What is Machine Learning Operations?
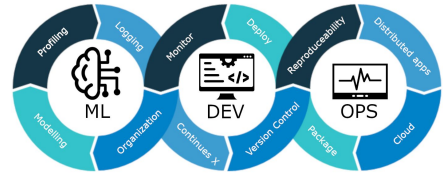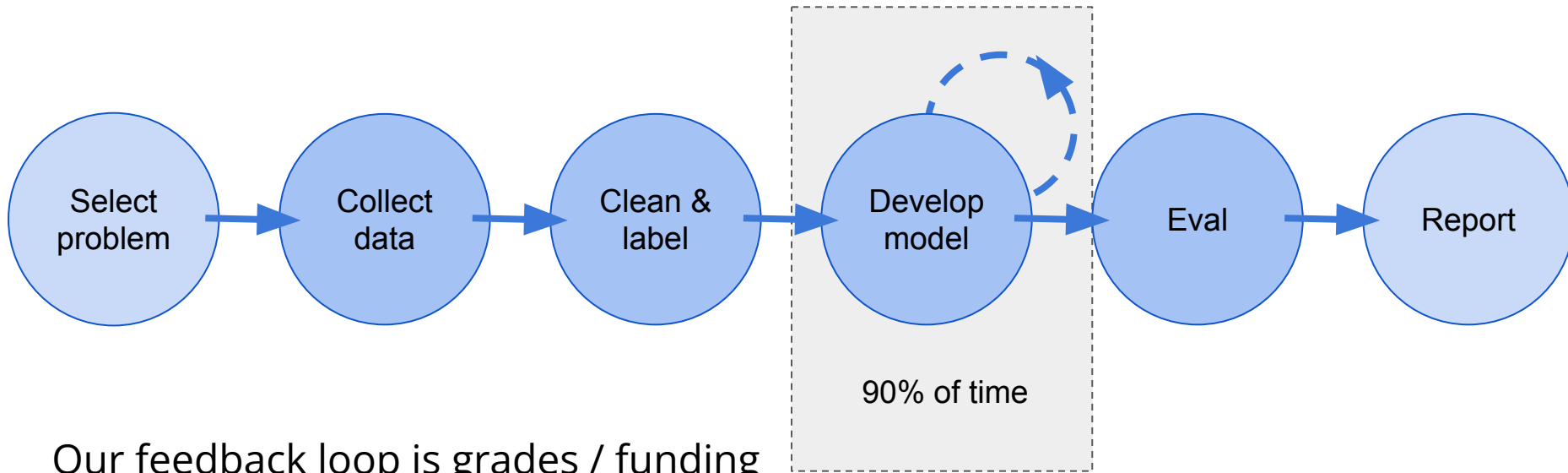
02476 Machine Learning Operations
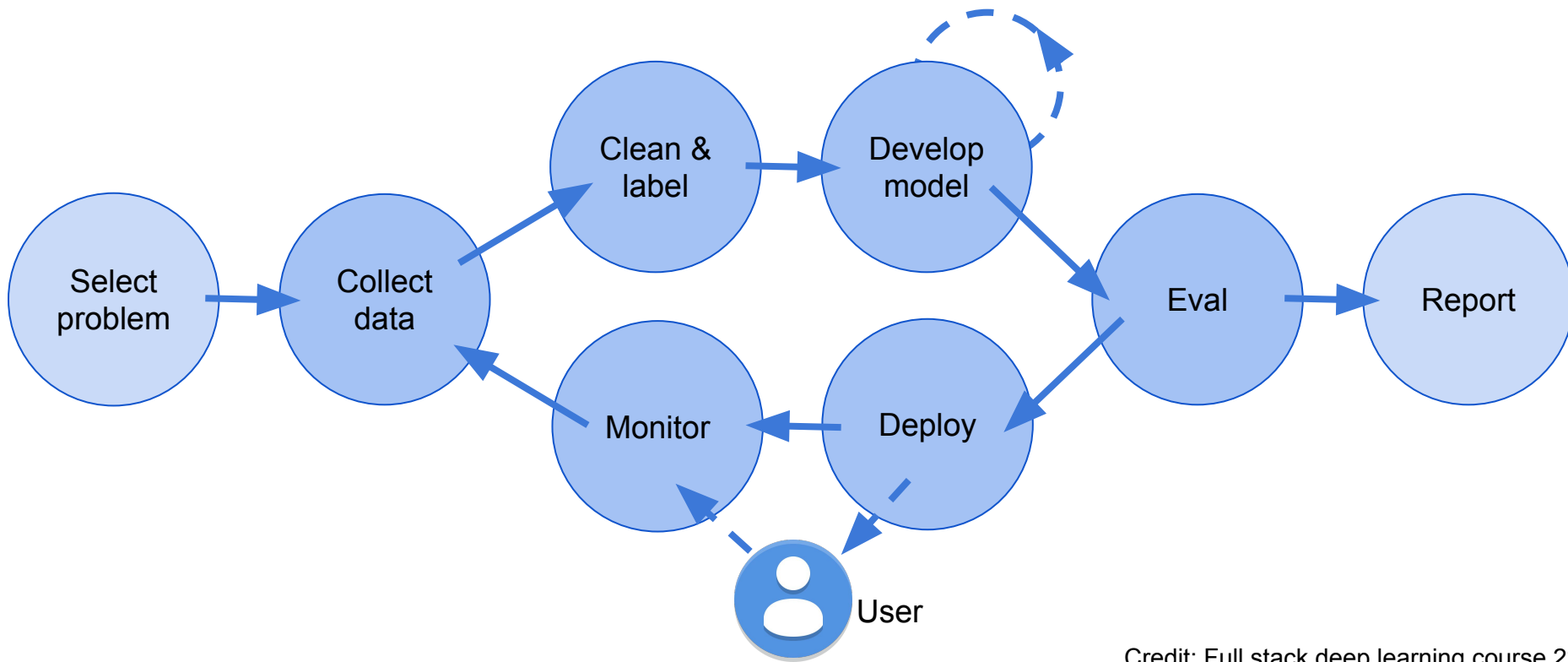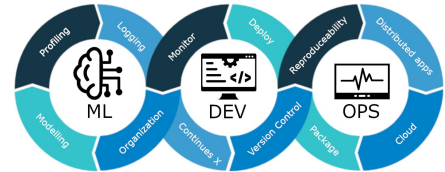Nicki Skafte Detlefsen

Let start where you are now

Courses / Projects are linear in nature
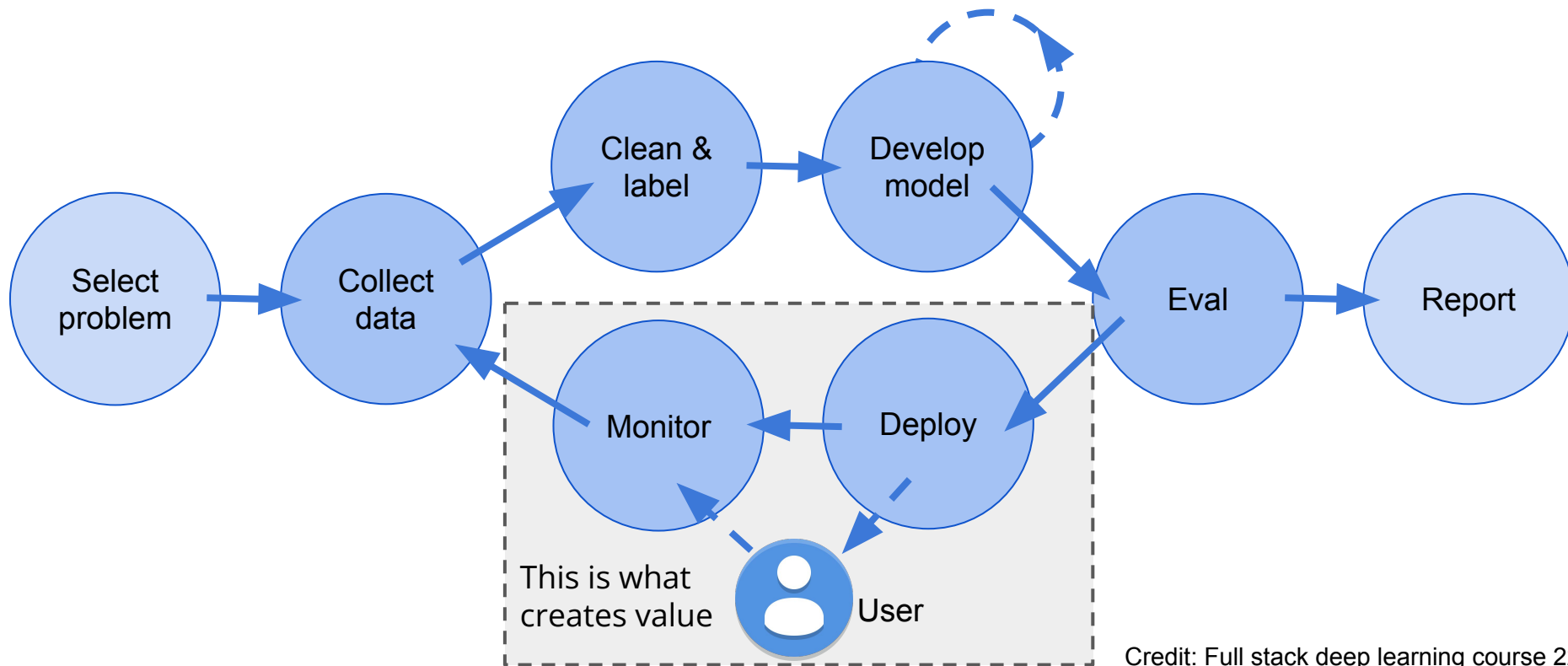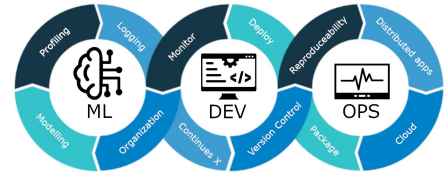

Our feedback loop is grades / funding

90% of time

Select problem → Collect data → Clean & label → Develop model → Eval → Report

ML in the real world

Credit: Full stack deep learning course 22
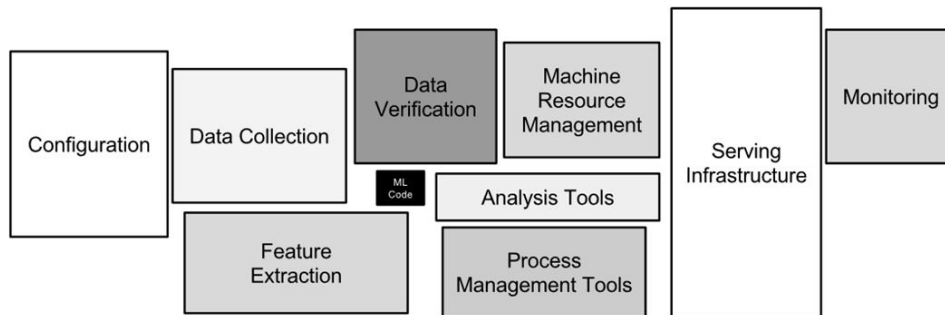
ML in the real world

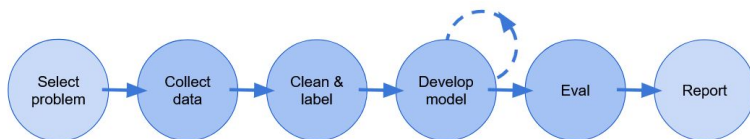Credit: Full stack deep learning course 22
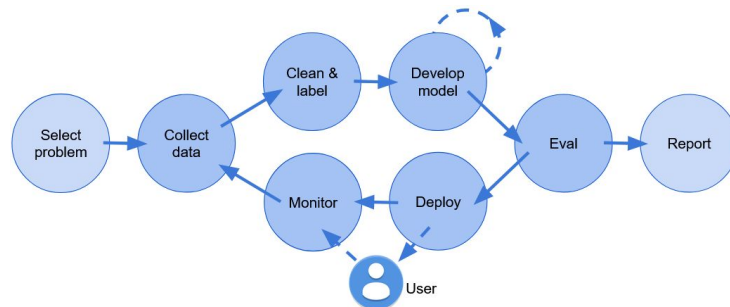
Key observations

1. Machine learning in production is much more than doing ML modelling

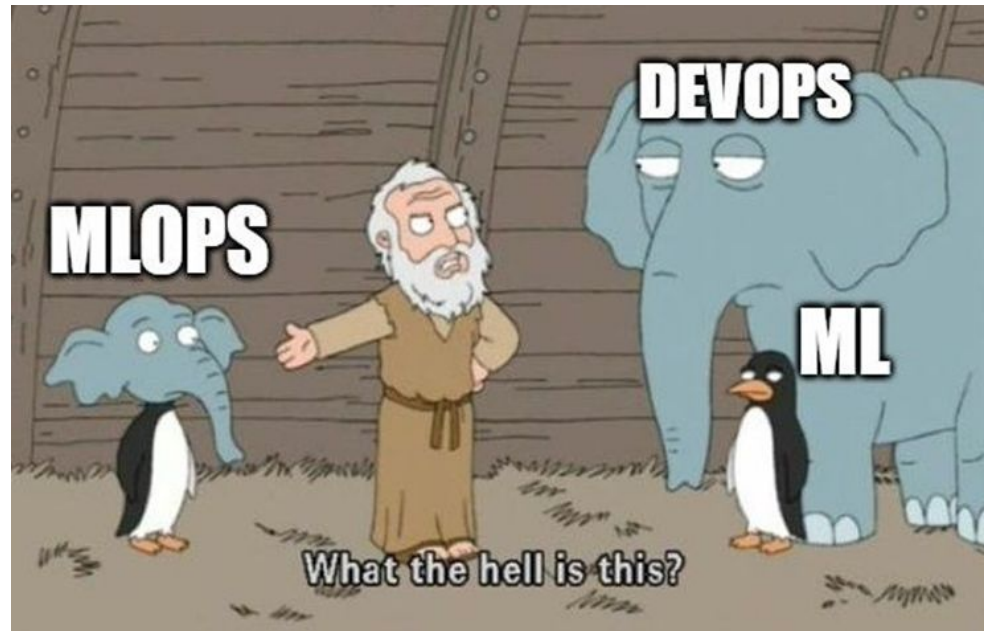2. Machine Learning in production is a cycle

vs.

What is MLOps?

This is both a joke and not.

MLOps is directly derived from DevOps.

Therefore, let's try to understand DevOps first.

So, what is DevOps?

This is the closest to a definition that I could find:

> DevOps is a set of practices that combines software development (*Dev*) and IT operations (*Ops*). It aims to shorten the systems development life cycle and provide continuous delivery with high software quality. It's an combination of human mindset, processes and technologies that continuously creates value.

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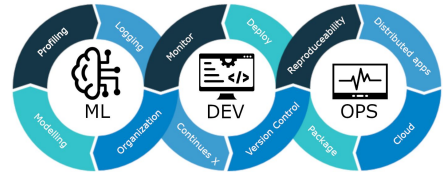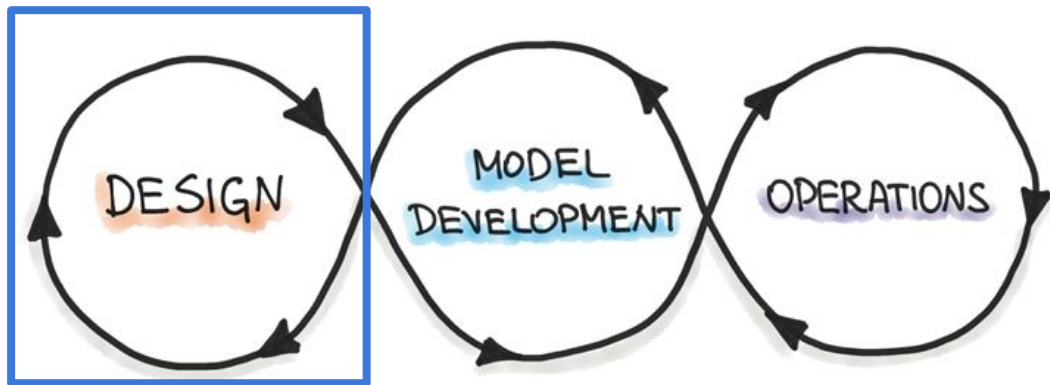
Tools + Processes + Mindset = Value
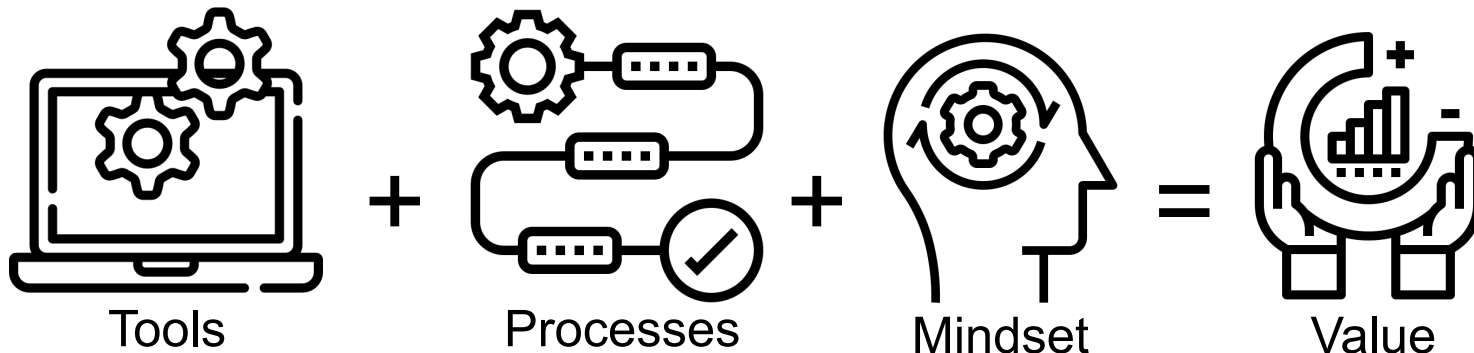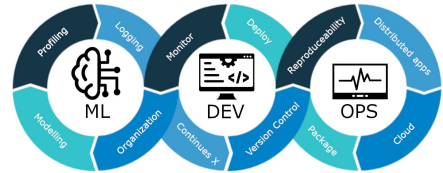
But then MLOps must be…

Is a set of <u>tools</u>, <u>processes</u>, and <u>mindset</u> that aim to make **ML Lifecycle** reproducible, trackable, testable and maintainable to continuously create value.
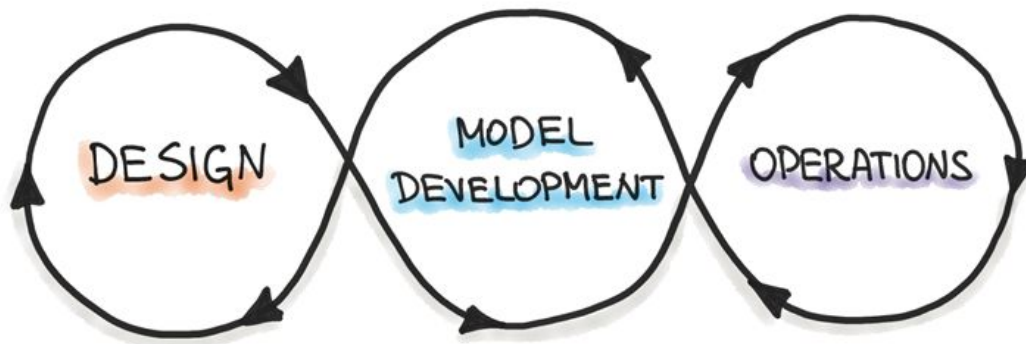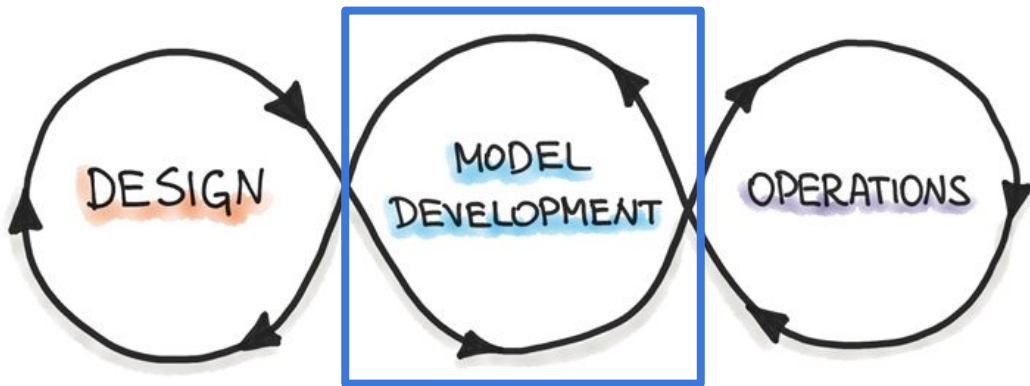
Design

- Business understanding
- Data understanding
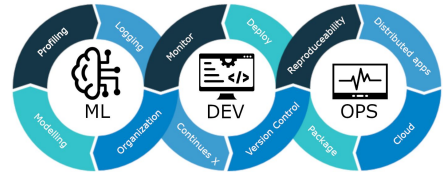- Designing the ML-powered software

Figure credit: https://ml-ops.org/content/mlops-principles
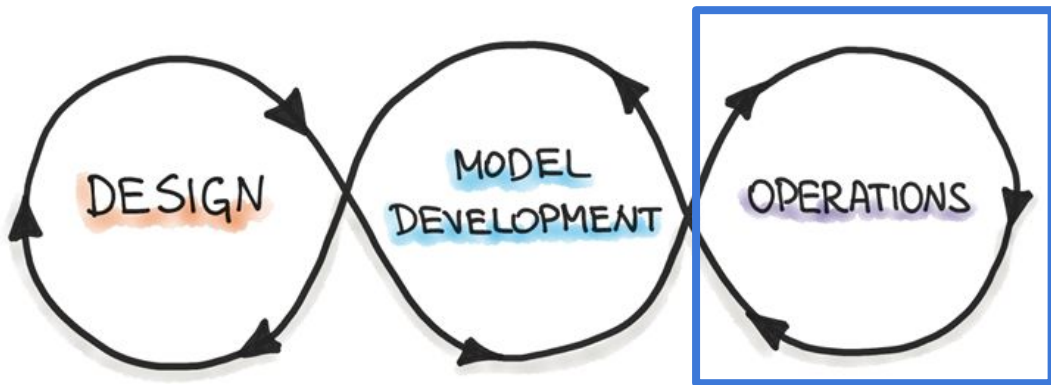
Model development

- Model engineering
- Data engineering
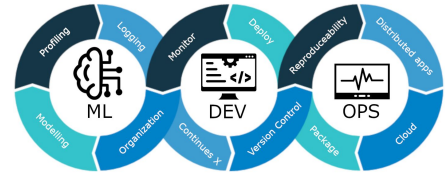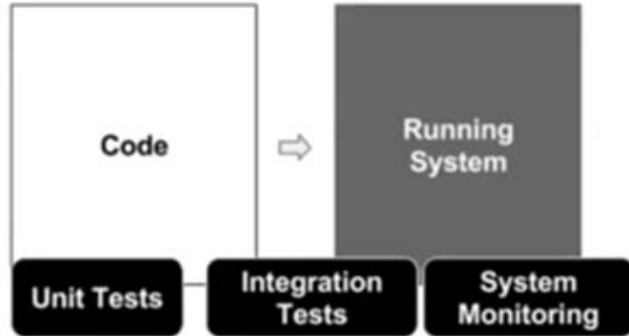- Deliver a stable quality ML model that we will run in production

Operations

- Deliver the previously developed ML model in production
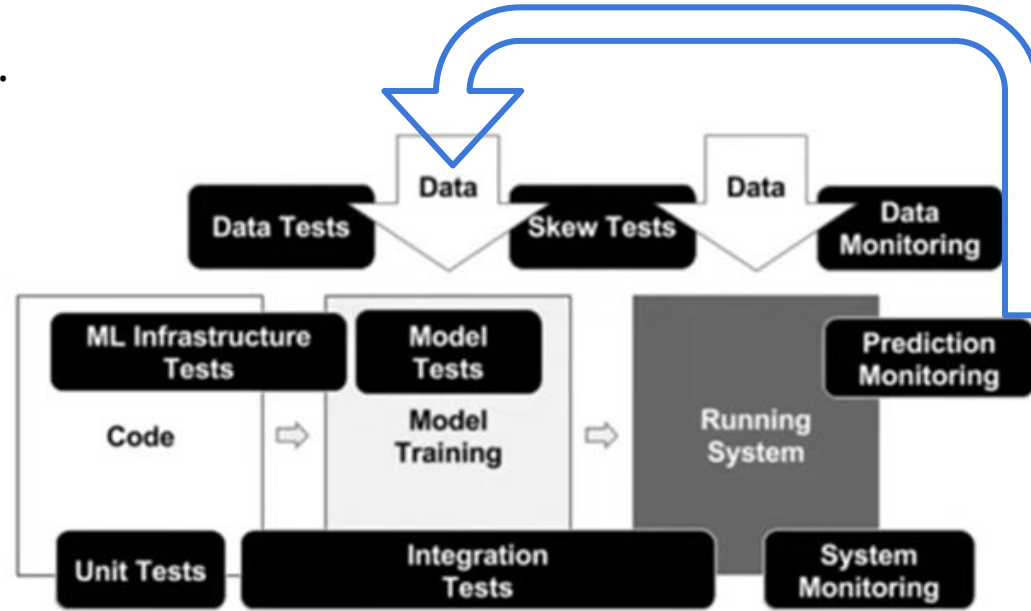- Testing, versioning, continuous delivery, and monitoring
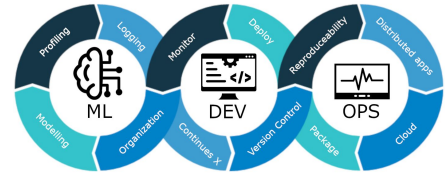
Why is DevOps not enough?

Because *data* changes everything…

Traditional System Testing and Monitoring

ML-Based System Testing and Monitoring

Why does companies care about MLOps

Having automated model deployed with errors can cost A LOT of money:

> *"A famous example of the dangers here was Knight Capital´s system losing $465 millions in 45 minutes, apparently because of unexpected behavior from obsolete experimental codepaths"* – Hidden Technical depth in Machine Learning Systems
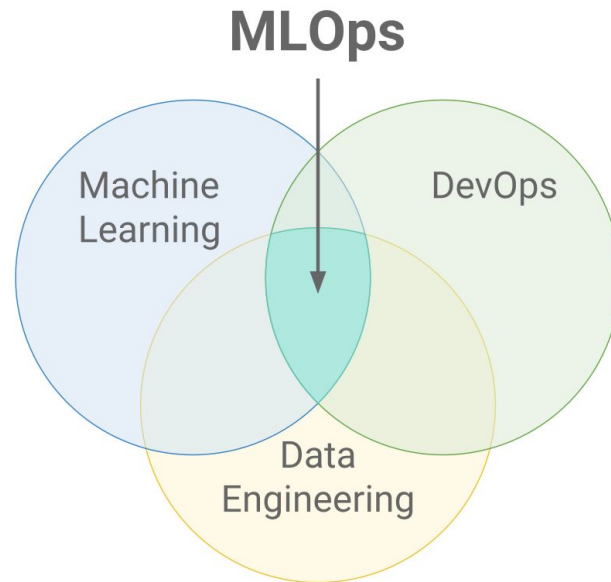
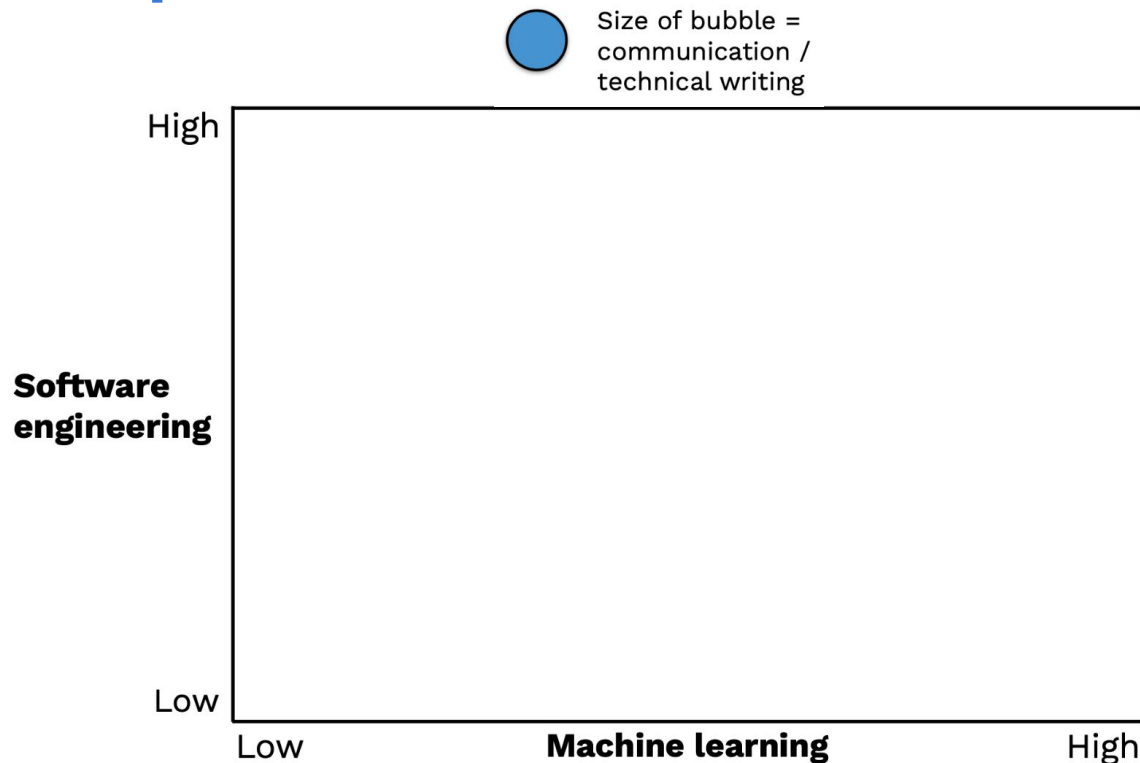

The Impact of AI Automation on Jobs
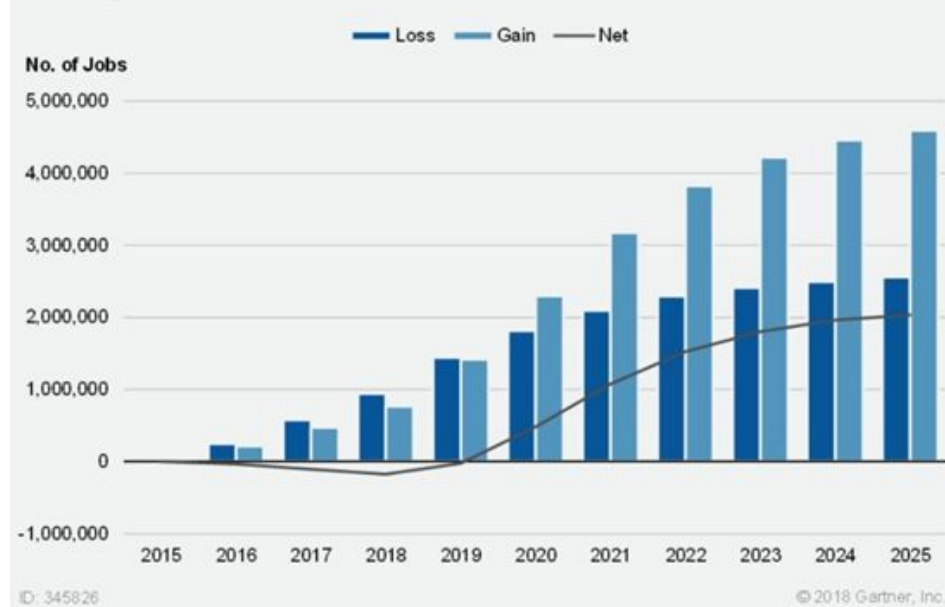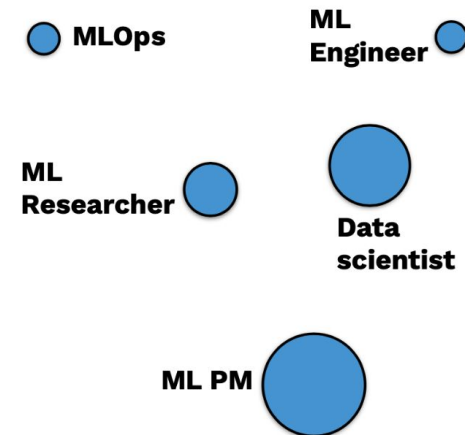
What makes an MLOps engineer?

An mix of

- Software developing
- Machine Learning
- Data Engineering

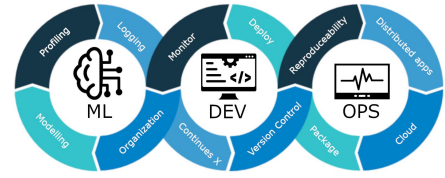Credit: https://en.wikipedia.org/wiki/MLOps

MLOps vs ML Researcher vs Data scientist

Size of bubble = communication / technical writing

High

Software engineering

Low

Low　　**Machine learning**　　High

Where should different positions be?

MLOps

ML Engineer

ML Researcher

Data scientist

ML PM

MLOps vs ML Researcher vs Data scientist

Size of bubble = communication / technical writing
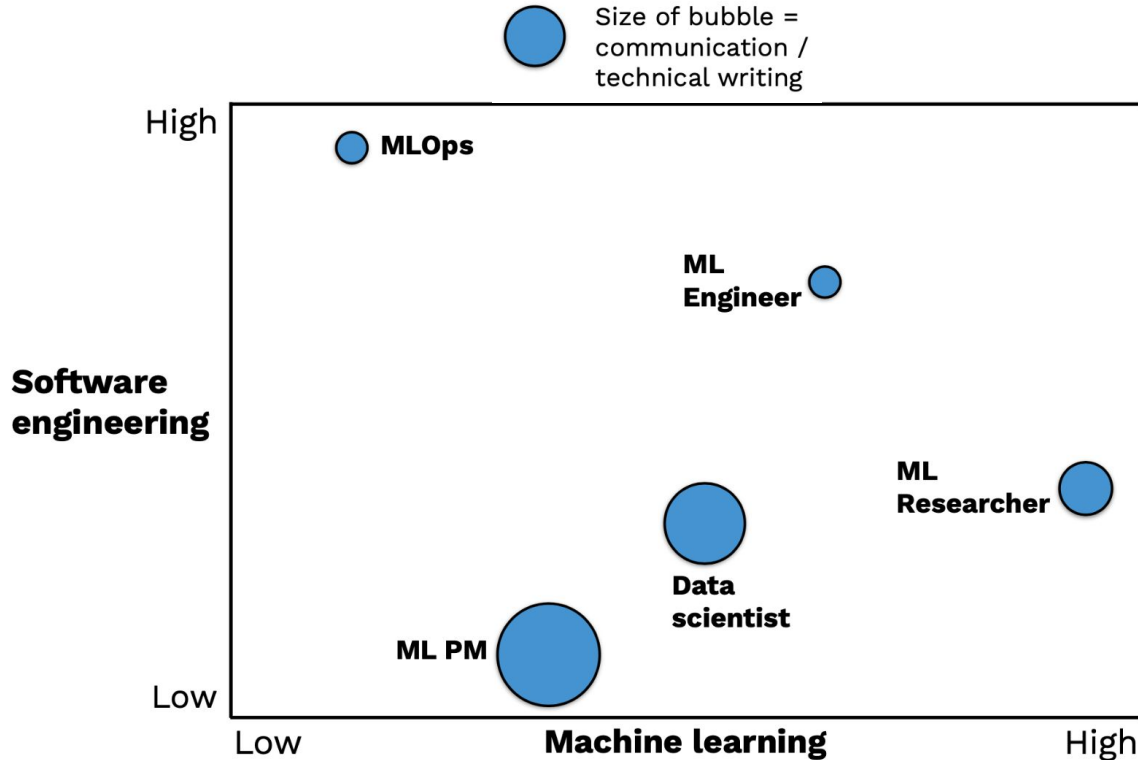
Embrace that you cannot do everything

Credit: Full stack deep learning course 22
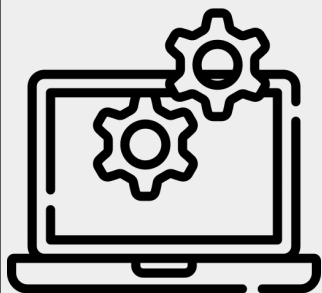
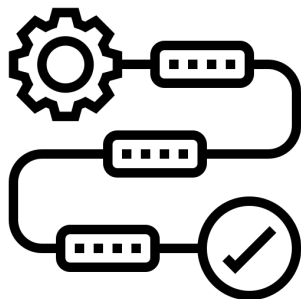# MLOps trends

MLOps has been trending for a couple of years.
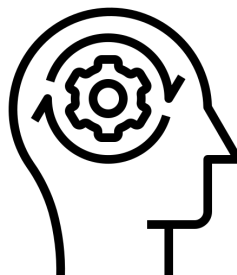
Tools have been the main priority
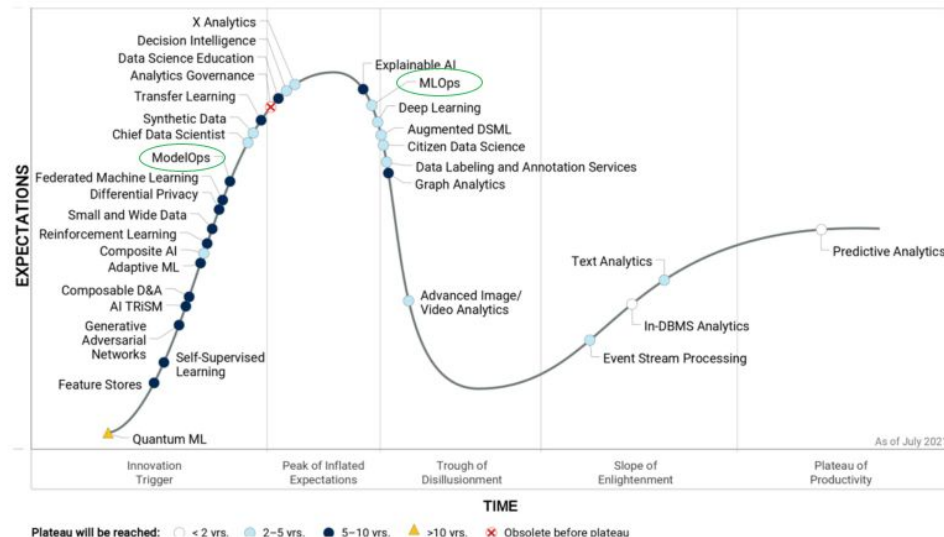

Main priority

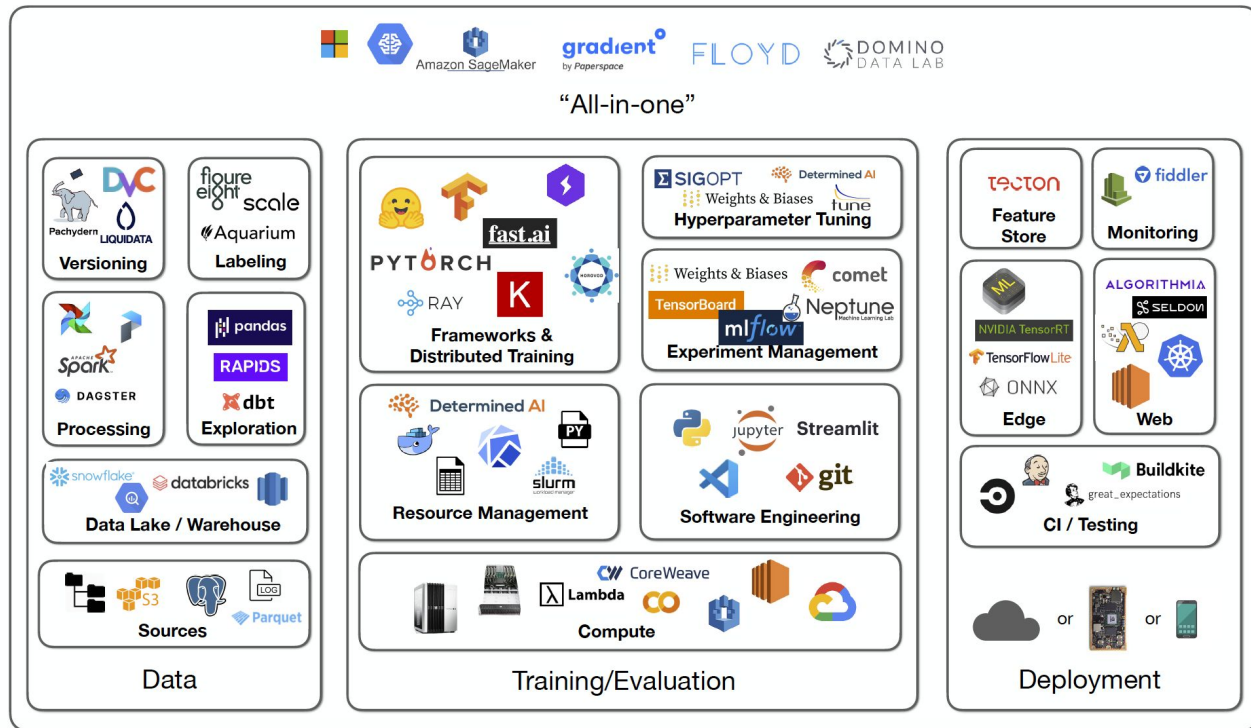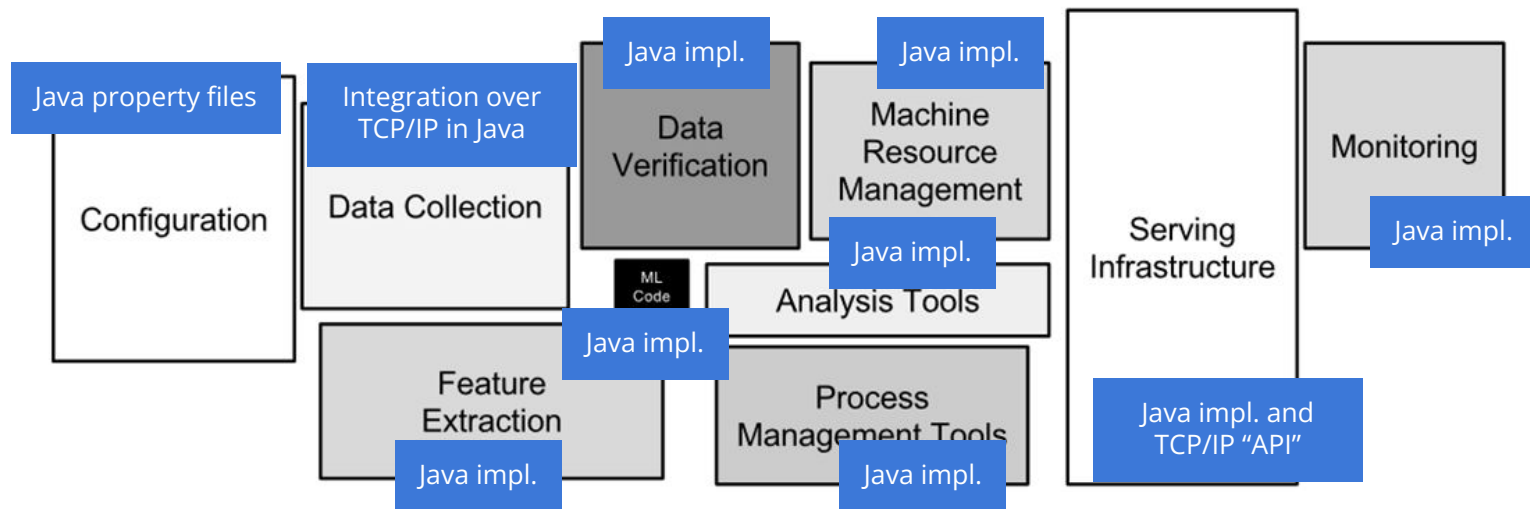Tools + Processes + Mindset = Value

Credit: Gartner 2021 Hype report

MLOps trends: TOOLS!

Anything you need there is a tool for

MLOps in the past

MLOps around 2006 = write everything from scratch

Credit: Mikkel Baun Kjærgaard
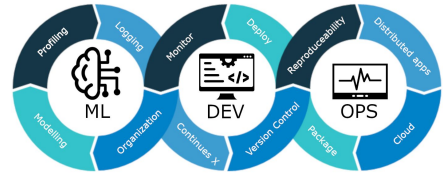
MLOps now

Pick a *stack* of tools
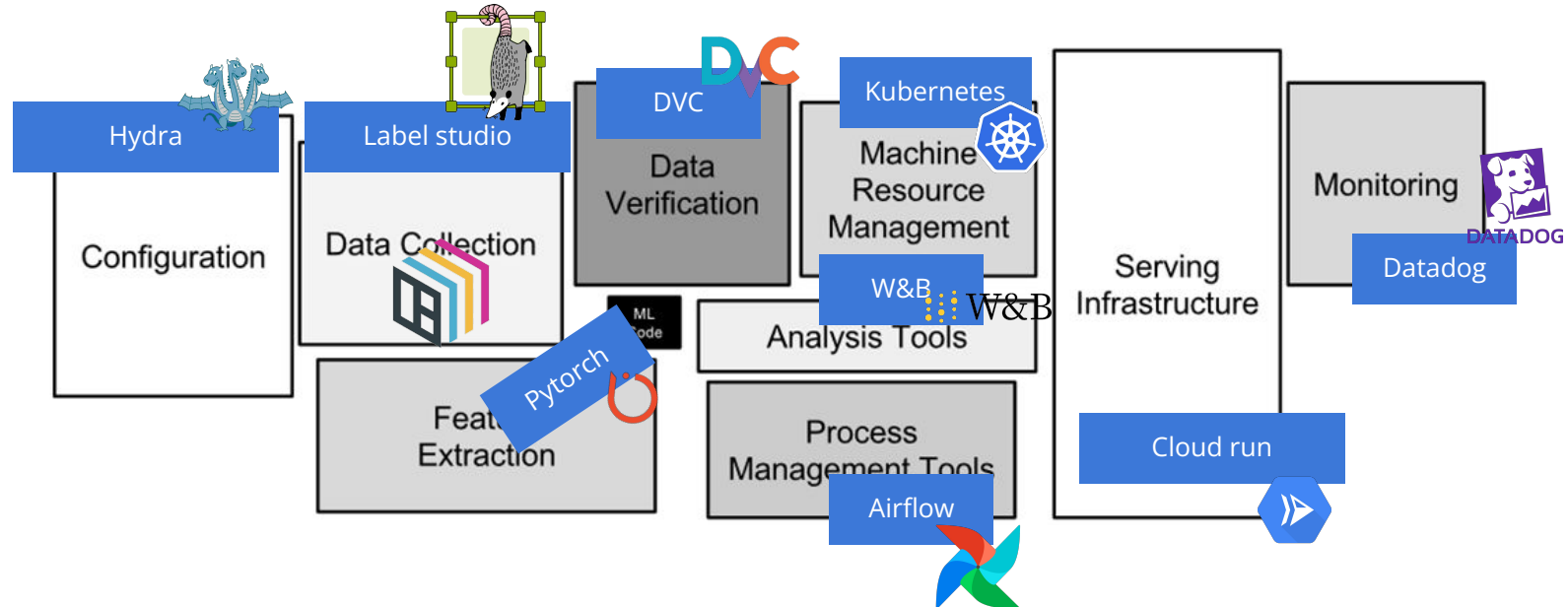
MLOps is kind of full stack engineering

In MLOps we embrace the full stack of problems that comes from the full lifecycle.

Criteria for what goes into the stack:

- Cost
- Flexibility
- Complexity

The core challenges in MLOps

1. Deployment and automation
2. Reproducibility of models and predictions
3. Diagnostics
4. Governance and regulatory compliance
5. Scalability
6. Collaboration
7. Business uses
8. Monitoring and management

Meme of the day