goto;

GOTO
AARHUS 2021

#GOTOaar

About Me

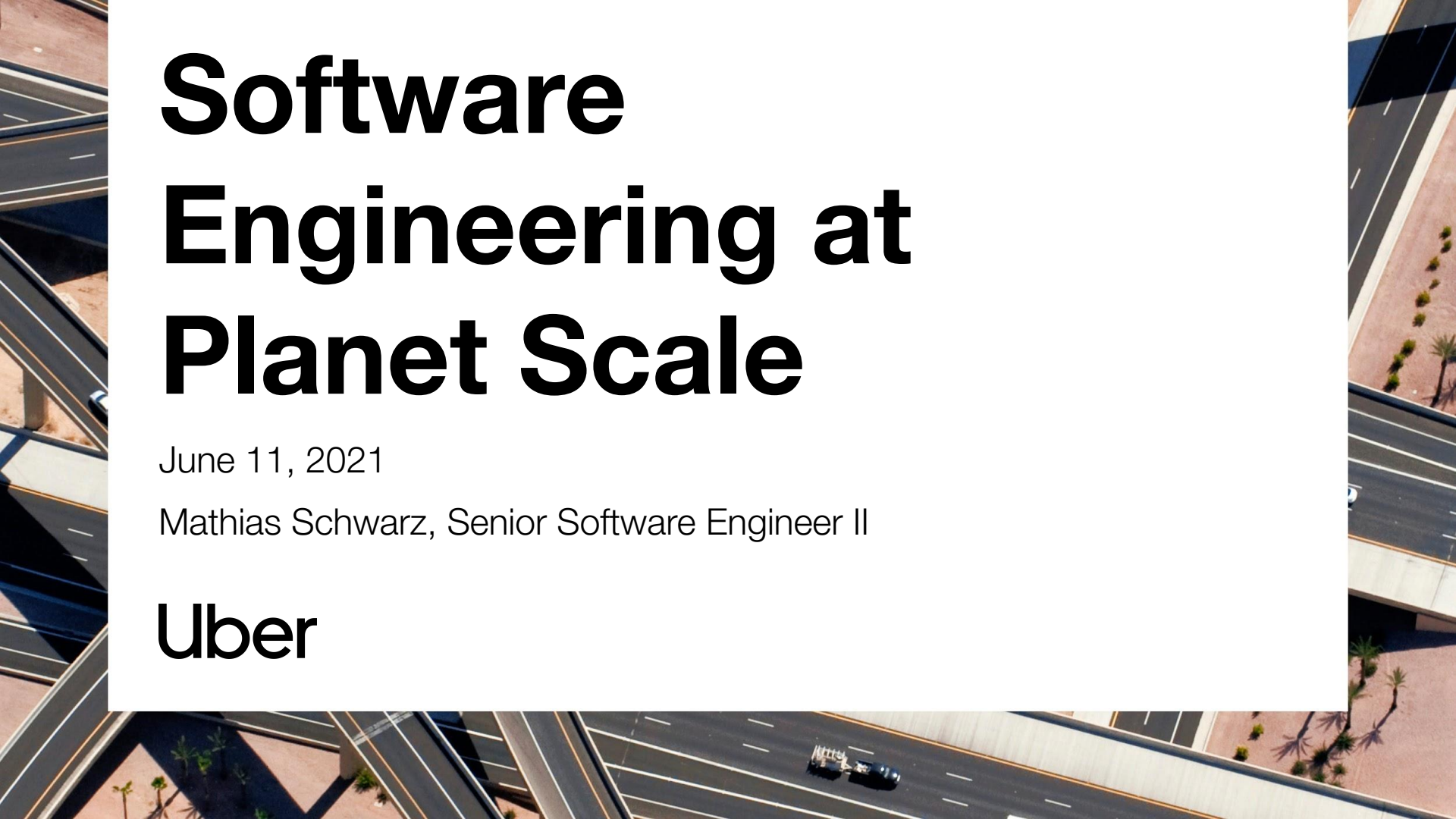
Mathias Schwarz

PhD in CS from Aarhus University

Senior Software Engineer II at Uber

Love to build infrastructure software

6 years into building stateless platforms at Uber



Software Engineering at Planet Scale

June 11, 2021

Mathias Schwarz, Senior Software Engineer II

Uber

The Uber Infrastructure team @aarhus

Products

Product Platform

Infrastructure

- Microservice deployment
- Runtime Configuration
- Storage
- Auto scaling

Scale: Business

18M

Trips happening every day,
based on Q1 2020

Scale: Infrastructure

4000

Services across several of our own data centers plus cloud zones such as AWS

Scale: Deployment

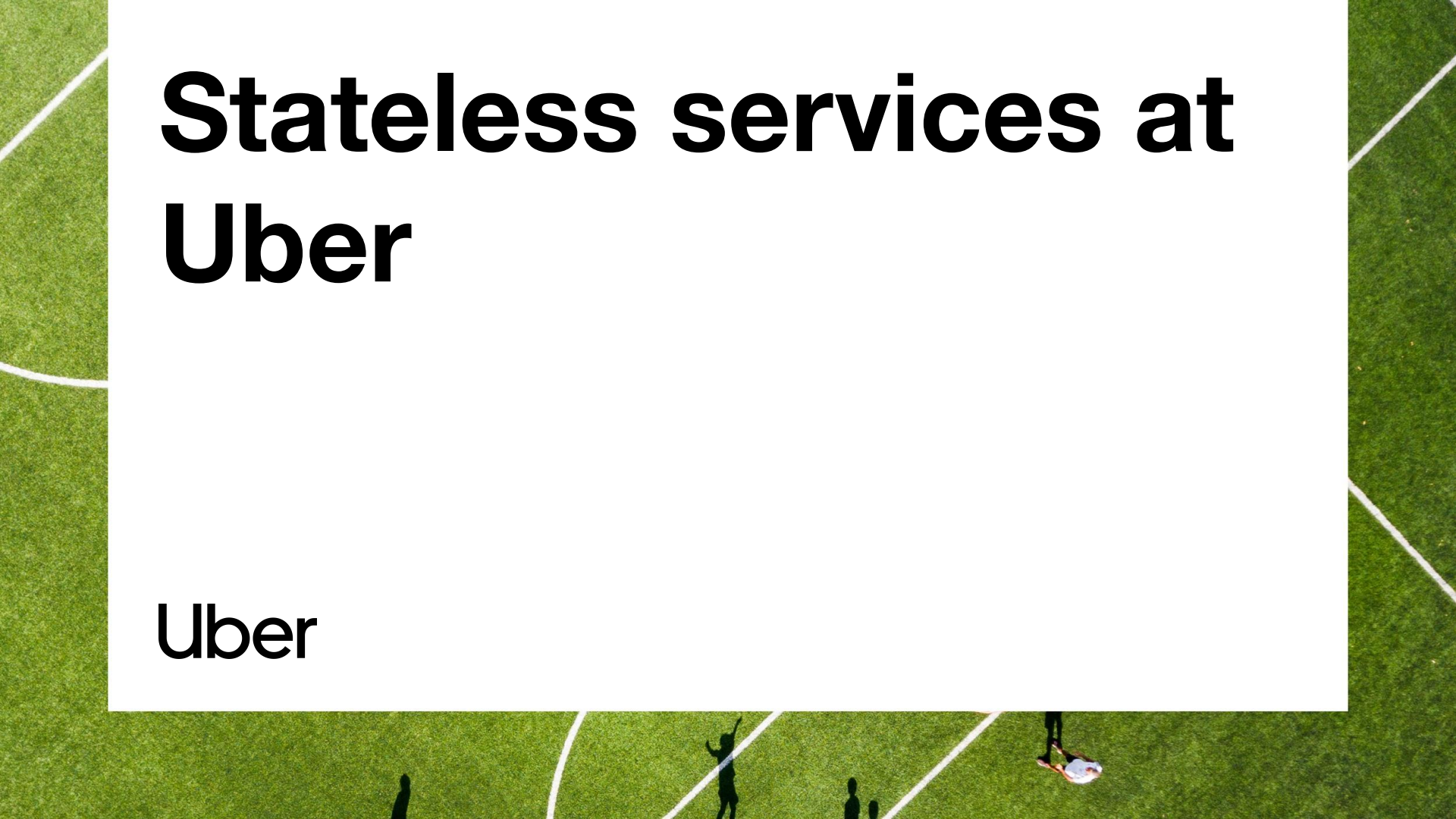
58K

Builds / week

5K

Production deploys / week

Stateless services at Uber

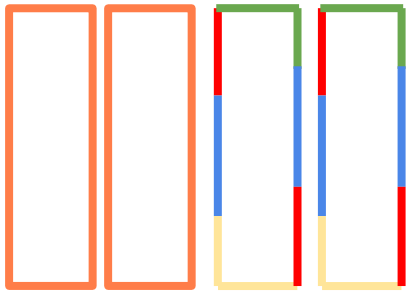


Uber

Hybrid cloud

More elastic (if you are small)

Special purpose hardware



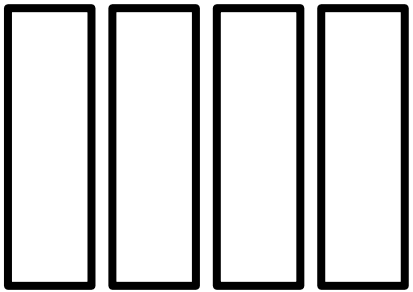
Cloud Zones / POPs

AZs with virtual Hardware

+

Cheaper

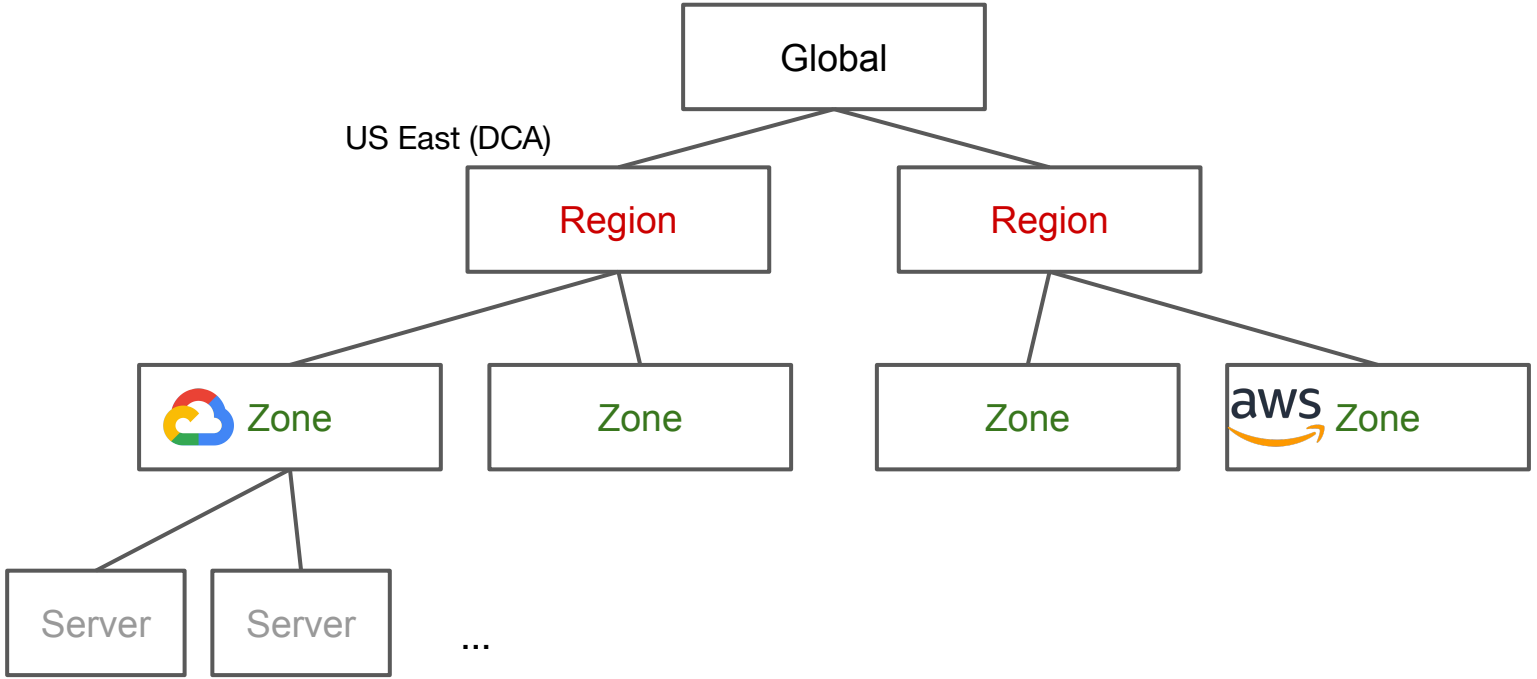
Few dependencies



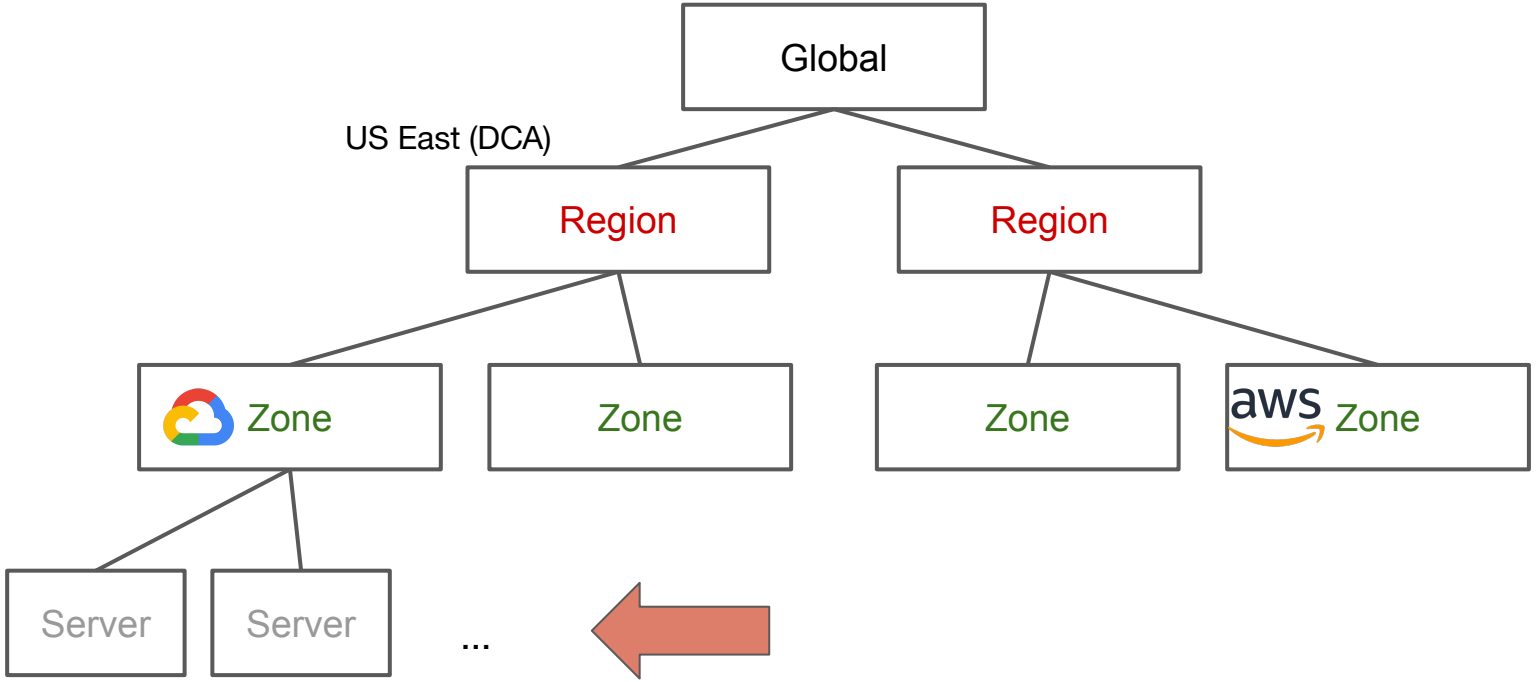
Private / On Prem

Core AZs with ODM Hardware

Regions and availability zones



Early days: Unstructured deploys



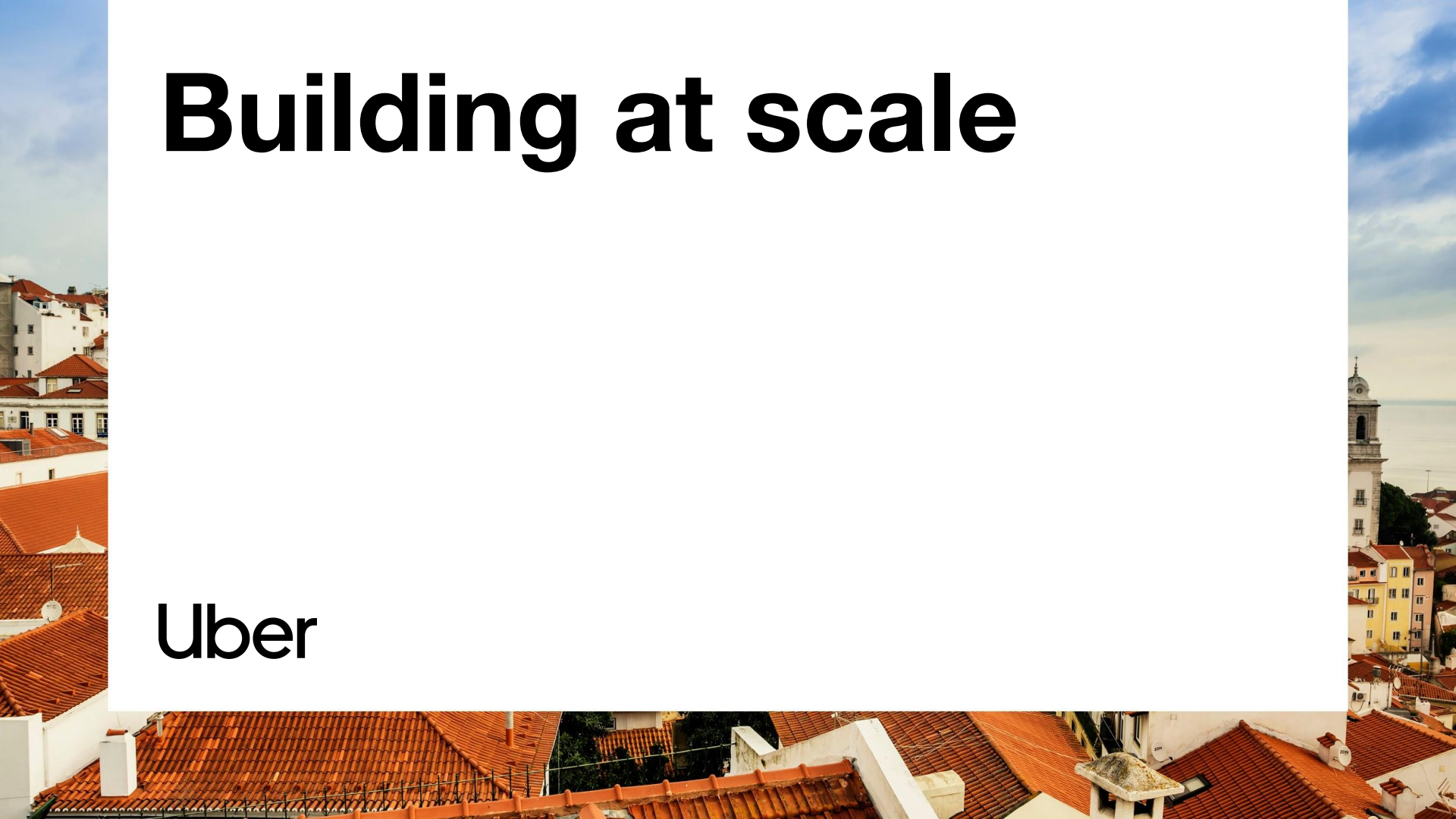
Important deploy system features

Consistent builds

Zero downtime

Outage prevention

Building at scale



Uber

Code repository

Go & Java

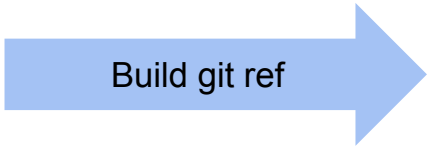
The preferred backend language

Bazel

Monorepo management

https://eng.uber.com/go-monorepo-bazel/

Build a docker image



Makisu

+ uBuild

Builds docker images

https://github.com/uber/makisu
https://eng.uber.com/makisu/

Publish docker image

Makisu
+uBuild

Upload

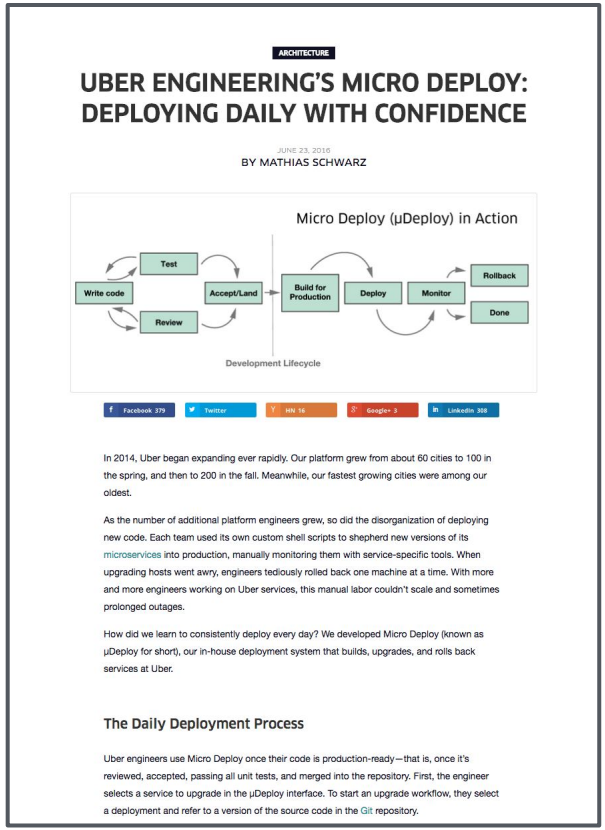
Kraken

Distributed P2P Docker Registry

https://github.com/uber/kraken ,
https://eng.uber.com/introducing-kraken/

Structured deploys with µDeploy

Uber



ARCHITECTURE

UBER ENGINEERING'S MICRO DEPLOY: DEPLOYING DAILY WITH CONFIDENCE

JUNE 23, 2016

BY MATHIAS SCHWARZ

In 2014, Uber began expanding ever rapidly. Our platform grew from about 60 cities to 100 in the spring, and then to 200 in the fall. Meanwhile, our fastest growing cities were among our oldest.

As the number of additional platform engineers grew, so did the disorganization of deploying new code. Each team used its own custom shell scripts to shepherd new versions of its microservices into production, manually monitoring them with service-specific tools. When upgrading hosts went awry, engineers tediously rolled back one machine at a time. With more and more engineers working on Uber services, this manual labor couldn't scale and sometimes prolonged outages.

How did we learn to consistently deploy every day? We developed Micro Deploy (known as µDeploy for short), our in-house deployment system that builds, upgrades, and rolls back services at Uber.

The Daily Deployment Process

Uber engineers use Micro Deploy once their code is production-ready—that is, once it's reviewed, accepted, passing all unit tests, and merged into the repository. First, the engineer selects a service to upgrade in the µDeploy interface. To start an upgrade workflow, they select a deployment and refer to a version of the source code in the Git repository.

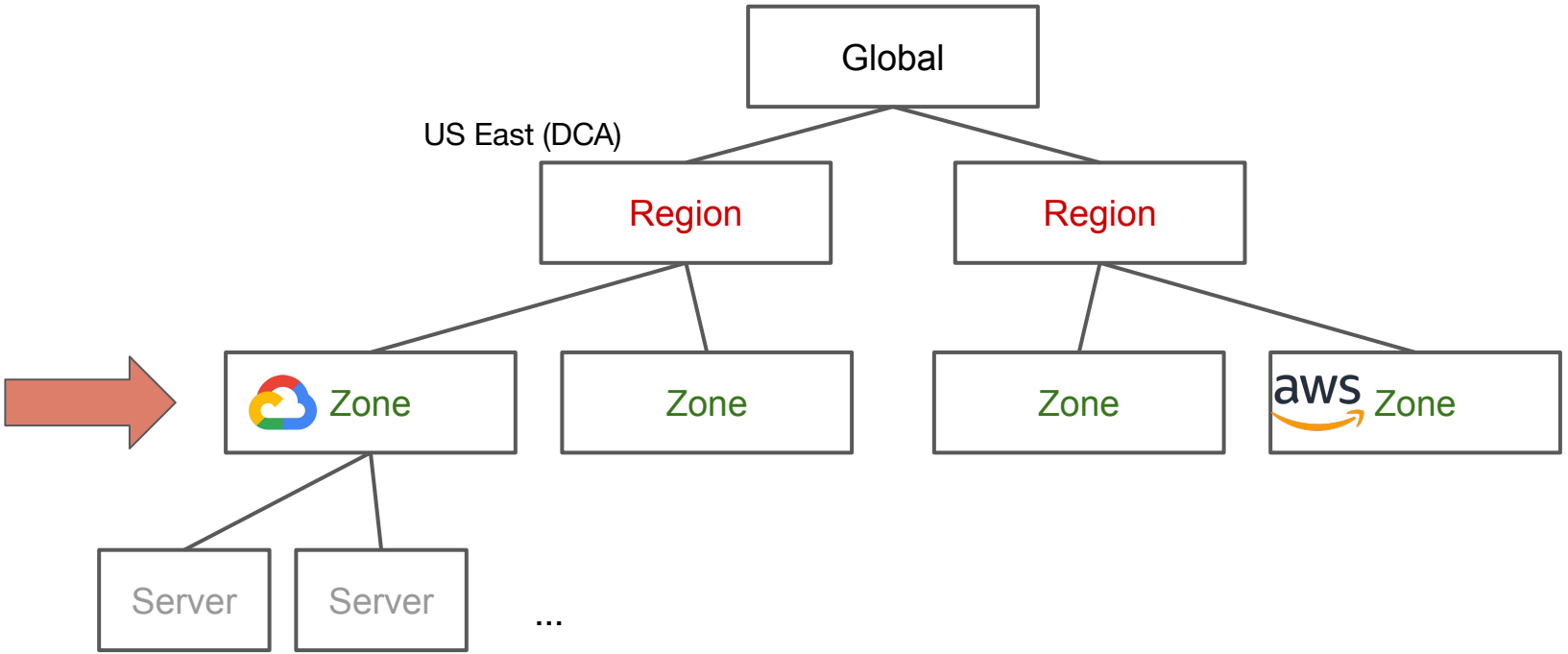
Rollout to clusters, not servers

Scheduler+Manager for compute clusters

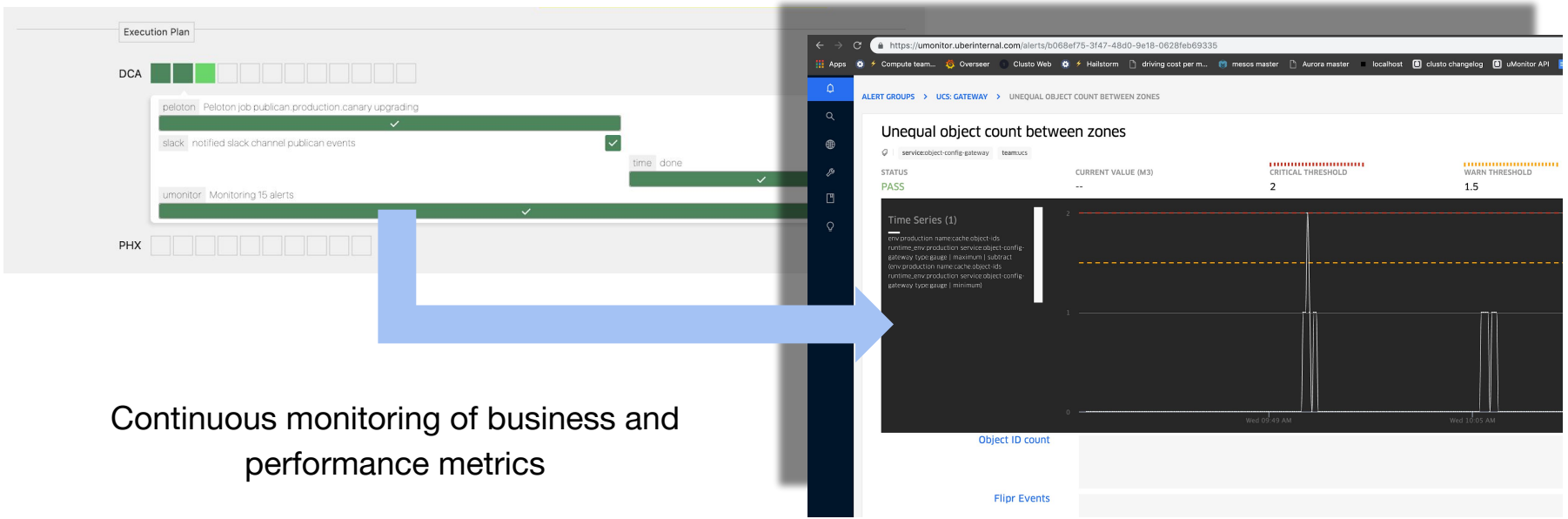
https://github.com/uber/peloton

https://eng.uber.com/resource-scheduler-cluster-management-peloton/

Deploy into cluster in zones



Safety: Monitoring metrics

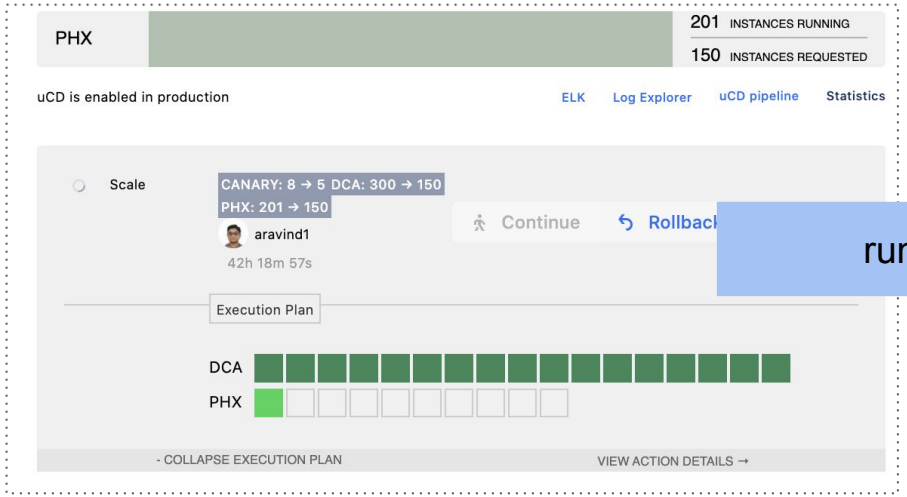


Continuous monitoring of business and performance metrics

uMonitor

time-series based rollback triggers

Safety: Whitebox integration



run

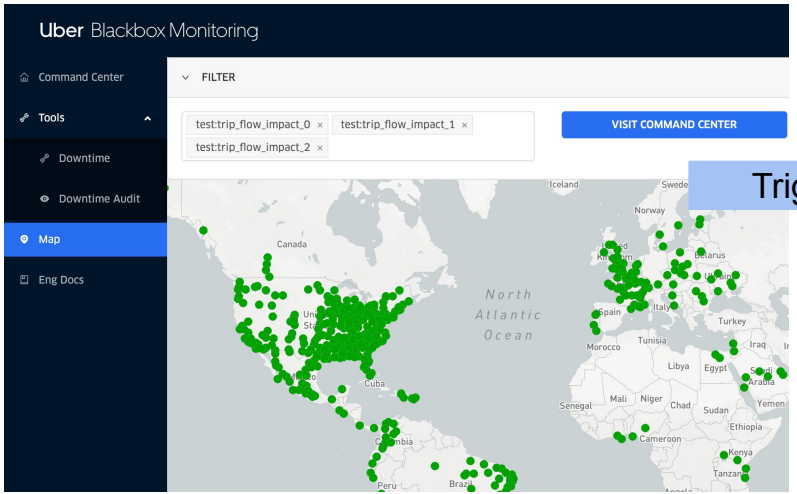
Explicit part of the rollout plan

Hailstorm

Load tests

Whitebox integration tests

Safety: Continuous blackbox



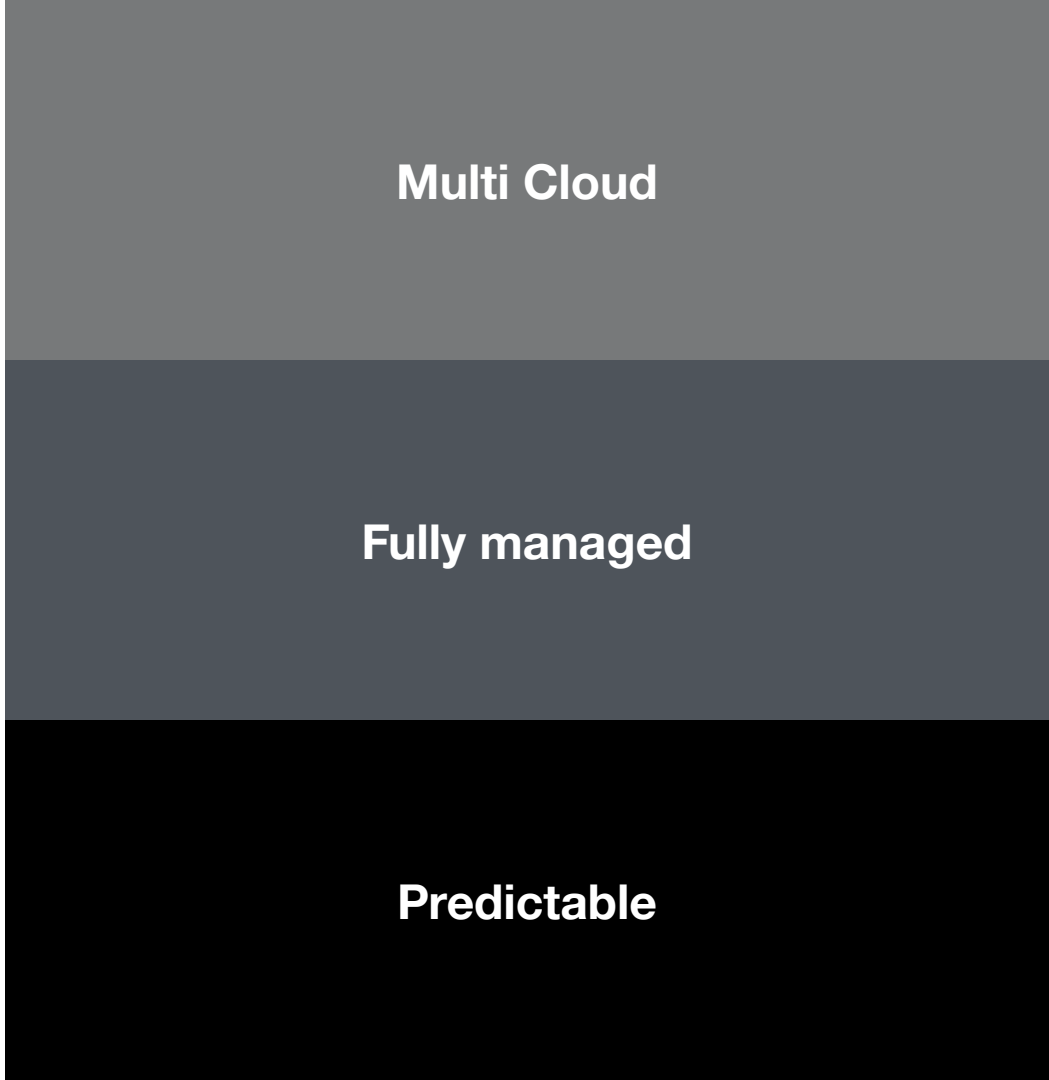
Trigger page

Engineers decide on rolling back

Blackbox testing/monitoring

Virtual trips in production

Efficiency at scale



Alternatives

”Deploy across multiple cloud providers including AWS EC2, Kubernetes, Google Compute Engine, Google Kubernetes Engine, Google App Engine, Microsoft Azure, Openstack, Cloud Foundry, and Oracle Cloud Infrastructure, with DC/OS coming soon”

Anthos

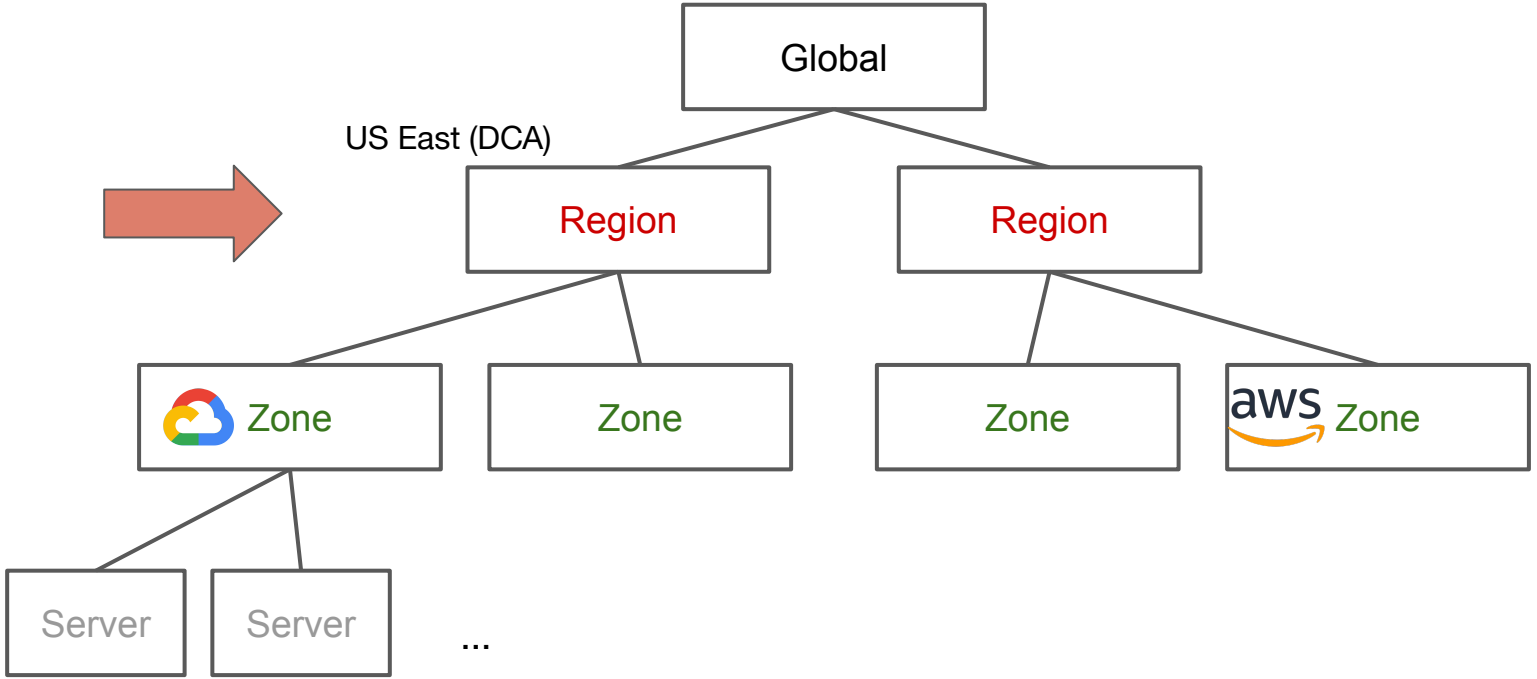
GitLab

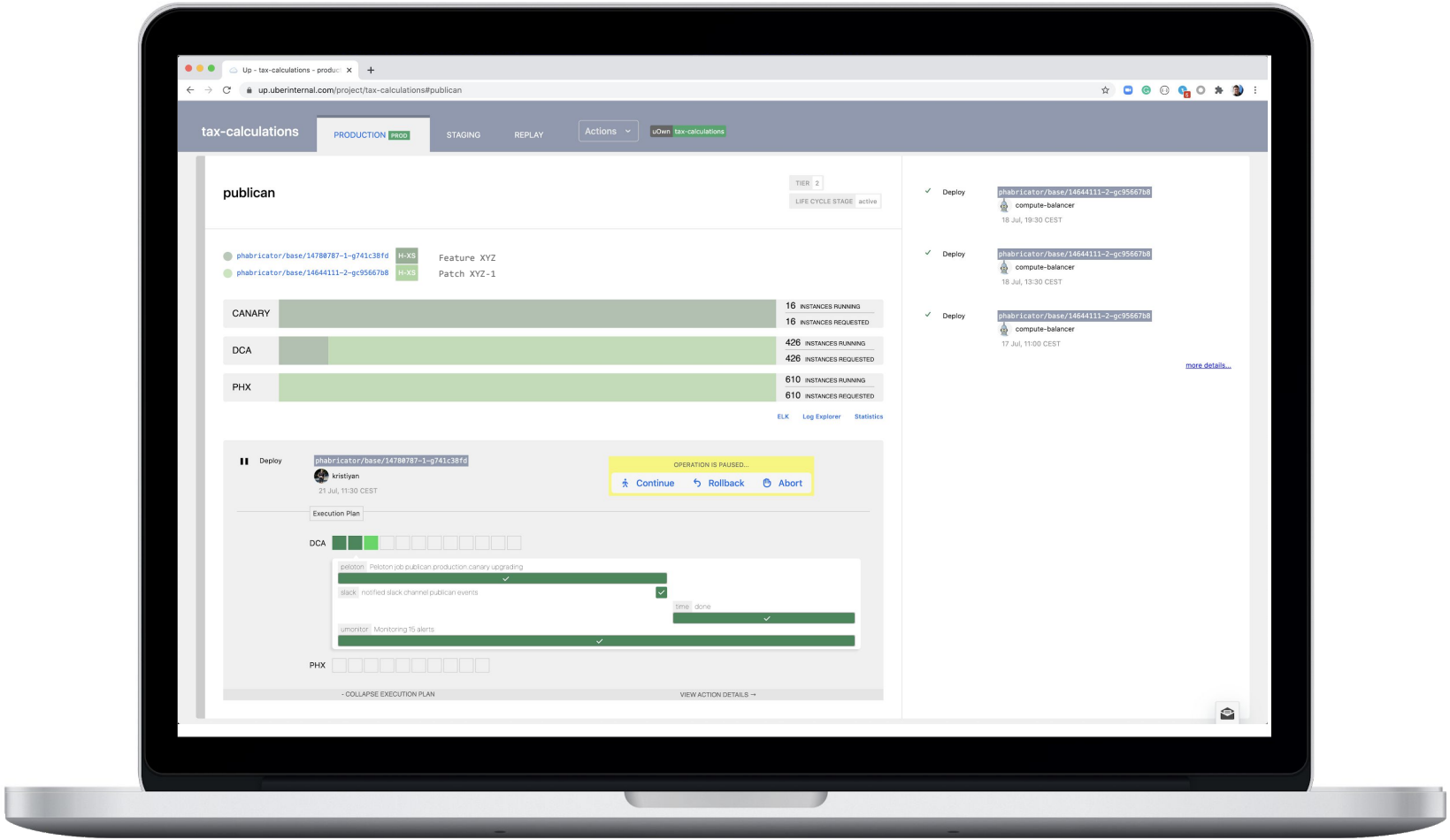
https://spinnaker.io/

Efficient infrastructure with Up

Uber

Deploy into regions

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LIFE CYCLE STAGE active
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16 INSTANCES REQUESTED
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Statistics
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21 Jul, 11:30 CEST
OPERATION IS PAUSED...
Continue
Rollback
Abort
Execution Plan
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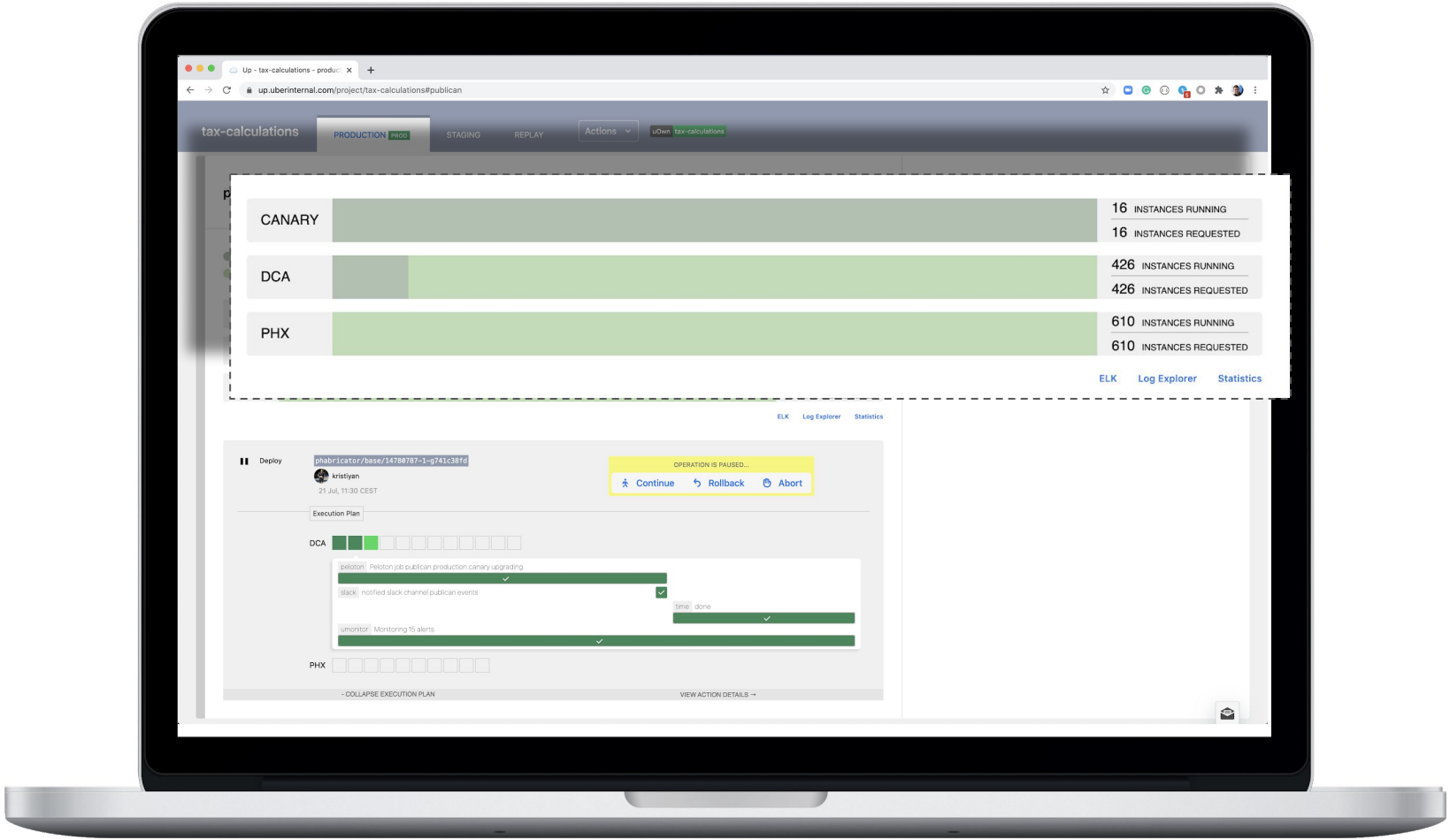
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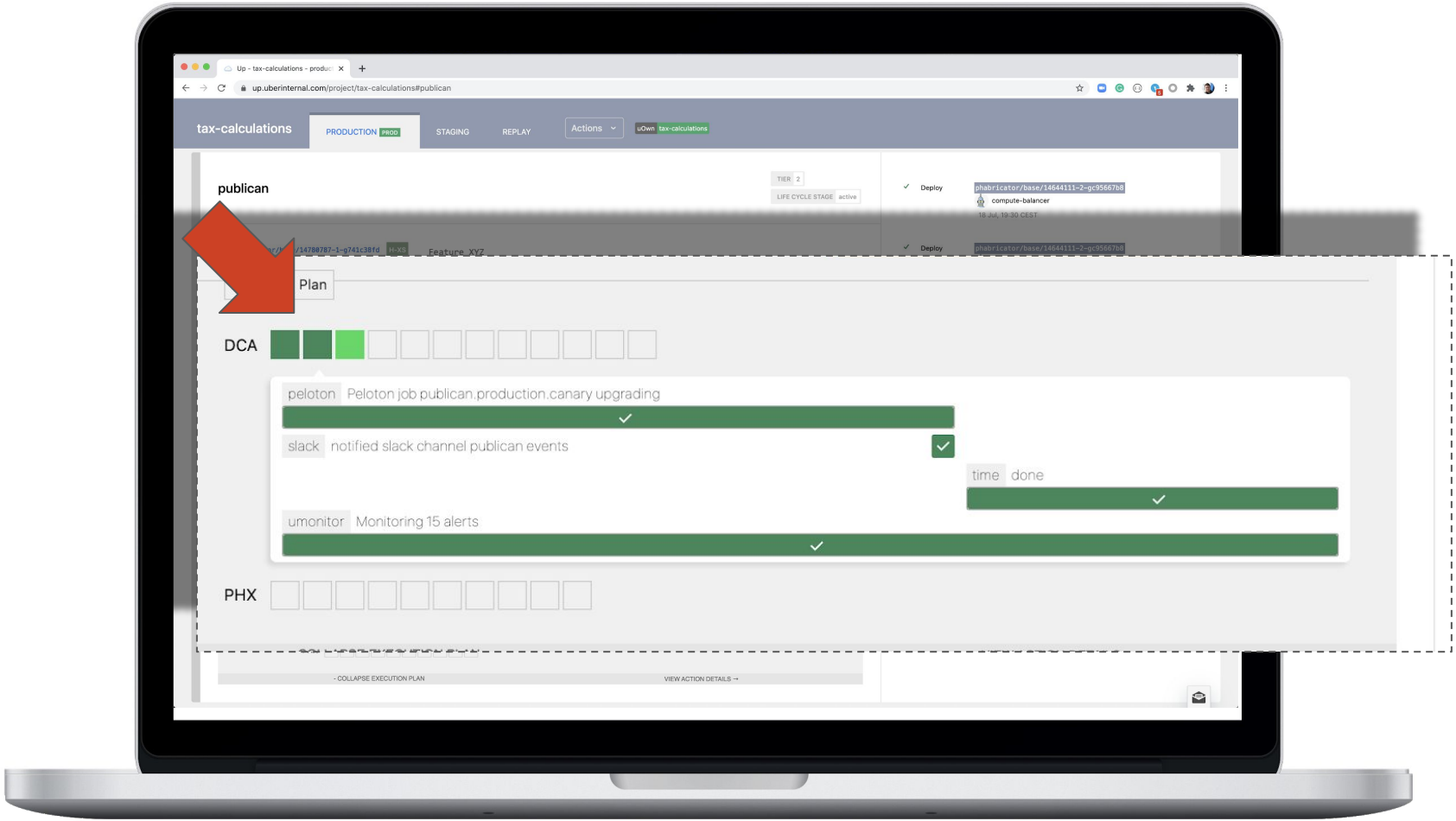
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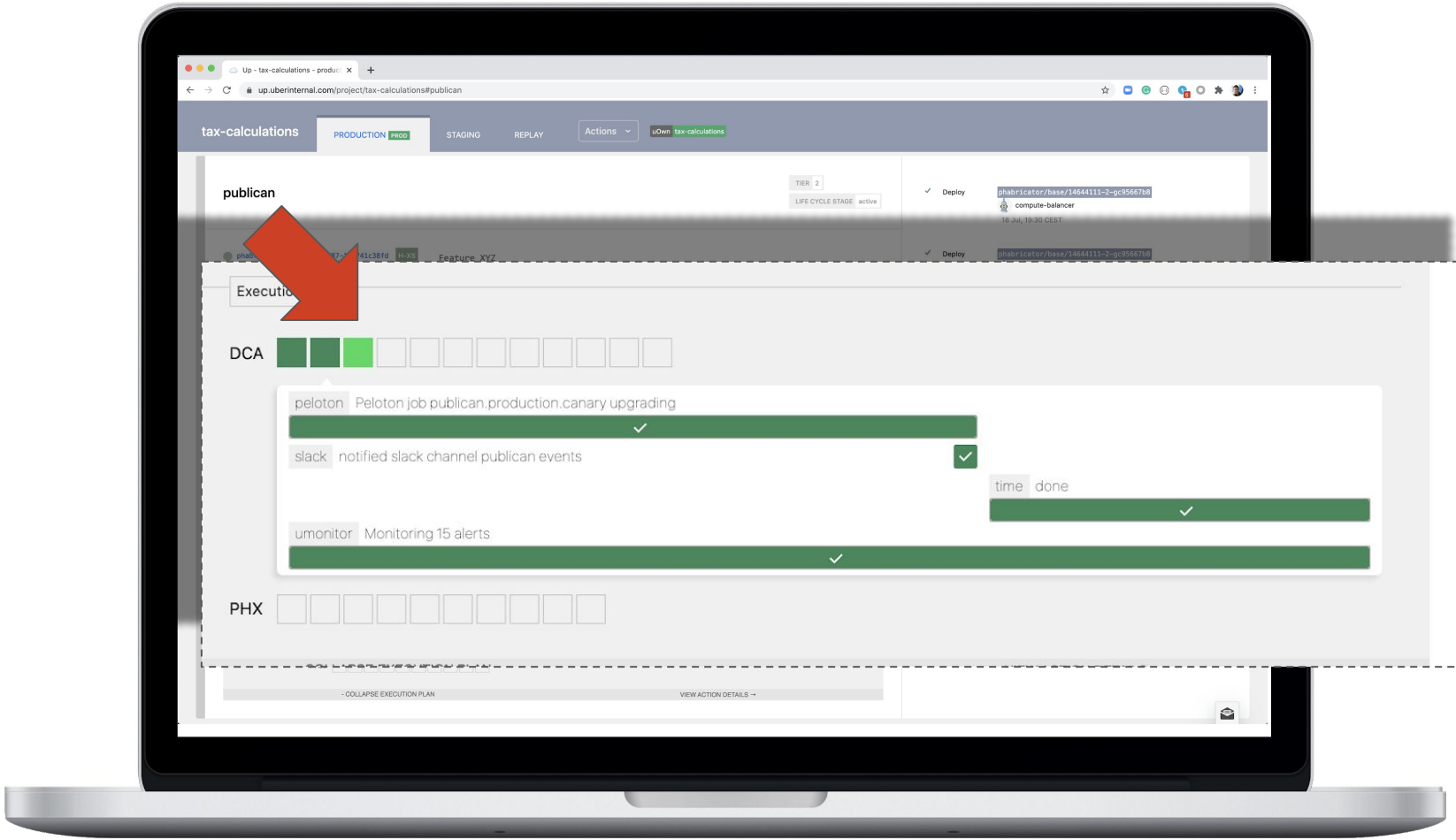
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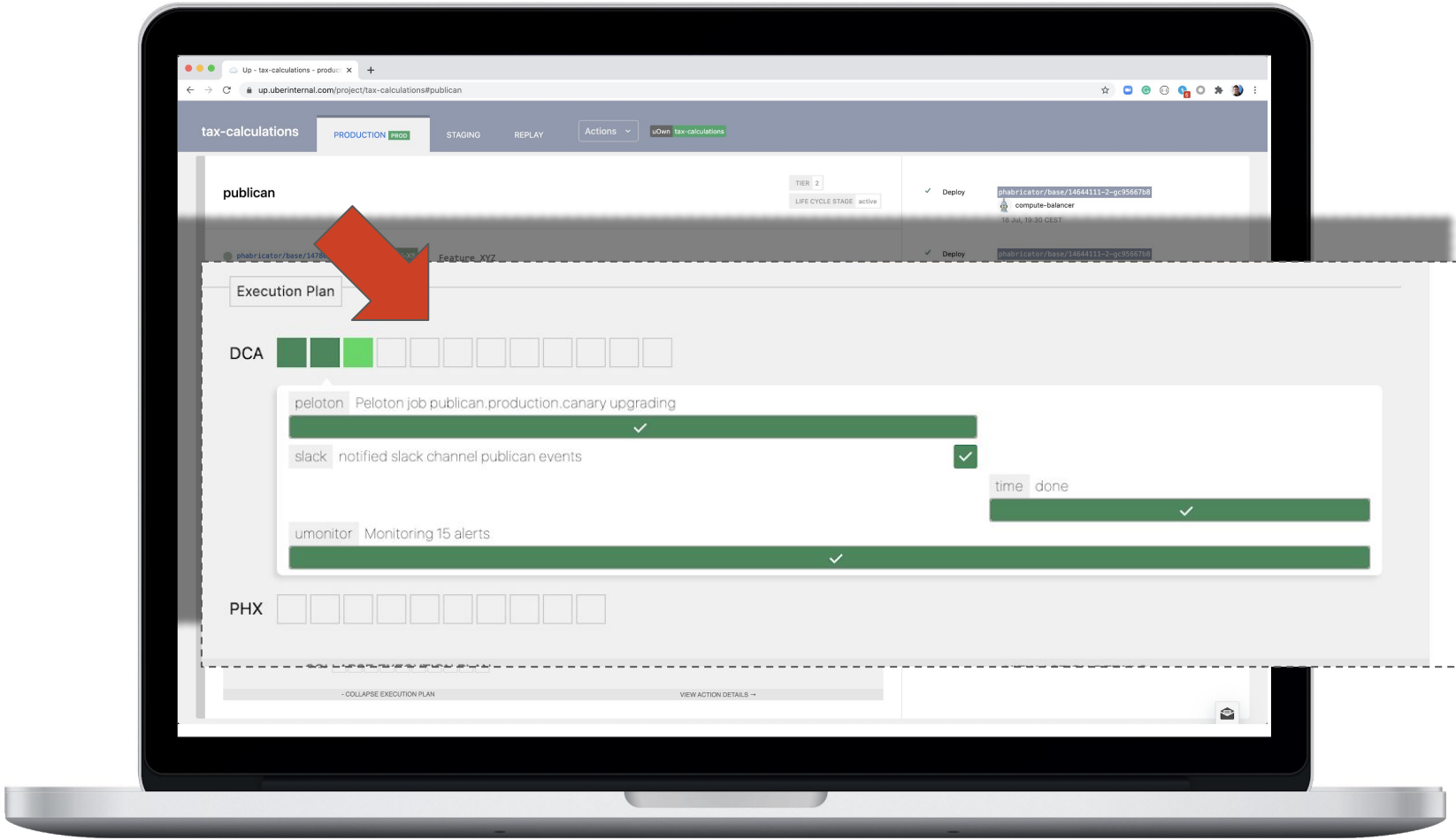
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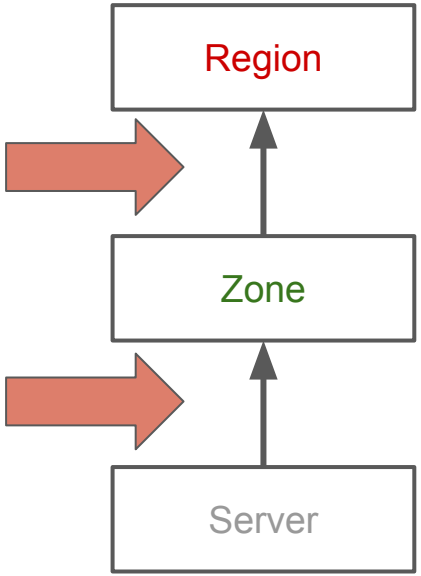
Challenges in abstraction

Dependency on low latency

Dependency on host data



Avoiding manual migrations

Uber

Plan for migrations

- More productive teams
- More reliable / available
- Faster
- Lower cost of capacity

- Cloud <-> On-prem zones
- Zones come and go
- Cluster rolls change
- New cluster technologies
- New container runtimes
- New base images
- ….

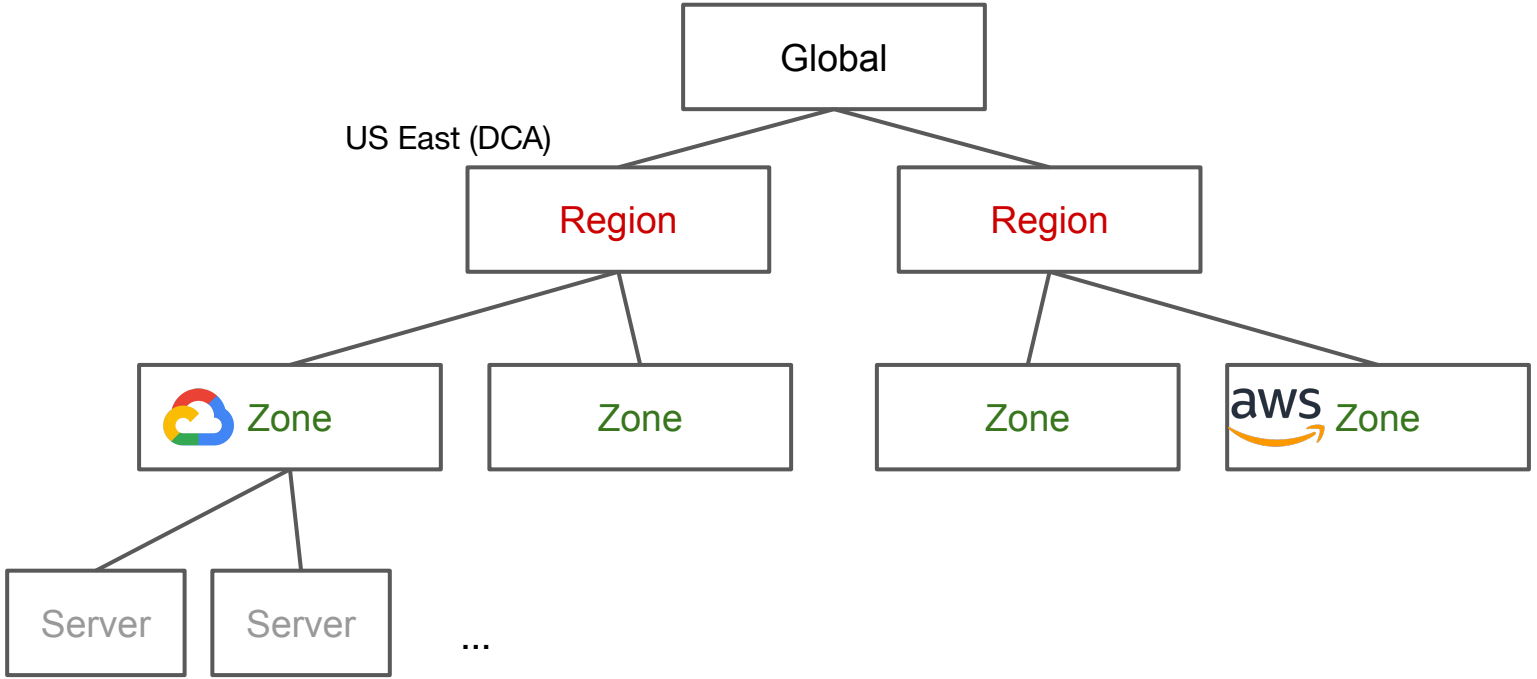
Goals

A continuous need for improving efficiency and reducing the cost of running the company

Infra changes

Must **not** have a negative impact on the goals

Let’s add a new zone



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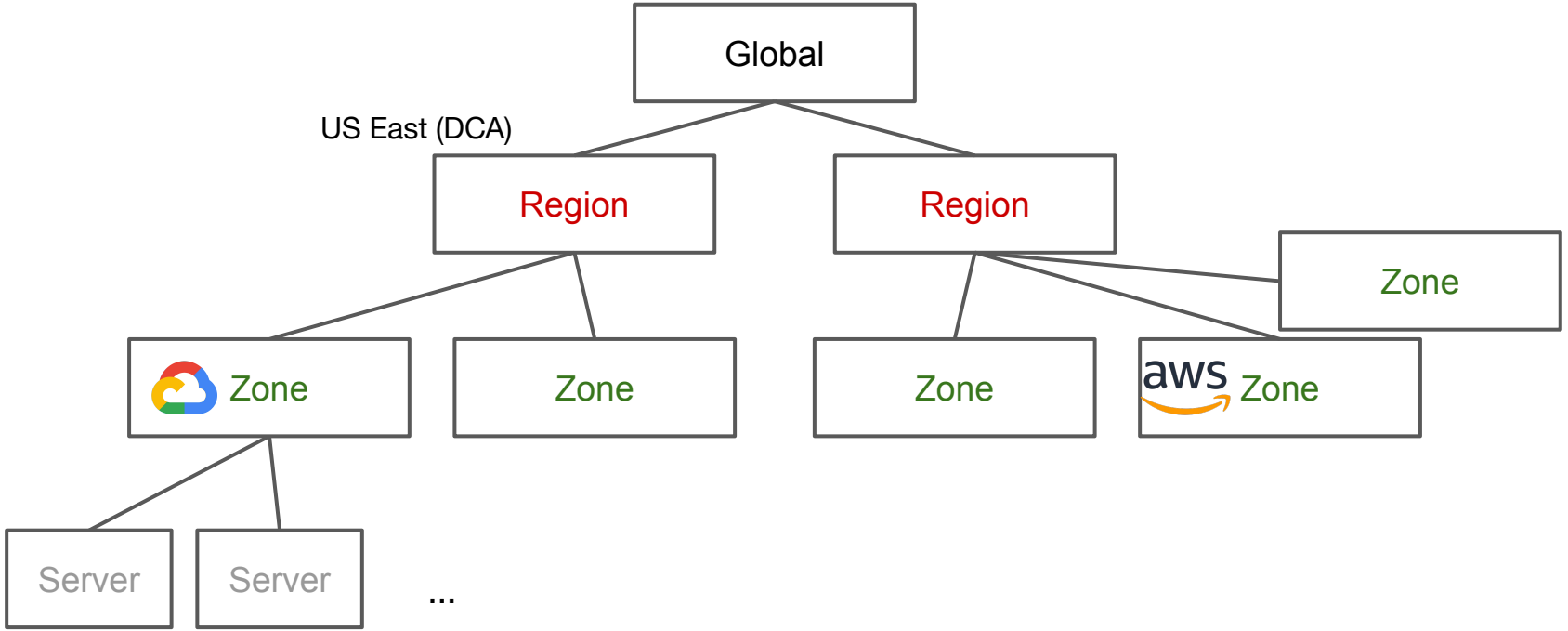
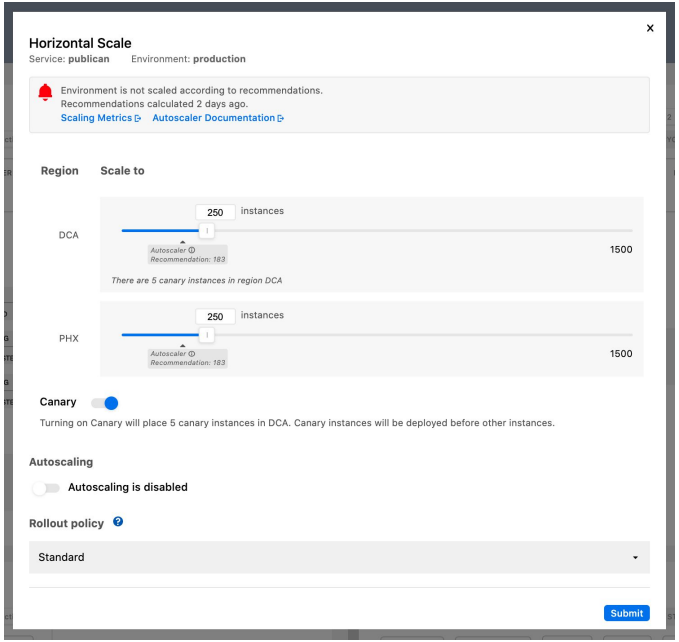
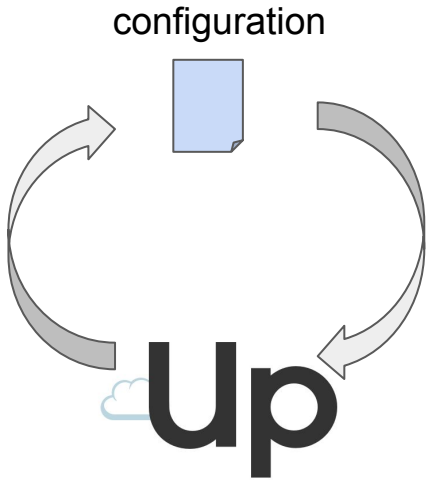


Declarative Configuration



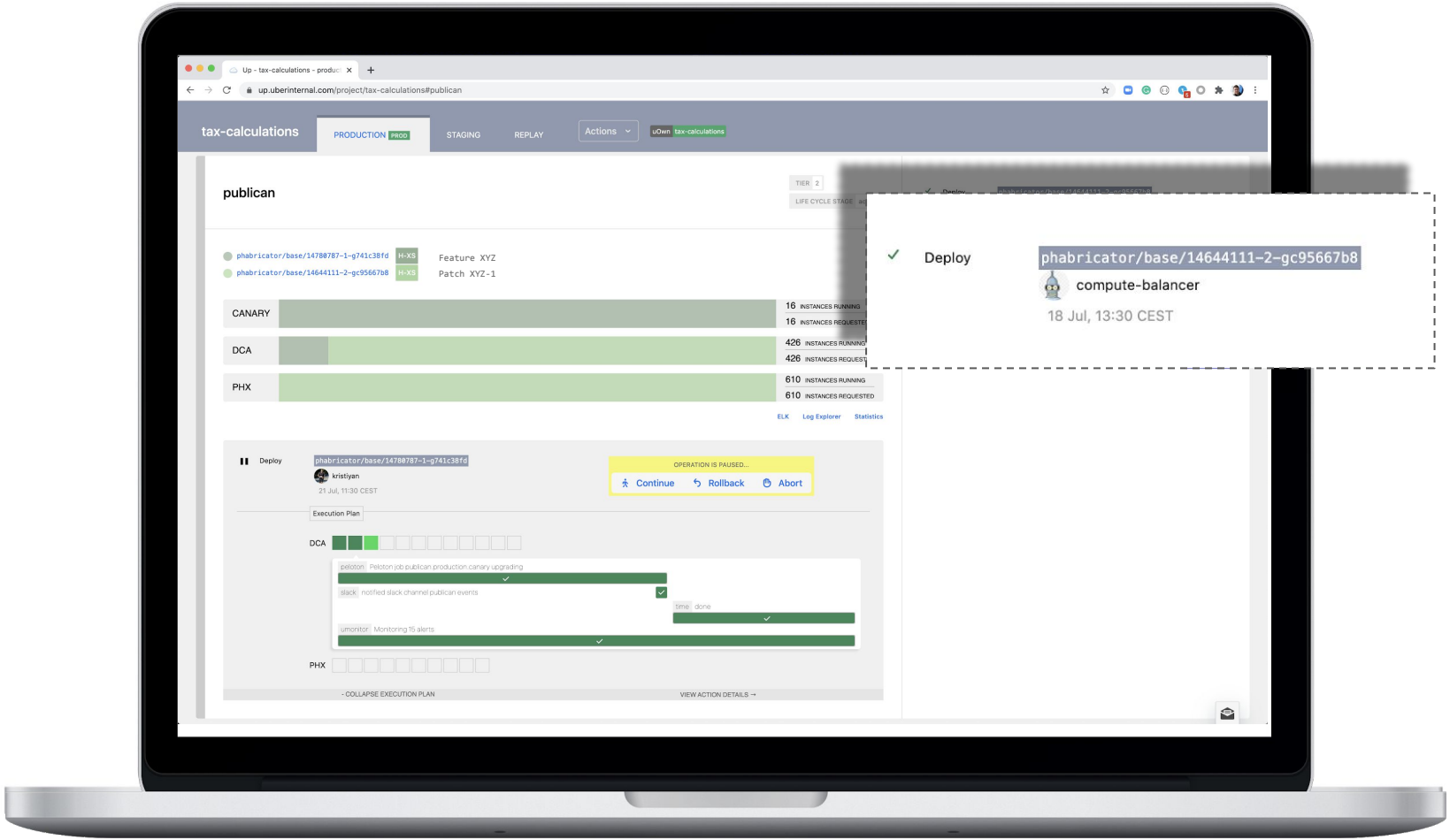


Declarative configurations

- Region placement
- Dependencies

Continuous evaluation

Optimal application of the configuration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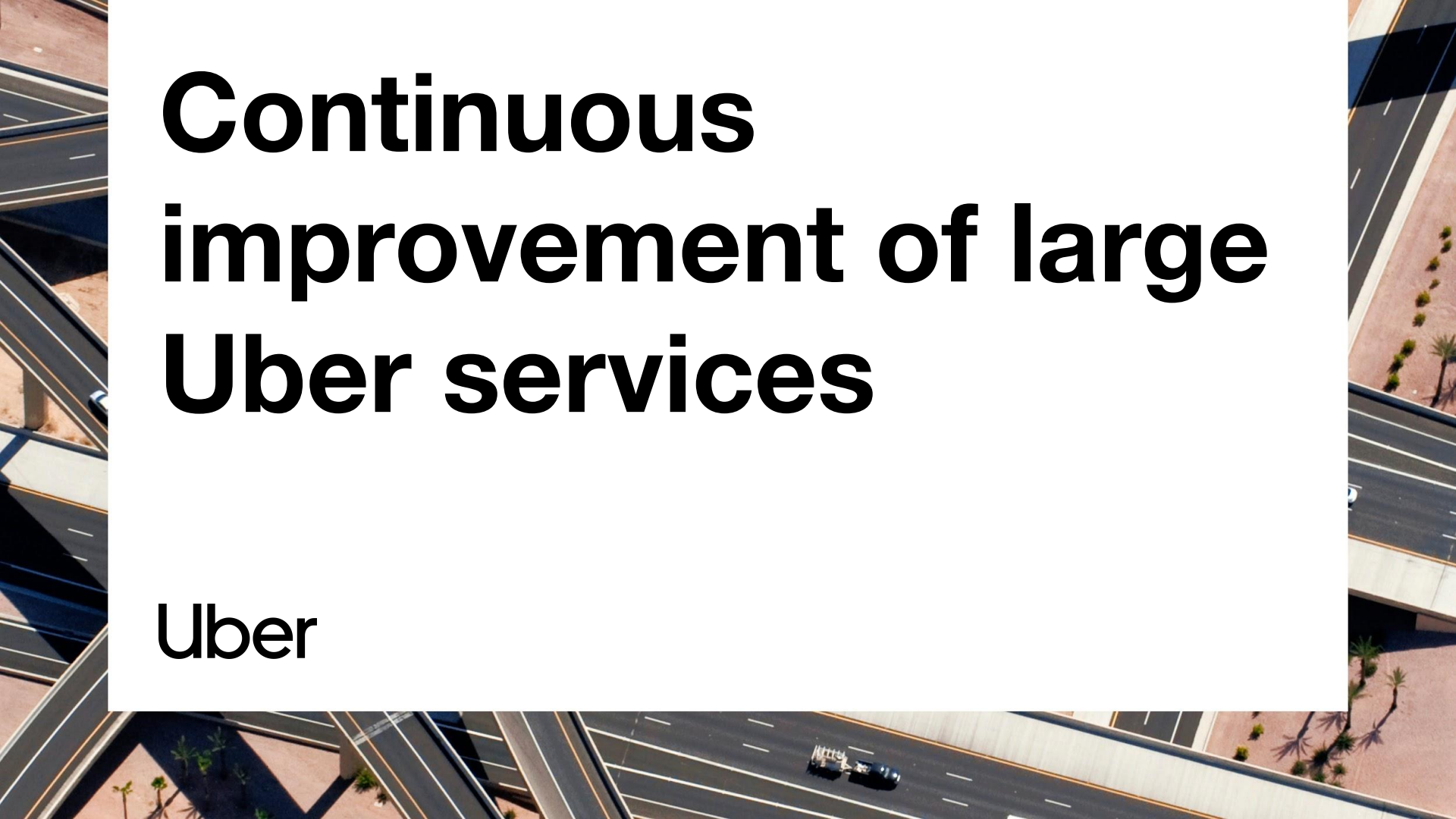


Continuous improvement of large Uber services

Uber

Metrics

Prometheus on M3DB

Metrics ingestion platform

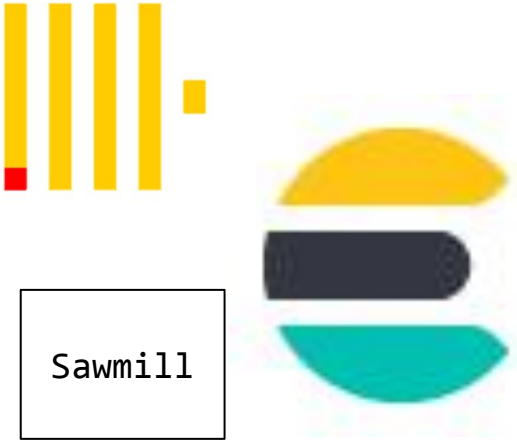
Feeds

Grafana

Graphs and dashboards

Log indexing and aggregation

Healthline

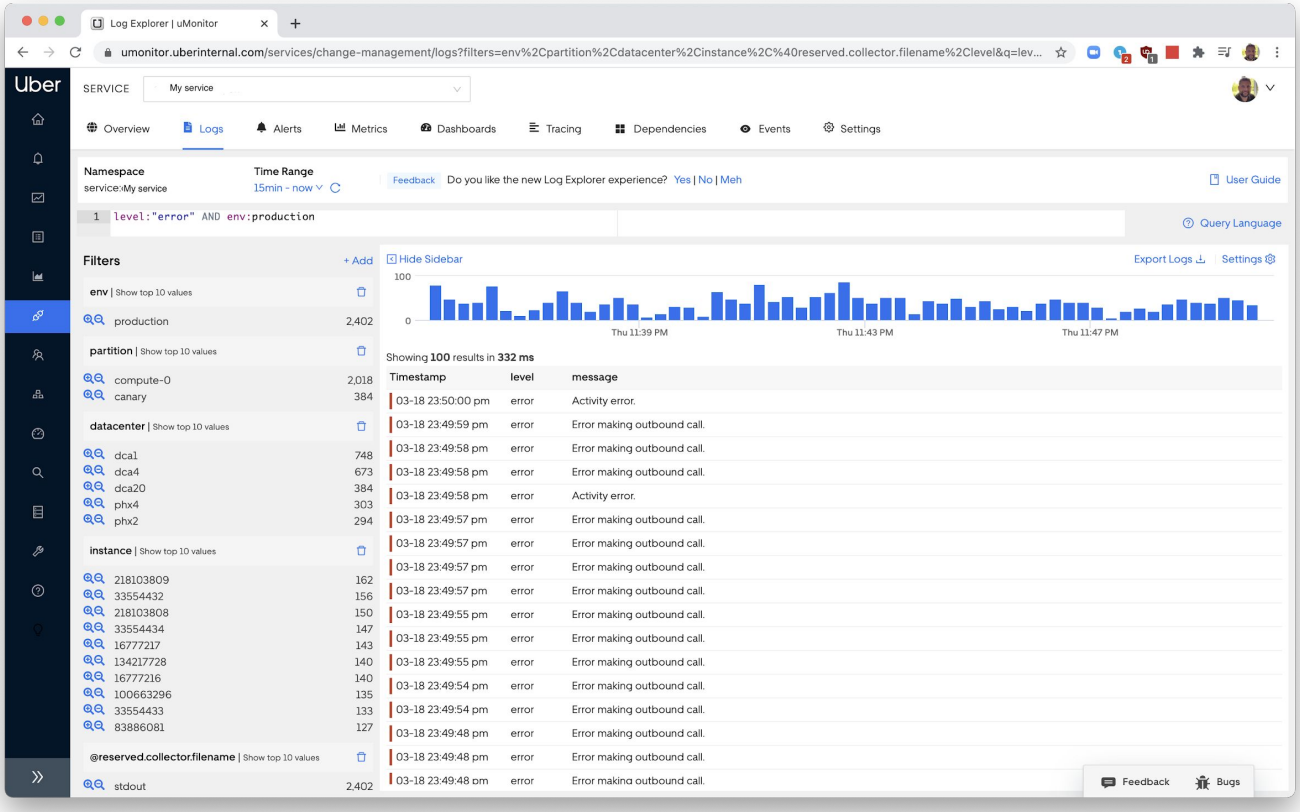


Healthline

Error log aggregation

Elasticsearch, Clickhouse, Sawmill

Log Aggregation/Queries



Distributed tracing

Jaeger

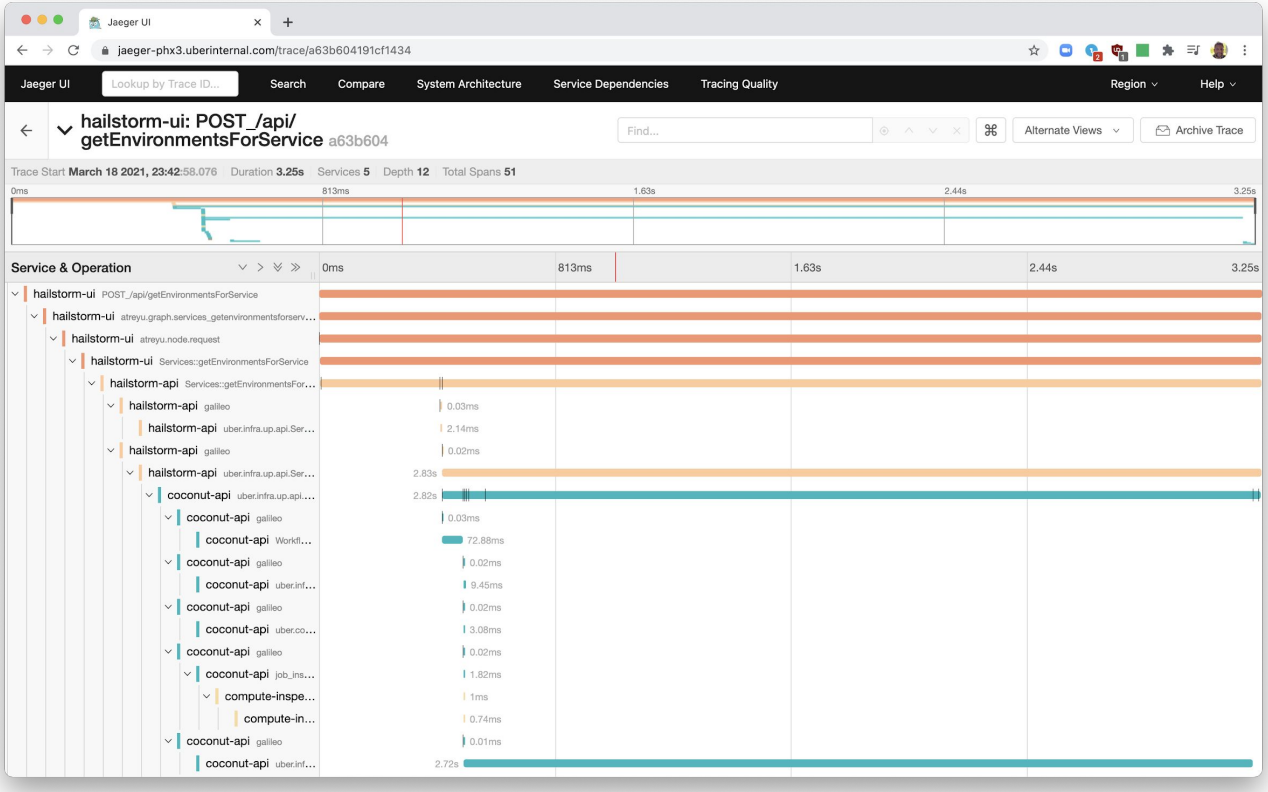
Distributed tracing for all services

https://github.com/jaegertracing/jaeger
https://opentelemetry.io/

Snapshot of callgraph

All 4K microservices and how they interact

Distributed tracing

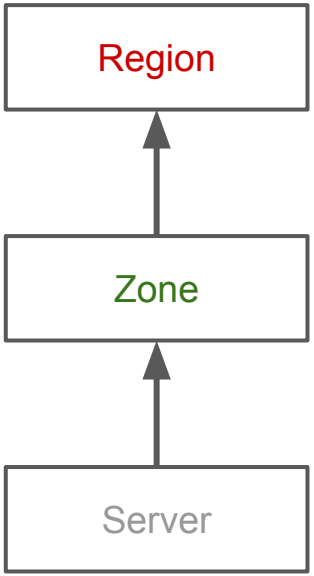


Summary

You can scale every aspect of software engineering

You can safely roll out 5000 times to production per week

Automation + abstractions are key to avoid constant manual migrations



Questions?

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Backup slides