Centre for
Data Analytics

Insight

From Git Fork to Server Farm

Mesos in research infrastructure &
An approach to traceability in the mesos ecosystem

Naoise Dunne (Insight Centre for Data Analytics)

DCU NUI Galway OÉ Gaillimh UCC University College Cork, Ireland Coláiste na hOllscoile Corcaigh UCD DUBLIN sfi

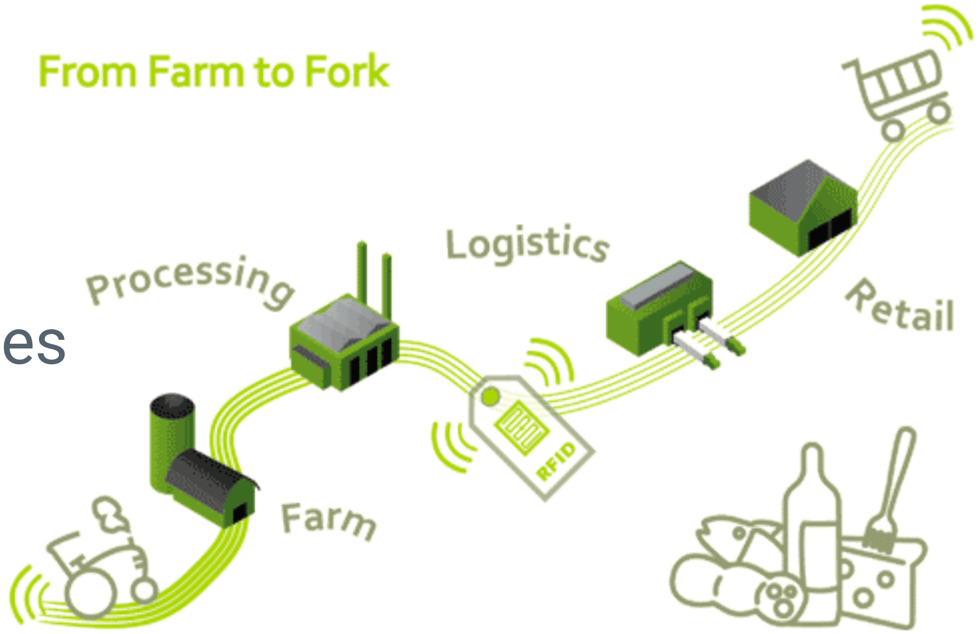
Overview

1. Why Mesos as research infrastructure
2. Overview of support infrastructure for Mesos
3. How we implement traceability on mesos infrastructure in continuous Integration/deployment
4. Demo

Why Farms and Forks

In Food and Farming Traceability and holistic approach makes

- better crafted food
- happier farm communities
- Safer food
- Tastier food
- Happier customers



Why Farms and Forks

In Infrastructure

Traceability and holistic approach makes

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- happier dev communities
- Safer Applications
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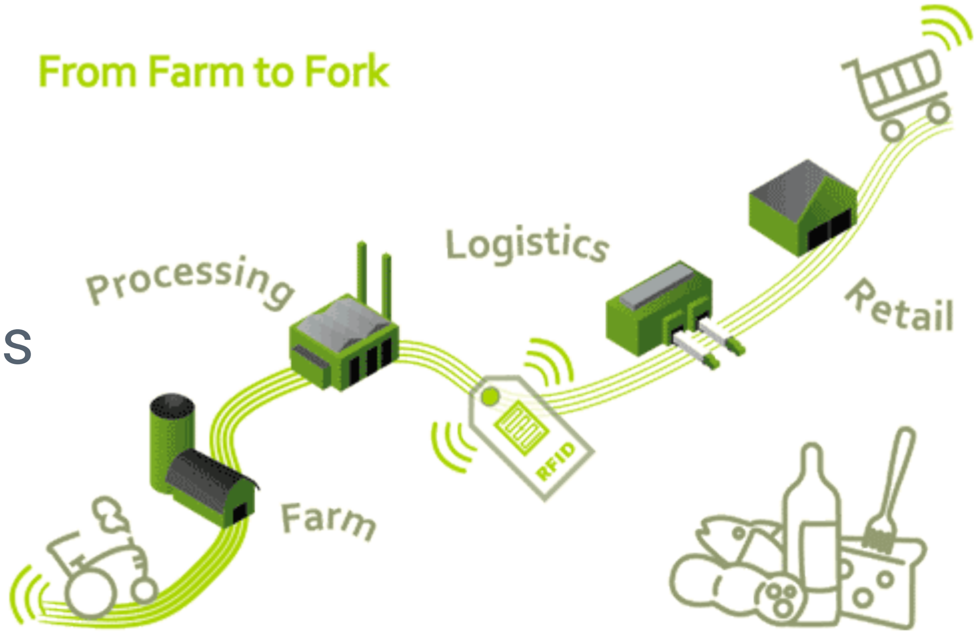

Who am I?

Naoise Dunne

Research Fellow
Work on Distributed Applications
Focusing on linked data analytics at large scales
Driving “research-ops” at insight

Insight Centre

Centre for Data Analytics
60M investment in research
Europe's largest research centre for Data Analytics
Empowering a data-driven society to enable better decisions by individuals, communities, business and governments.

Why Mesos?

The Challenges that helped us choose Mesos for our research infrastructure

What are the challenges for infrastructure at Insight?

Insight Centre Infrastructure Challenges

Characteristics of Infrastructure for Analytics Research

- Mix of Data Science skillsets and roles
  - Phd students, Post Doc researchers, University Administration
  - Partner Institutes, Commercialisation Partners

What are the profiles of these Data Scientists?

Data Science skillsets and roles at Insight

Engineer

Focused on the technical problem of managing data

Normally strong software developers

Creative

Need to explain the meaning of the data.

Good generalists, can code, with a flare for the visual or data narrative.

Researcher

People with deep academic background in science, maths, machine learning

Reluctant coders, amazing analysts

Insight Centre Infrastructure Challenges

Characteristics of Infrastructure for Analytics Research

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- Unscheduled bursts of Activity
  - Little or no planning, loose communication
  - Very real, very immediate need for access to resources

Insight Centre Infrastructure Challenges

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- Unscheduled bursts of Activity
    - Little or no planning, loose communication
    - Very real, very immediate need for access to resources
        - Need to create Proposal
        - Paper is accepted, need to reproduce expensive query on huge dataset
        - We need last years Big Data demo up on Tuesday

Planning is impossible

Very real, very immediate need for access to resources

Insight Centre Infrastructure Challenges

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- Unscheduled bursts of Activity
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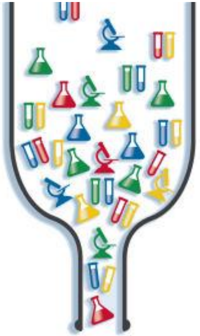
  - Very real, very immediate need for access to resources
- Very small ops team
  - Ratio of about 80:1 developers to operations staff
- Data Science and "Big Data" focus

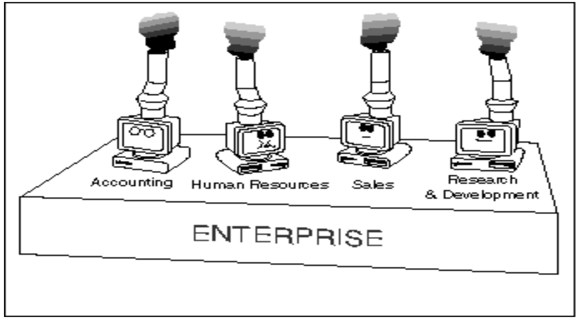
Small ops team

Bottlenecks

- Could not keep up with workload - thrashing release cycle
- Research becomes waste and huge backlog, apps get dropped
- Cutting corners hurts security etc.



BEFORE



Stovepipes

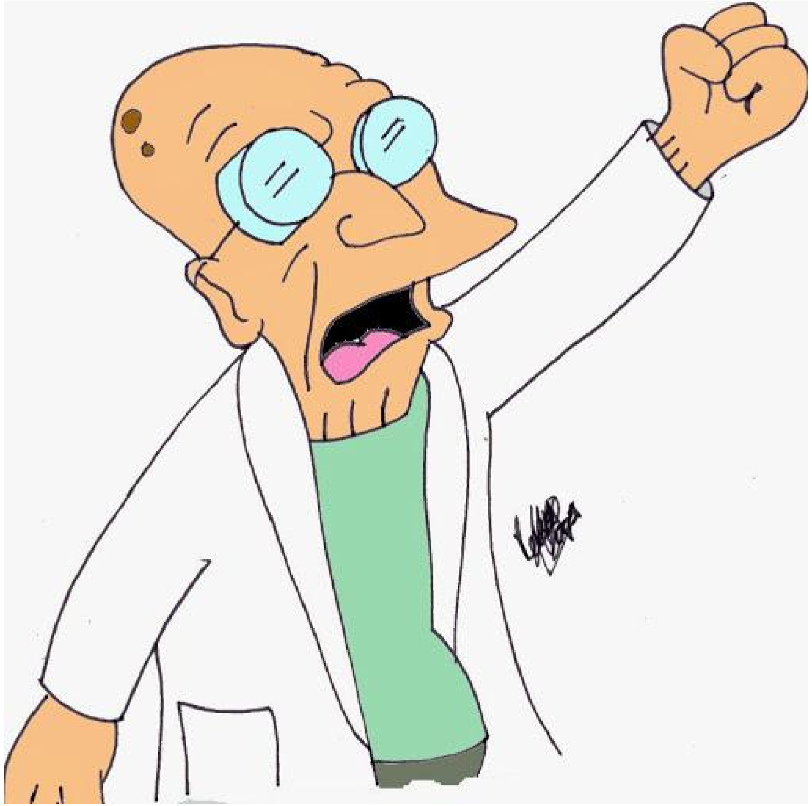
- When researchers leave can’t manage their applications
  - tacit knowledge exists only within research teams - easily lost
- No shared approach to managing applications
  - digital archiving

Insight Centre Infrastructure Challenges

What was the result of these challenges?

- Mix of Data Science skillsets and roles
  - huge waste as teams “baked in” overlapping skillsets and resources
- Unscheduled bursts of Activity
  - At best brittle deliveries, quickly failing services, vaporware
- Very small ops team
  - workload bottlenecks, thrashing delivery cycle, infrastructure suffered, software rot
- Data Science and “Big Data” focus
  - Hadoop and similar infrastructure goes to seed… a lot

How did our researchers feel about this?



Enter Mesos

Mesos Ecosystem

How we use mesos at Insight

Insight Centre Infrastructure Challenges

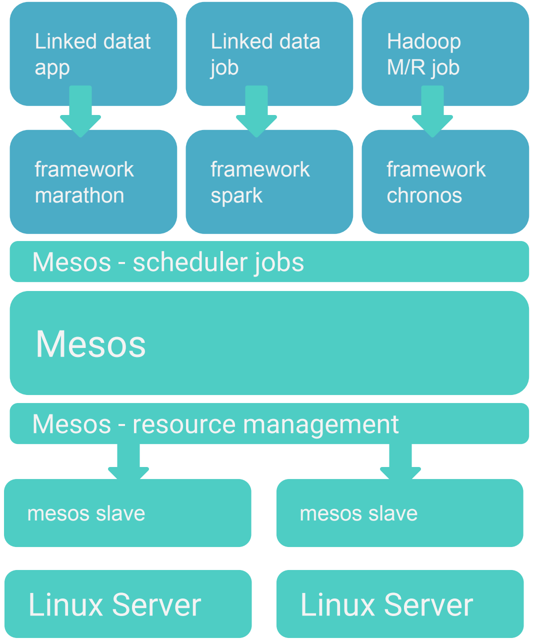
What we needed to meet these challenges...

- Mix of Data Science skillsets and roles
  - Service Mix right DB & services for our 3 kind of scientists
- Unscheduled bursts of Activity
  - Agility change our application mix with no turnaround
- Very small ops team
  - Efficiency best use of computing resources
- Data Science and “Big Data” focus
  - Scalability grow to the current demand of our apps

Mesos

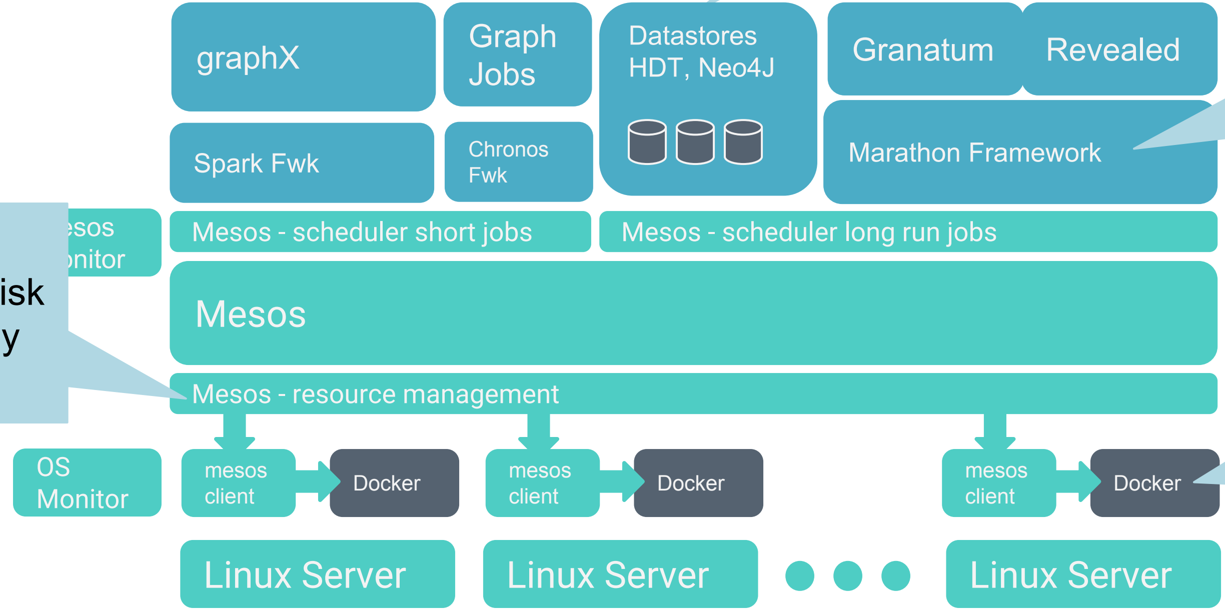
2 level scheduler : flexible, agile

- Can Schedule many kinds of applications
- Frameworks (such as spark) are delegated the per application scheduling
- Mesos responsible for resource distribution between applications and enforcing overall fairness
- Very modular, due to 2 level scheduling. frameworks manage apps as they like



Linked Data Infrastructure

Applications work with frameworks to get resources they need



graphX

Graph Jobs

Datastores HDT, Neo4J

Granatum

Revealed

Spark Fwk

Chronos Fwk

Marathon Framework

esos onitor

Mesos - scheduler short jobs

Mesos - scheduler long run jobs

Mesos

Mesos - resource management

OS Monitor

mesos client

Docker

mesos client

Docker

mesos client

Docker

Linux Server

Linux Server

Linux Server

Frameworks Negotiate with mesos to run their jobs

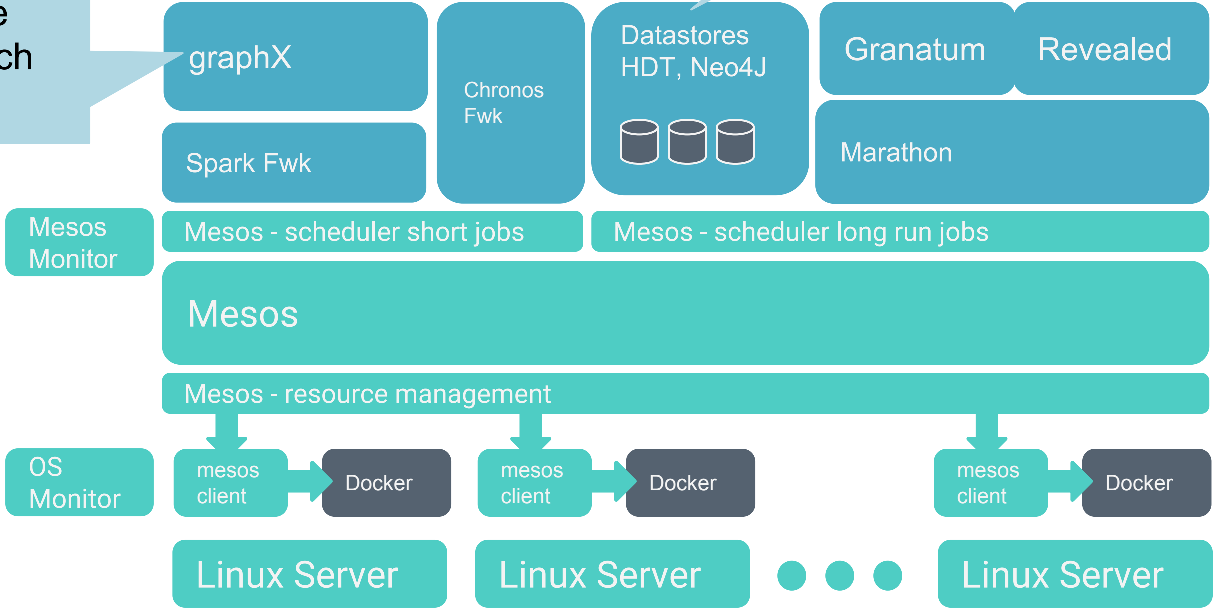
Resources cpu mem disk Managed by Mesos

Docker manages isolation on Linux servers

Linked Data Infrastructure

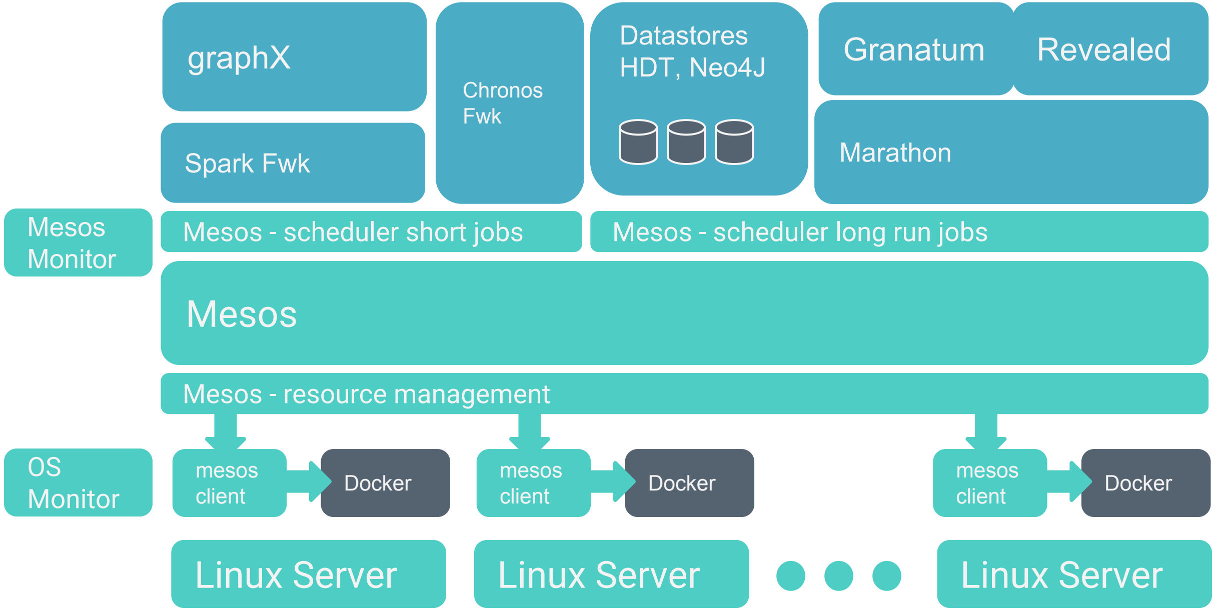
We use both HDT (RDF Store) Neo4J (Graph)

We use graph X for large graph batch jobs



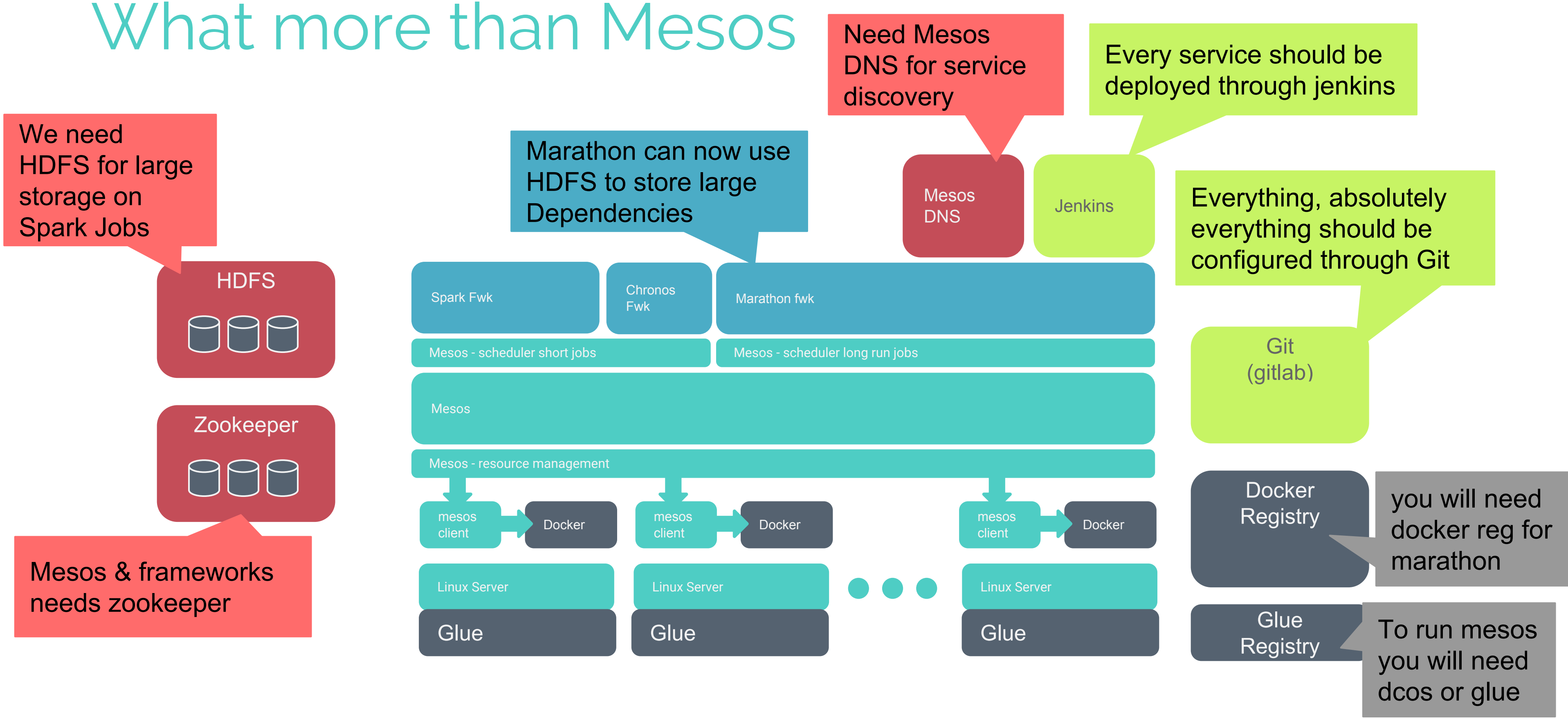
We deploy specialised linked data applications to cluster

Linked Data Infrastructure



Looking at the wider Mesos environment

What more than Mesos


Need Mesos DNS for service discovery

Every service should be deployed through jenkins

We need HDFS for large storage on Spark Jobs

Marathon can now use HDFS to store large Dependencies

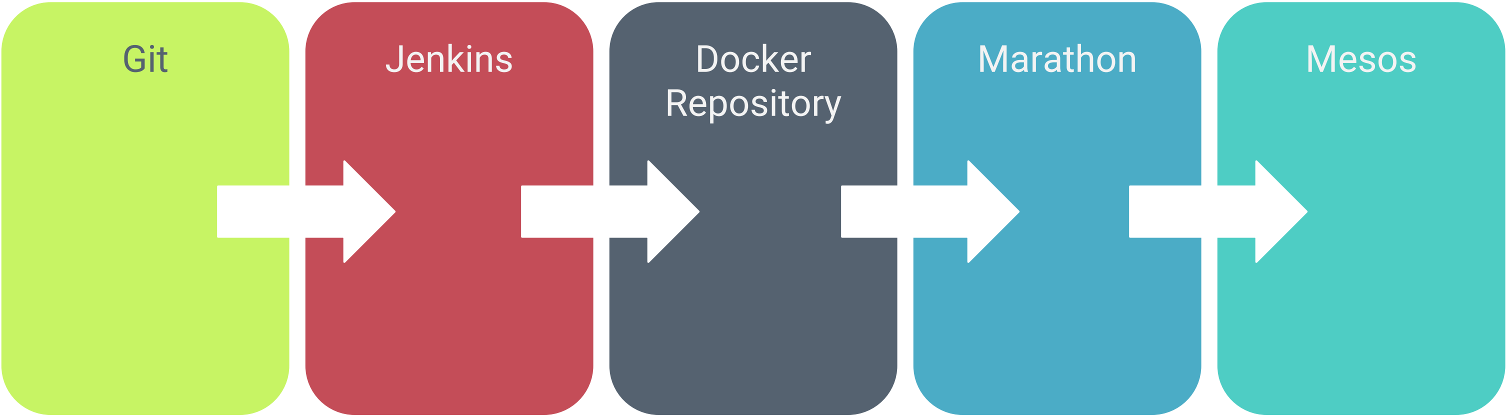
Everything, absolutely everything should be configured through Git

Mesos & frameworks needs zookeeper

you will need docker reg for marathon

To run mesos you will need dcos or glue

Deployment Flow for Web services


Git

Jenkins

Docker Repository

Marathon

Mesos

Mesos Delivers…

- Efficiency - scheduler gives best use of resources
  - we can build our own! try alternatives to FAIR
- Agility - change our app mix with no turnaround
  - marathon for web service, spark for batch
- Scalability - grow to the current demand of our app
  - most framework take advantage of mesos flexibility
- Modularity - Mesos allows quick repurposing of cluster
  - Want to run hadoop rather than spark no problem

Good news! We are saved

Mesos ecosystem now providing:

- Efficiency
- Agility
- Scalability
- Modularity

However…

In real world we also need…

- Accountability (traceability)

Traceability

from git fork to server farm

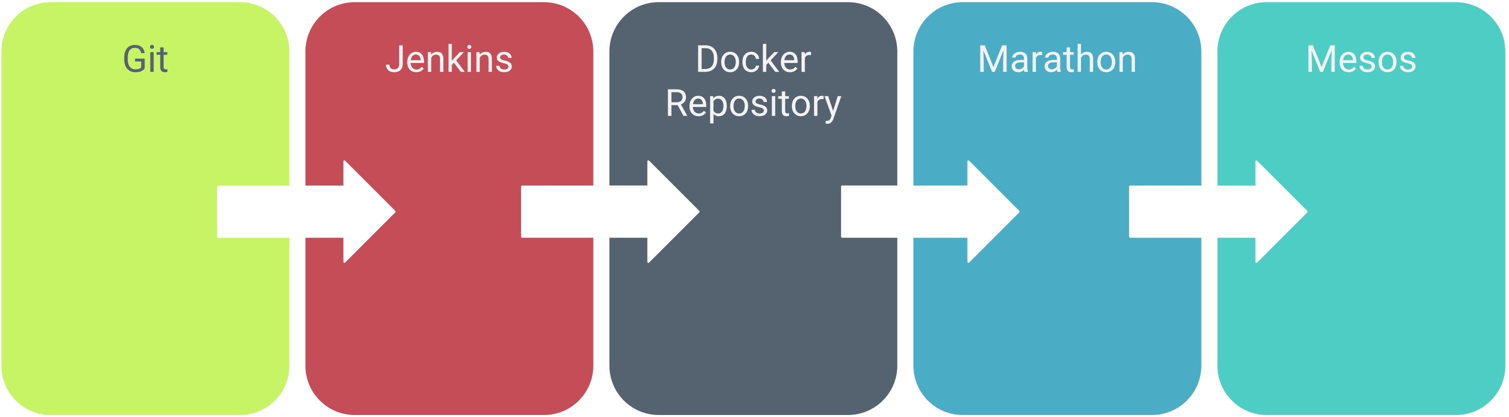
The need for accountability

After going live with mesos...

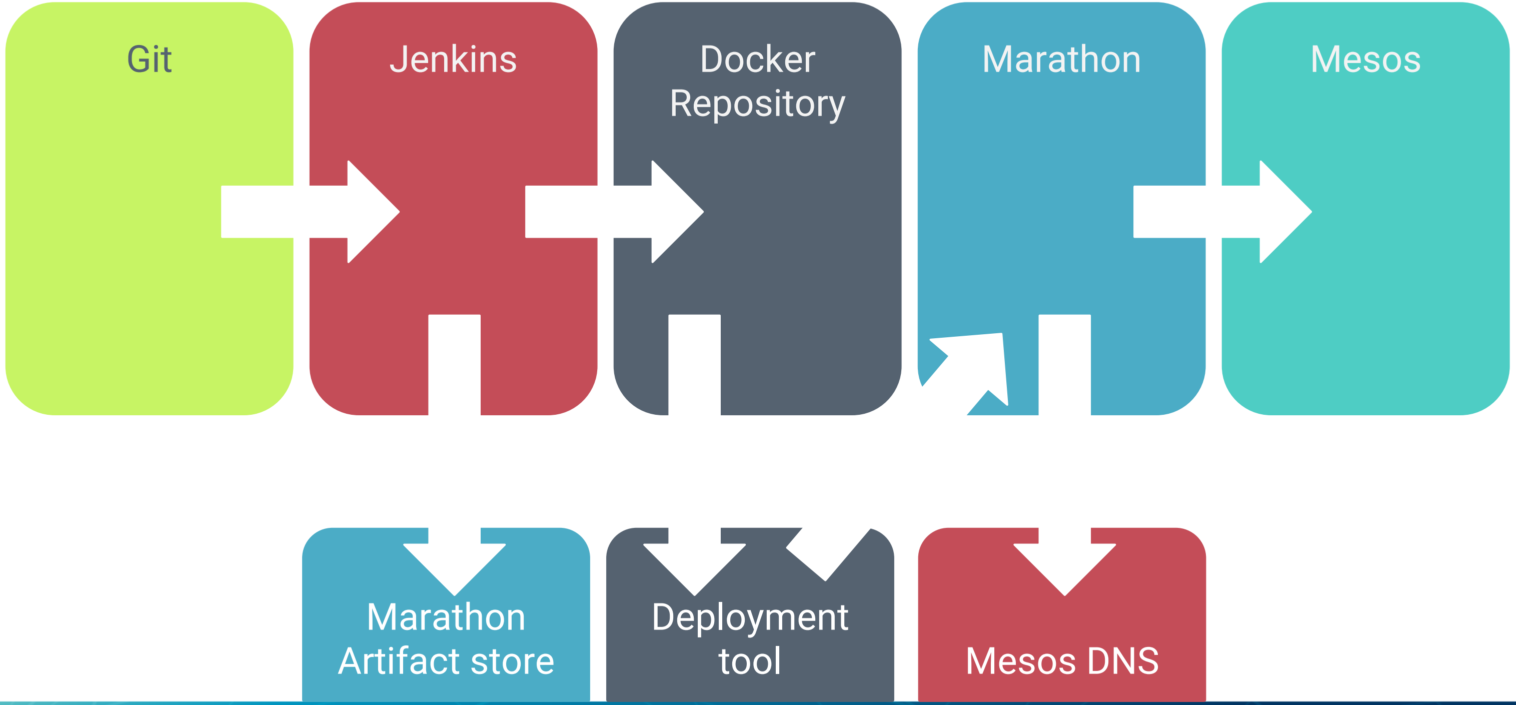
- Agility was good, but providence of application instances was difficult
- Multiple developers/researchers deploying the same application at the same time
- As applications could not be traced to code - difficult to debug and a lot of finger pointing between dev and ops
- Reporting was difficult across so many systems

We needed to understand the application Flow and trace the life of code

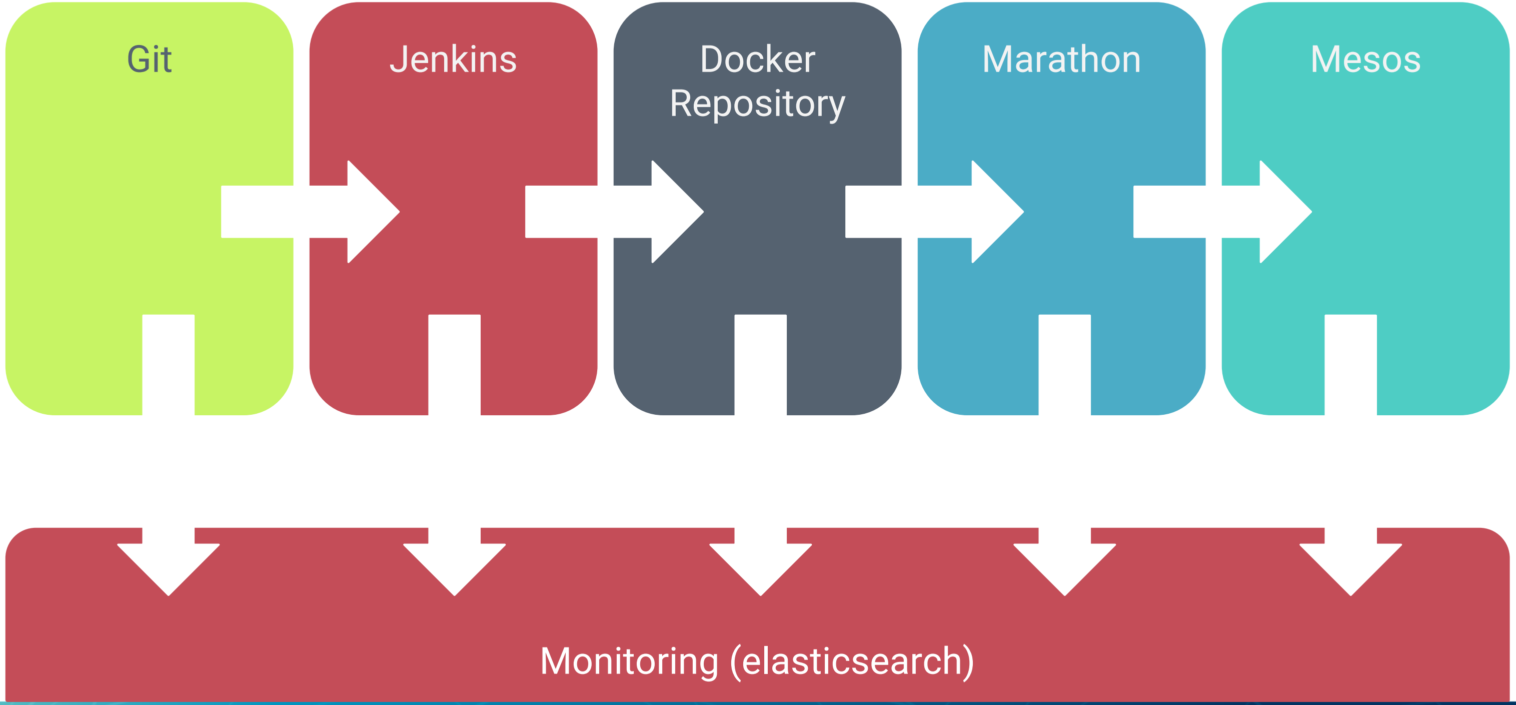
Tracing Deliveries along deployment flow



Tracing Deliveries: Actual Flow



Tracing Deliveries: Monitoring


Git

Jenkins

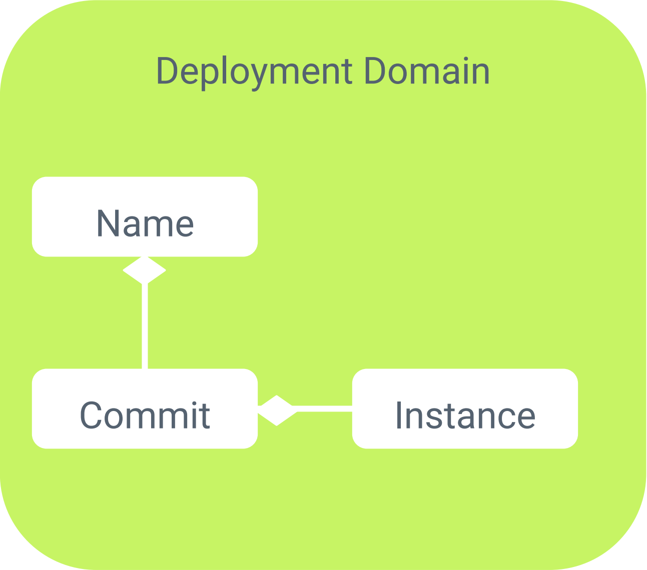
Docker Repository

Marathon

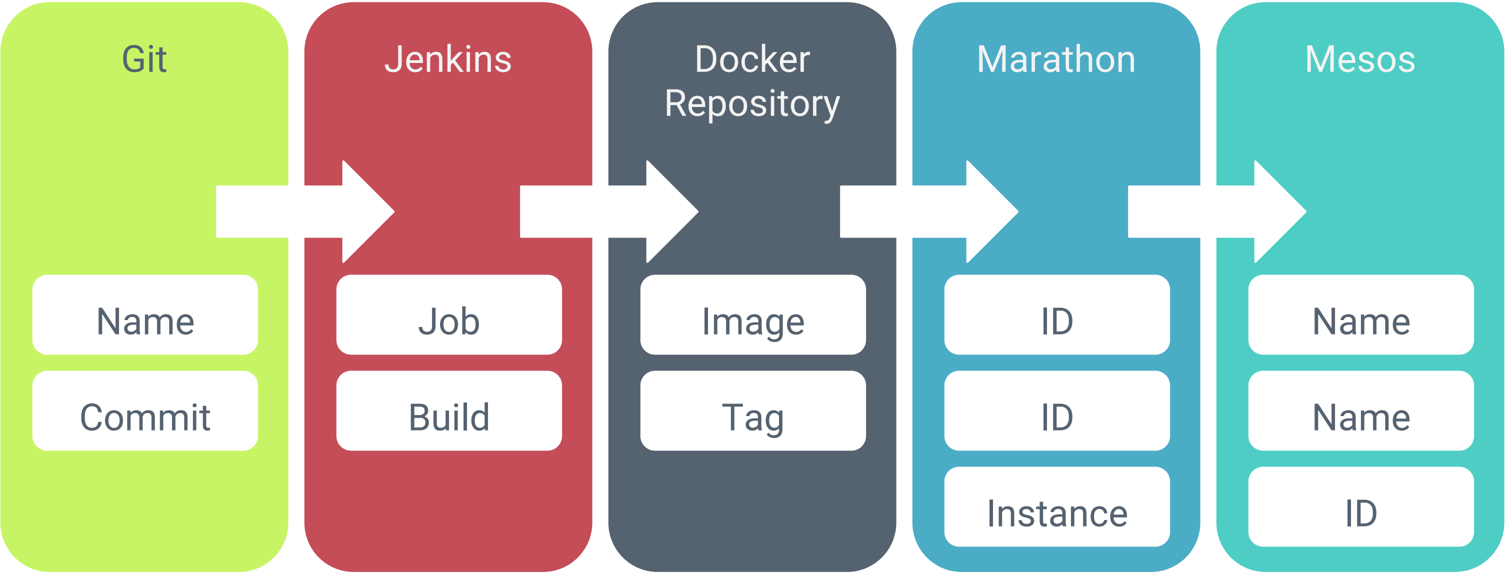
Mesos

Monitoring (elasticsearch)

What we trace



Deployment Flow



Git
Name
Commit

Jenkins
Job
Build

Docker Repository
Image
Tag

Marathon
ID
ID
Instance

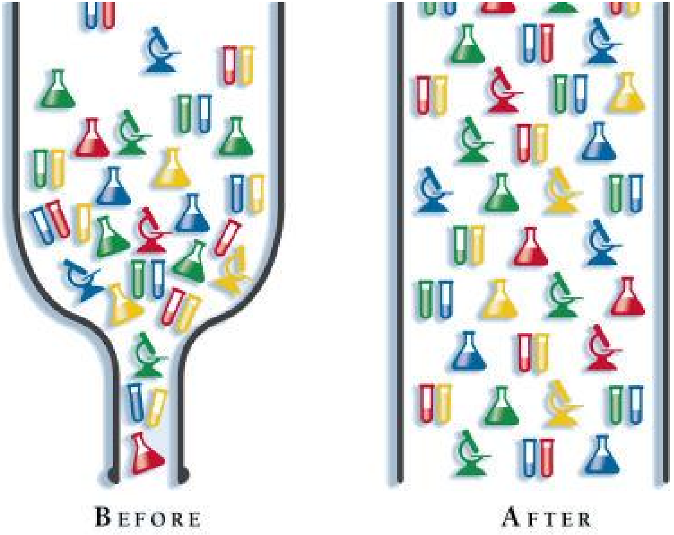
Mesos
Name
Name
ID

Demo

walk through of tracing on live system

Advantages of Traceability

- Consistent reporting
- Eases log aggregation
- Holistic view of Deployment Kanban
- Simplifies communication between Ops & Developers
- Multiple versions problem can be managed



After going live with mesos we

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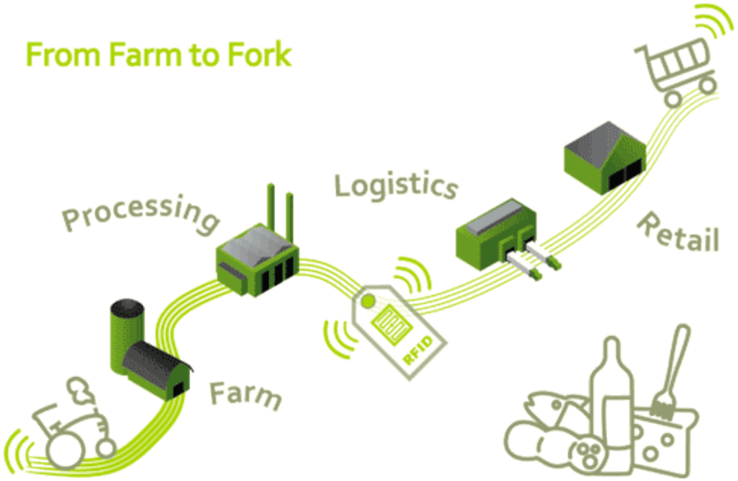

Thank you.
Questions?