B/S/H/

BSH Home Appliances Group

An End-to-End MLOps Platform

—

Practical Experiences

2023-09-19

Eric Joachim Liese

Speakers

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Who is BSH?

BSH – We improve quality of life at home.

- Oven Cooking
- Surface Cooking & Ventilation
- Cooling
- Dish Care
- Laundry Care
- Small Appliances

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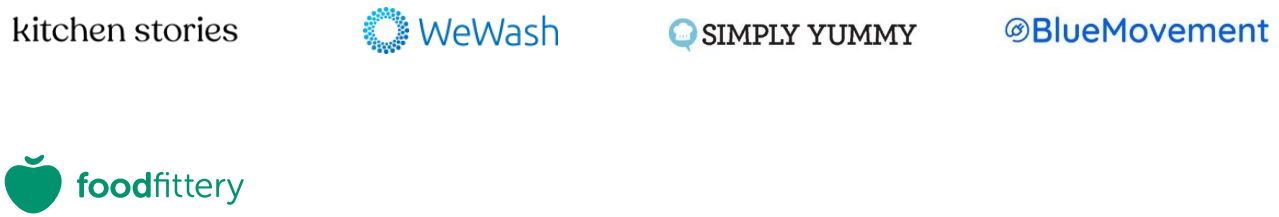
Our brands

Appliance Brands
Home Appliances under the brands

Ecosystem Brand

Service Brands



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We could offer consumer benefit if fridges would know what's inside them

Can I still eat this avocado?

What should I cook tonight?

I need to remember to get milk!

*
*

Expiry date reminder
We'll remind you to process your food before it turns bad

Recipes based on stock
We'll recommend recipes based on what you have already at home

Never run out
We'll remind you to purchase selected groceries when they run out

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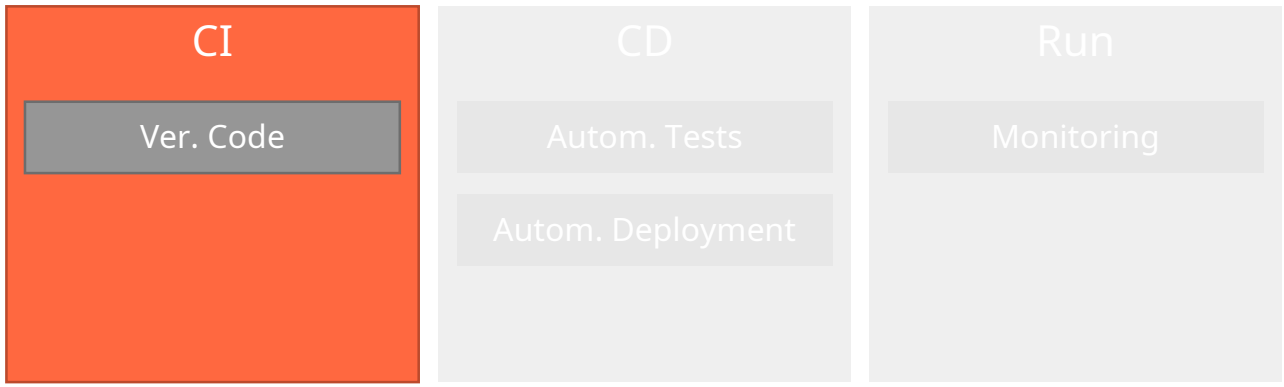
What is MLOps and why do we need it?

What is DevOps and why is it omnipresent in Software Engineering?

What is DevOps?

… and why is it omnipresent
in Software Engineering?

- CI – Continuous integration
  - One artifact – versioned code
  - Reproducability
  - Teamwork



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- CD – Continuous deployment
  - Automated test & deploy
    Check current status of code,
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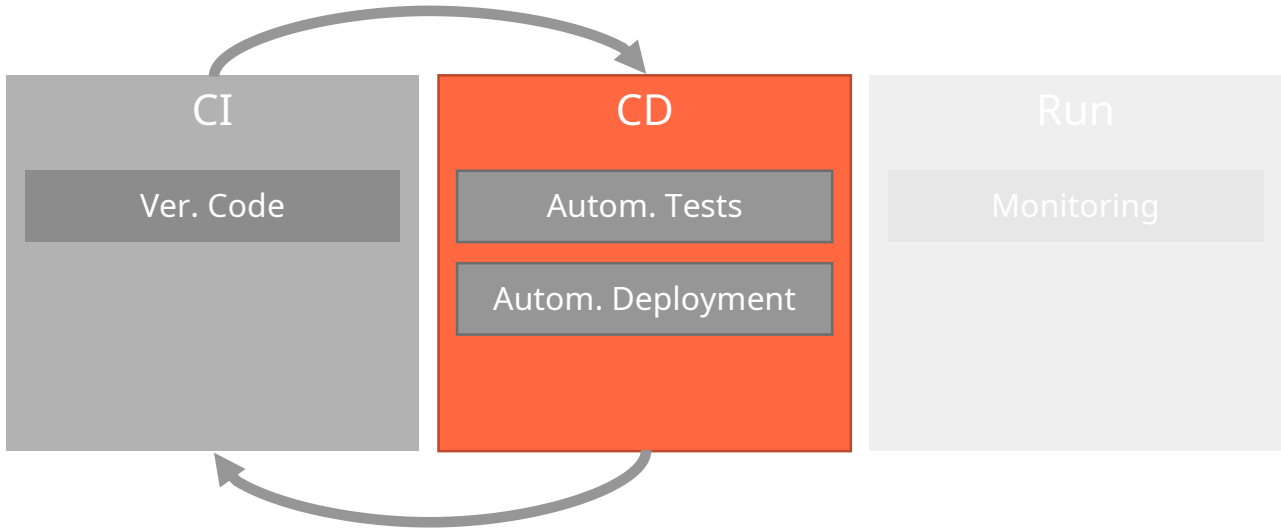

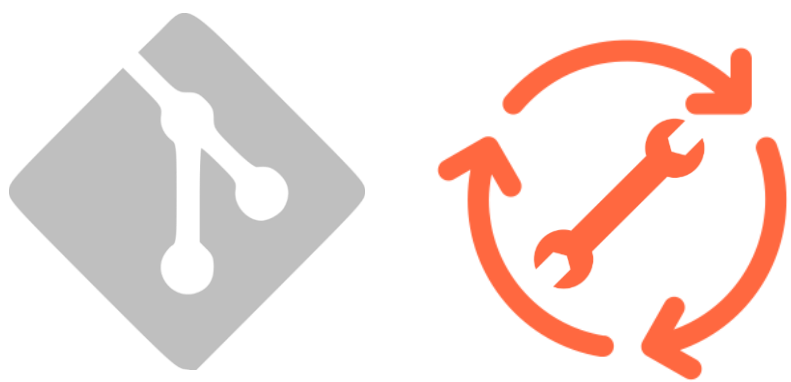

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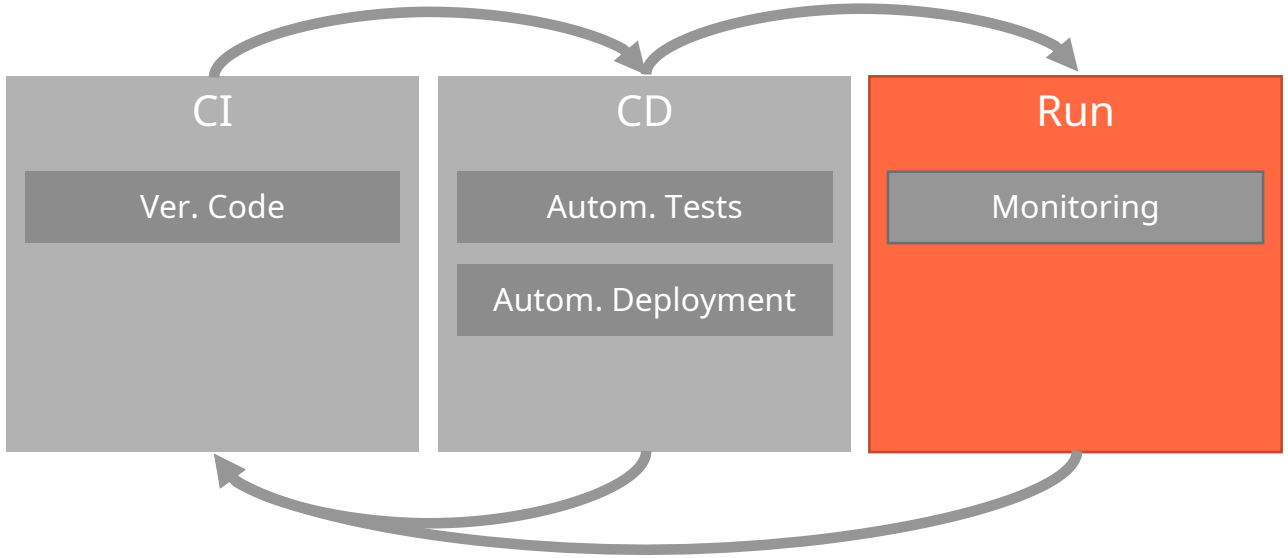
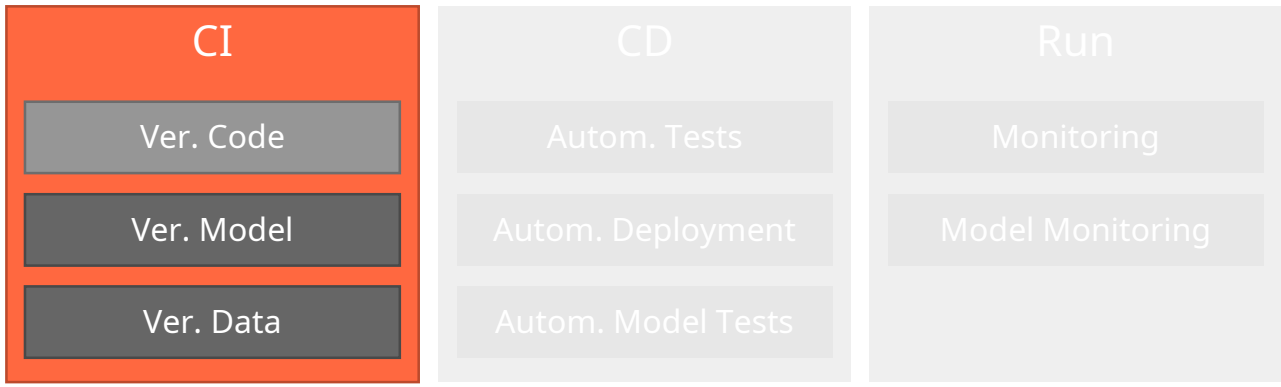
  - Check current status of code, i.e. does it work as intended?
- Run – Monitoring
  - Performance metrics
  - Robustness metrics
  - Infrastructure status



MLOps is (just) an extension of DevOps

Why MLOps?

- CI – Three artifacts
  - Versioned code
  - Versioned model
  - Versioned data snap shot



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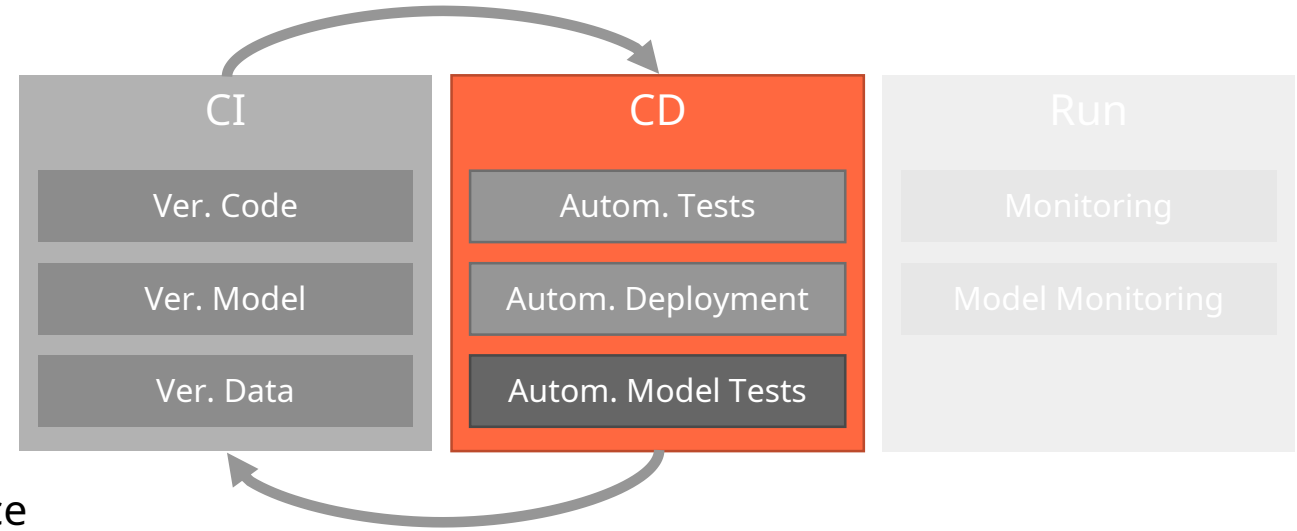
  - Expected predictions on well known data points



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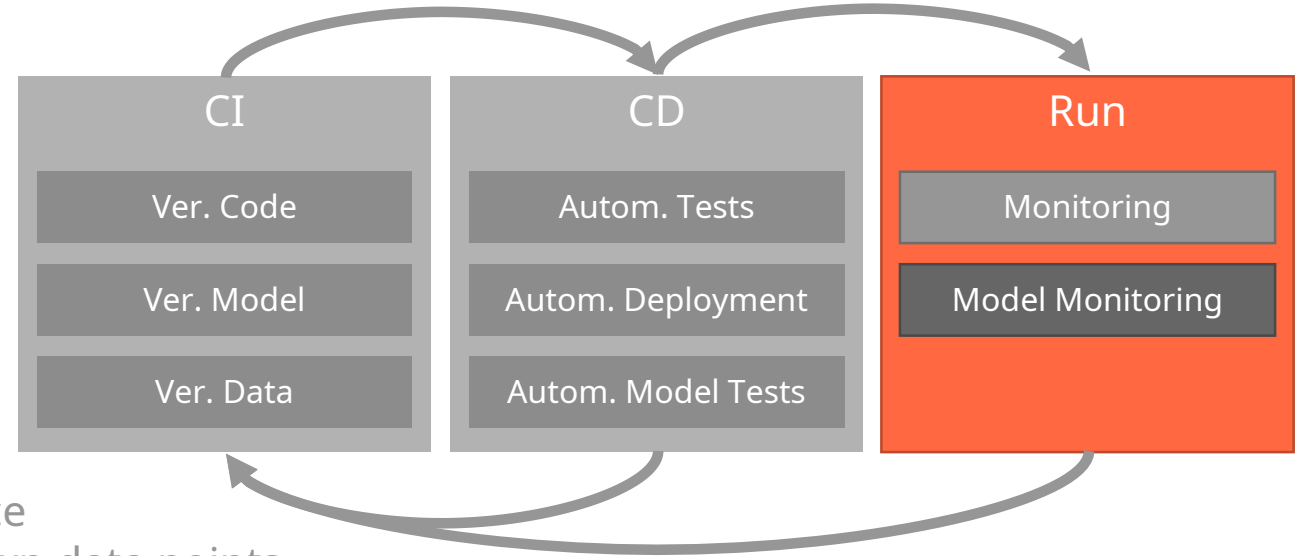
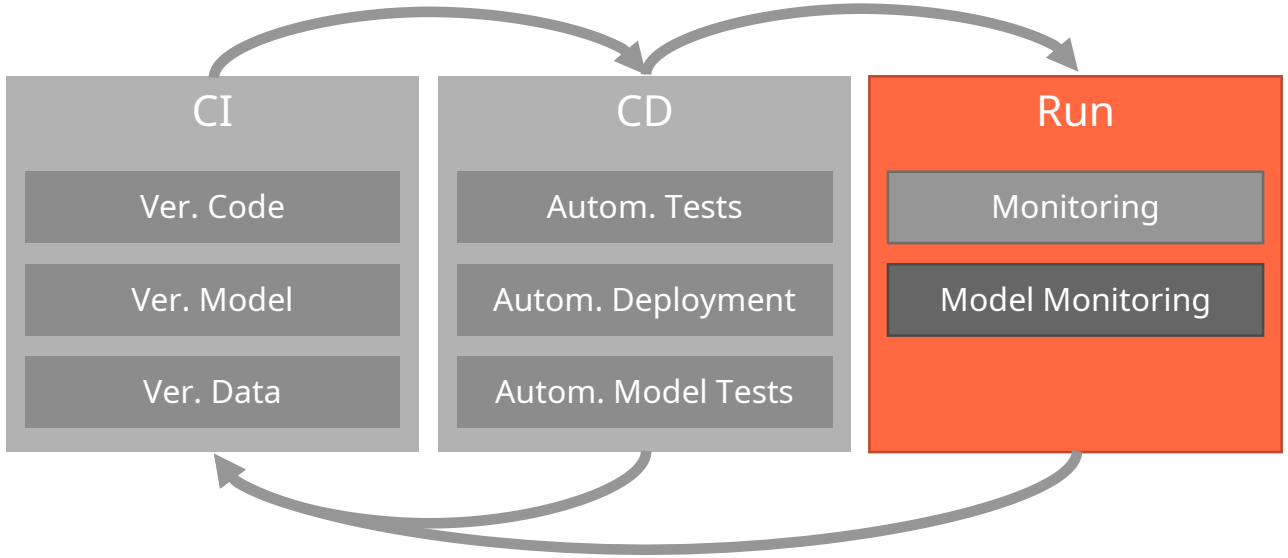
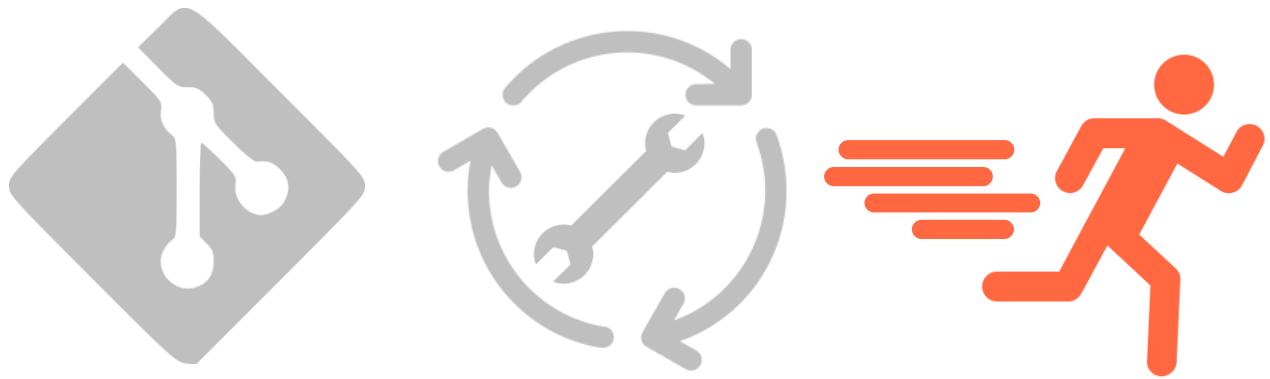
- Run – Extended monitoring
  - Model monitoring: degradation, concept drift, data drift, …



Why MLOps?

- Result
  - Faster rollout into production, i.e. shorter TTM or TTV
  - Reproducable behaviour

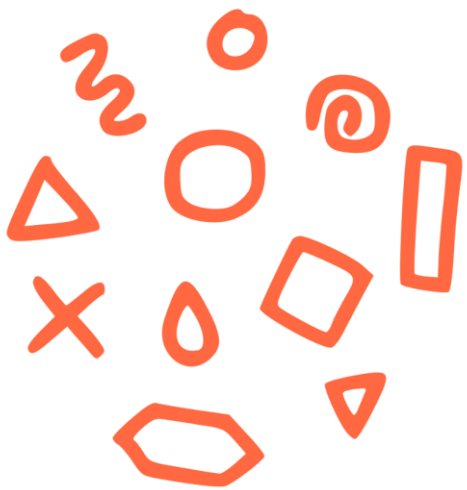




Why did we build our own generic MLOps Platform?

Why a Generic Platform?

- Have to deal with **heterogenous** use cases
  - Slow and fast moving data
  - Images and NLP
  - Sensor data from IoT, IIoT / I4.0
  - → need flexible, versatile, modular end-to-end Platforms



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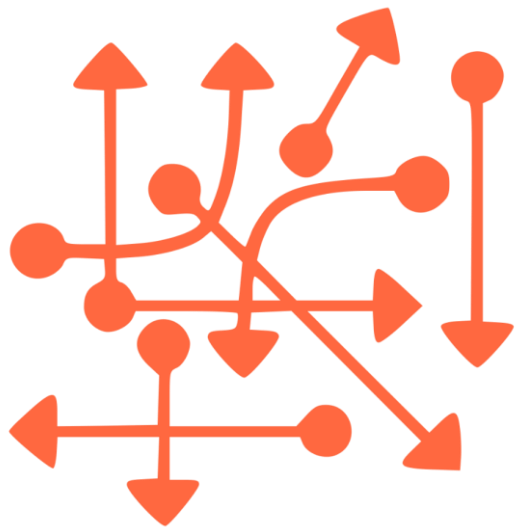
  - Many code versions on “lost“ Jupyter Notebooks
  - Hundreds of (functional) users with thousands of roles
  - Data Science has a high employee fluctuation



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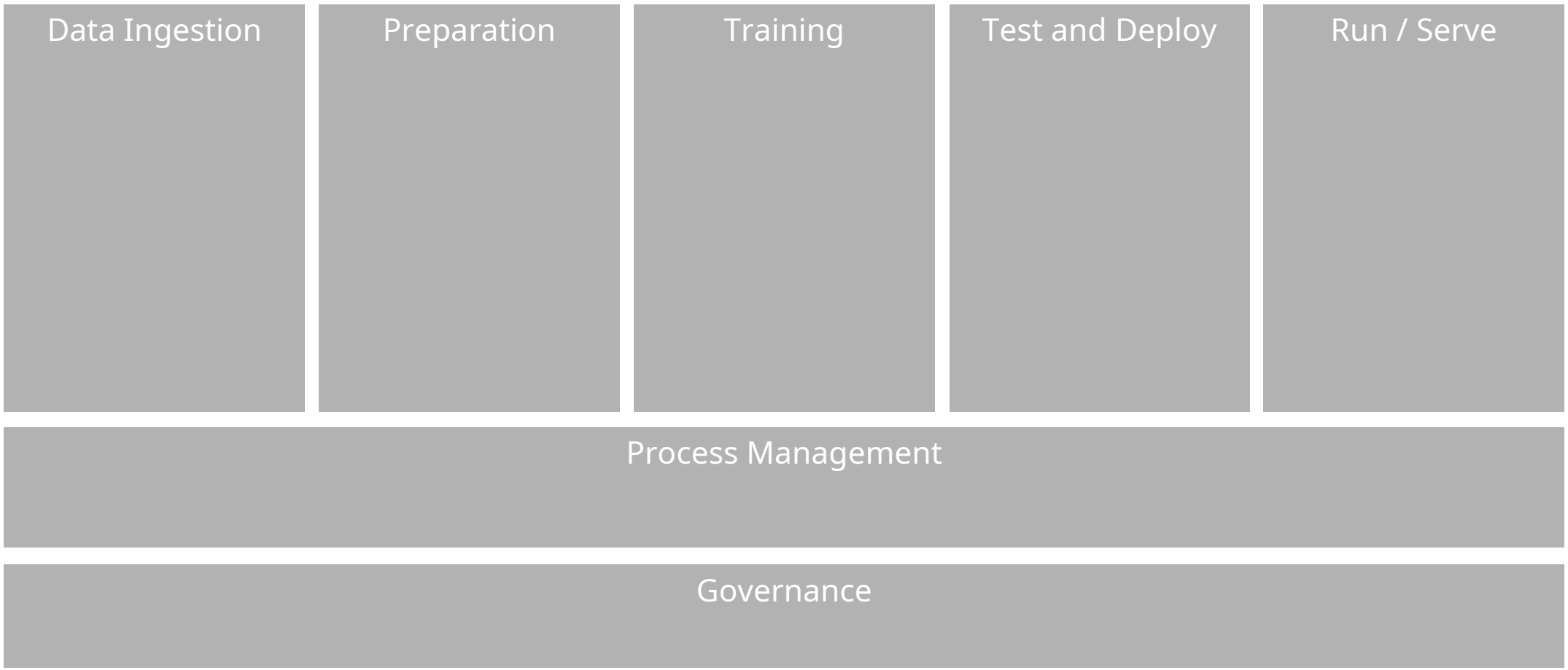
- Ready made platforms / off the shelfs often not sufficient
  - „black box“
  - Fast to apply but also reaching fast its limits and often its difficult to extend
  - E.g. we had to combine mlflow with Aporia and benefit from each strengths. -> Allows to change parts of the platform for better tools (chirurgical process) (drop in replacement)

The MLOps Platform at BSH

Platform Concept and Status at BSH



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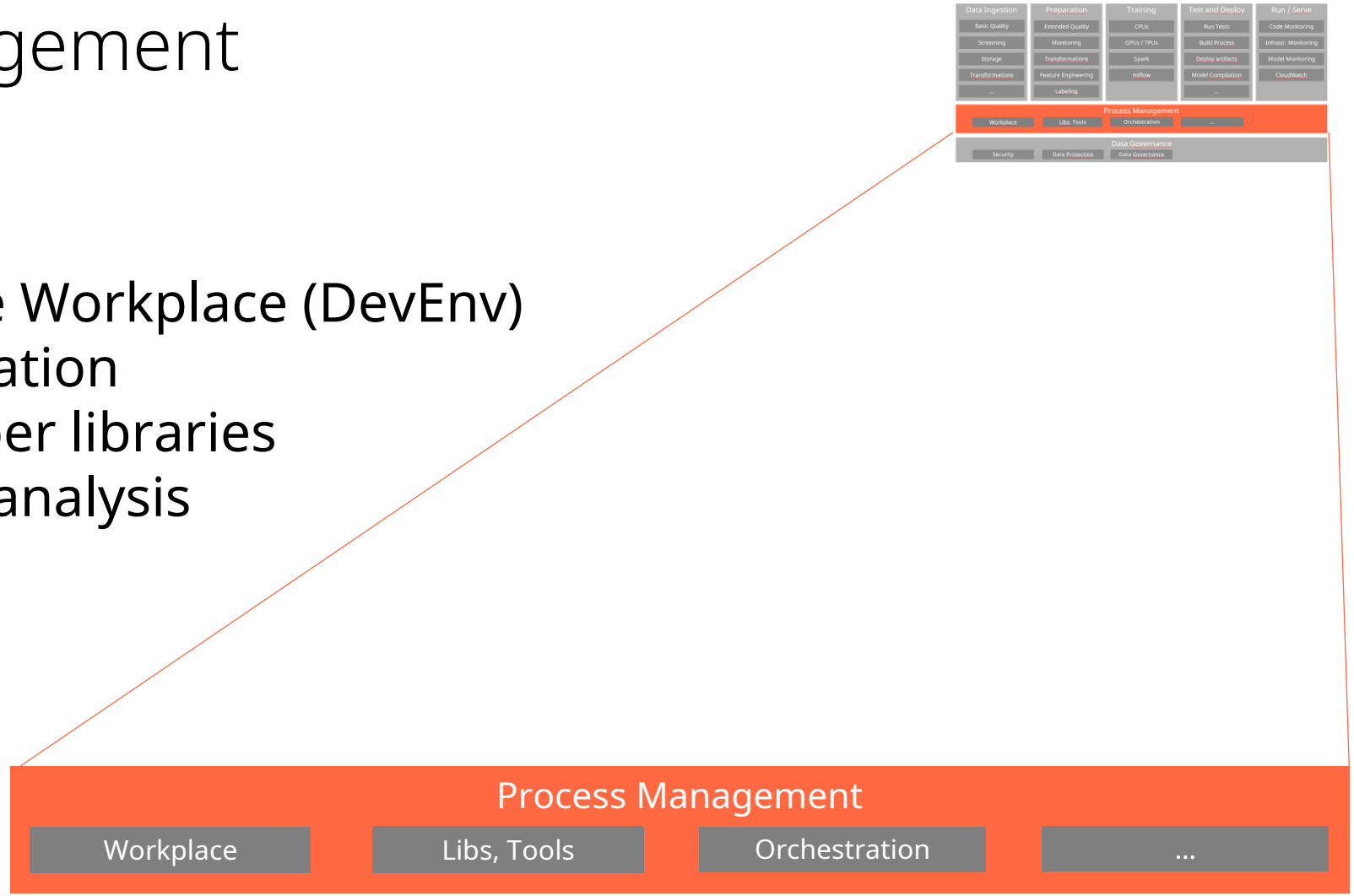
Process Management

- Data Science Workplace (DevEnv)
- Job orchestration
- Generic helper libraries
- Exploratory analysis
- Experiments



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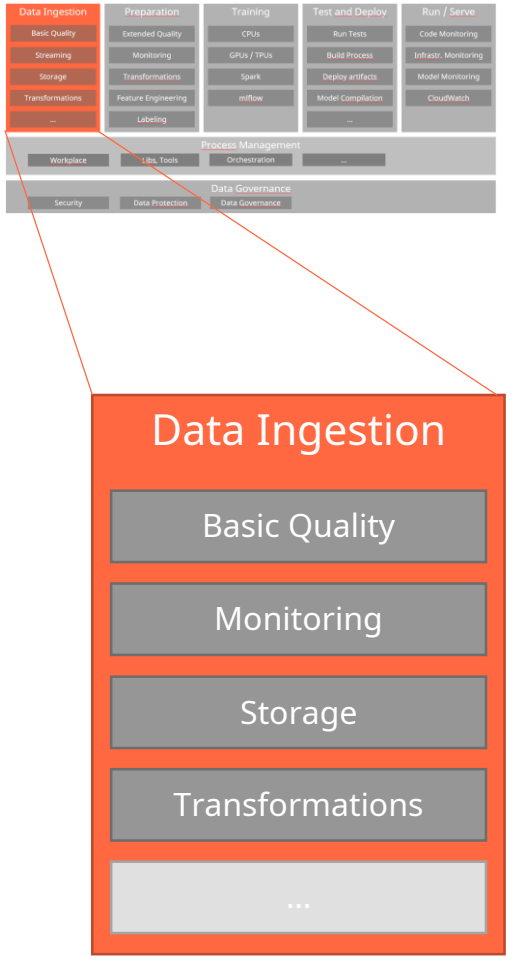
Data Ingestion

- Streaming / Batch
- Storage
- Best practice: basic quality checks and monitoring (use case agnostic)
- Storage optimizations for faster queries
- Anonymization / pseudonymization



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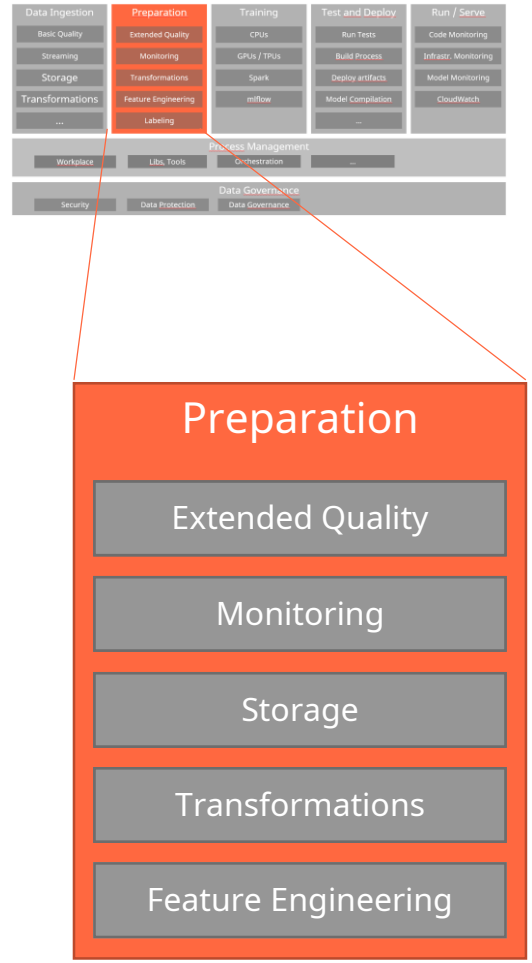
Preparation

- Transformations (Spark for heavy duty ETL)
- Feature engineering
- Best practice: extended quality checks and monitoring (use case specific)
- Data enrichment
- Labeling



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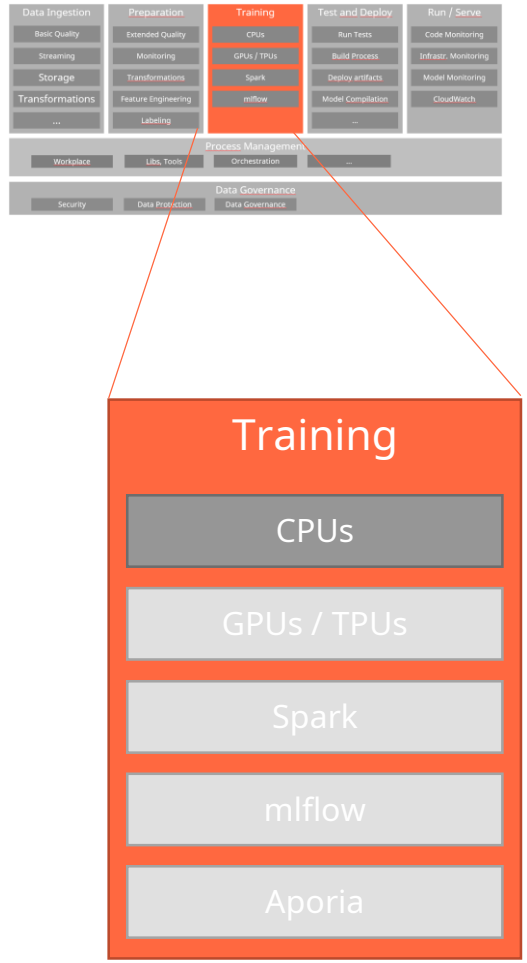
Training

- Model selection, training and evaluation
- CPU / GPUs / TPUs Cluster for deep learning
- Experiment tracking - mlflow
- Model versioning - mlflow



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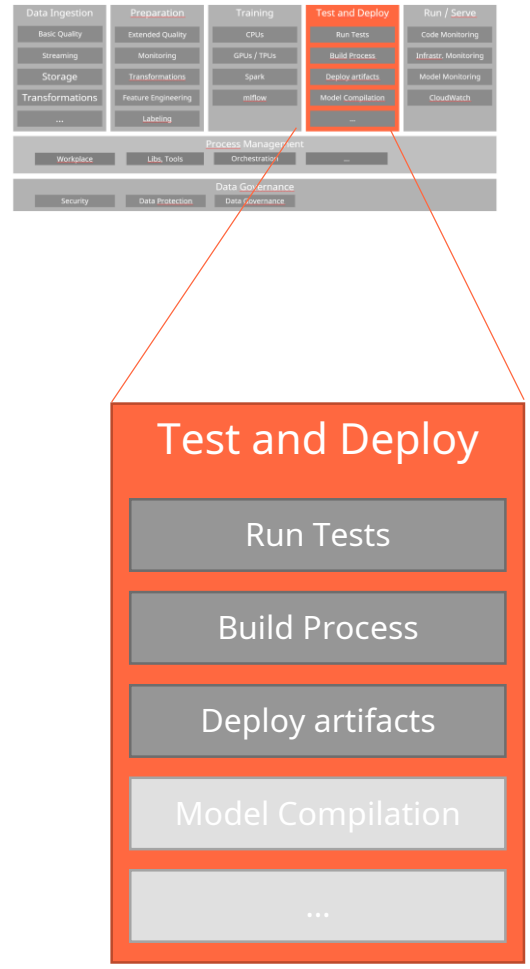
Test & Deploy

- Automated deployment
  - Blue / green
- Automated (re-) training
- One-Click-Deployment - mlflow
- Quality & security testing gateway
- Model compilation
- Containerization – Target specific deployment



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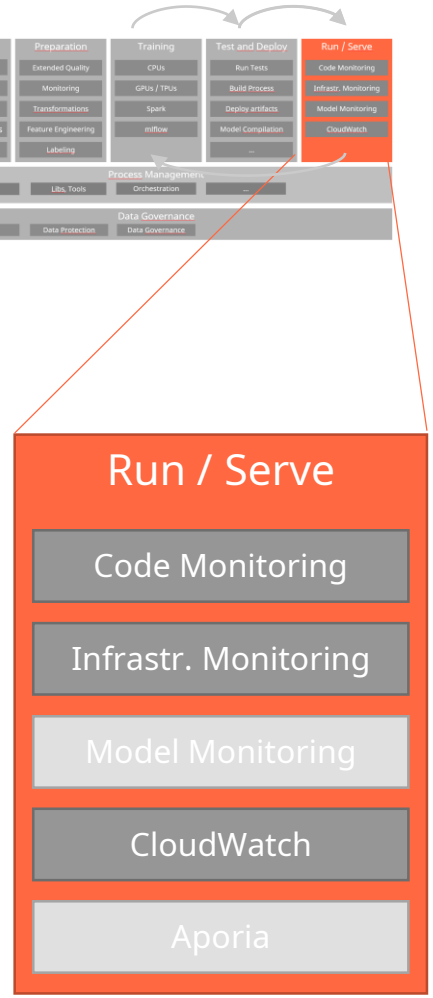
Run & Serve

- Infrastructure & software monitoring
- Model monitoring
  - Performance / feedback
  - Data drift
- Generic API for inception
- High availablity



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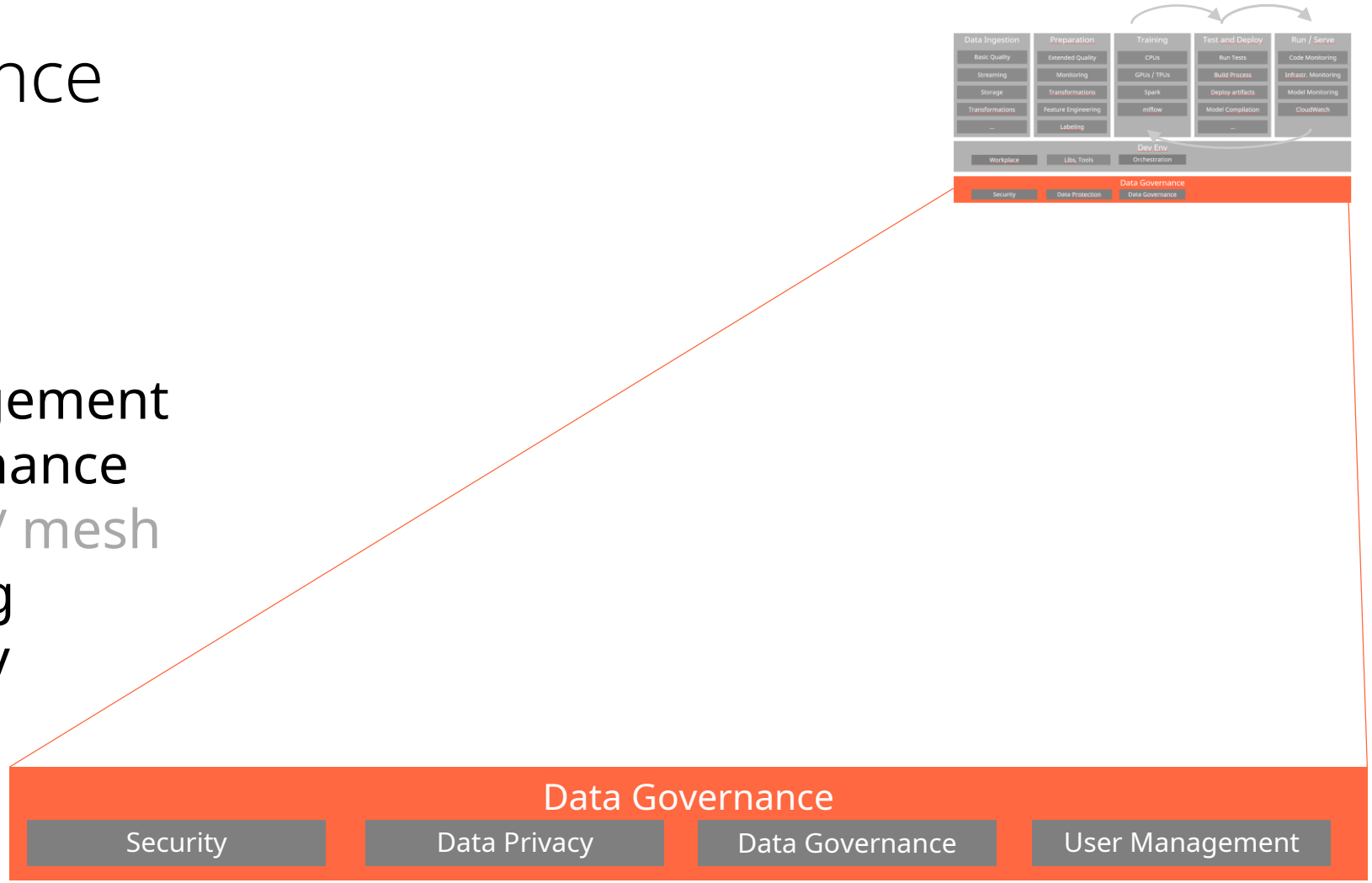
Data Governance

- Security
- User management
- Data governance
- Data fabric / mesh
- Data catalog
- Data privacy



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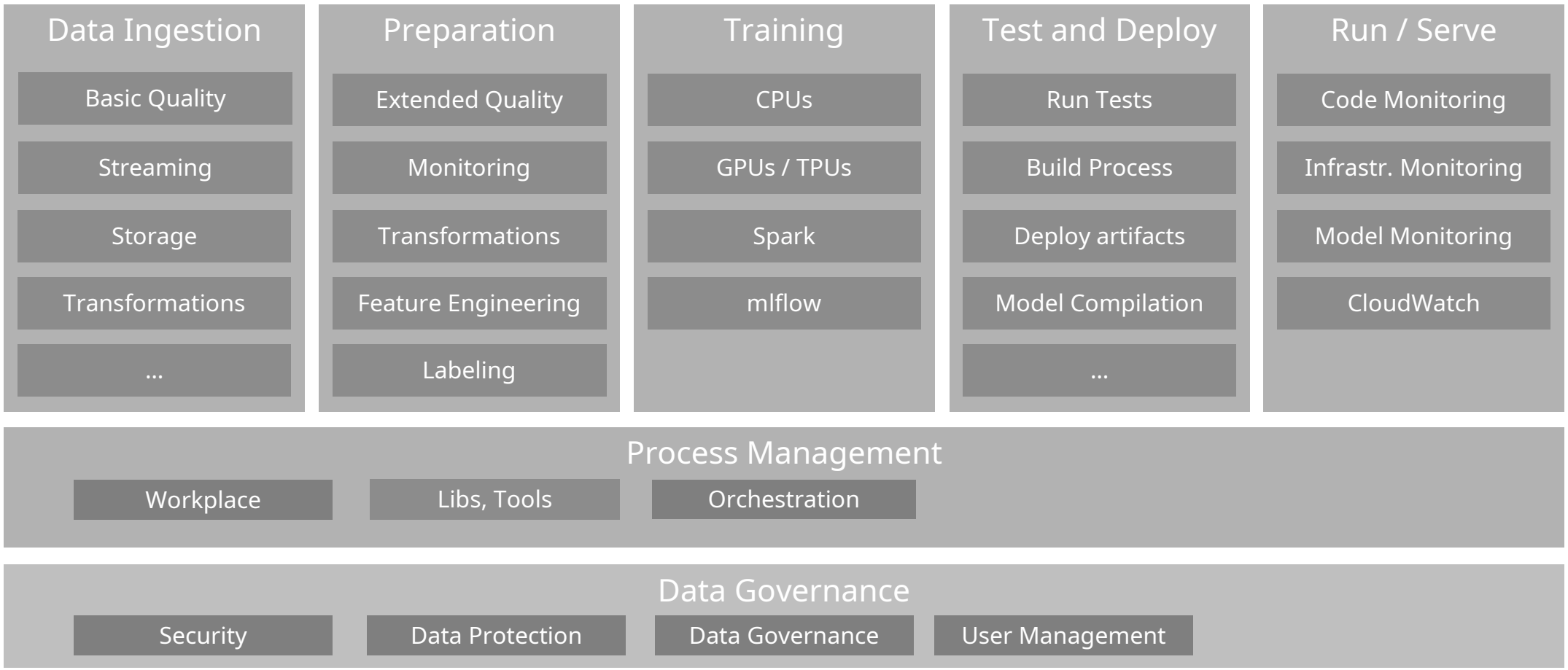

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So what can we take away?

Practical Considerations

- First get good understanding of the current and probable future demands, then find balance between both
- Flexibility to replace components of the platform for better ones – Tools evolve and descope very quick
- Fail early/fast -> start with small PoC and grow continuously
- Always look for generic solutions for specific use cases
- Reserve time for data governance

Pitfalls

- Avoid technology islands to reach quick wins
- Evaluation of tools is time consuming and expensive.
  Important to do it in a well-structured way.
  → do your proper due diligence
- Avoid vendor lock-ins
  → often leads to expensive migrations
- Do not sacrifice long-term value for short-term results.
- Don't prioritize short term agility over long term sclerosis
- Check the end-to-end perspective

Thank You!

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2023-09-19
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Illustrations by
Storyset

Questions?

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Backup / Archive

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Outlook

- Data Versioning
- Data Quality automation
- Model compilation
- Extending to LLMOps
- Personalization
  - Tailor made models, one for each appliance or household
  - Fleet management - deploy millions of models and keep track of them