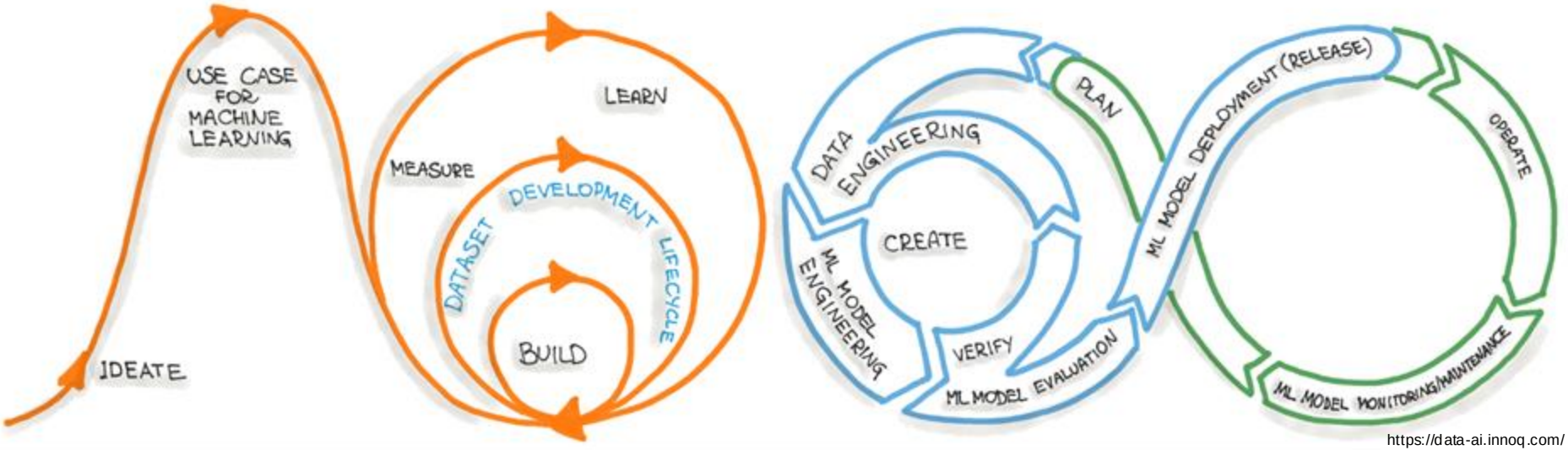


https://data-ai.innoq.com/

# MLOPS @ KSB

How MLOps practices speed up the development of condition monitoring services at KSB SE & Co. KgaA

KSB & esentri

# PRESENTATION
# AGENDA


- Who are we and what are we doing?
- Background information: Condition Monitoring at KSB
- Pain Points: Why we needed better MLOps
- Our MLOps Approach
  - Architectural view
  - Organizational view
  - Technical Details
- Conclusion

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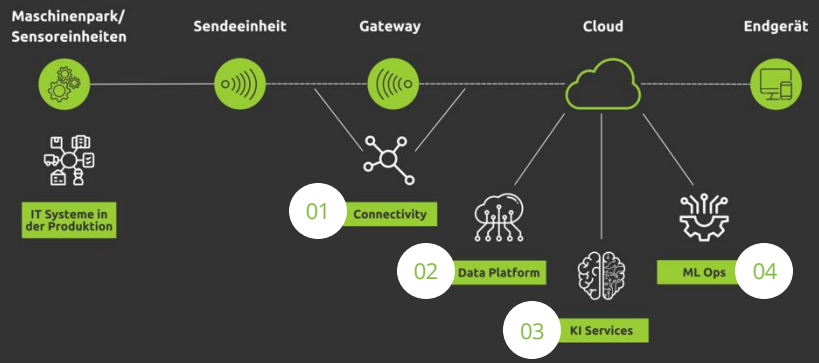
# WHO ARE WE AND WHAT ARE WE DOING?

esentri – Data & AI - Industrial Analytics & IoT




## IN-DEPTH SOURCES

Conceptual view: Der Weg vom Sensor zum Digitalen Produkt

Practical example: coffAI - Klassifizierung von Vibrationsdaten

01

### CONNECTIVITY & EDGE

Cloud connection of IoT devices & edge deployments and their control from the cloud

02

### DATA PLATTFORM

Building data platforms from raw sensor values to highly aggregated KPIs

03

### KI SERVICES

Implementation of machine learning services with a focus on vibration/time series

04

### ML OPS

Secure operation of ML-based applications and ensuring maintainability, extensibility and security

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# BACKGROUND INFORMATION

Condition Monitoring at KSB

- Plug & play monitoring solution for pumps (https://www.ksb.com/de-ch/guard).
- In addition to real-time dashboards and digital asset management, machine learning-based services such as condition monitoring and anomaly detection are also offered.
- These intelligent services need to be efficiently put into operation and maintained while being continuously developed.

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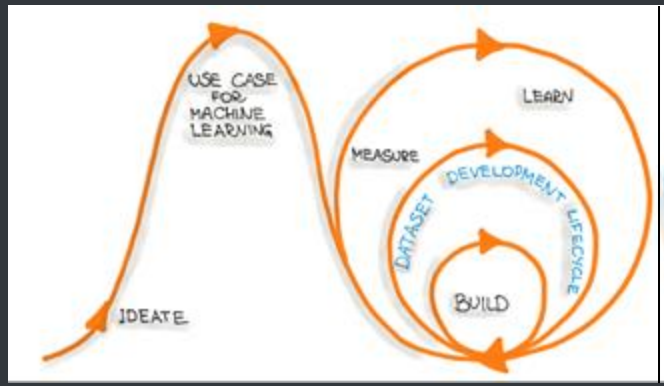
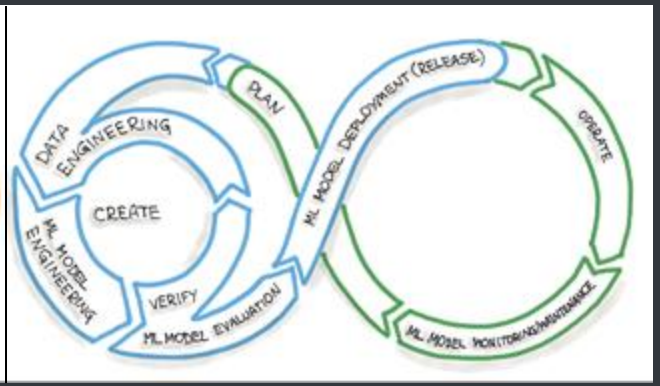
# PAIN-POINTS

Why we needed better MLOps



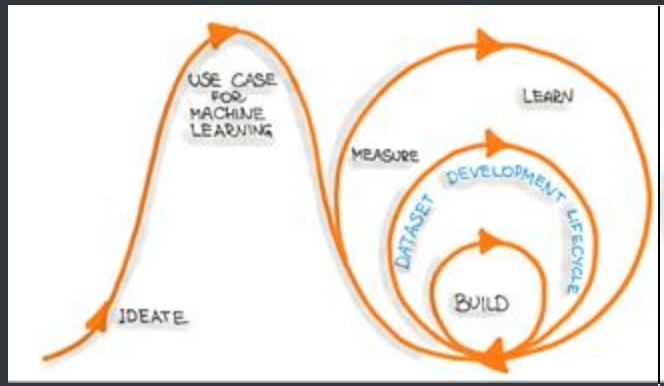



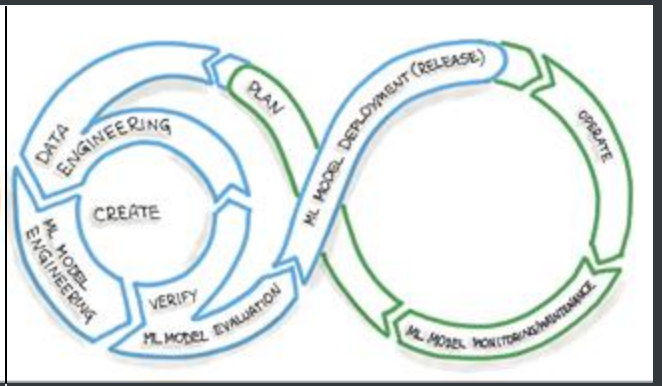

Data Science

DEV / DEV Ops

# PAIN-POINTS

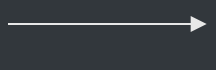
Why we needed better MLOps




Data Science

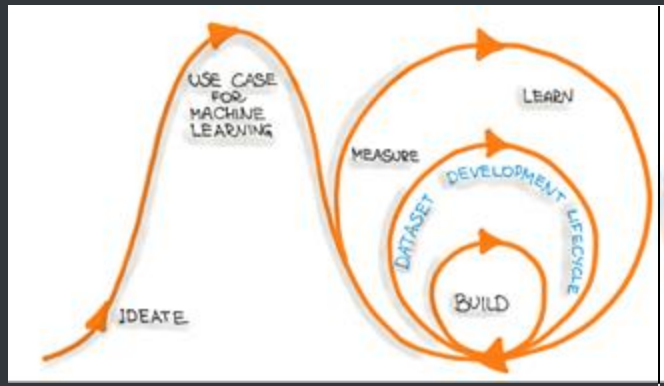
DEV / DEV Ops

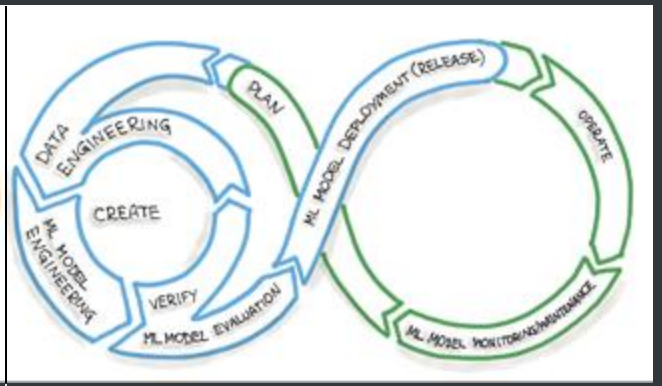


Clean Architecture, IaC, CI/CD, Elastic Container Service,..

# PAIN-POINTS

Why we needed better MLOps

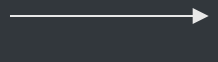



Data Science

DEV / DEV Ops





Clean Architecture, IaC, CI/CD, Elastic Container Service,..

- DS: We need to update our models! Your repo structure is completely incomprehensible, I won't touch it.
- DEV: How wild is this library structure, how do I even use it? I don't want to have anything to do with the logic!
- DS: Where are the models now? We have to monitor them continuously and need them in our account!
- DEV: So we've pulled up all the libraries! Why are the models suddenly no longer readable?
- ...

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# OUR MLOPS APPROACH

Architectural and Organizational view

### CLEAR RESPONSABILITIES

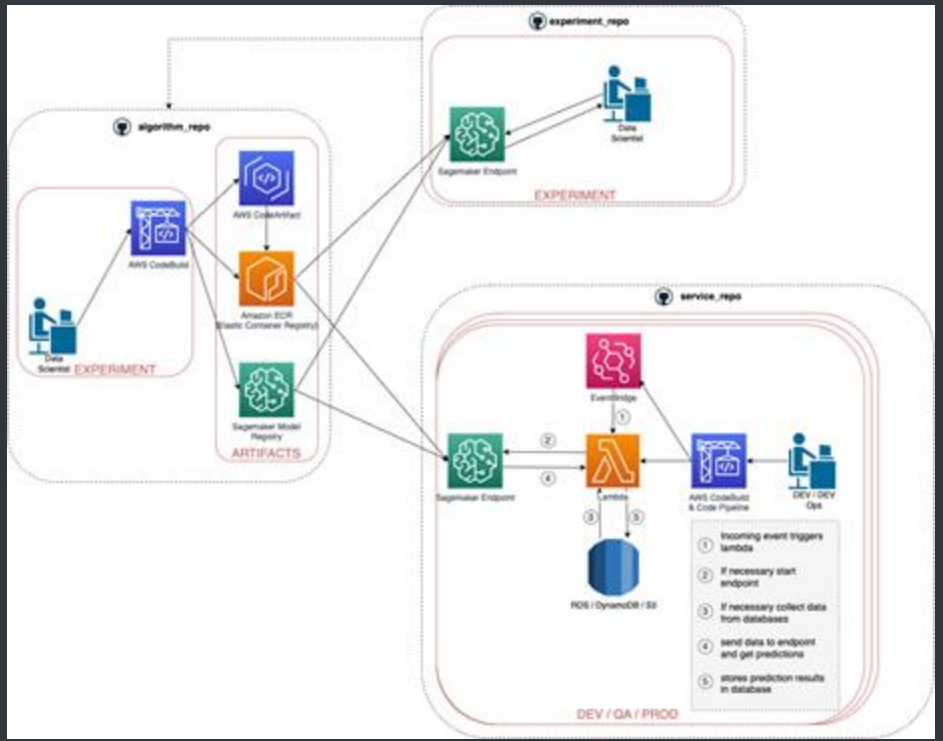
The data science team ensures that the Sagemaker endpoints are usable at all times. It does not worry about scaling, changing inputs, etc.

### MODEL MONITORING

Especially when a service is live, the data science team can monitor model usage, model drifts, data drifts etc. via the model registry.

### FURTHER MODEL DEVELOPMENT

As sovereignty over the models and their interaction is never relinquished, further developments are possible without any problems. From a DEV perspective, only the new endpoint needs to be used



# OUR MLOPS APPROACH

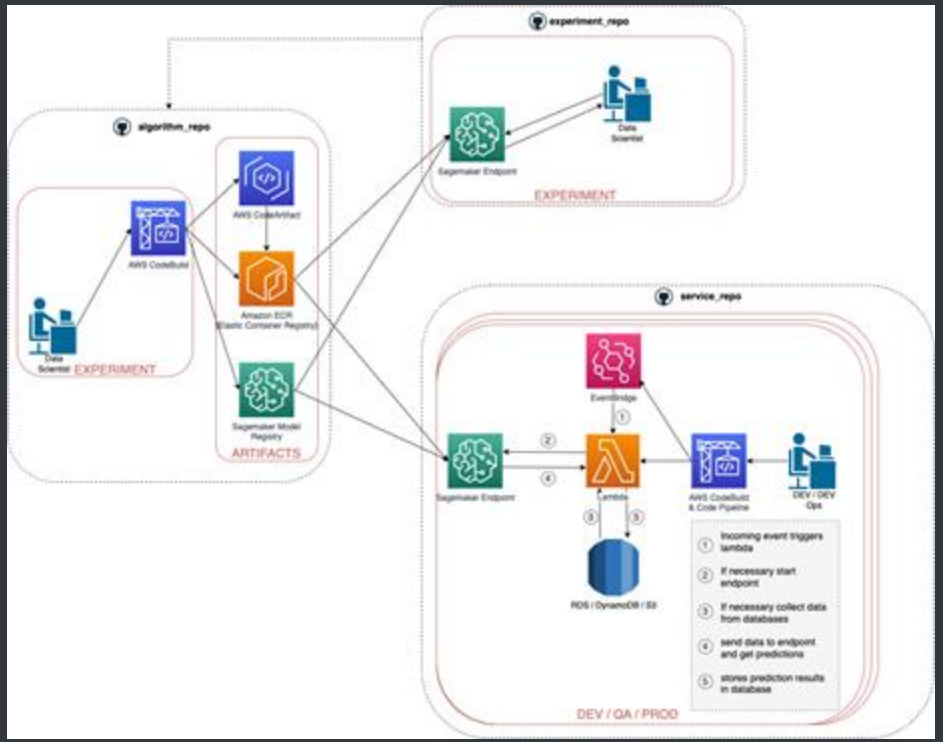
Architectural and Organizational view

### EXPANSION OF EXPERTISE NECESSARY

The data science team has to deal with topics such as CI/CD, containerisation, endpoint versioning, etc.

### INCREASED INFRASTRUCTURE COSTS

The loose coupling leads to an increase in infrastructure costs. In our experience, the efficiency gain outweighs this many times over.



# OUR MLOPS APPROACH

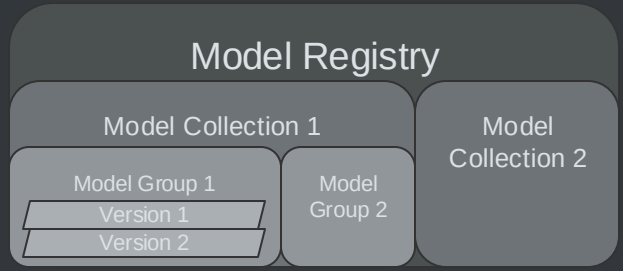
Technical details: Sagemaker Model Registry

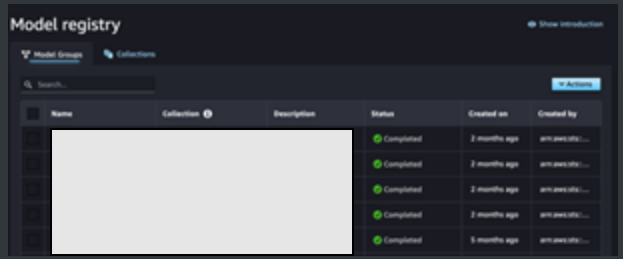
## What is a Model Registry?

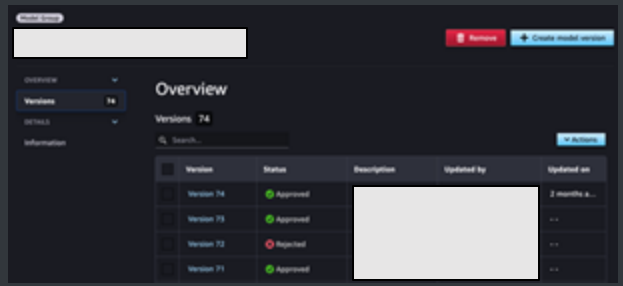
- Platform & (G)UI, to
  - manage (versioning) & organise machine learning models
  - moinitor the performance of machine learning models
- interface between Data Science & DEV

## Deep Dive: Sagemaker Model Registry Specifics

- Hierarchical structure divided into model collections, model groups and versions
- Models are stored (e.g. as a tar file) in S3
- Model Registry contains ModelPackage = metadata on the model, e.g:
  - Resource-Identifier (ARN) of the model
  - Version number
  - Approval Status
  - Infos about the Inference
  - Metrics
  - Custom(er) Metadata
- Collections do not influence the resource-identifier (ARN)!!!
- Cross Account Access to Sagemaker Model Registry is possible



# OUR MLOPS APPROACH

Technical details: Sagemaker Endpoints

## What is a Sagemaker Endpoint?

- Abstract instance on which one or more ML models are running
- can be called via API
- Computing power can be customised and (automatically) scaled up if required

## Deep Dive: What do I need to start an endpoint?

- Specification: Singlemodel or Multimodel Endpoint
- (Docker)Image from container registry (ECR)
- Selection of computing power and scaling

## Deep Dive: What kind of endpoint do I need?

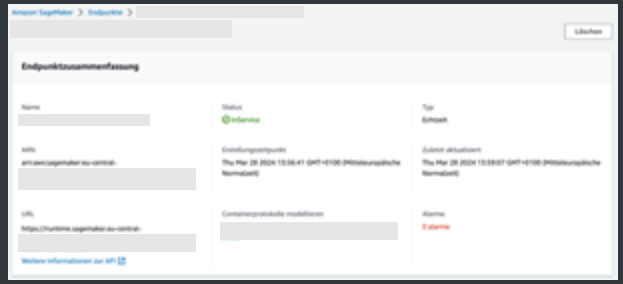
Single Model Endpoint

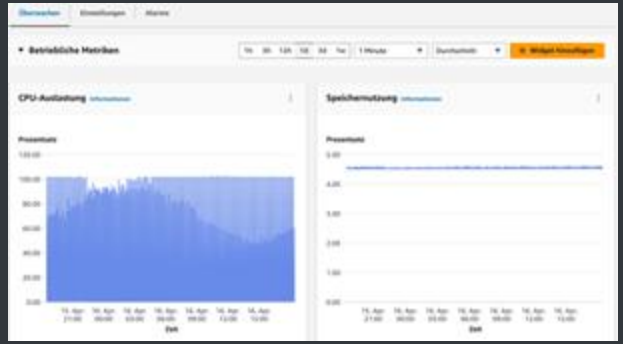
➔ fix Model

Multimodel Endpoint:

➔ Many models

➔ Model must be specified when the endpoint is called



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# CONCLUSION

What should you take away from this lecture?

Growing need for further development of ML models requires clear responsabilities of DEV and data science / Introduction of MLOps processes

- Reduces friction
- brings speed and efficiency

Having good templates in place that standardize the MLOps Processes makes it much easier for Data Scientists to get from PoC to production

AWS Sagemaker is sometimes unintuitive (‘the devil is in the detail’), but offers good functionality and scalability

KSB

Fast Bugfixing as responsabilities are clear

From Prototype to usable and maintanable Endpoints in hours

Continuous improvement of the ML models without any „fear“ of breaking something

# What are your MLOps experiences?

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