# When Airflow Meets Kubernetes

## *An Introduction to MLOps*

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- International Tech Speaker
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- Publications at International Journals
- ALL STACK DEVELOPER
- Mentor

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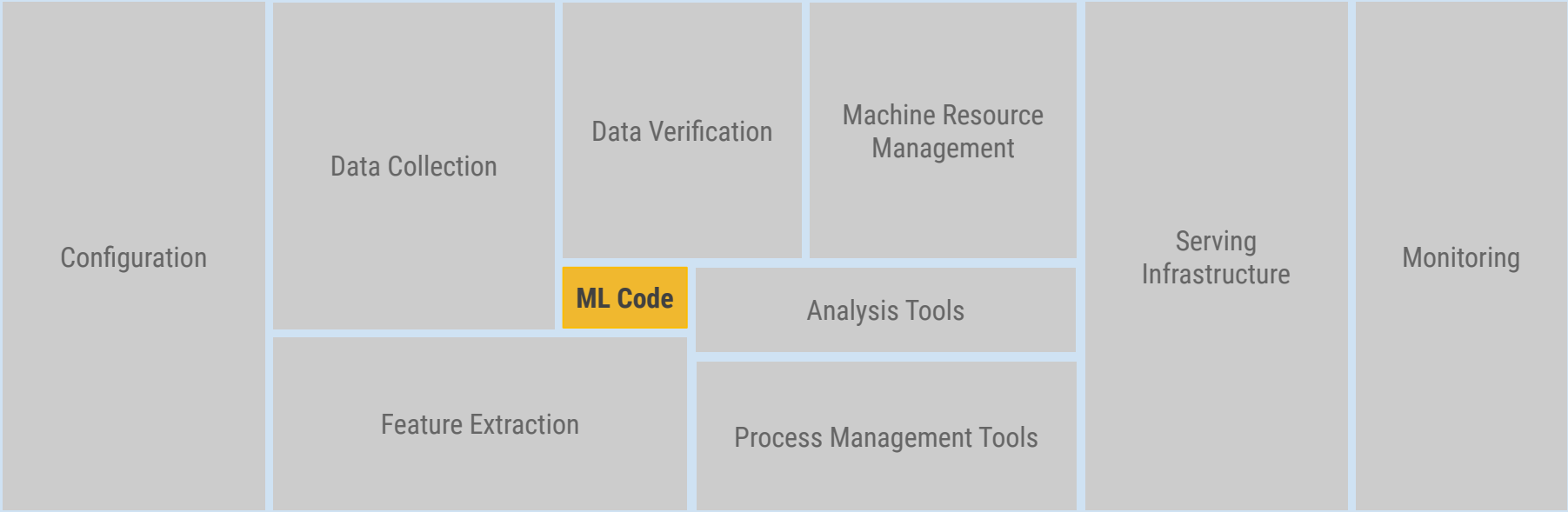
# Flow of the Talk

- The Need for MLOps
- Basics of MLOps
- Orchestration Frameworks
- Introduction to Airflow
- Airflow on Kubernetes
- Demo

# The Need for MLOps

# A Production Solution Requires Much More than just *"ML Code"*



***Science*** gears toward ***research*** and ***Engineering*** gears toward ***production***

Operational Excellence

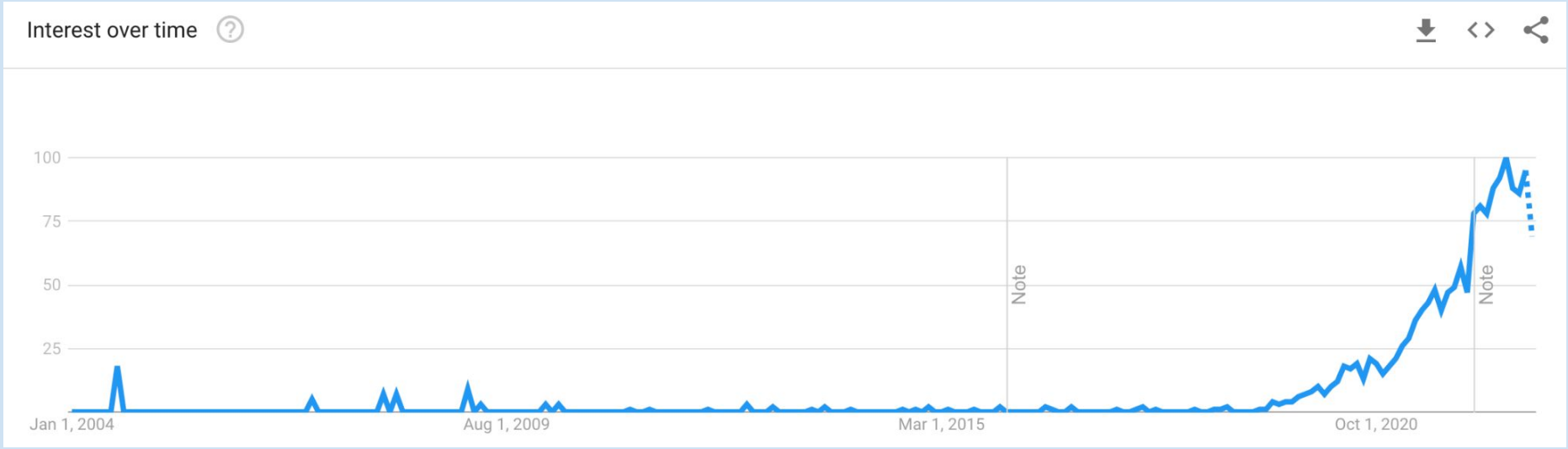
Multiple ***teams*** using multiple ***tools*** trying to build multiple ***models***

***Data Scientists*** are building ***Notebooks*** which rarely make to ***production***

Large backlog of ***models*** waiting to be deployed; by the time they hit the release stage, ***data*** and ***requirements change***

No standard way to test, monitor, reuse, audit, and maintain the models; No well established ***Lifecycle*** or ***Governance***

# Google Trend for *"MLOps"*



# What's required for ML/AI Projects?

Cloud Native Platforms

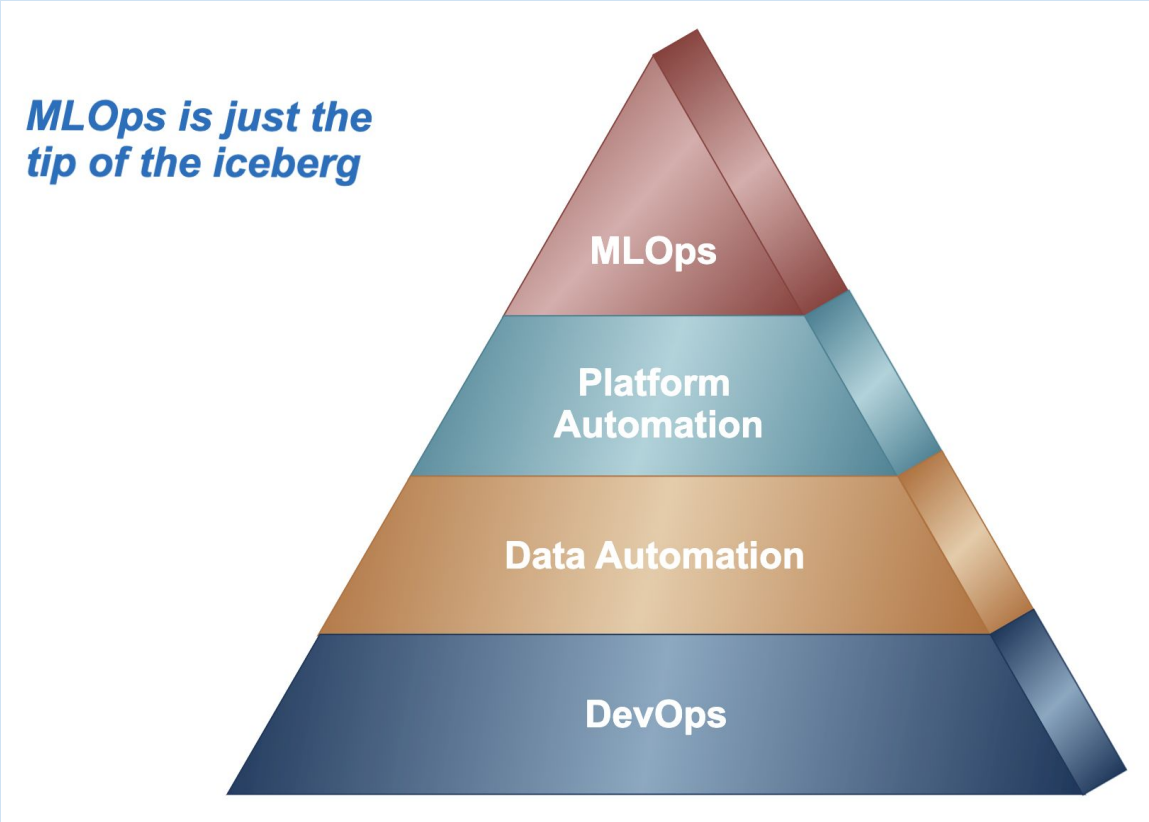
Containerized Workloads

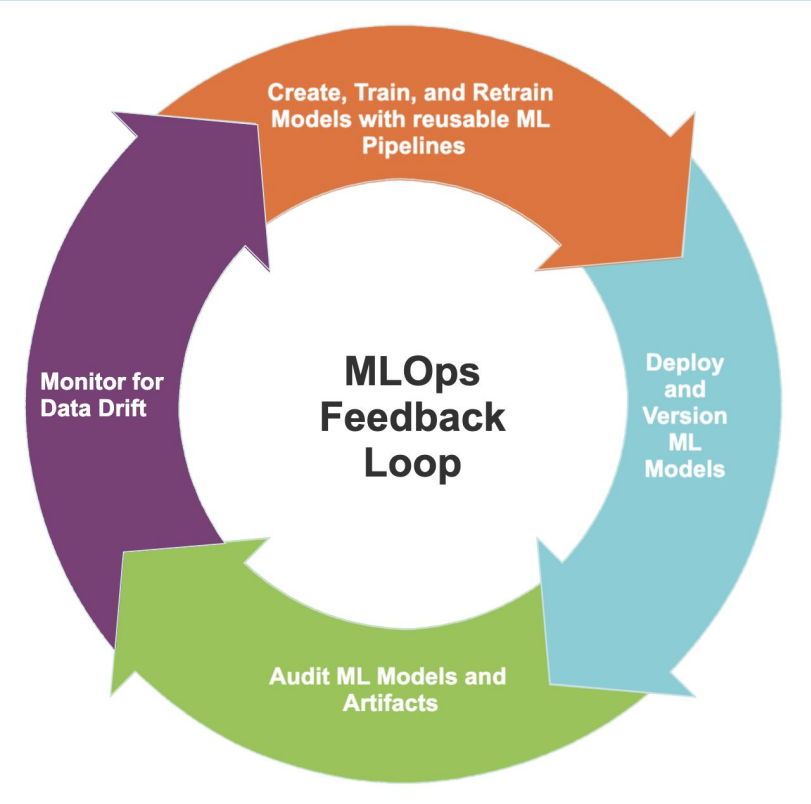
Serverless Technology

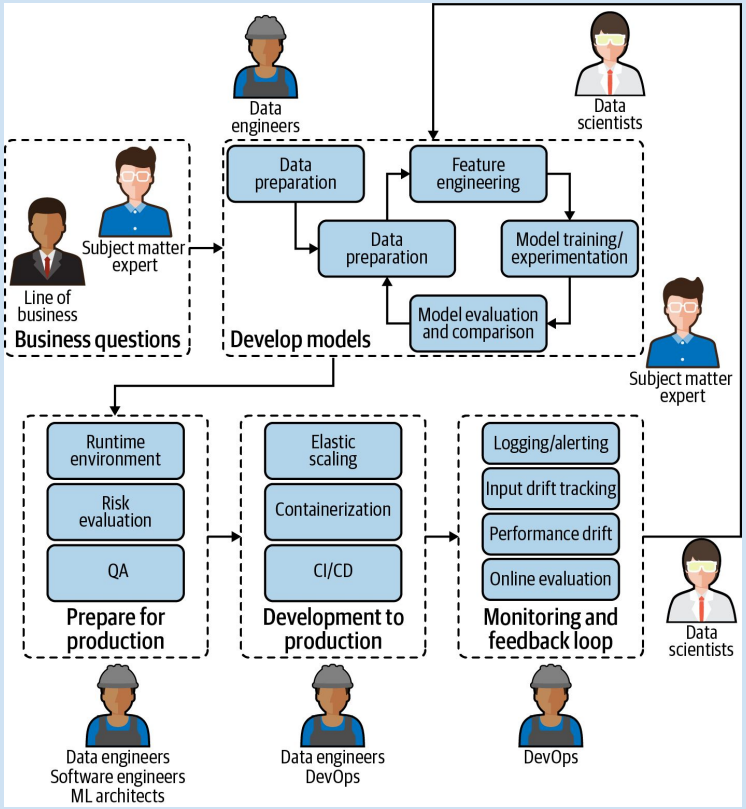
Specialized Hardware for ML/AI

Big Data Platforms and Tools

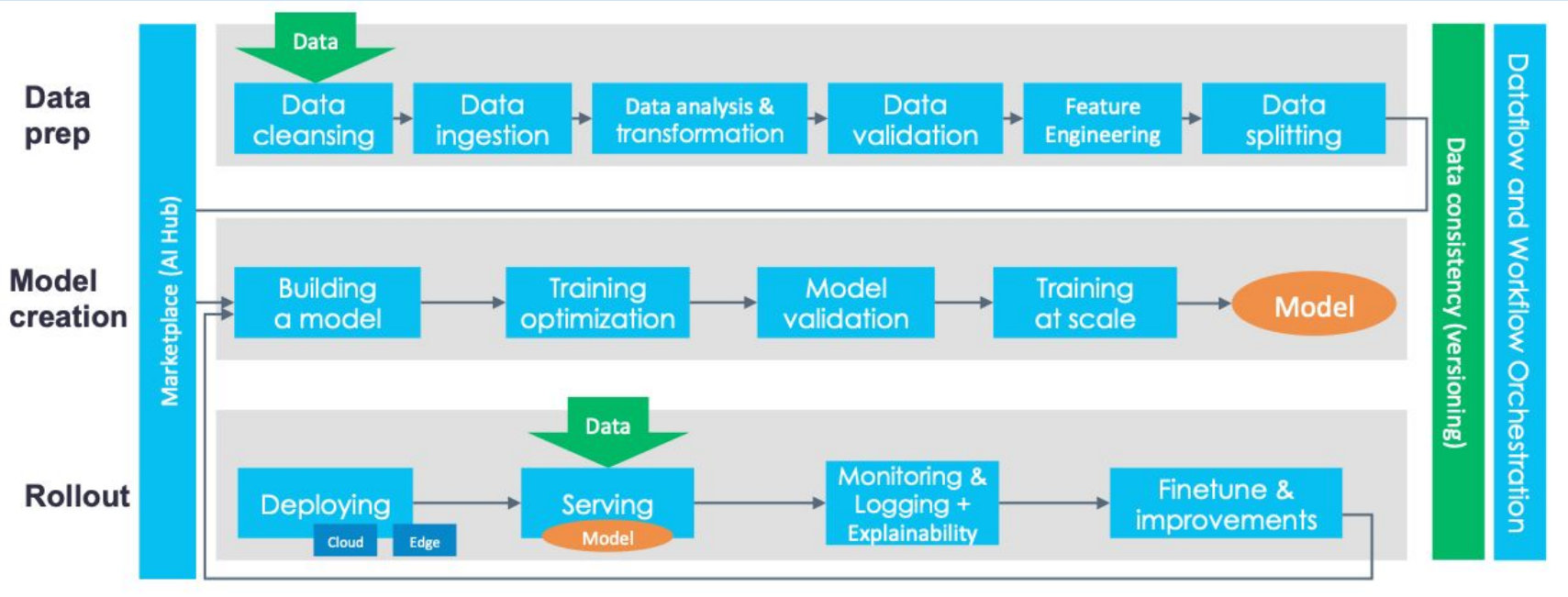
# MLOps


MLOps is just the tip of the iceberg
MLOps
Platform Automation
Data Automation
DevOps


Create, Train, and Retrain Models with reusable ML Pipelines
Deploy and Version ML Models
Audit ML Models and Artifacts
Monitor for Data Drift
MLOps Feedback Loop


Data engineers
Data scientists
Data preparation
Feature engineering
Data preparation
Model training/ experimentation
Model evaluation and comparison
Subject matter expert
Line of business
Business questions
Develop models
Subject matter expert
Runtime environment
Risk evaluation
QA
Prepare for production
Elastic scaling
Containerization
CI/CD
Development to production
Logging/alerting
Input drift tracking
Performance drift
Online evaluation
Monitoring and feedback loop
Data scientists
Data engineers
Software engineers
ML architects
Data engineers
DevOps
DevOps

# High-level MLOps Workflow




https://cd.foundation/blog

# Introduction to Airflow



Apache Airflow

Open source platform for developing, scheduling, and monitoring batch-oriented workflows

Python-first; supports parameterization using Jinja

DAG workflows

Extensible with Operators

Task Dependency Management, Parallel Execution, and Retries

Monitoring, Logging, Reporting, and Alerting

# Airflow Components

Airflow Webserver

Airflow Scheduler

Airflow Executor

Metastore Database

# Airflow Executors

Sequential; no parallelism or concurrency

Local; parallel but local

Celery; production-grade

Kubernetes; production-grade and has Celery variant available as well

# Airflow
# +
# Kubernetes



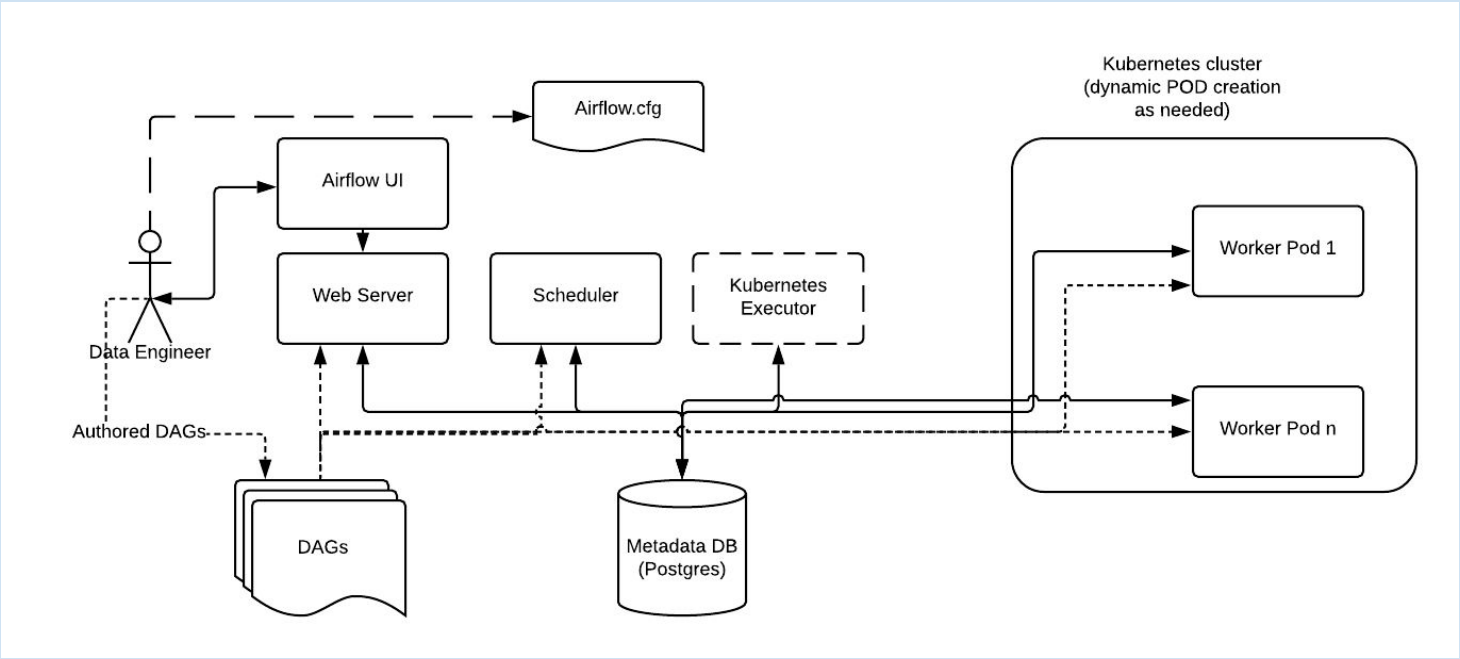
Apache Airflow

Kubernetes Pod Operator

Kubernetes Executor

Airflow + KEDA

# Kubernetes Executor



# Demo

# Thanks Everyone !

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#Kubernetes
#MLOps
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