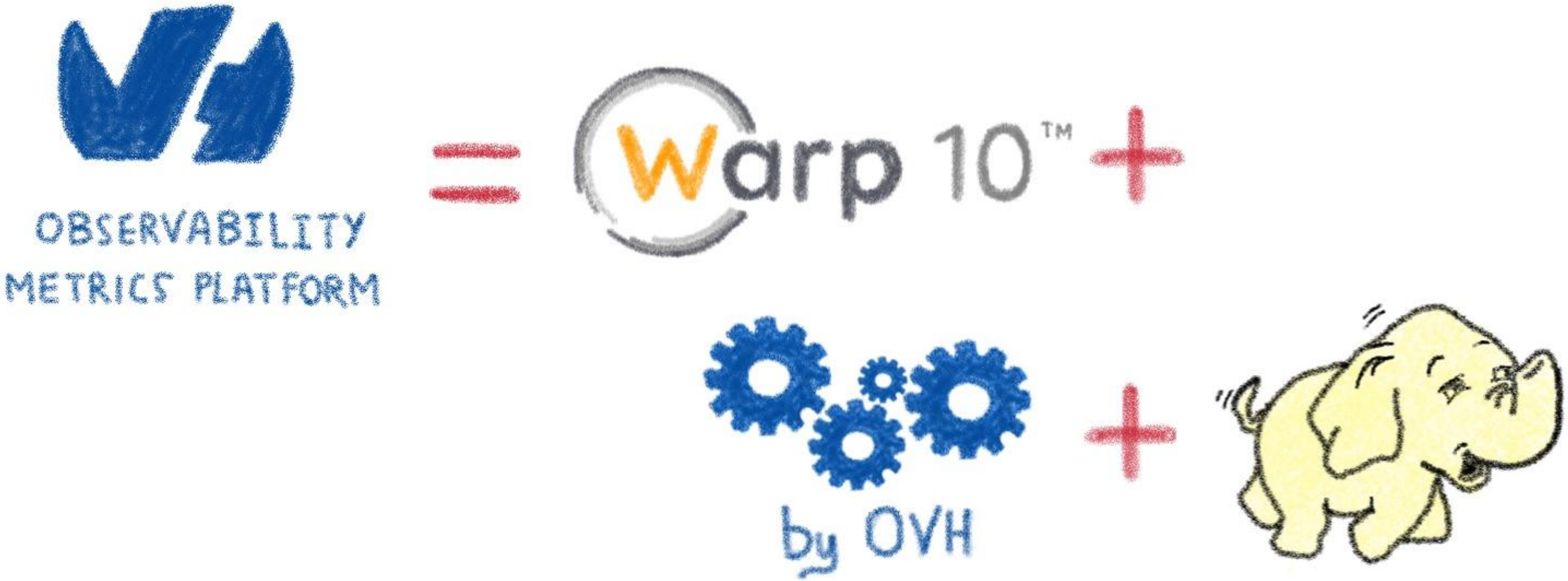
From the smallest to the largest...

More Warp 10 goodness

- Secured & multi tenant
- In memory Index
- No cardinality issues
- Lockfree ingestion
- WarpScript Query Language
- Support more data types

- Synchronous (transactions)
- Better Performance
- Better Scalability
- Versatile
  (standalone, distributed)

OVH Observability Metrics Platform



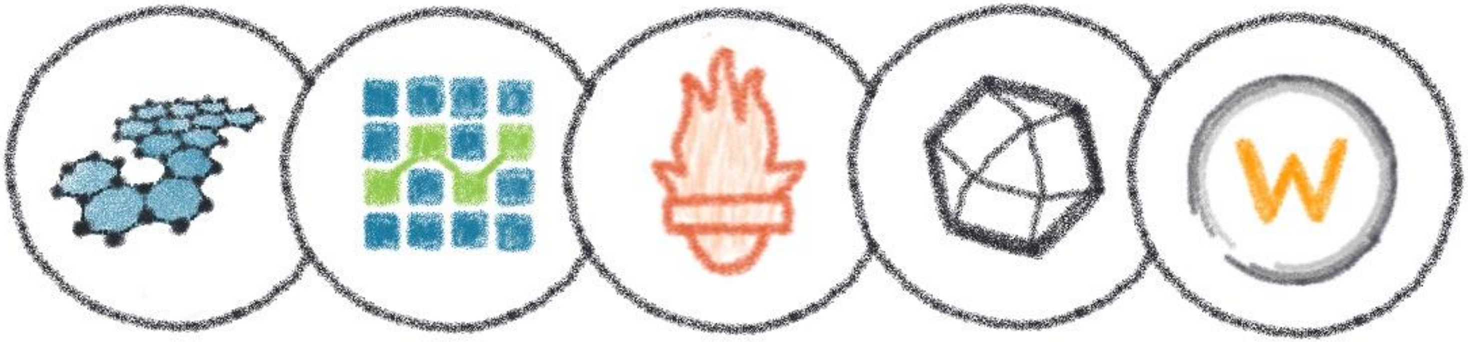
Building an ecosystem

From Warp 10 to OVH Metrics

What protocols should we support?

Who must do the effort?

Open source monitoring tools



Open source monitoring tools

Open source monitoring tools

Open source monitoring tools

Prometheus

Open source monitoring tools

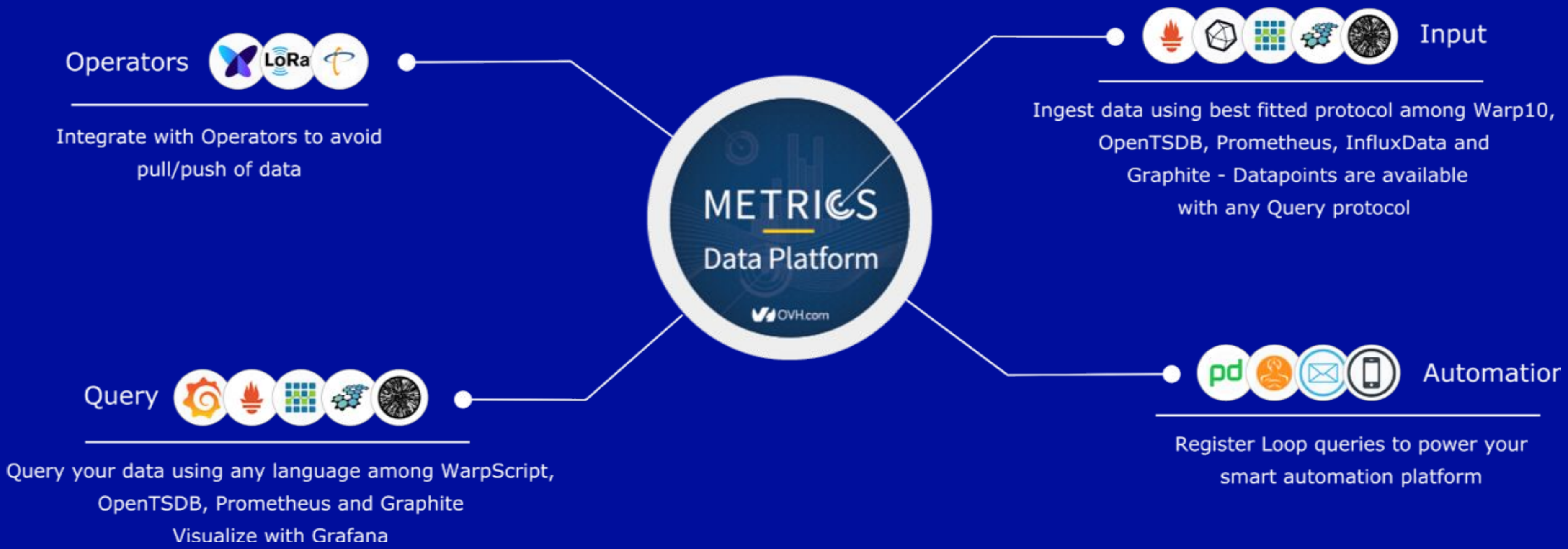
Open source monitoring tools

Open source monitoring tools

Why choose?

Let’s support all of them!

Metrics Platform



Operators

Integrate with Operators to avoid pull/push of data

Input

Ingest data using best fitted protocol among Warp10, OpenTSDB, Prometheus, InfluxData and Graphite - Datapoints are available with any Query protocol

Query

Query your data using any language among WarpScript, OpenTSDB, Prometheus and Graphite
Visualize with Grafana

Automatior

Register Loop queries to power your smart automation platform

Metrics Platform

https:// **graphite** .<region>.metrics.ovh.net

influx

opentsdb

prometheus

Warp10

tsl

...

Metrics Platform

graphite

influx

https:// opentsdb .<region>.metrics.ovh.net

prometheus

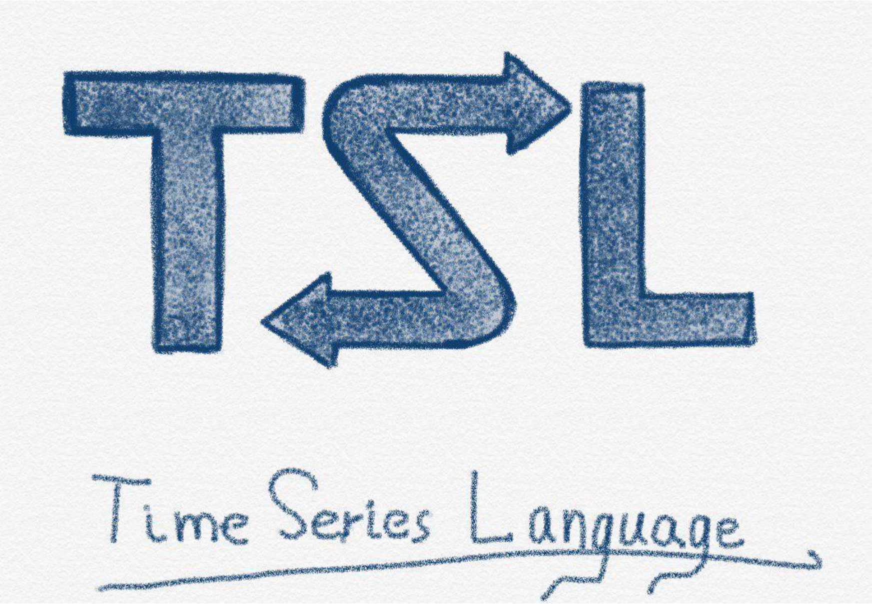
Warp10

tsl

...

TSL

```
select("cpu.usage_system")
 .where("cpu~cpu[0-7]*")
 .last(12h)
 .sampleBy(5m,max)
 .groupBy(mean)
 .rate()
```

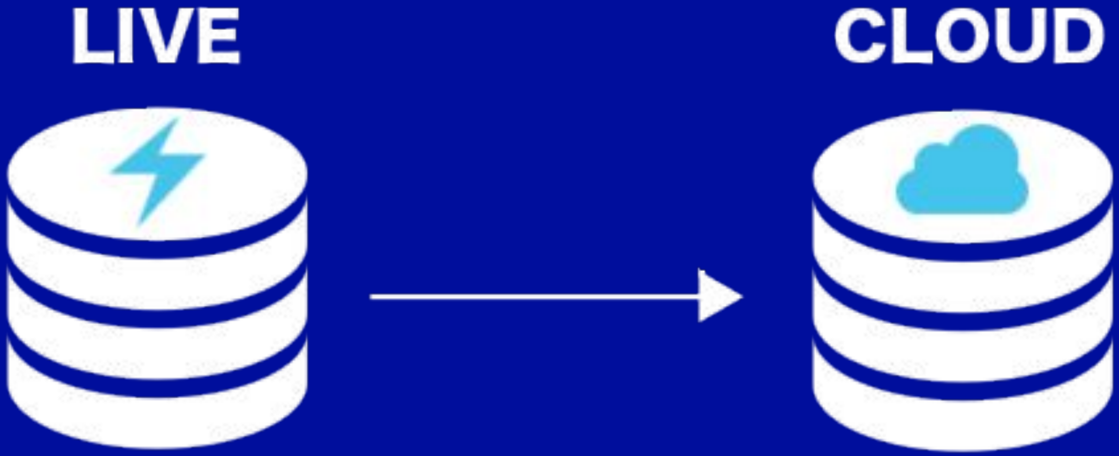


github.com/ovh/tsl

Metrics Live

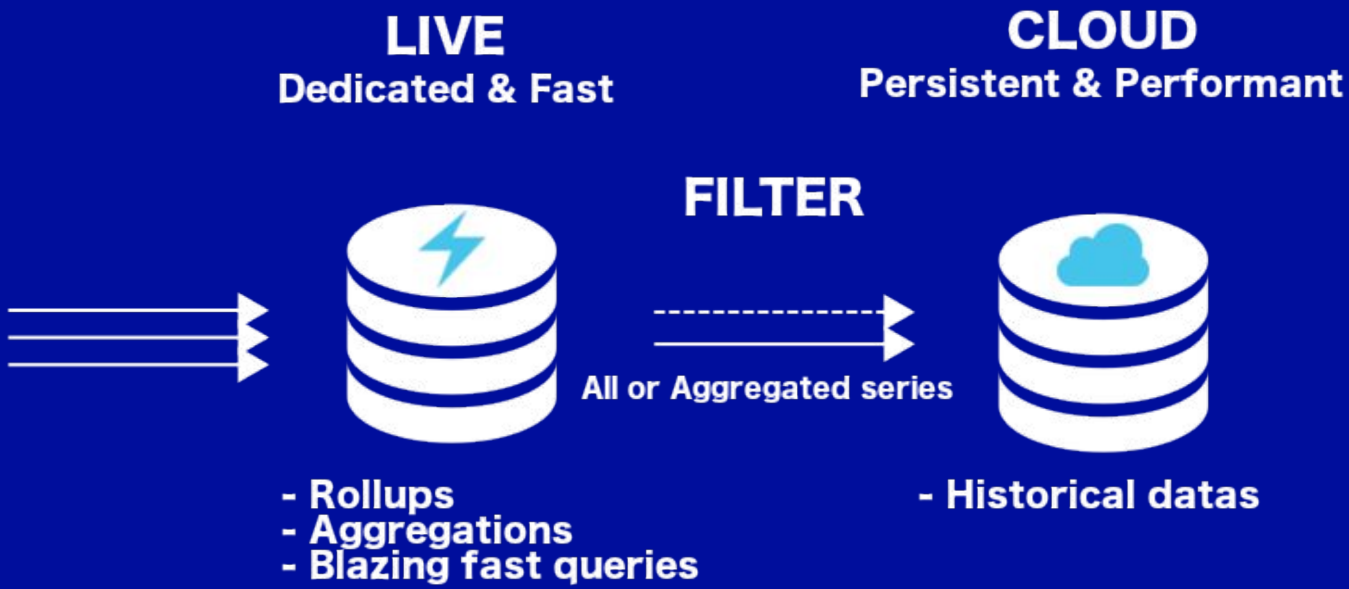
In-memory, high-performance Metrics instances

In-memory: Metrics live



millions of writes/s

In-memory: Metrics live



In-memory: Metrics live

STAGE 1

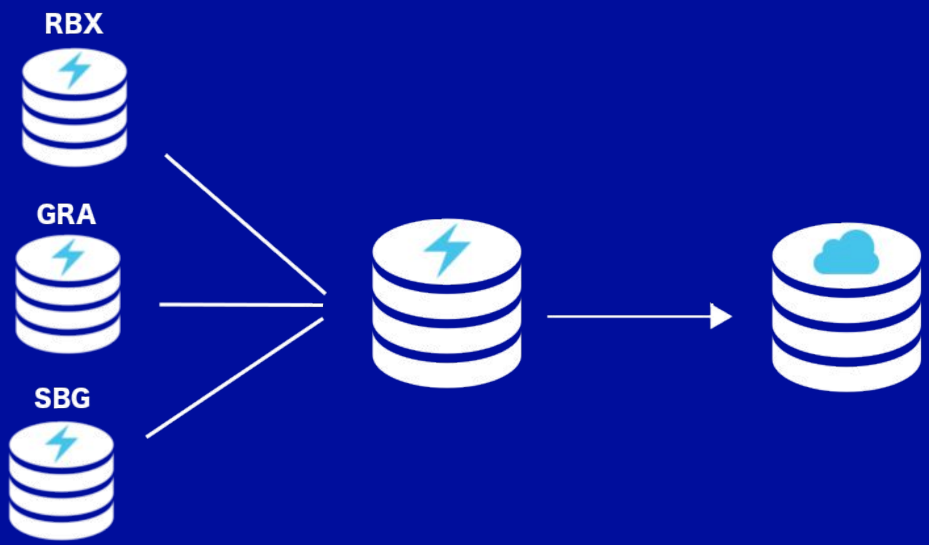
- Short retention - hours
- Fine grained monitoring
- Raw data

STAGE 2

- Short retention - days
- Consolidated aggregations
- Global infra monitoring

STAGE 3

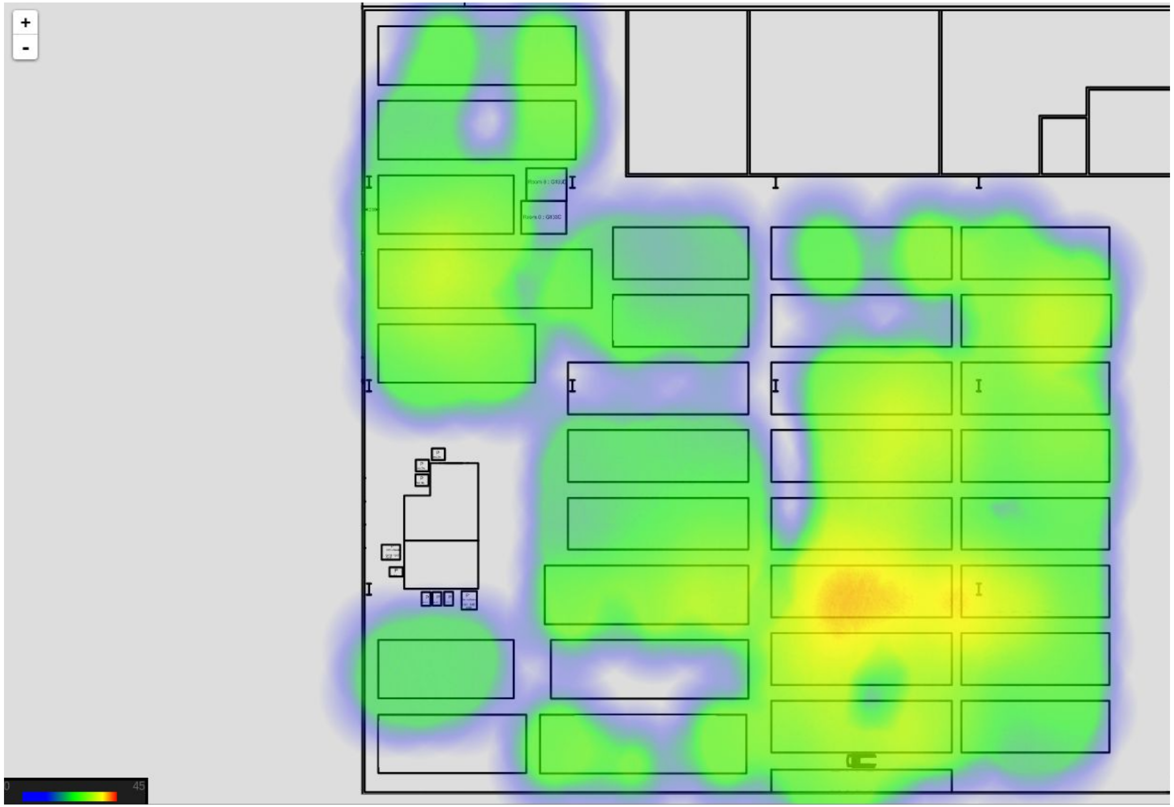
- Customer metrics
- Historical datas



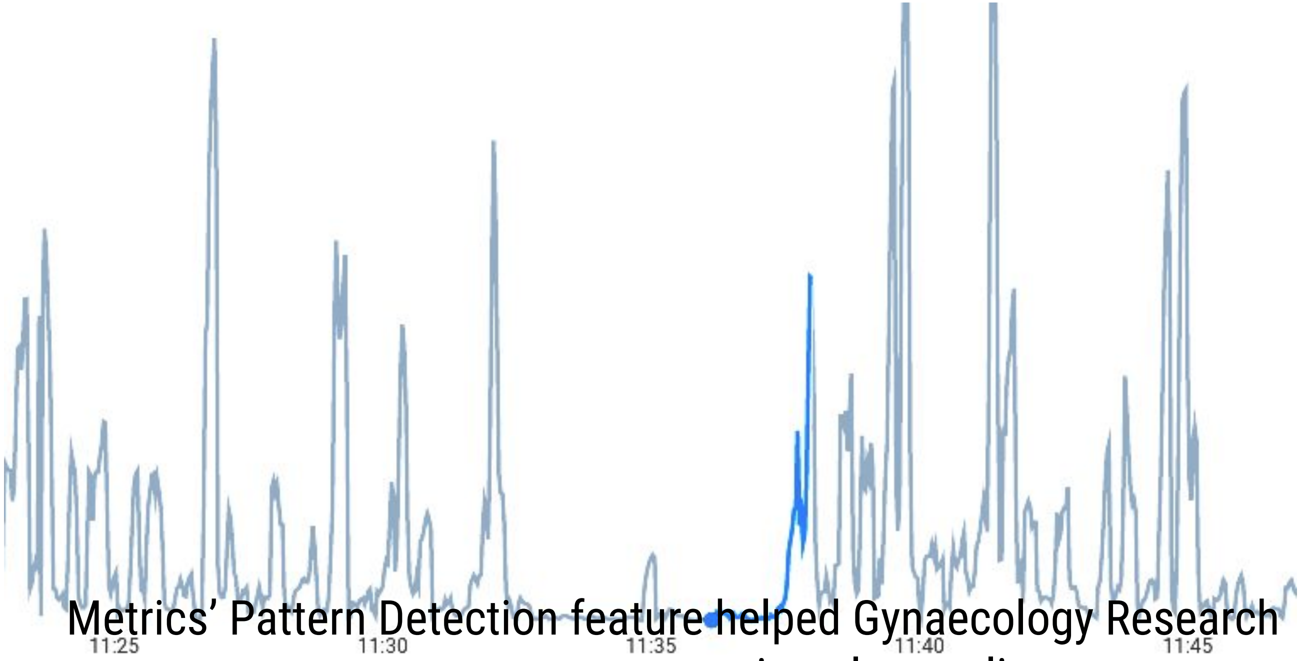
Monitoring is only the beginning

OVH Metrics answer to many other use cases

Graveline rack's temperature



Even medical research...



Metrics’ Pattern Detection feature helped Gynaecology Research
to prove patterns on perinatal mortality

Use cases families

- Billing ....(e.g. bill on monthly max consumption)
- Monitoring ....(APM, infrastructure,appliances,...)
- IoT ....(Manage devices, operator integration, ...)
- Geo Location ....(Manage localized fleets)

Use cases

- DC Temperature/Elec/Cooling map
- Pay as you go billing (PCI/IPLB)
- GSCAN
- Monitoring
- ML Model scoring (Anti-Fraude)
- Pattern Detection for medical applications

SREing Metrics

With a great power
comes a great responsibility

Metrics's metrics

432.000.000.000

datapoints / day

Our stack overview

- More than 666 machines operated by 5 people
- >95% dedicated servers
- No Docker, only SystemD
- Running many Apache projects:
  - Hadoop
  - HBase
  - Zookeeper
  - Flink
- And Warp 10

Our biggest Hadoop cluster

200 datanodes

2.3 PB of **capacity**
8.5Gb/s of **bandwidth**

~60k regions of 10Gb

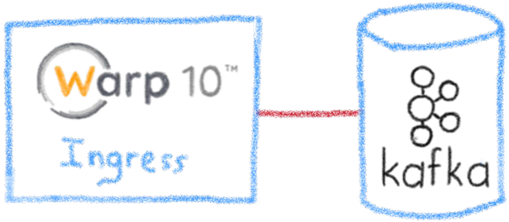
1.5M of **writes**/s
3M of **reads**/s

Hadoop need a lot of ♥

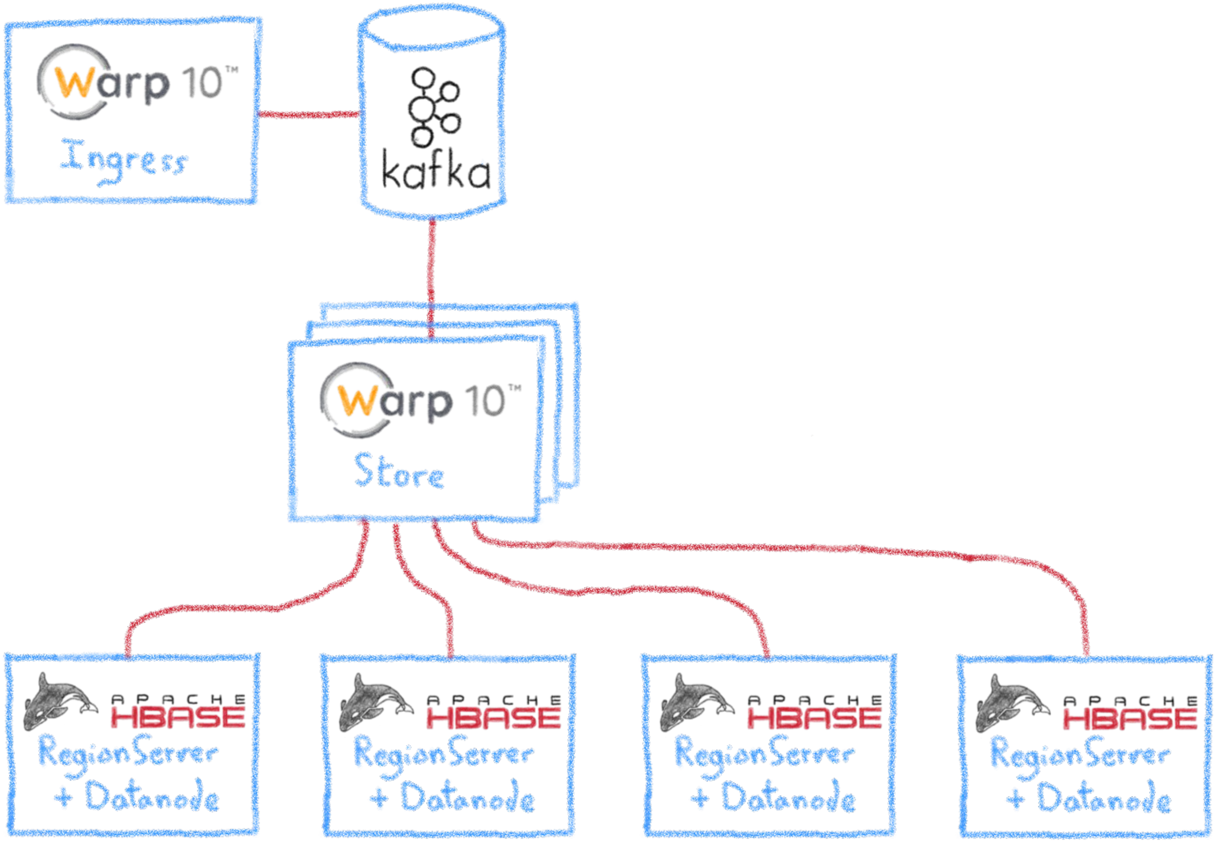
Warp10: distributed overview

Warp 10™
Ingress

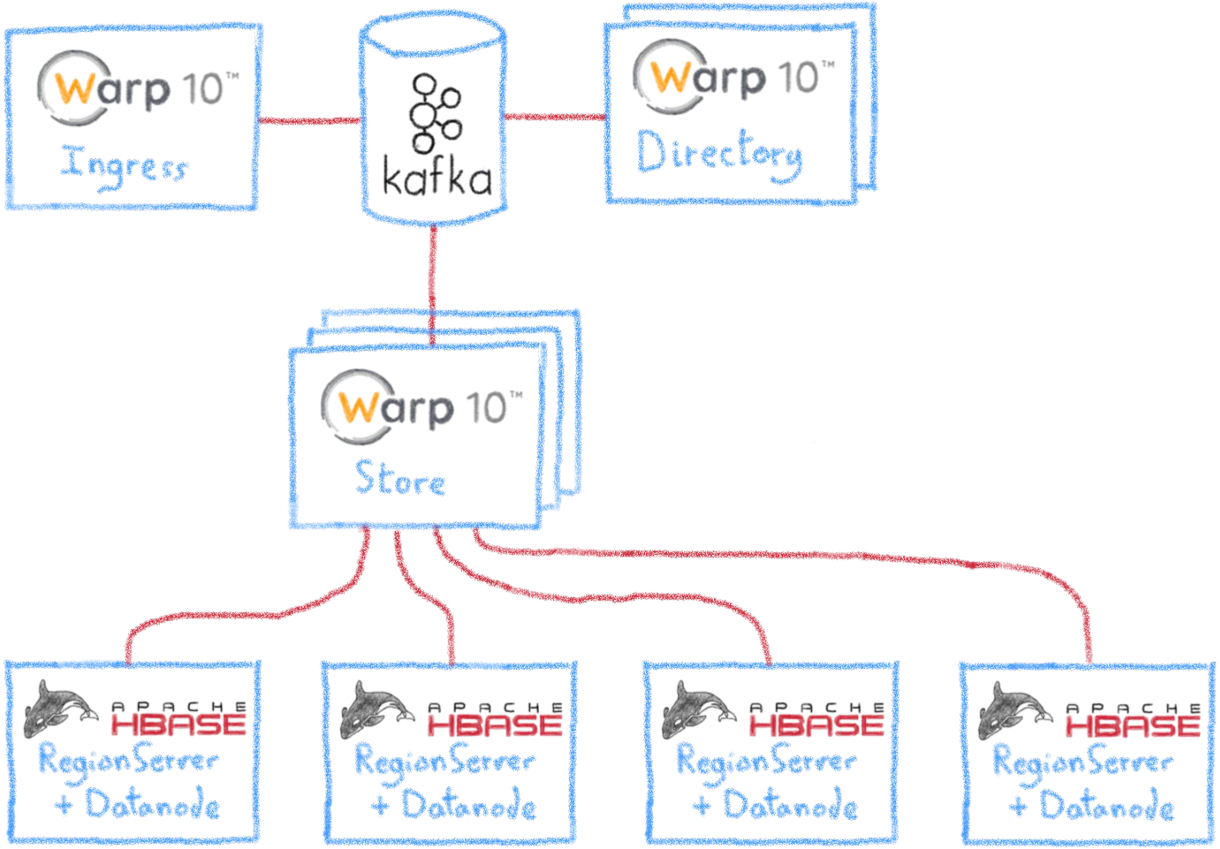
Warp10: distributed overview



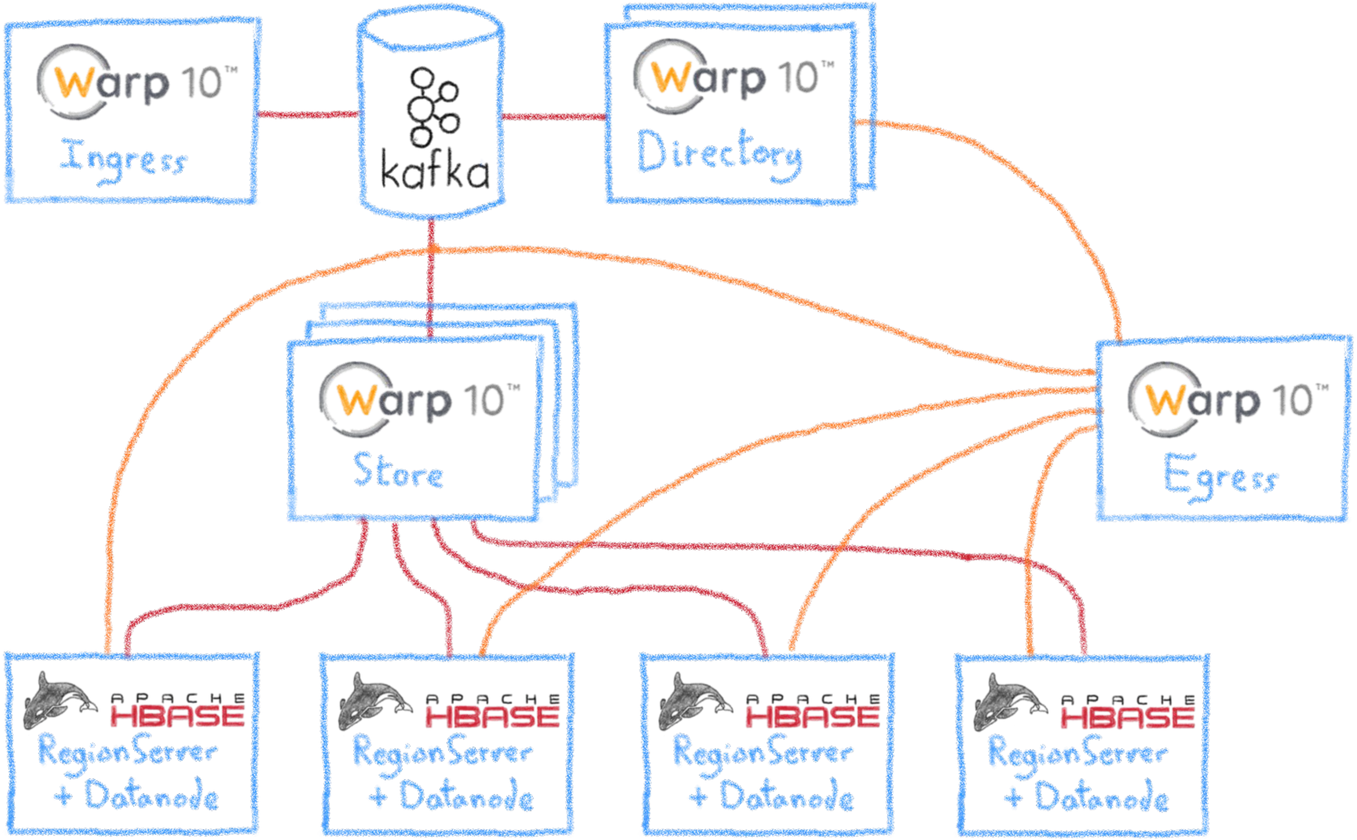
Warp10: distributed overview



Warp10: distributed overview



Warp10: distributed overview



Hadoop nodes

Most of the nodes are the following:

- 16 to 32 cores
- 64 to 128 GB of RAM 😱
- 12 to 16 TB

But, we also have some huge nodes:

- 2x 20 cores (xeon gold)
- 320 GB of RAM 😱 😱
- 12x 4TB of Disk

Warp10 nodes

Ingress (cpu-bound):

- 32 cores
- 128 GB of RAM 😱

Directory (ram-bound):

- 48 cores
- 512 GB of RAM 😱😱😱

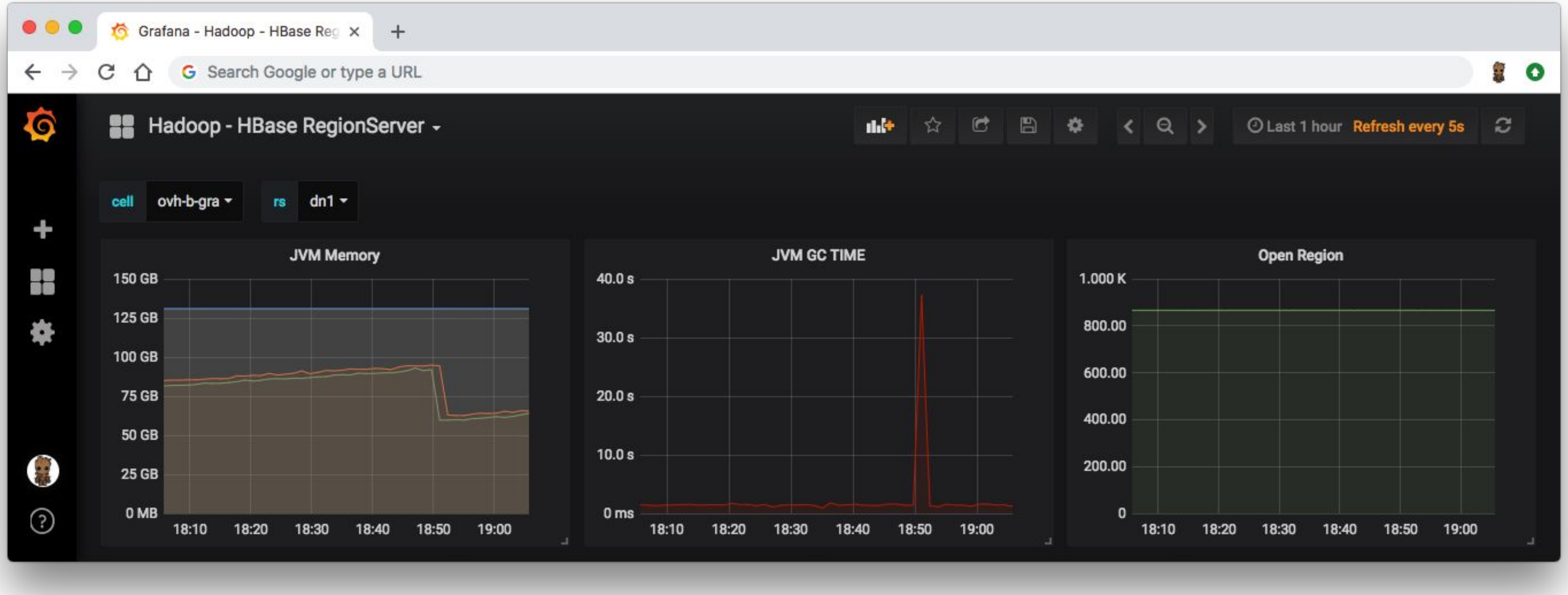
Egress (cpu-bound):

- 32 cores
- 128 GB of RAM 😱

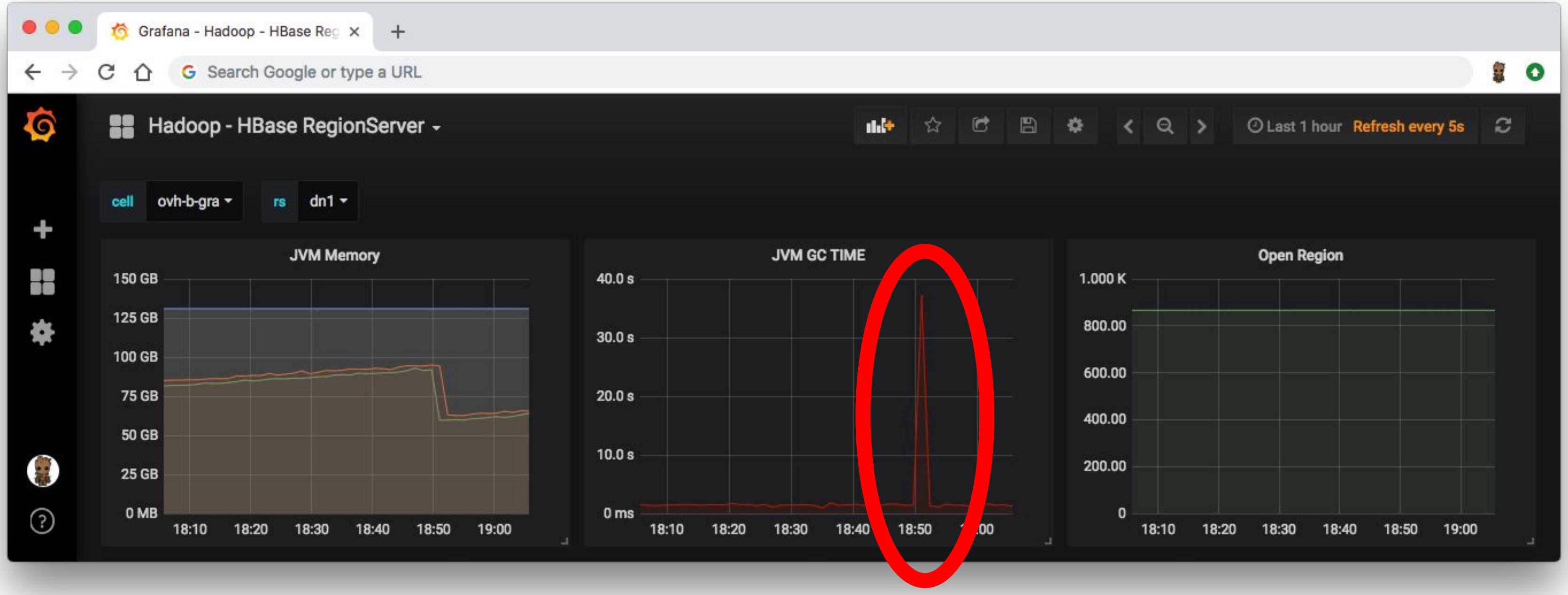
Store (cpu-bound):

- 32 cores
- 128 GB of RAM 😱

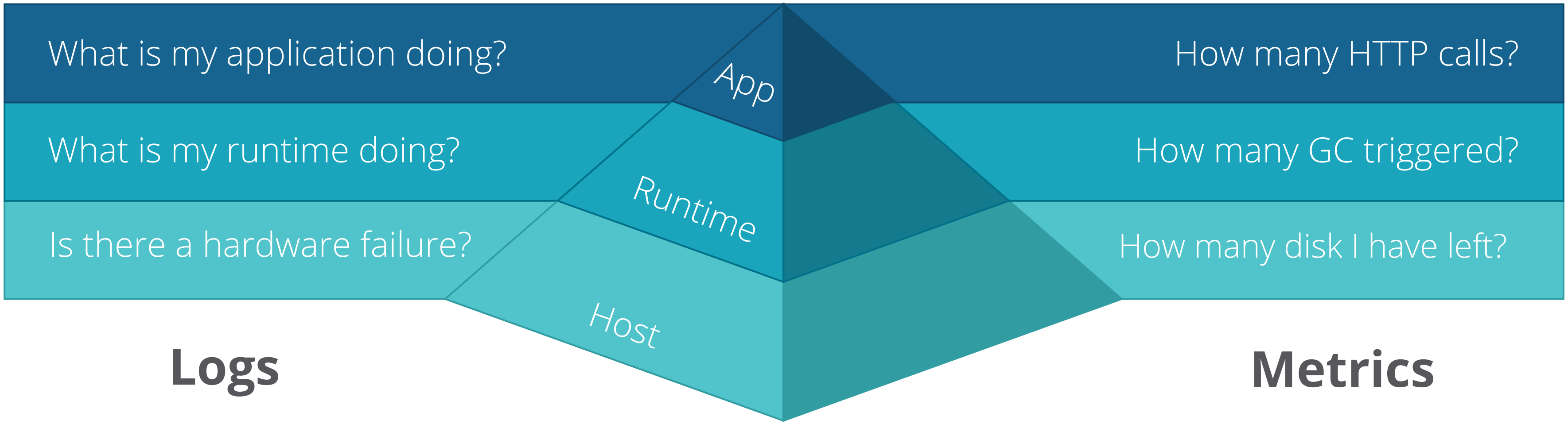
Why you should care?



Why you should care? (>30s) 😱



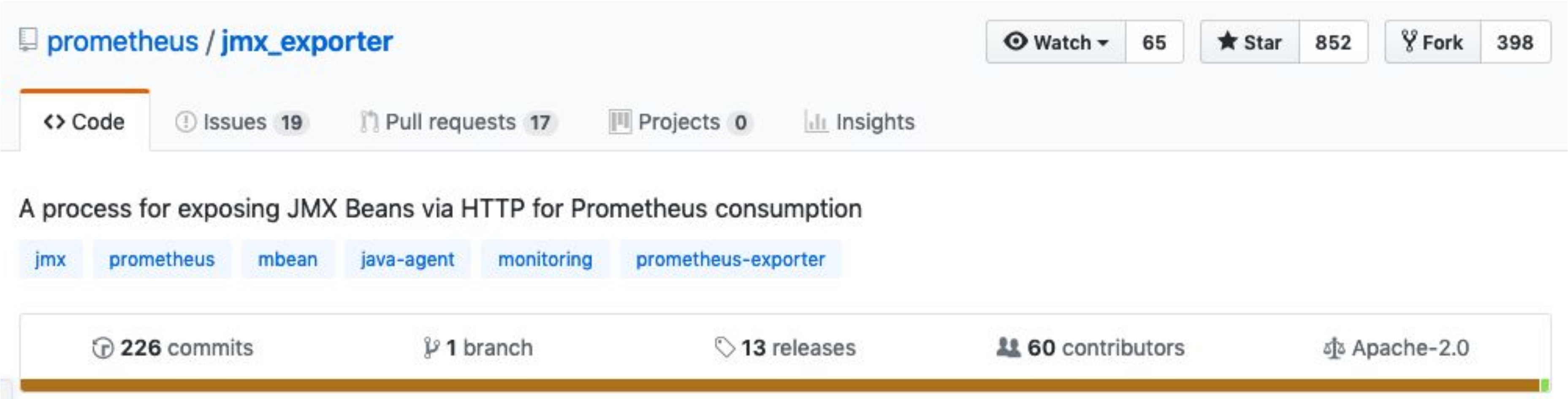
The only way to optimize: measure


What is my application doing?
How many HTTP calls?
App
What is my runtime doing?
How many GC triggered?
Runtime
Is there a hardware failure?
How many disk I have left?
Host

Logs

Metrics

Monitoring JVM with metrics



prometheus / jmx_exporter

Watch 65 | Star 852 | Fork 398

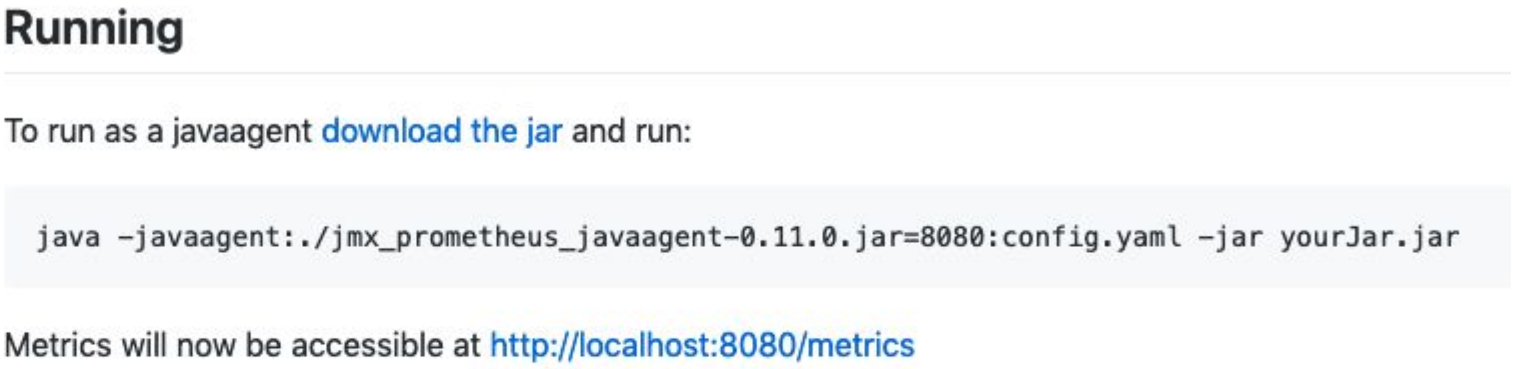
Code | Issues 19 | Pull requests 17 | Projects 0 | Insights

A process for exposing JMX Beans via HTTP for Prometheus consumption

jmx prometheus mbean java-agent monitoring prometheus-exporter

226 commits | 1 branch | 13 releases | 60 contributors | Apache-2.0

Monitoring JVM with metrics



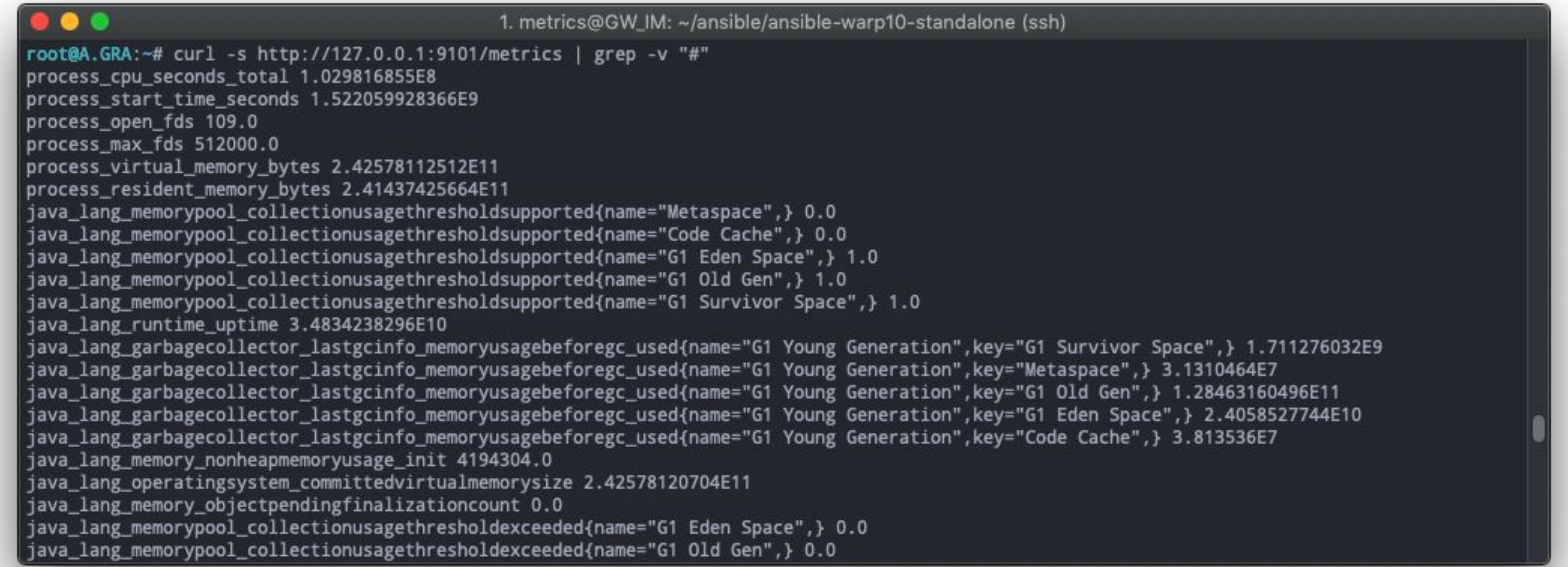
Running

To run as a javaagent download the jar and run:

```
java -javaagent:./jmx_prometheus_javaagent-0.11.0.jar=8080:config.yaml -jar yourJar.jar
```

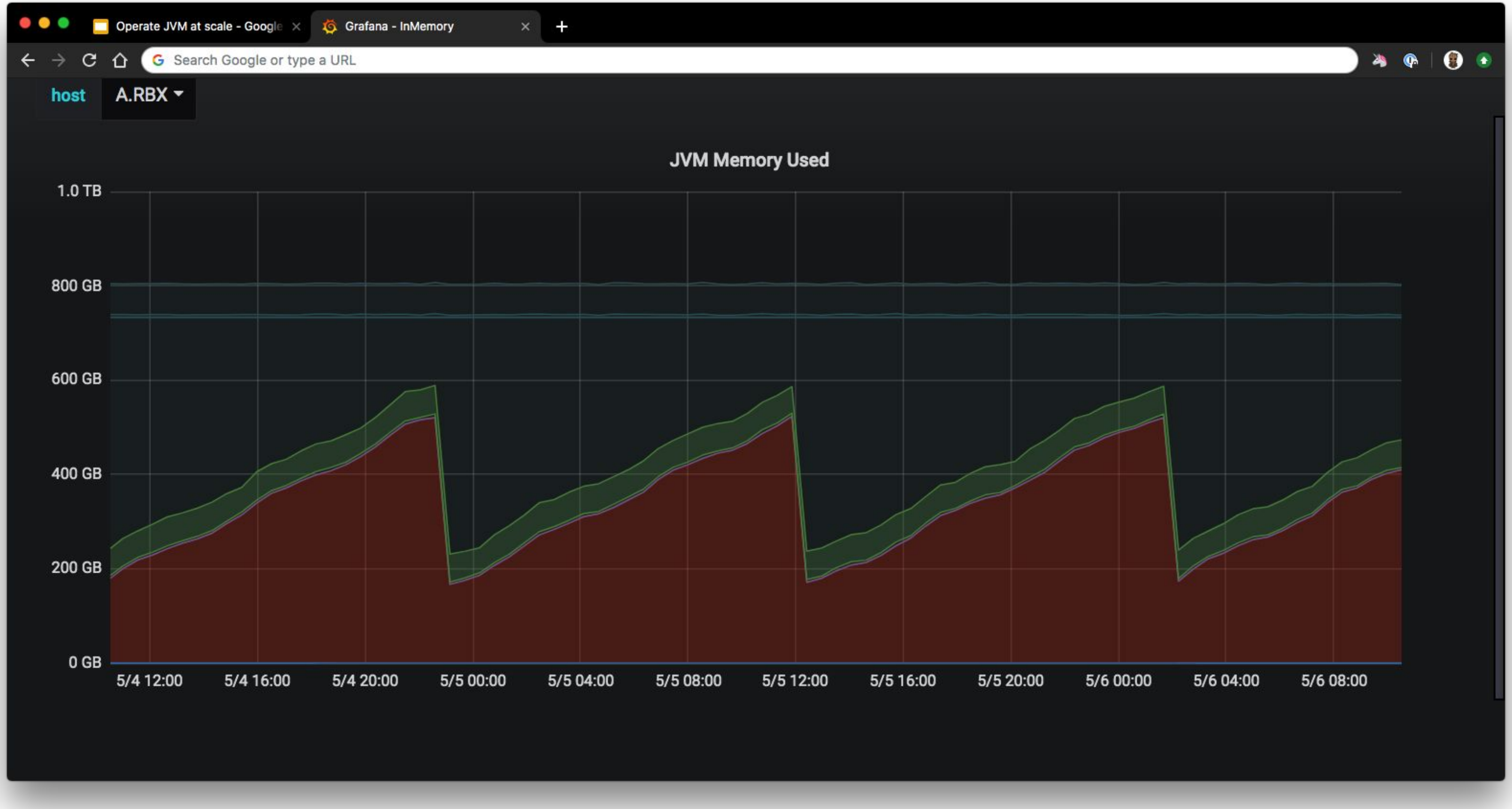
Metrics will now be accessible at http://localhost:8080/metrics

Monitoring JVM with metrics

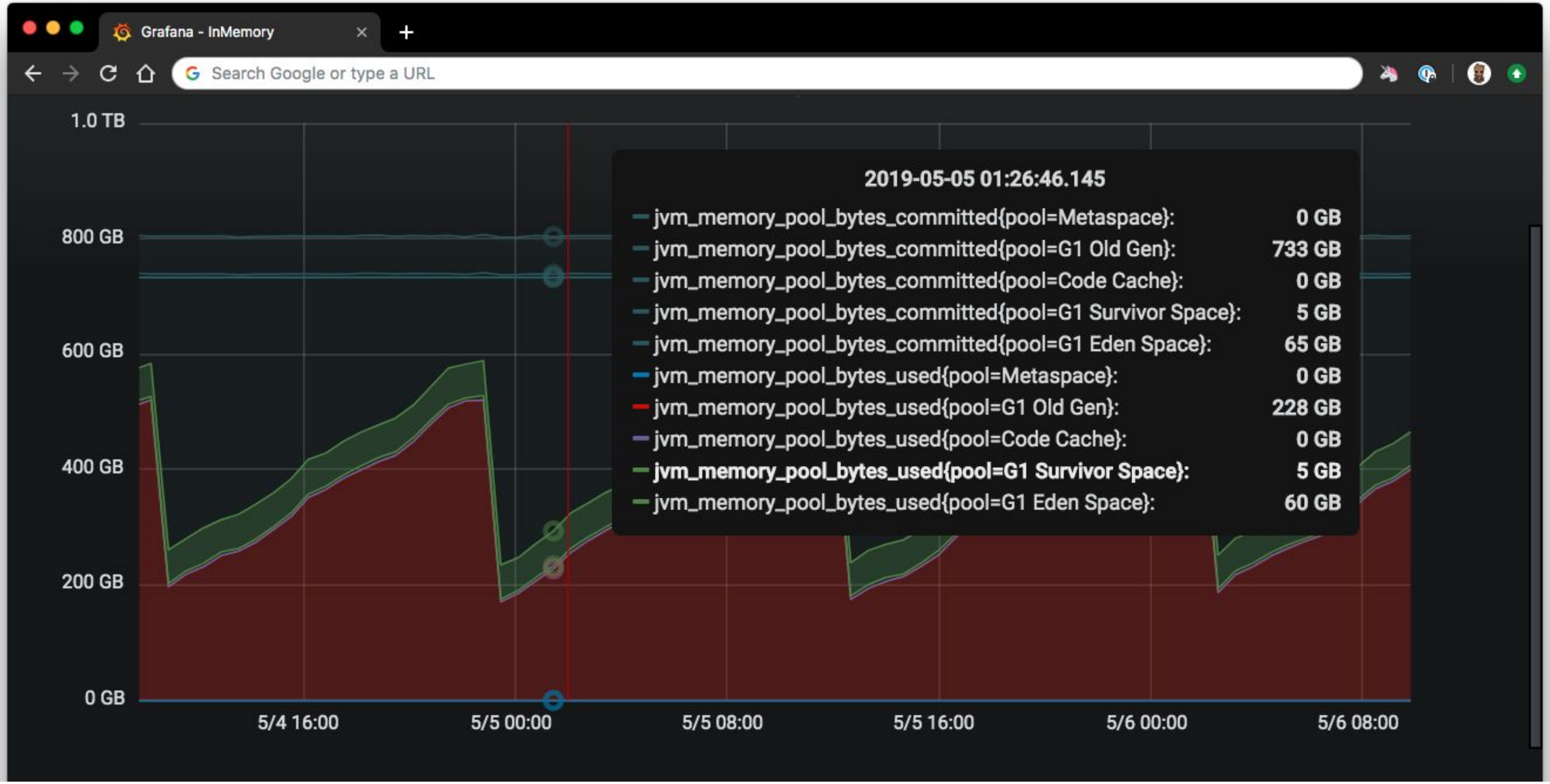


```
root@A.GRA:~# curl -s http://127.0.0.1:9101/metrics | grep -v "#"
process_cpu_seconds_total 1.029816855E8
process_start_time_seconds 1.522059928366E9
process_open_fds 109.0
process_max_fds 512000.0
process_virtual_memory_bytes 2.42578112512E11
process_resident_memory_bytes 2.41437425664E11
java_lang_memorypool_collectionusagethresholdsupported{name="Metaspace",} 0.0
java_lang_memorypool_collectionusagethresholdsupported{name="Code Cache",} 0.0
java_lang_memorypool_collectionusagethresholdsupported{name="G1 Eden Space",} 1.0
java_lang_memorypool_collectionusagethresholdsupported{name="G1 Old Gen",} 1.0
java_lang_memorypool_collectionusagethresholdsupported{name="G1 Survivor Space",} 1.0
java_lang_runtime_uptime 3.4834238296E10
java_lang_garbagecollector_lastgcinfo_memoryusagebeforegc_used{name="G1 Young Generation",key="G1 Survivor Space",} 1.711276032E9
java_lang_garbagecollector_lastgcinfo_memoryusagebeforegc_used{name="G1 Young Generation",key="Metaspace",} 3.1310464E7
java_lang_garbagecollector_lastgcinfo_memoryusagebeforegc_used{name="G1 Young Generation",key="G1 Old Gen",} 1.28463160496E11
java_lang_garbagecollector_lastgcinfo_memoryusagebeforegc_used{name="G1 Young Generation",key="G1 Eden Space",} 2.4058527744E10
java_lang_garbagecollector_lastgcinfo_memoryusagebeforegc_used{name="G1 Young Generation",key="Code Cache",} 3.813536E7
java_lang_memory_nonheapmemoryusage_init 4194304.0
java_lang_operatingsystem_committedvirtualmemorysize 2.42578120704E11
java_lang_memory_objectpendingfinalizationcount 0.0
java_lang_memorypool_collectionusagethresholdexceeded{name="G1 Eden Space",} 0.0
java_lang_memorypool_collectionusagethresholdexceeded{name="G1 Old Gen",} 0.0
```

Monitoring JVM with metrics



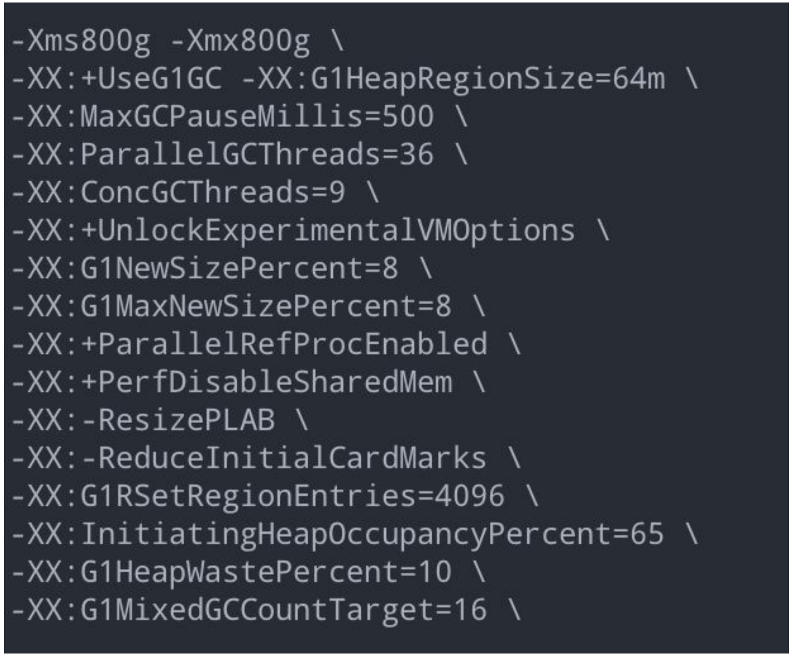
Monitoring JVM with metrics



2019-05-05 01:26:46.145

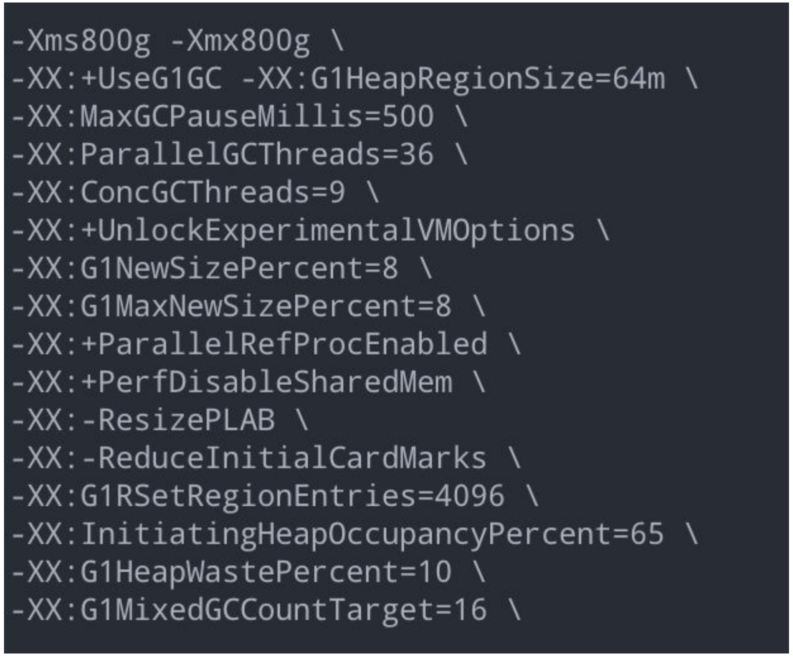
jvm_memory_pool_bytes_committed{pool=Metaspace}:	0 GB
jvm_memory_pool_bytes_committed{pool=G1 Old Gen}:	733 GB
jvm_memory_pool_bytes_committed{pool=Code Cache}:	0 GB
jvm_memory_pool_bytes_committed{pool=G1 Survivor Space}:	5 GB
jvm_memory_pool_bytes_committed{pool=G1 Eden Space}:	65 GB
jvm_memory_pool_bytes_used{pool=Metaspace}:	0 GB
jvm_memory_pool_bytes_used{pool=G1 Old Gen}:	228 GB
jvm_memory_pool_bytes_used{pool=Code Cache}:	0 GB
jvm_memory_pool_bytes_used{pool=G1 Survivor Space}:	**5 GB**
jvm_memory_pool_bytes_used{pool=G1 Eden Space}:	60 GB

Tuning G1 is hard 😢

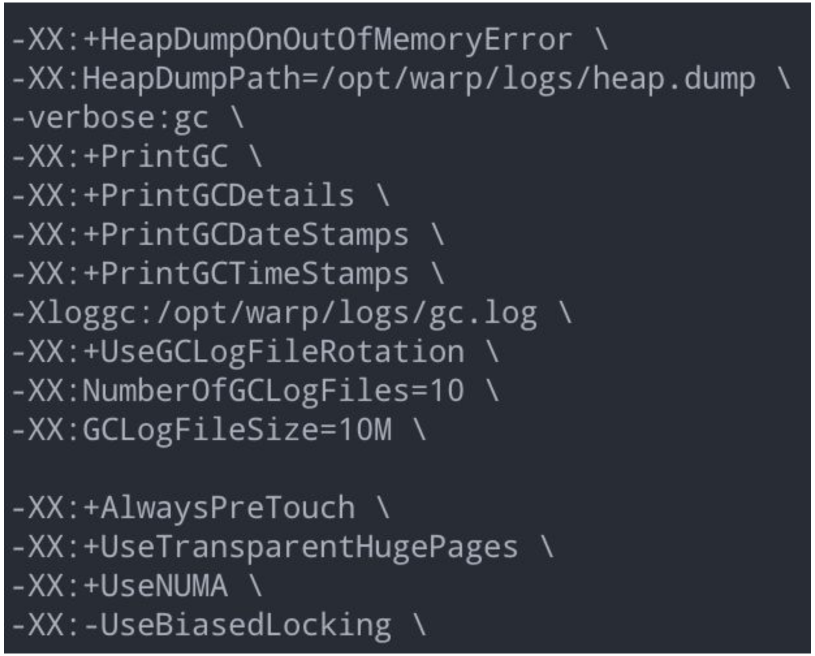


```
-Xms800g -Xmx800g \
-XX:+UseG1GC -XX:G1HeapRegionSize=64m \
-XX:MaxGCPauseMillis=500 \
-XX:ParallelGCThreads=36 \
-XX:ConcGCThreads=9 \
-XX:+UnlockExperimentalVMOptions \
-XX:G1NewSizePercent=8 \
-XX:G1MaxNewSizePercent=8 \
-XX:+ParallelRefProcEnabled \
-XX:+PerfDisableSharedMem \
-XX:-ResizePLAB \
-XX:-ReduceInitialCardMarks \
-XX:G1RSetRegionEntries=4096 \
-XX:InitiatingHeapOccupancyPercent=65 \
-XX:G1HeapWastePercent=10 \
-XX:G1MixedGCCountTarget=16 \
```

Tuning G1 is hard 😢😢



```
-Xms800g -Xmx800g \
-XX:+UseG1GC -XX:G1HeapRegionSize=64m \
-XX:MaxGCPauseMillis=500 \
-XX:ParallelGCThreads=36 \
-XX:ConcGCThreads=9 \
-XX:+UnlockExperimentalVMOptions \
-XX:G1NewSizePercent=8 \
-XX:G1MaxNewSizePercent=8 \
-XX:+ParallelRefProcEnabled \
-XX:+PerfDisableSharedMem \
-XX:-ResizePLAB \
-XX:-ReduceInitialCardMarks \
-XX:G1RSetRegionEntries=4096 \
-XX:InitiatingHeapOccupancyPercent=65 \
-XX:G1HeapWastePercent=10 \
-XX:G1MixedGCCountTarget=16 \
```



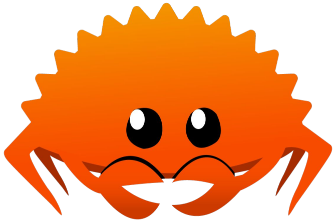
```
-XX:+HeapDumpOnOutOfMemoryError \
-XX:HeapDumpPath=/opt/warp/logs/heap.dump \
-verbose:gc \
-XX:+PrintGC \
-XX:+PrintGCDetails \
-XX:+PrintGCDateStamps \
-XX:+PrintGCTimeStamps \
-Xloggc:/opt/warp/logs/gc.log \
-XX:+UseGCLogFileRotation \
-XX:NumberOfGCLogFiles=10 \
-XX:GCLogFileSize=10M \

-XX:+AlwaysPreTouch \
-XX:+UseTransparentHugePages \
-XX:+UseNUMA \
-XX:-UseBiasedLocking \
```

Our programming stack

- We mostly use garbage collected languages as
  - Go
  - Java
  - JavaScript

Our programming stack

However, we are using non-garbage collected languages as Rust when needed



Our friends for µservices

PostgreSQL

APACHE
kafka®
A distributed streaming platform

We ❤️ open-source

Code contribution:

- https://github.com/ovh/beamium
- https://github.com/ovh/noderig
- https://github.com/ovh/tsl
- https://github.com/ovh/ovh-warp10-datasource
- https://github.com/ovh/ovh-tsl-datasource
- ...

Involved in:

- Warp10 community
- Apache Hbase/Flink development
- Prometheus/InfluxData discussions
- TS Query Language Working group

Conclusion

That's all folks!