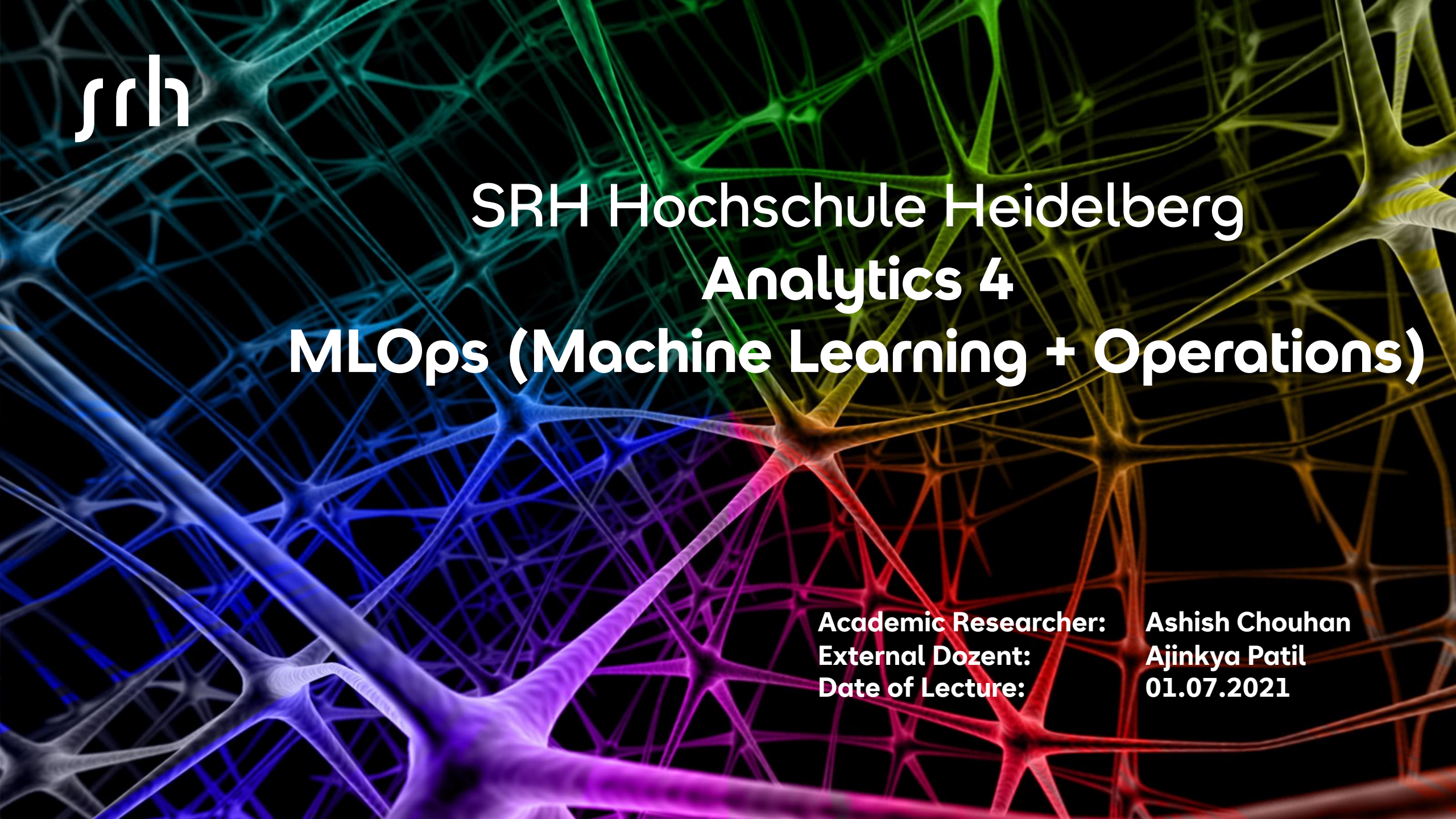


SRH Hochschule Heidelberg
Analytics 4
MLOps (Machine Learning + Operations)

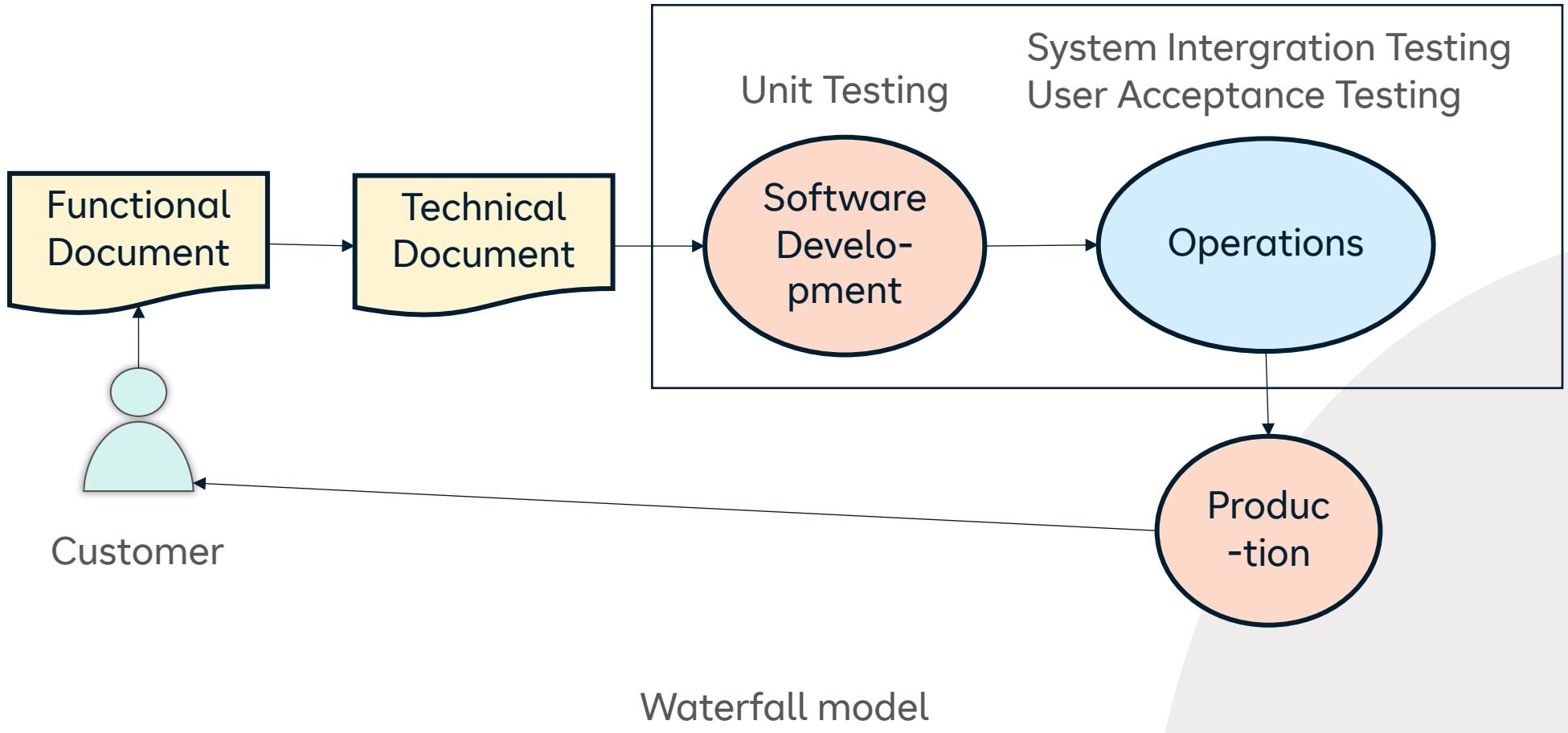
Academic Researcher: Ashish Chouhan
External Dozent: Ajinkya Patil

Date of Lecture: 01.07.2021

DevOps (Development + Operations)

01

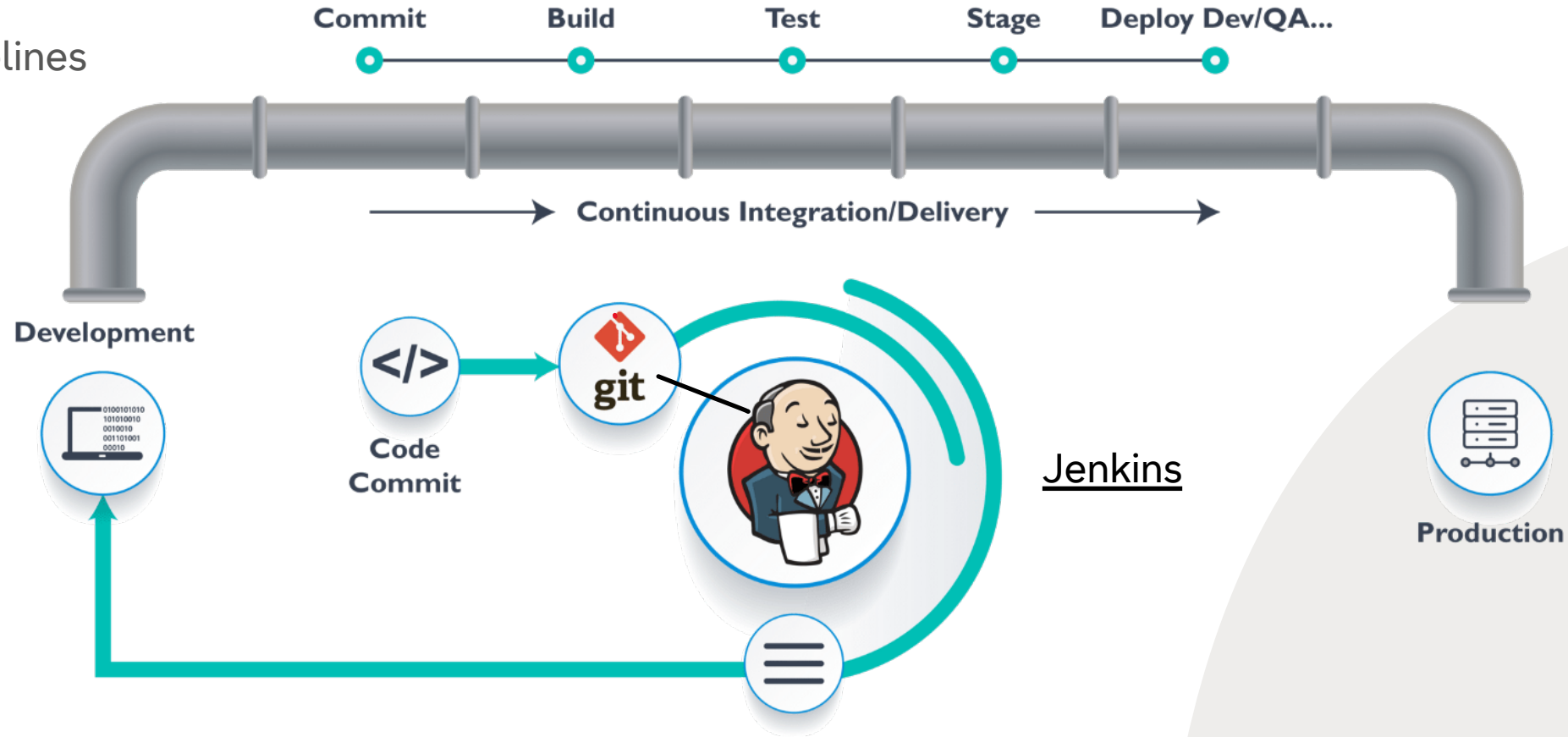
Traditional Software Development



Waterfall model

DevOps

Circle CI
Azure Pipelines
GitLab



https://faun.pub/jenkins-pipeline-tutorial-first-step-guide-to-continuous-delivery-87f74d322ab7

MLOps (Machine Learning or Deep Learning + Operations)

02

Machine Learning System

Team Skills:

- Data Scientist or ML Researchers focus on Exploratory Data Analysis (EDA) and Model Development.
- No Experience in **software engineering**.

Development:

- **Different feature, algorithms, modelling techniques, parameter configurations** are tried to find out the best performing combination for the respective problem statement.
- **Challenge is the tracking of combination that worked**, maintaining reproducibility, and maximum code reusability.

Machine Learning System

Testing:

- Similar to testing of other software system
  - Unit Testing
  - Integration Testing
- **Data Validation, trained** model quality evaluation, and model validation.

Deployment:

- Simplest is to deploy an **offline-trained ML model** for solving the problem.
- ML System can require multiple steps to be executed in order to retrain and deploy model.
- Automating multiple steps that are manually performed.

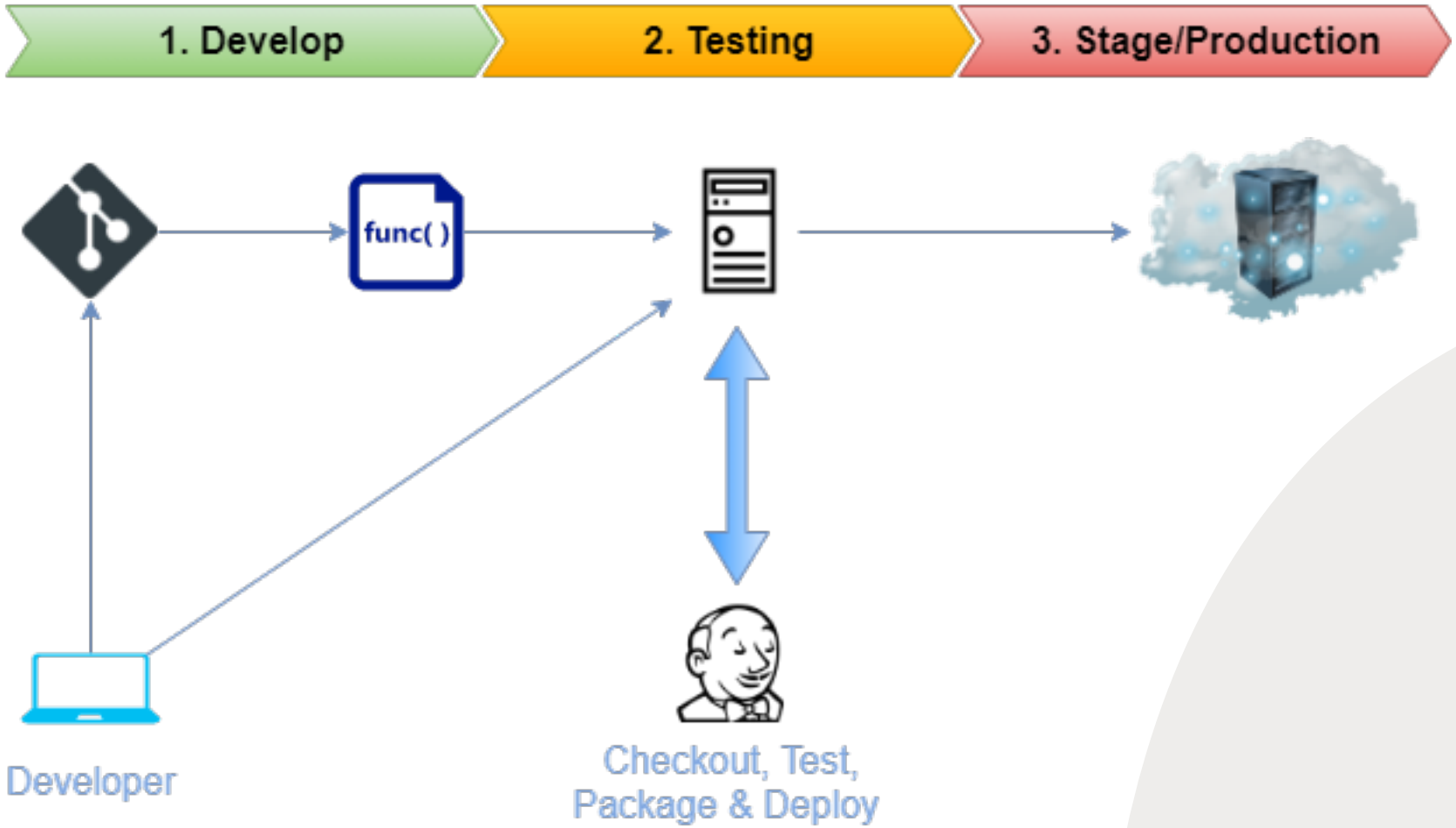
Machine Learning System

Production:

- ML models can have reduced performance:
  - Coding
  - Evolving data profiles
- Track summary statistics of the data and monitor the online performance of the model.

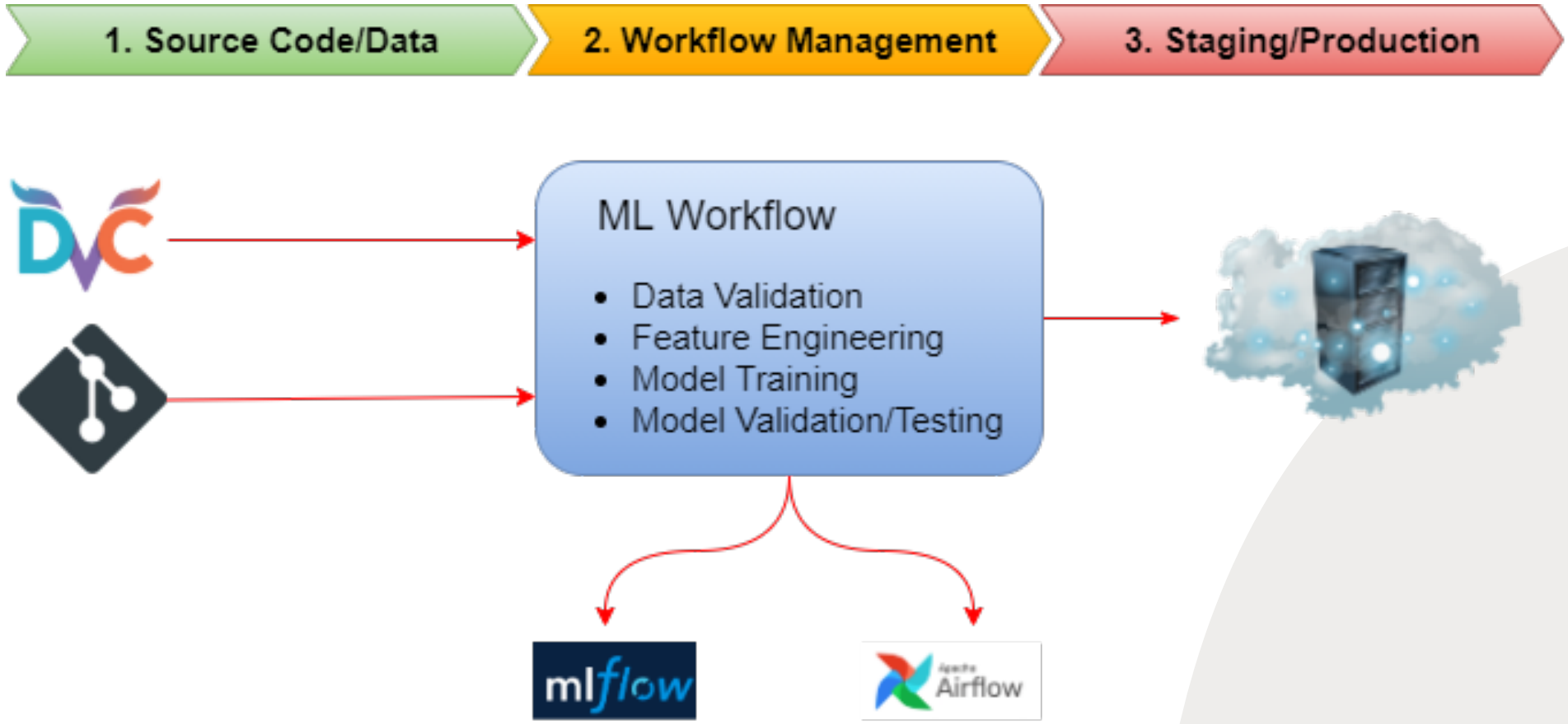
- Concept Drift
- Model Stability
- Model Scalability

DevOps Vs MLOps



DevOps

DevOps Vs MLOps



MLOps

MLOps

“ The Extension of the DevOps methodology to include Machine Learning and Data Science assets as the first-class citizens within the DevOps ecology”

- Continuous Delivery Foundation’s SIG-MLOps

“ MLOps is a set of practices to **improve collaboration** and **communication** between **Machine Learning and Operations professionals**. It aims to shorten and manage the complete development life cycle and provide continuous delivery of high-quality predictive services”

- GOOGLE (2018)

MLOps

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MLOps

Lifecycle of Machine Learning or Data Science or Deep Learning Project:

- Requirement Gathering
- Exploratory Data Analysis
- Feature Engineering
- Feature Selection
- Model Creation
- Model Hyper-parameter Tuning
- Model Deployment
- Retraining approaches

MLOps

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MLOps

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Continuous Integration + Continuous Delivery

MLOps

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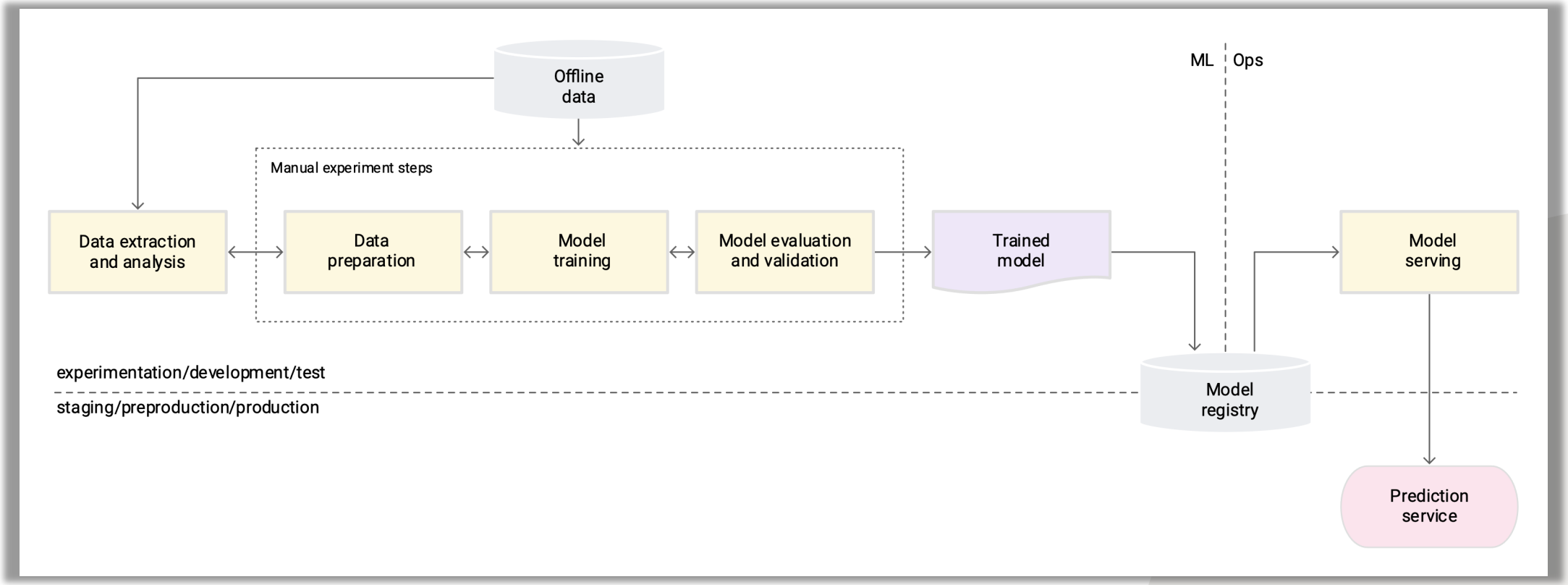
Continuous Integration + Continuous Delivery + Continuous Training

MLOps

Important points in MLOps:

- Continuous Integration (Instead of only testing code, **validating data** is also important in the pipeline)
- Continuous Delivery (Delivery is a pipeline that involves hyperparameters tuning, feature selection)
- Continuous Training (Models are automatically retrained and monitored)

Levels of MLOps

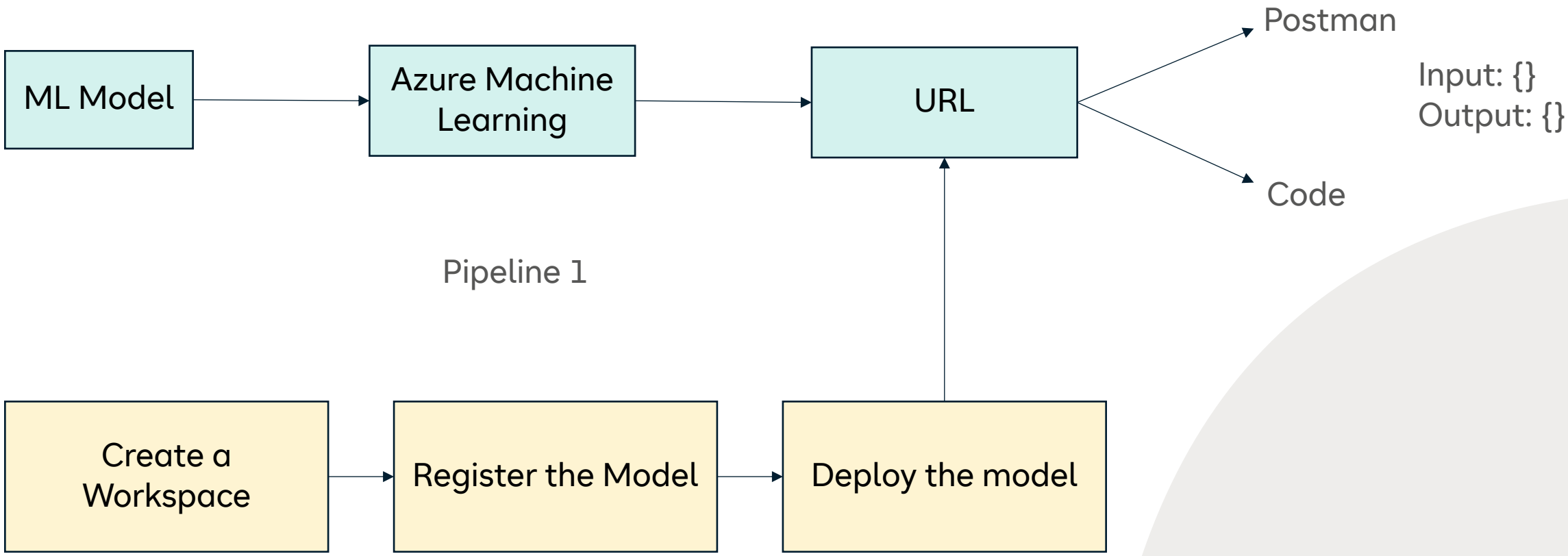


MLOps Level 0: Manual Process

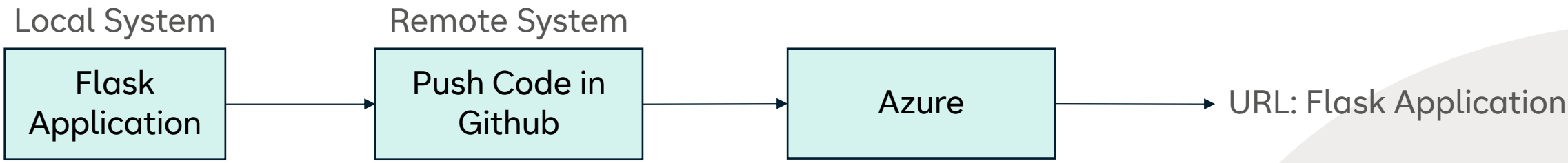
MLOps Level 0: Manual Process

Demo

MLOps Level 0: Manual Process



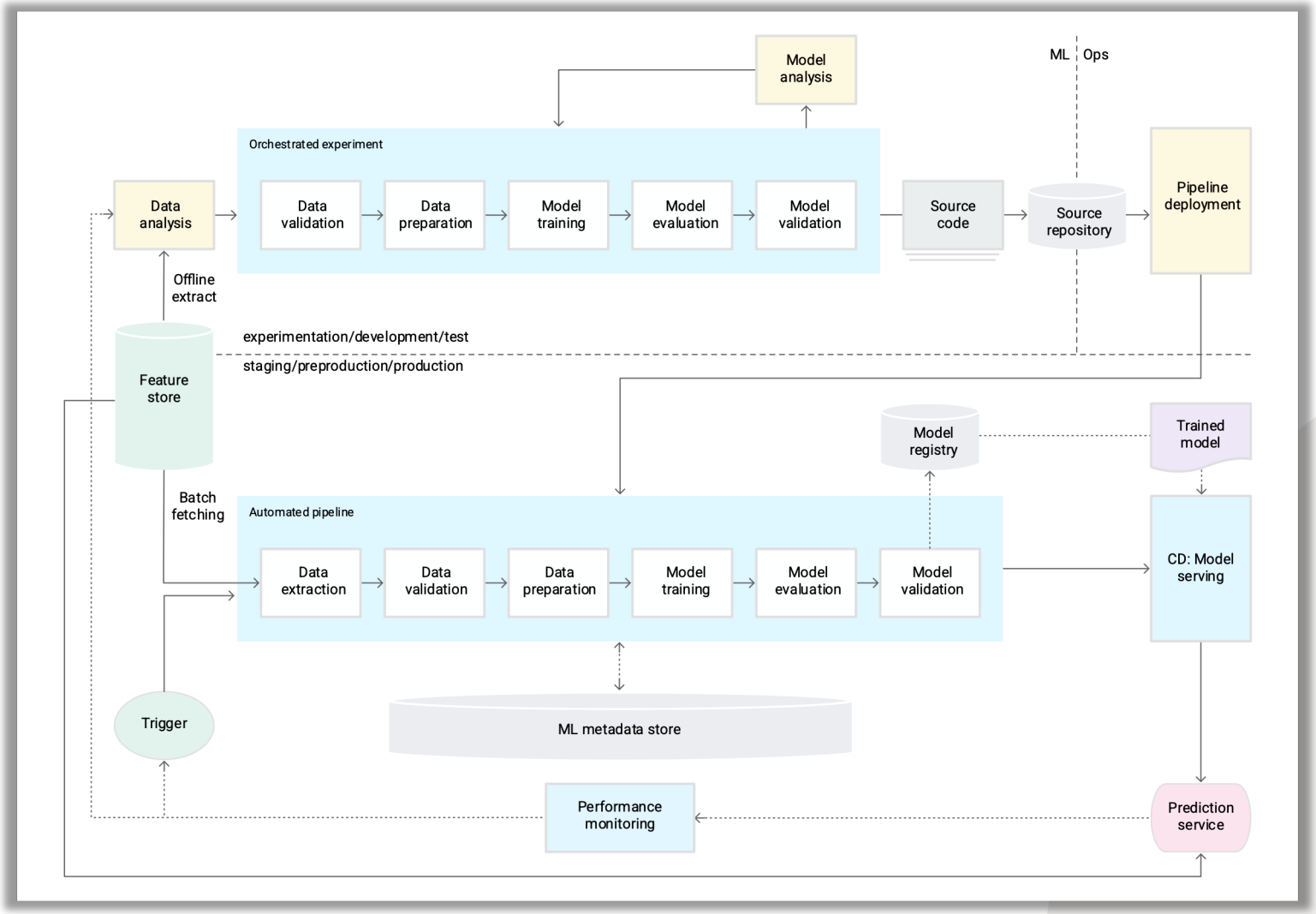
MLOps Level 0: Manual Process



Pipeline 2

Levels of MLOps

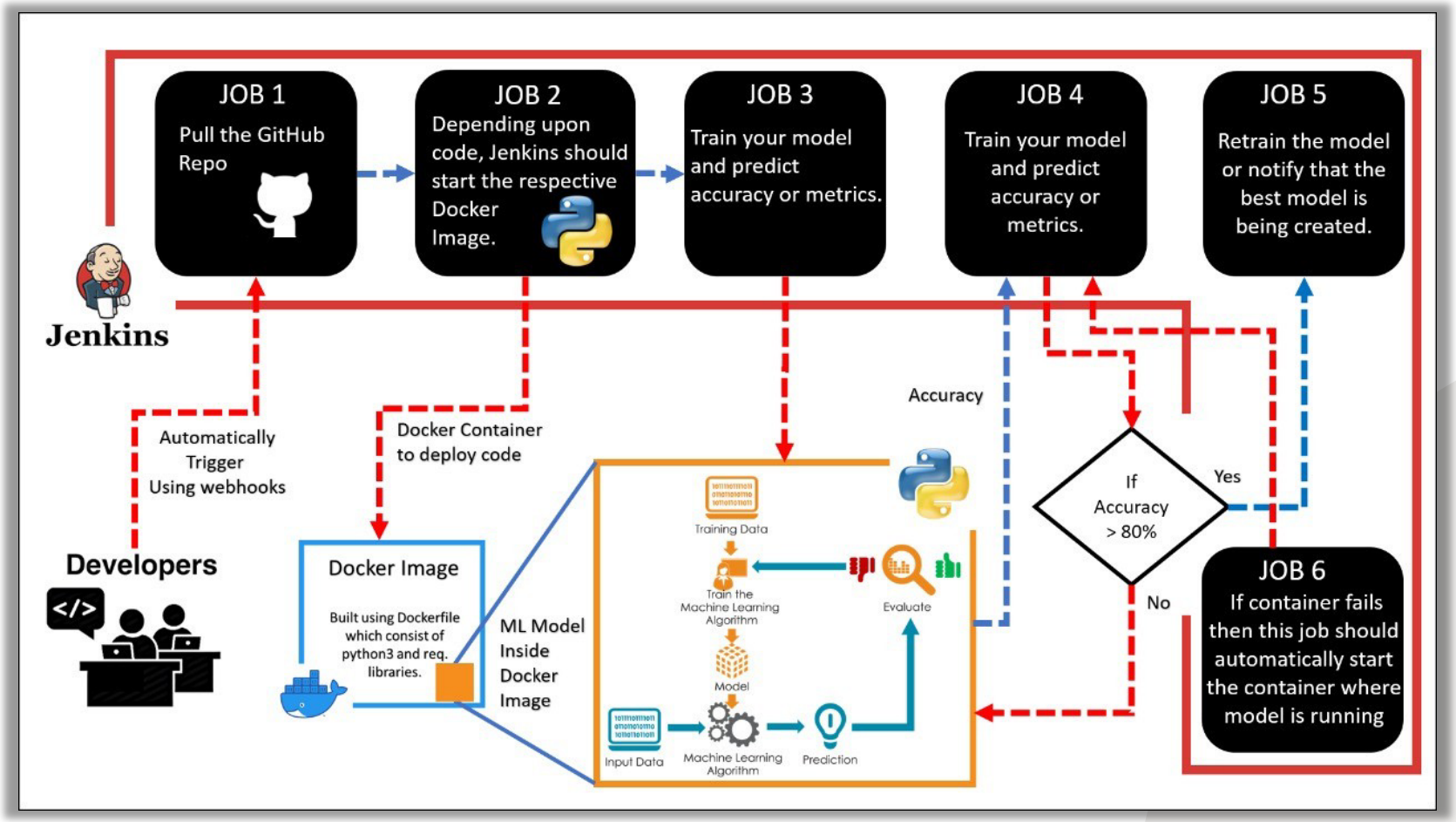
MLOps Level 1: ML Pipeline Automation



MLOps Level 1: ML Pipeline Automation

Demo

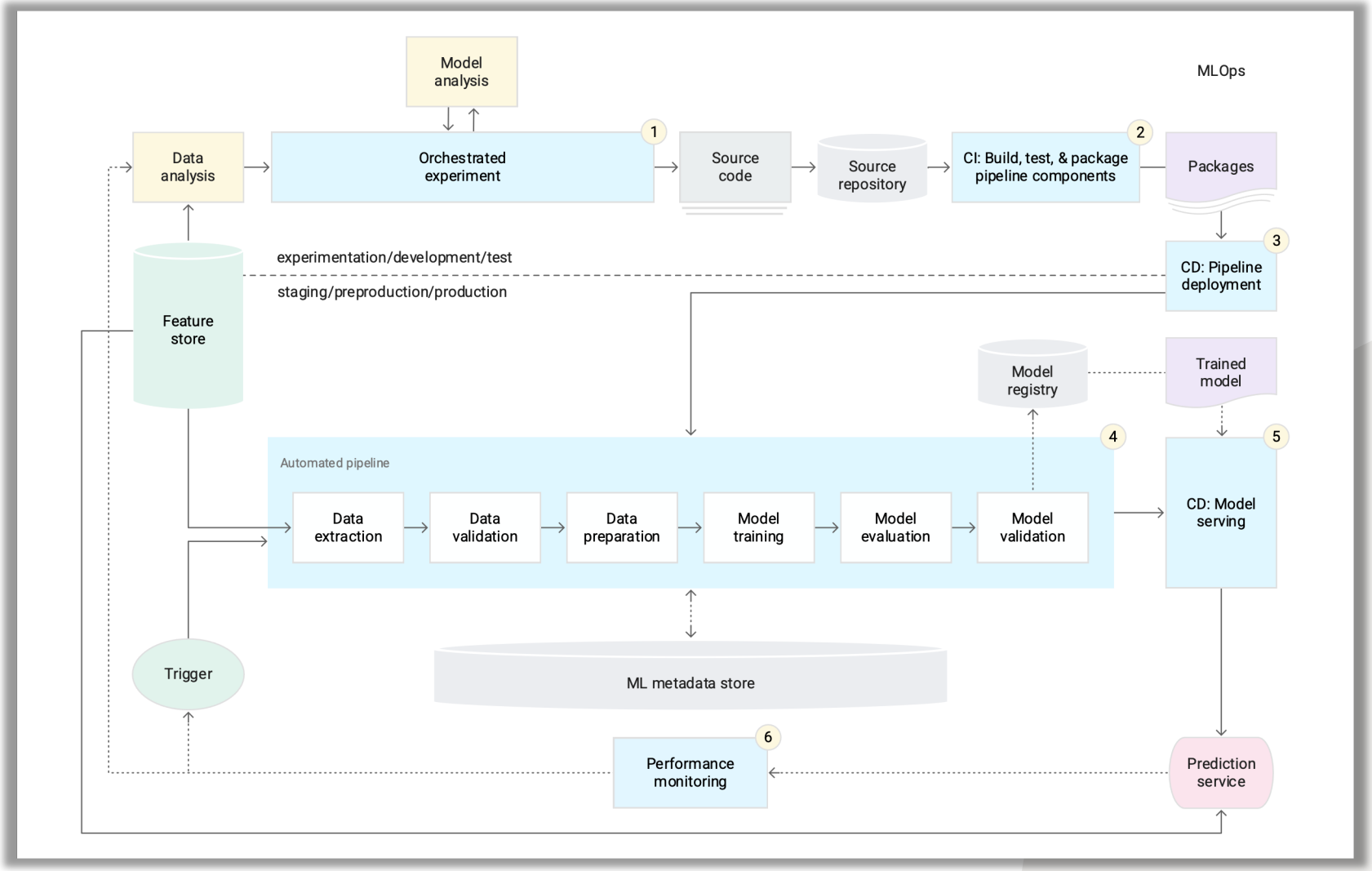
Levels of MLOps



MLOps Level 1: ML Pipeline Automation

Levels of MLOps

MLOps Level 2: ML Pipeline Automation



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