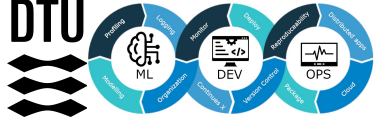
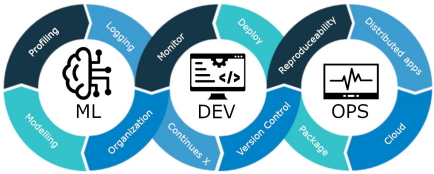


What is Machine Learning Operations?

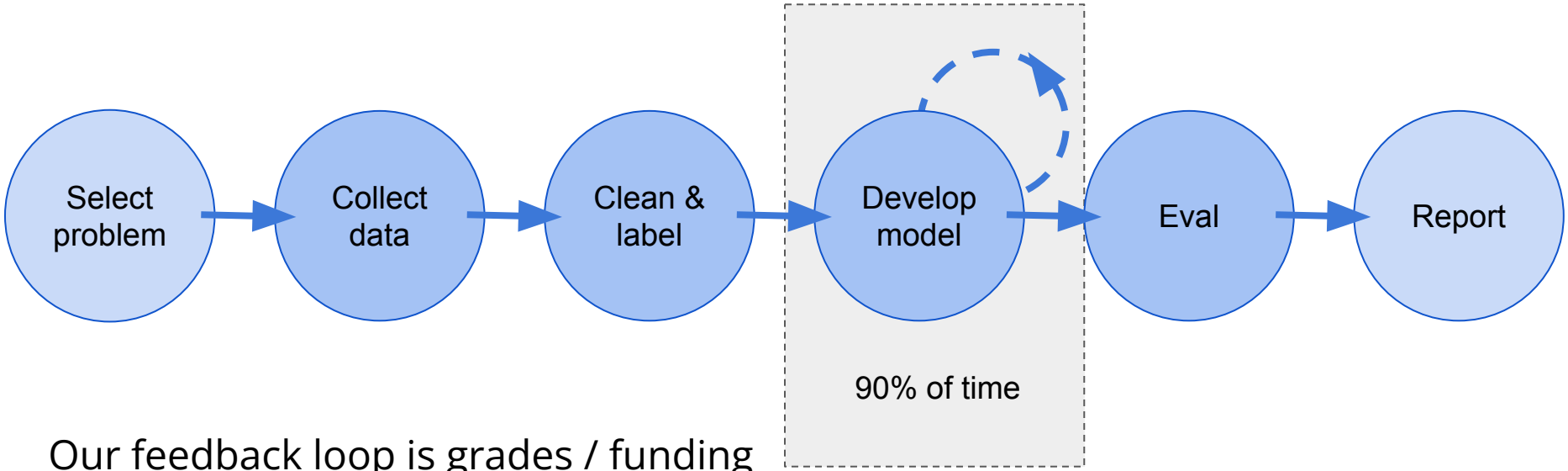
02476 Machine Learning Operations

Nicki Skafte Detlefsen



Let start where you are now

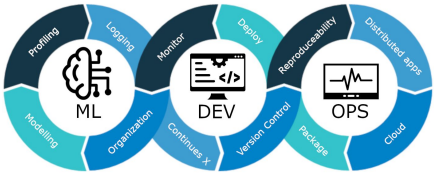
Courses / Projects are linear in nature

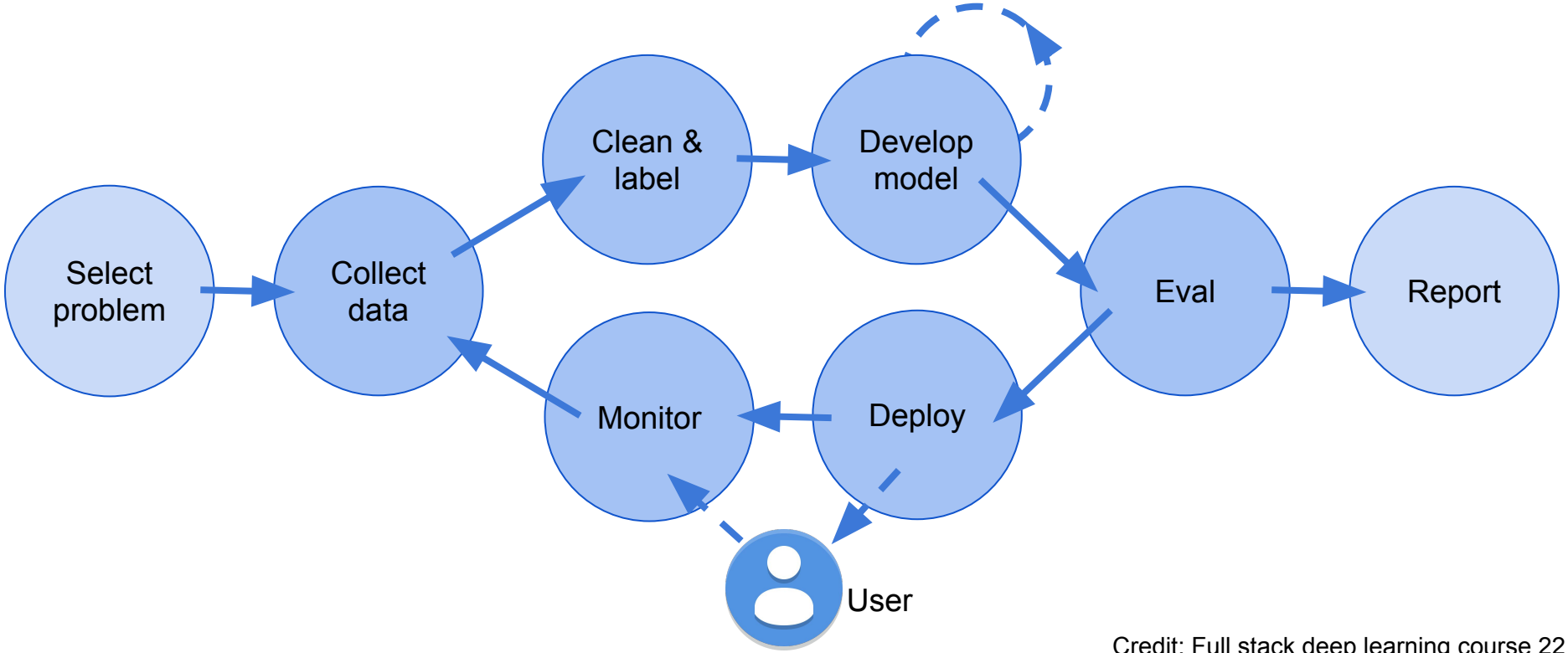


Our feedback loop is grades / funding

Credit: Full stack deep learning course 22

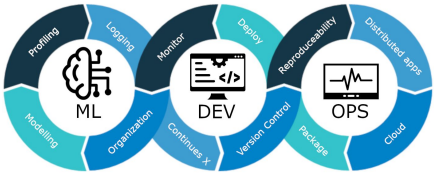
ML in the real world

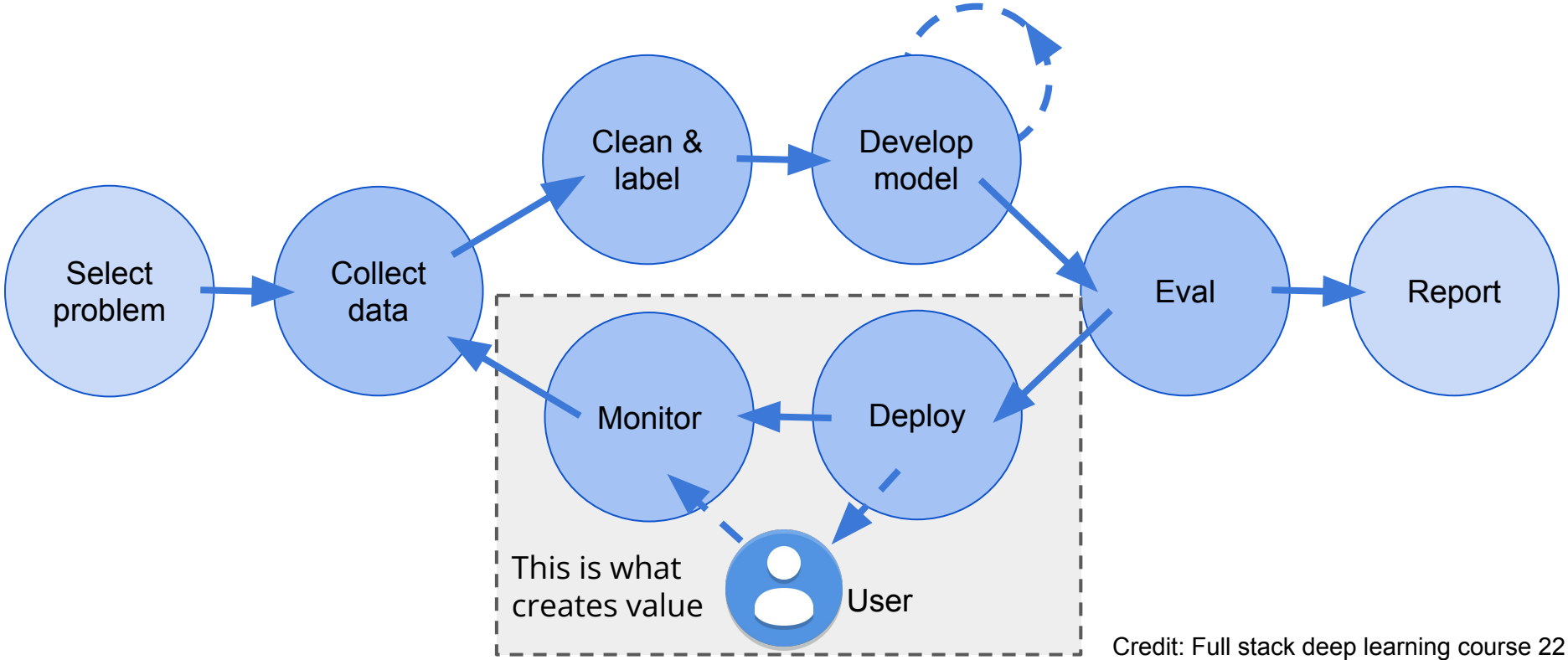




Credit: Full stack deep learning course 22

ML in the real world

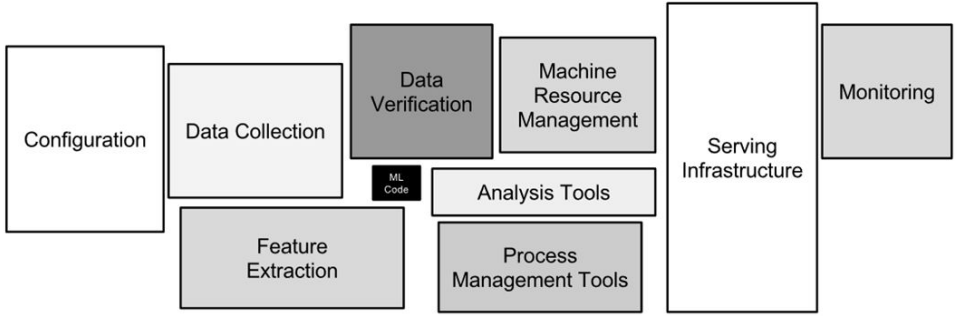




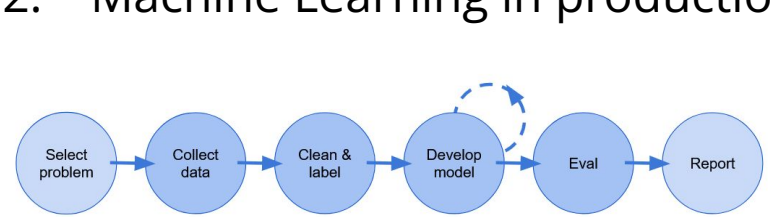
Credit: Full stack deep learning course 22

Key observations

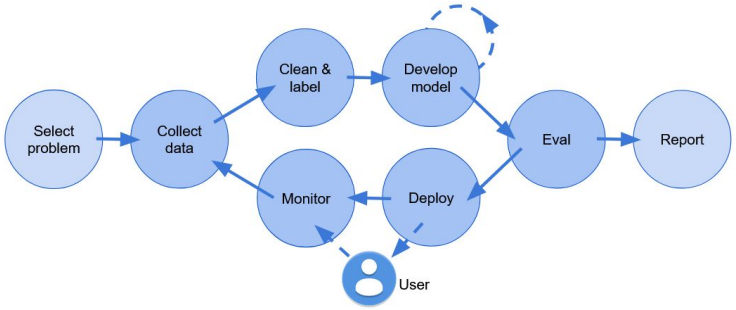
1. Machine learning in production is much more than doing ML modelling



2. Machine Learning in production is a cycle



vs.



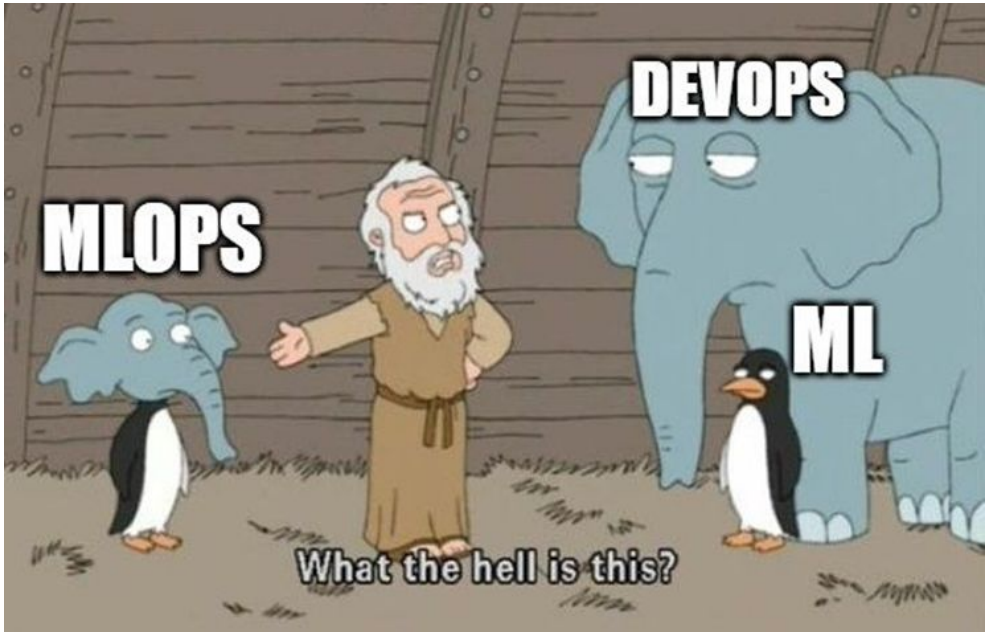
Credit: Hidden Technical Debt in Machine Learning Systems, Sculley et al. 2015

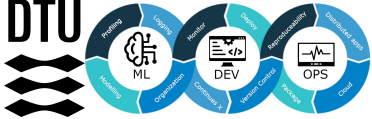
What is MLOps?

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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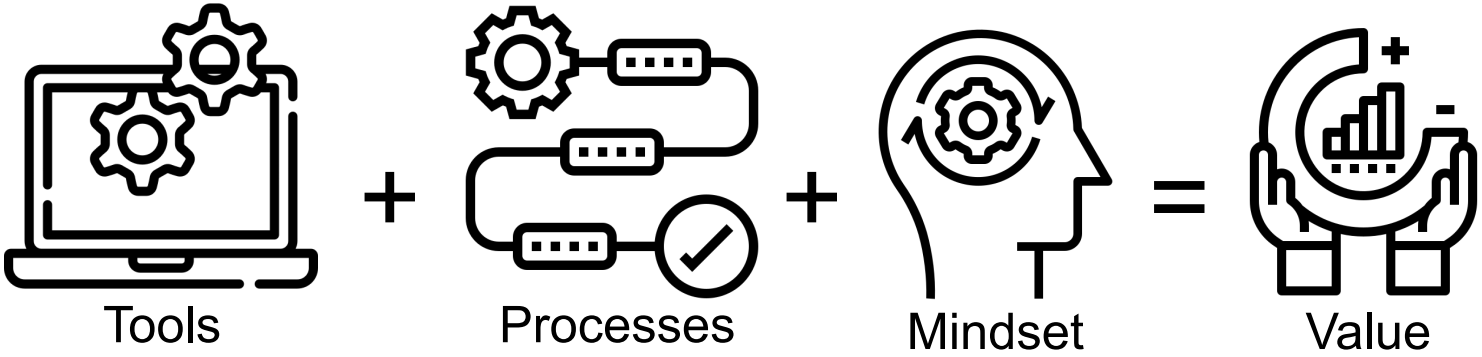


But then MLOps must be…

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

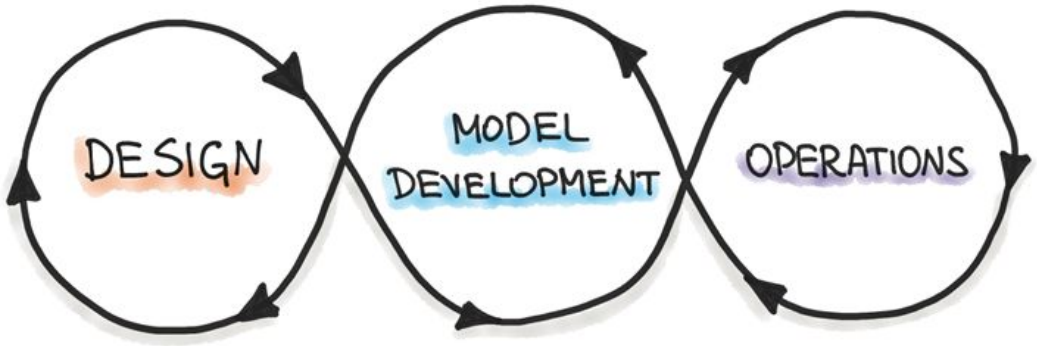
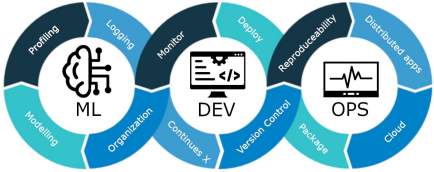
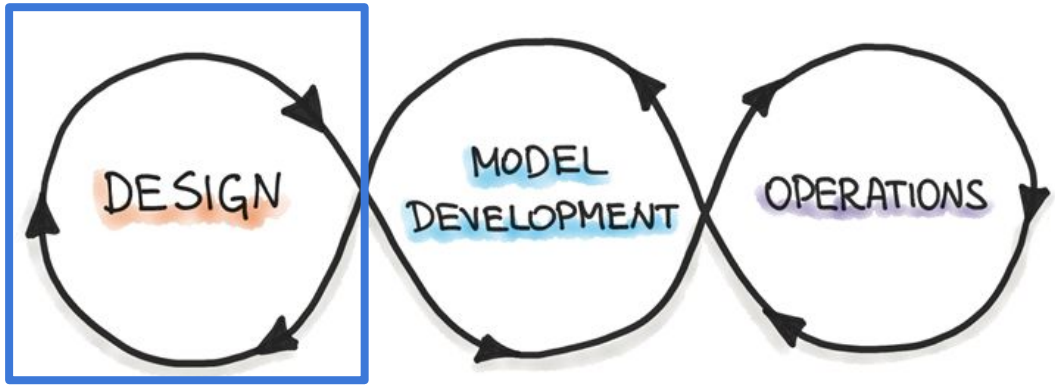


Figure credit: https://ml-ops.org/content/mlops-principles



Design

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



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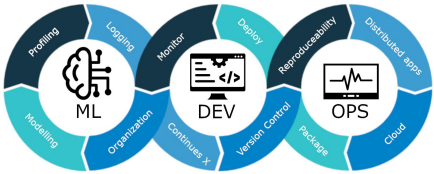


Model development

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

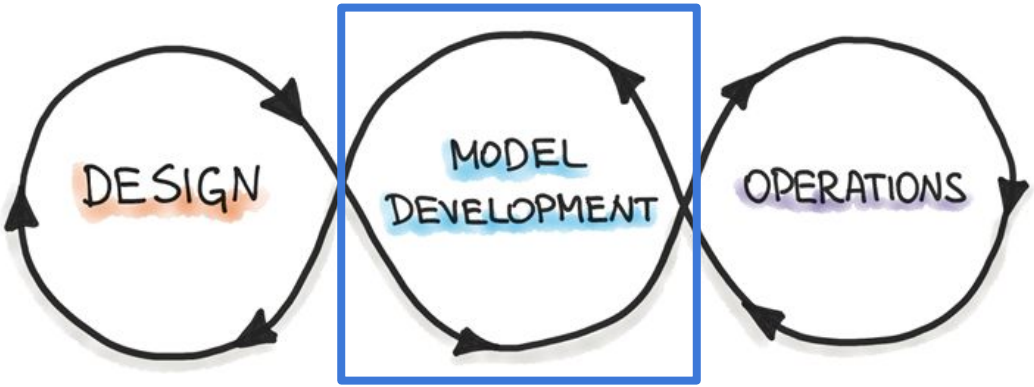
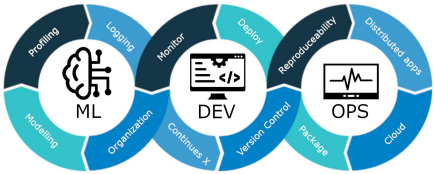


Figure credit: https://ml-ops.org/content/mlops-principles



Operations

- Deliver the previously developed ML model in production
- Testing, versioning, continuous delivery, and monitoring

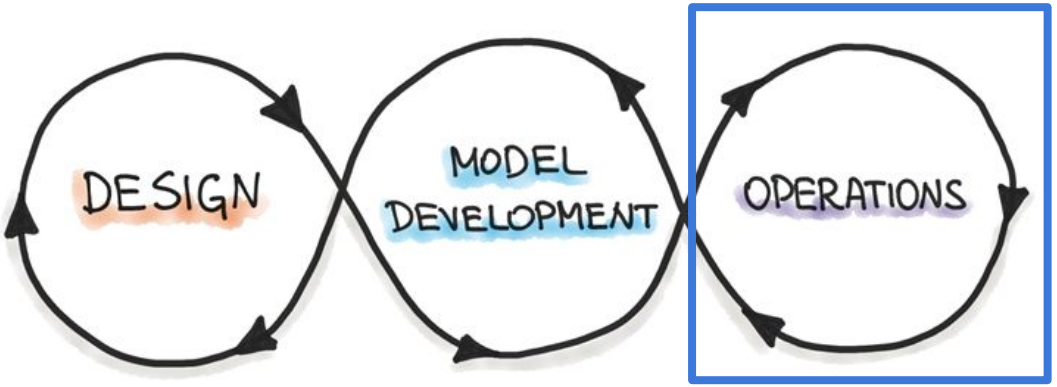
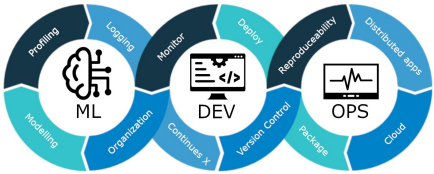
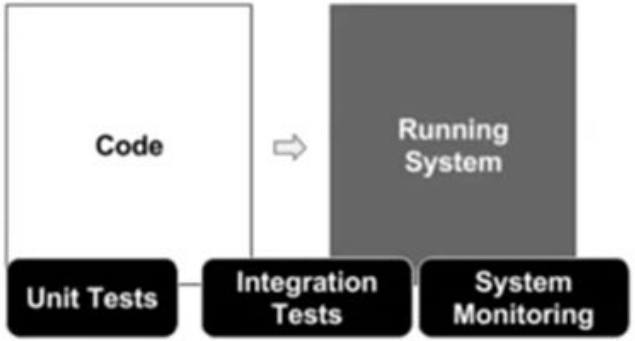


Figure credit: https://ml-ops.org/content/mlops-principles

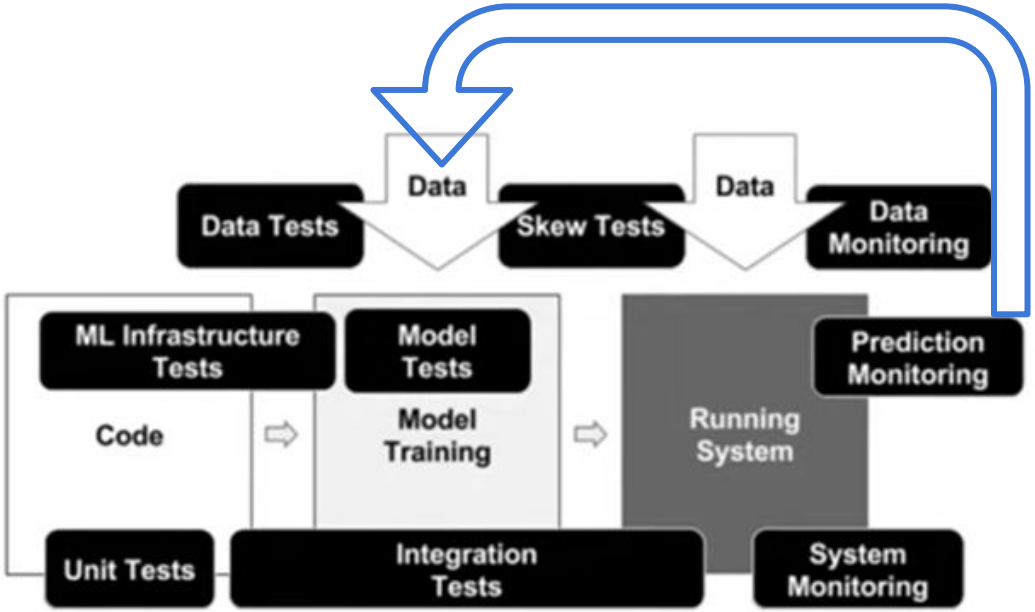


Why is DevOps not enough?

Because *data* changes everything…

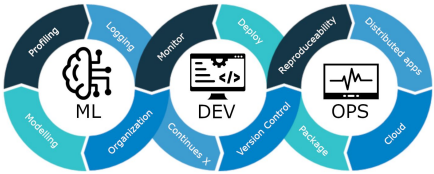


Traditional System Testing and Monitoring



ML-Based System Testing and Monitoring

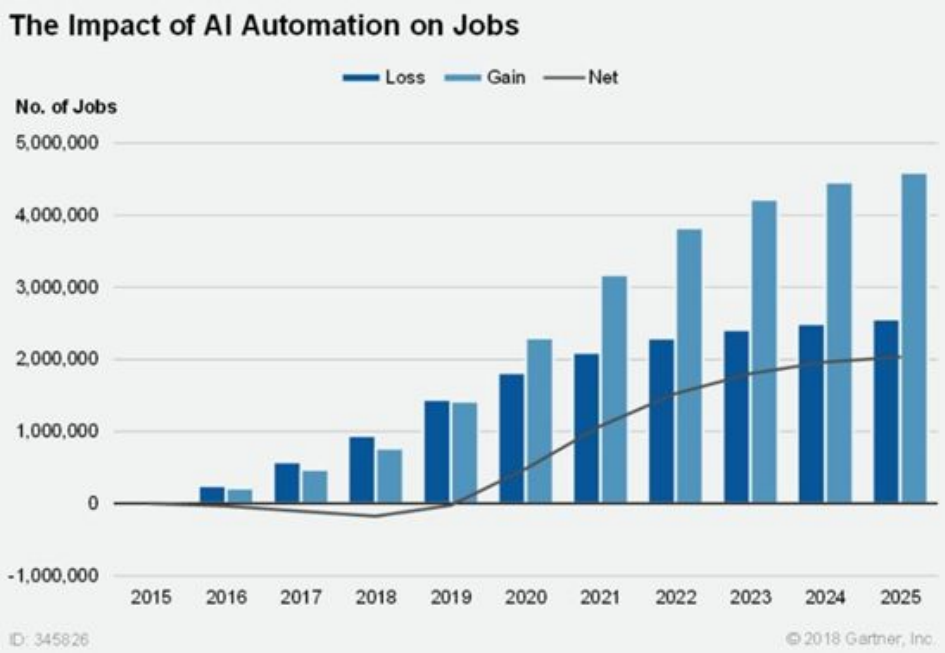
Credit: Gustav Millen



Why does companies care about MLOps

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

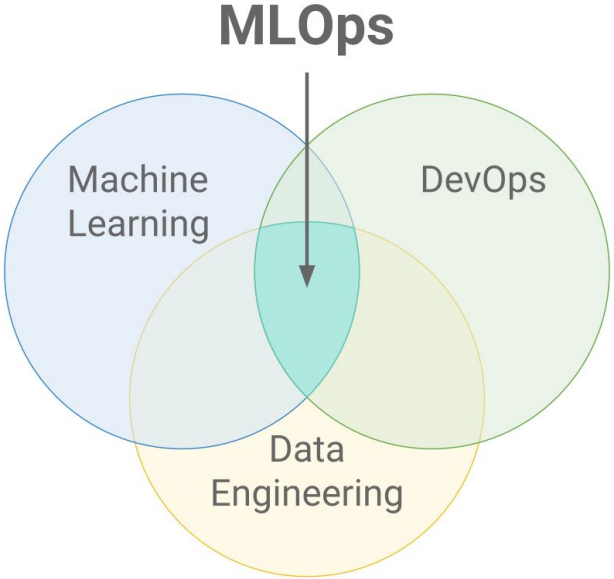
> *"A famous example of the dangers here was Knight Capital´s system losing $465 millions in 45 minutes, apparently because of unexpected behavior from obsolete experimental codepaths"* – Hidden Technical depth in Machine Learning Systems



What makes an MLOps engineer?

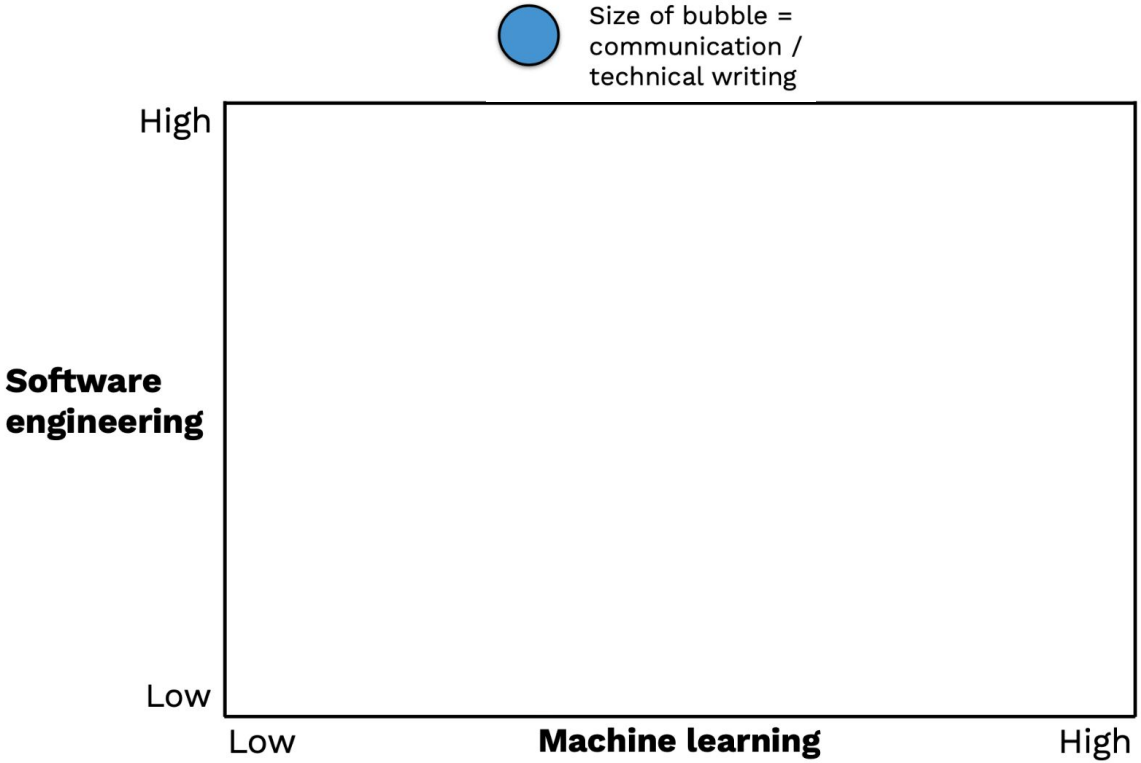
An mix of

- Software developing
- Machine Learning
- Data Engineering

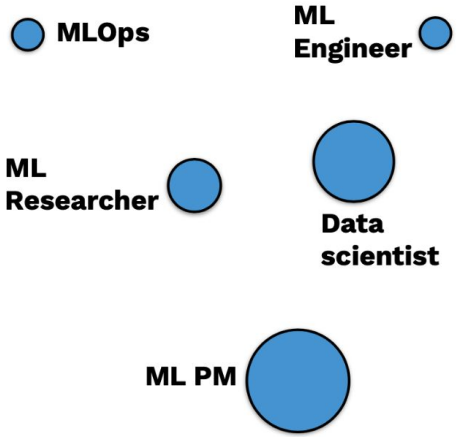


Credit: https://en.wikipedia.org/wiki/MLOps

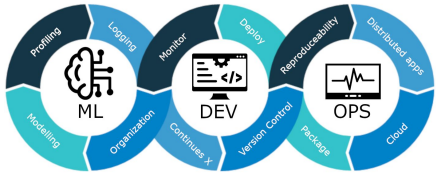
MLOps vs ML Researcher vs Data scientist



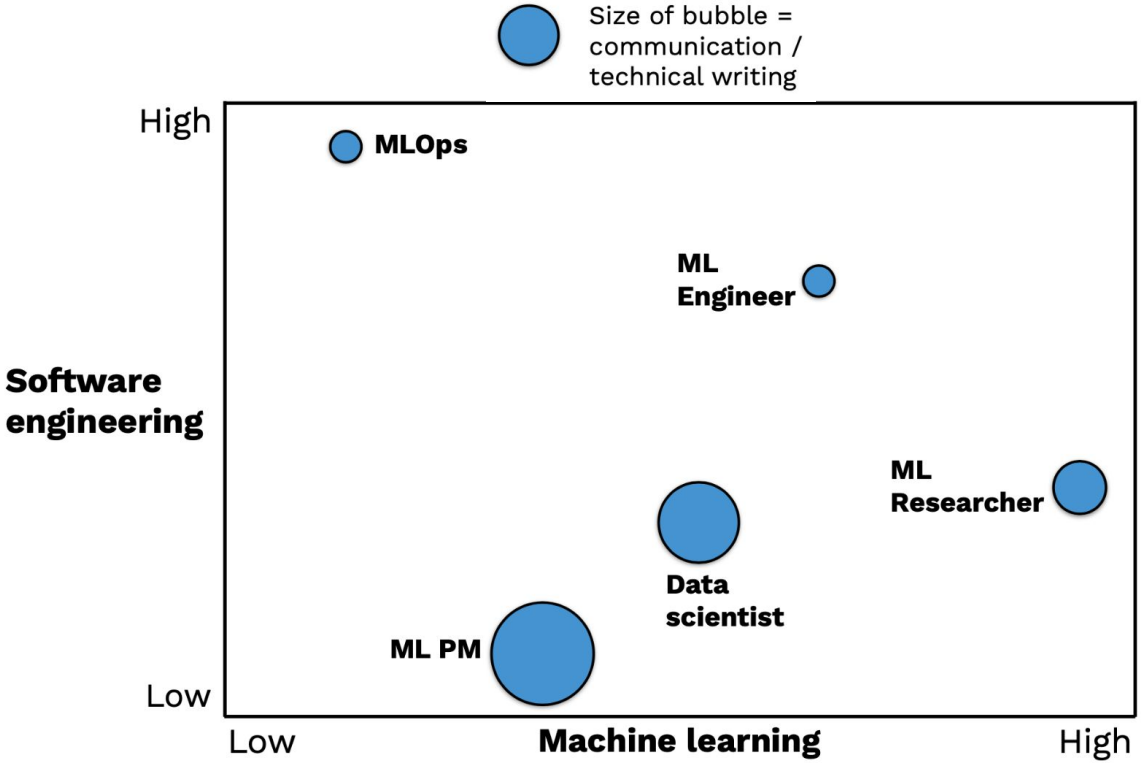
Where should different positions be?



Credit: Full stack deep learning course 22



MLOps vs ML Researcher vs Data scientist



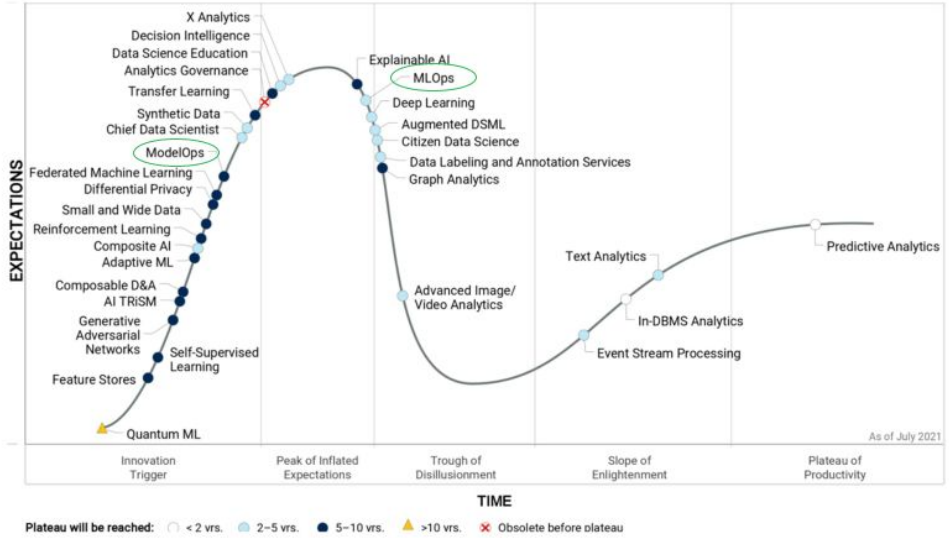
Embrace that you cannot do everything

Credit: Full stack deep learning course 22

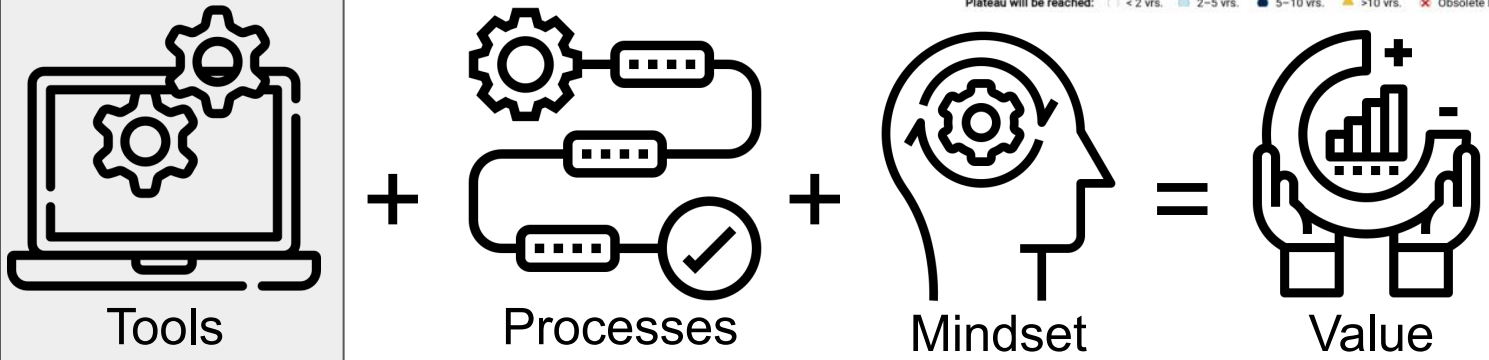
MLOps trends

MLOps has been trending for a couple of years.

Tools have been the main priority



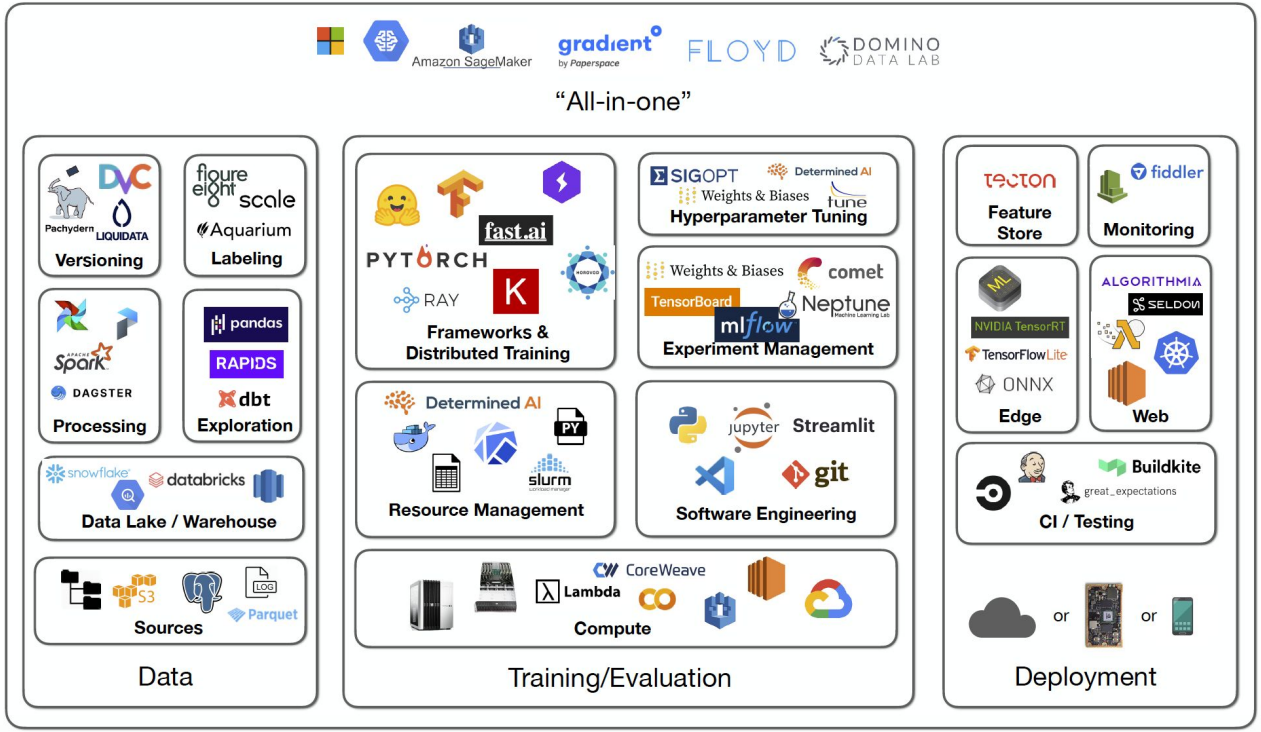
Main priority



Credit: Gartner 2021 Hype report

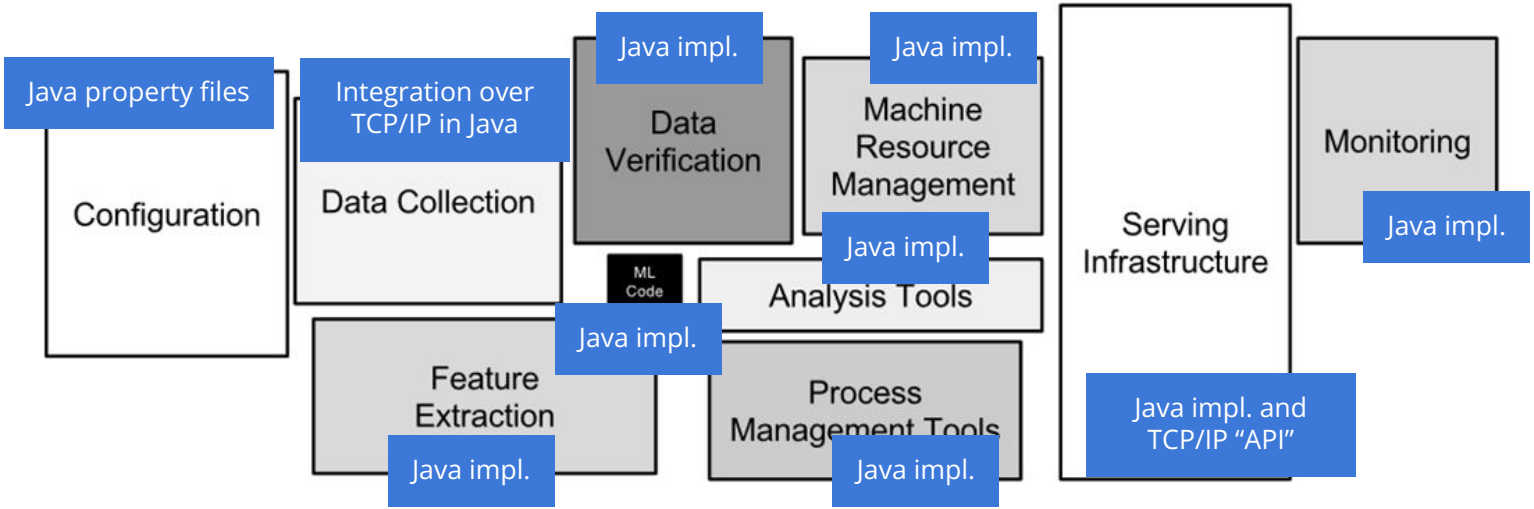
MLOps trends: TOOLS!

Anything you need there is a tool for



MLOps in the past

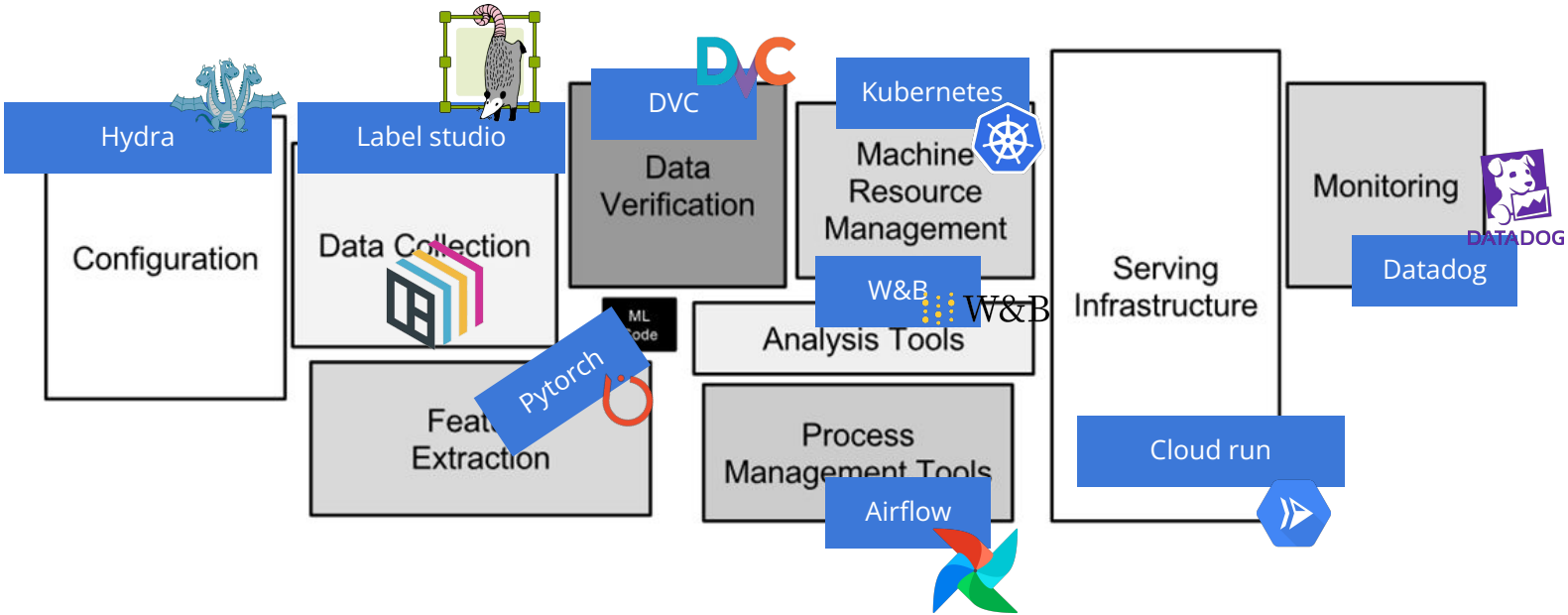
MLOps around 2006 = write everything from scratch



Credit: Mikkel Baun Kjærgaard

MLOps now

Pick a *stack* of tools



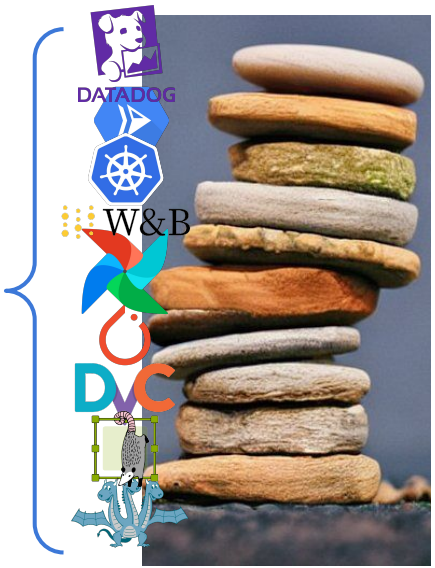
MLOps is kind of full stack engineering

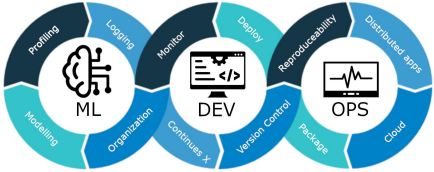
In MLOps we embrace the full stack of problems that comes from the full lifecycle.

Criteria for what goes into the stack:

- Cost
- Flexibility
- Complexity

Amazon SageMaker





The core challenges in MLOps

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

Meme of the day