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Tech-talk with ML professionals

Design Thinking of MLOps

The Strategic Approach to MLOps

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About Me

- I am **a Sr. AWS AI ML Solution Architect** and **AI researcher** at **IBM** with this Generative AI Expert, Quantum Machine Learning Practitioner and technical book reviewer(Packt Publication, Manning, Apress).
- I am the author of the Book: **Hands-on Time Series Analytics with Python, published by Apress Springer Publication**
- with over **11+ years of experience** in the field of AI, I have a keen interest and ambition to conduct research in the following domains: machine learning Operations, machine learning, deep learning, time series analysis, natural language processing, reinforcement learning, audio analytics, signal processing, sensor technology, the Internet of things, computer vision, spatial-temporal data, satellite time series, quantum computing, etc.
- I published more than **15+ research papers** in the field of data science with reputed publications such as **IEEE, Taylor, Francis, Springer, etc.**
- I holed Rank 3 as a kernel master in Kaggle.
- I am a LinkedIn influencer with more than 85k+ followers.
- I hold a GitHub repository containing more than 25k+ stars and 6k+ followers with a Specialists profile. I am technical book reviewer with review more than 63+ Books in AI technology.
- I am certified with IBM Advanced Badge, more than 15+Quantum Computing Practitioners Challenges, and Quantum Machine Learning Certified from Coding Schools (MIT, University of Oxford Venture, and IBM)

Outline

- Why MLOps?
- Introduction to MLOps
- MLOps Process Cycle
- MLOps Benefit and Challenges
- MLOps Technology Landscape
- CI/CD of MLOps
- Persona of MLOps
- MLOps Key Principle and Best Practises
- MLOps at Your Organization
- Hidden Technical debt in ML System
- MLOps Maturity Models
- Books and Research Paper

Why MLOps?

Today

- ✓ 53% of POCs Make it into Production take an average of 9 months

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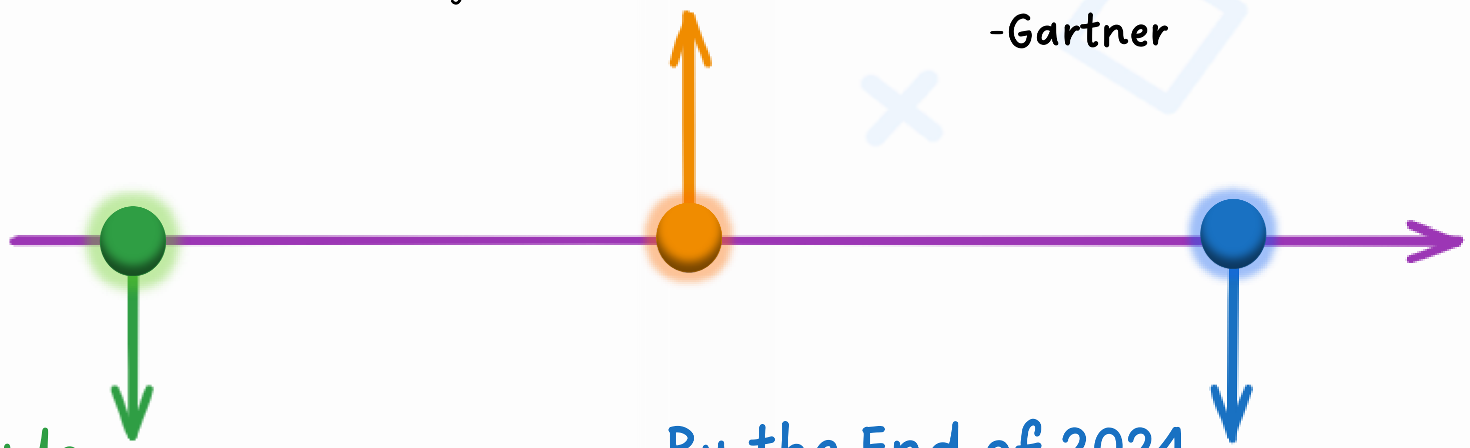

Last Decade

- ✓ Focusing mostly on Building Machine Learning Models
- ✓ Operationalization was an afterthought

By the End of 2024

- ✓ 75% of the organization will shift from piloting to operationalizing AI

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Introduction to MLOps

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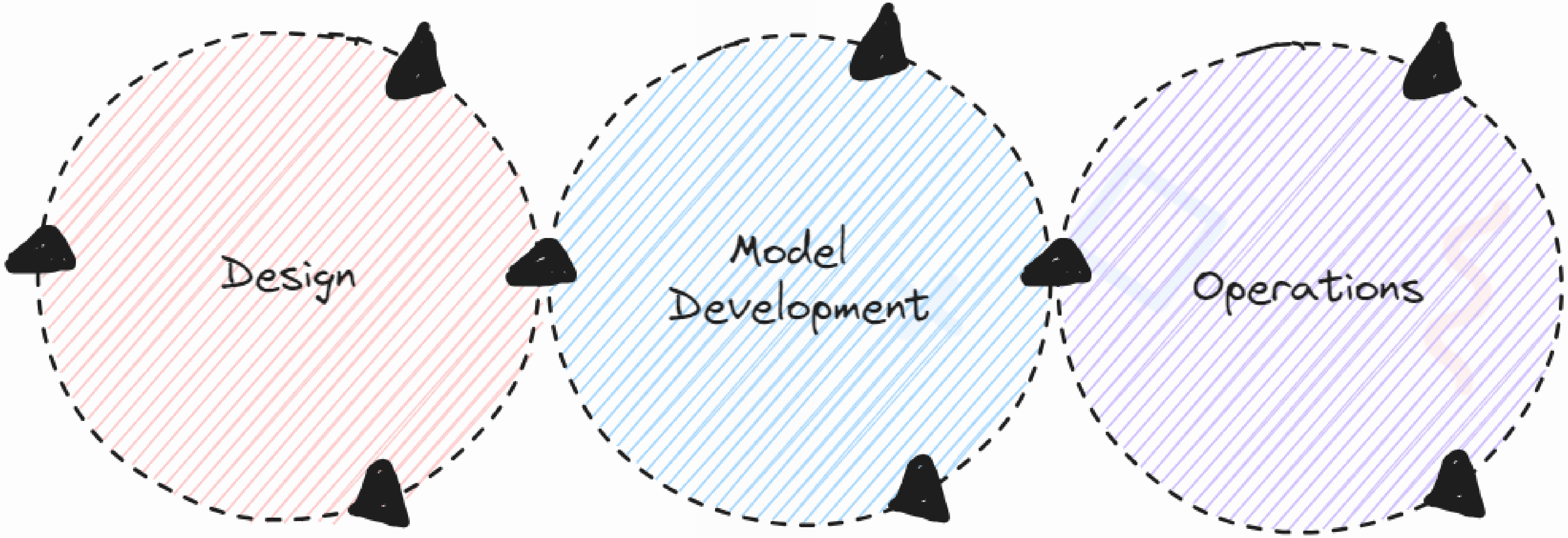

ML + Dev + Ops = MLOps

ML

- Requirement Engineering
- ML Use Case Priorization
- Data Availability Check

Dev

- Data Engineering
- ML Model Engineering
- Model Testing and Validation

Ops

- ML Model Deployment
- CI/CD Pipelines
- Monitoring and Triggering

MLOps Process Cycle

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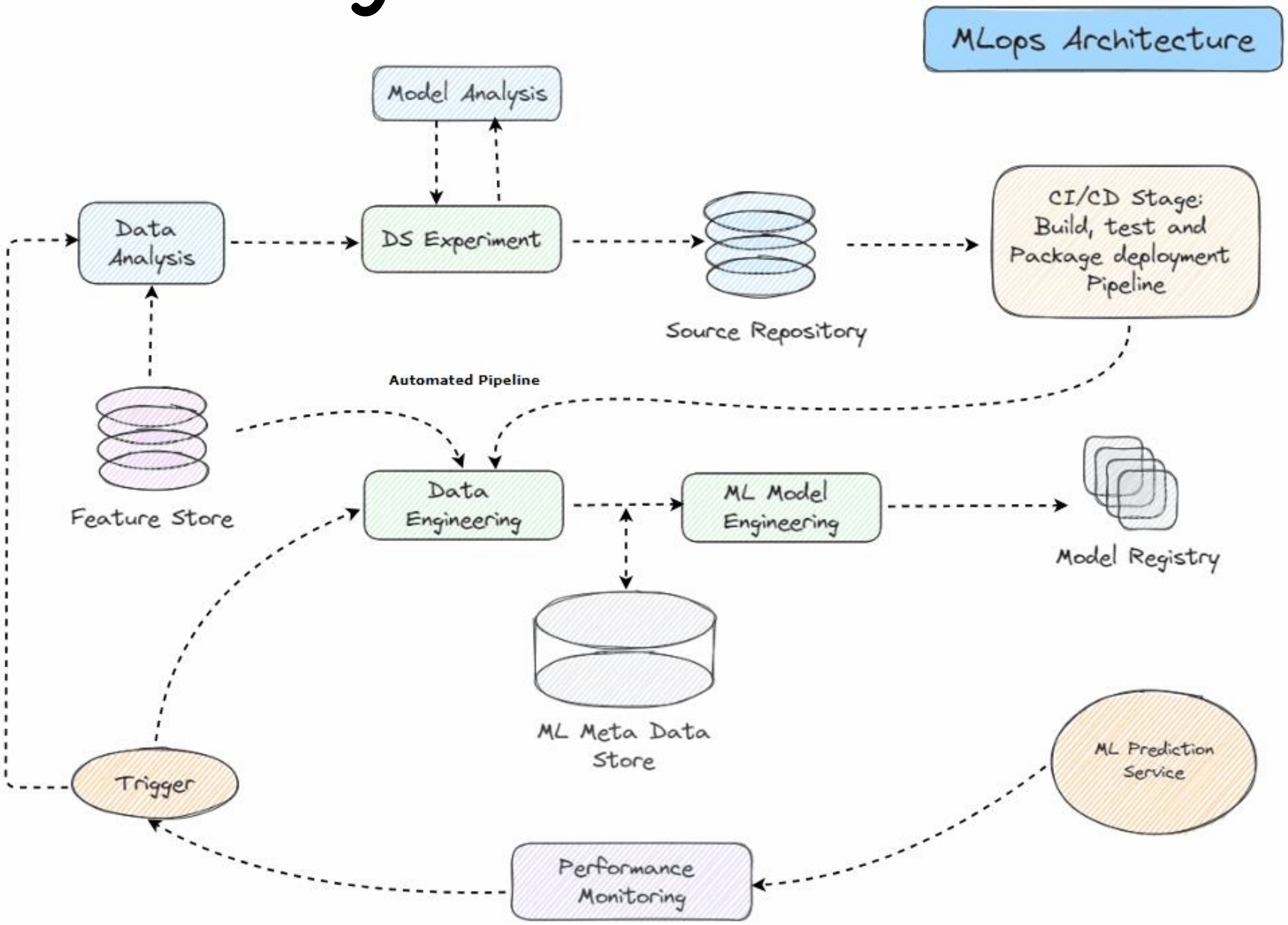

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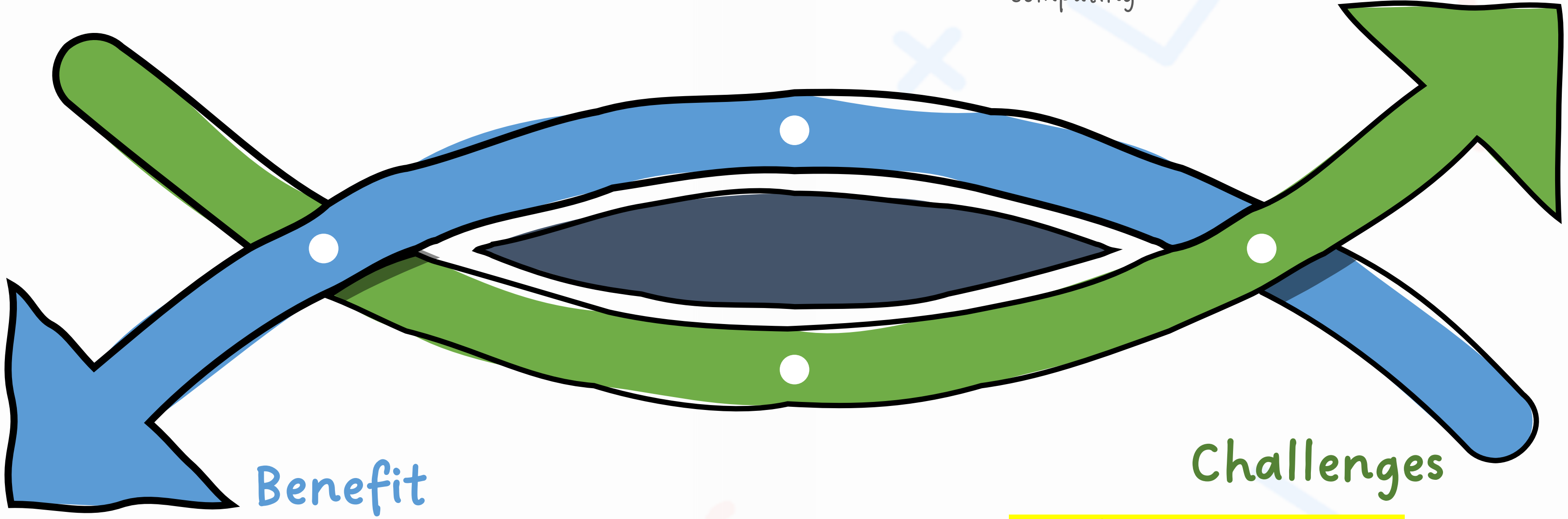
MLOps Benefit and Challenges

Benefit

- **Faster time to market:** MLOps can help to get ML models to production faster, allowing businesses to reap the benefits of their investments in ML sooner.
- **Better governance: MLOps** can help to ensure that ML models are compliant with regulations and ethical guidelines.

Challenges

- **Cultural shift:** Implementing MLOps requires a cultural shift within organizations, as it requires a more collaborative and DevOps-oriented approach to ML development.
- **Technical complexity:** MLOps can be technically complex to implement, as it requires expertise in a variety of areas, such as DevOps, ML, and cloud computing



Benefit

- **Improved efficiency:** MLOps can automate and standardize the ML lifecycle, making it more efficient and less prone to human error.
- **Improved quality:** MLOps can help to ensure that ML models are developed, trained, and deployed in a controlled and consistent manner, leading to higher quality models.

Challenges

- **Lack of tools and standards:** There is a lack of mature and standardized tools and platforms for MLOps, which can make it difficult to get started.
- **Cost:** Implementing MLOps can be expensive, as it requires investment in tools, infrastructure, and training.

MLOps Technology Landscape

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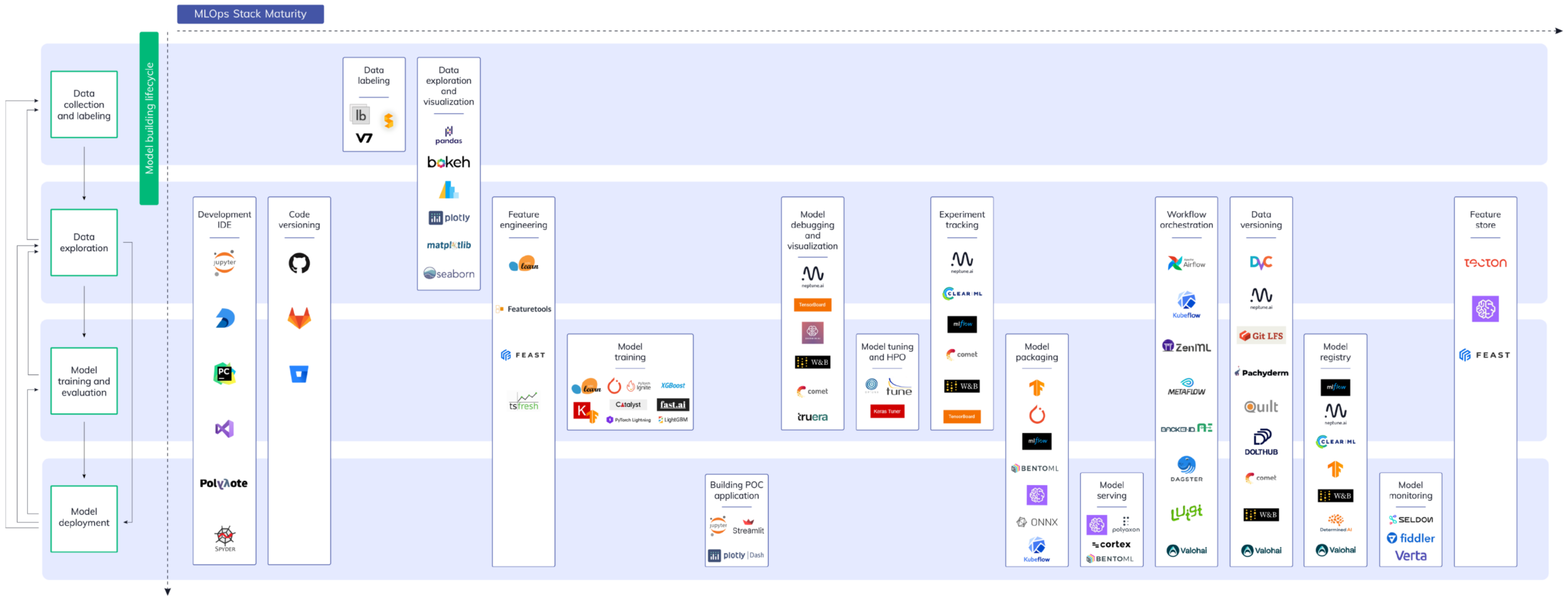

DevOps vs MLOps

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	DevOps	MLOps
Code versioning	✓	✓
Compute environment	✓	✓
Continuous Integration/ Delivery(CI/CD)	✓	✓
Monitoring in Production	✓	✓
Data Provenance		✓
Datasets		✓
Models		✓
Hyperparameters		✓
Metrics		✓
Workflows		✓

MLOps – End to End ML Life Cycle Management

MLOps: The Epoch of Productionizing ML Models | by Aditya Soni | Analytics Vidhya | Medium

CI/CD for MLOps

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Phase 1: Research / Experiment(CI)

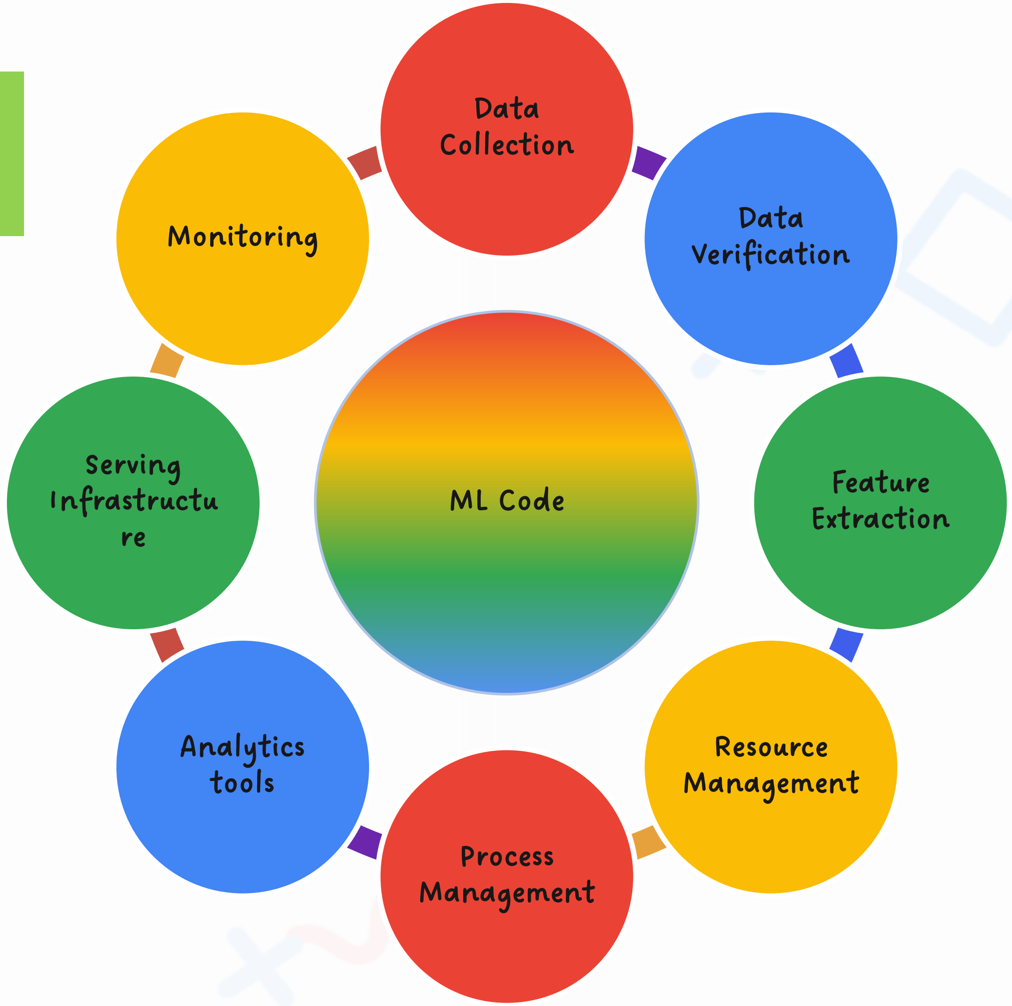
Question: " Can ML be used to address this issue? "

- ✓ *"Is it possible to…?"*
- ✓ *"Can we use this data to solve the following problem?"*
- ✓ *" Surely, we must be able to…"*

Typical Scenarios

- ✓ *Scientific Projects*
- ✓ *Proofs-of-concept (PoCs)*

Continuous integration (CI):
Automates the testing and building of models, ensuring quality and consistency.



Phase 2: Operational(CD)

Question: " How do we implement this method at scale? "

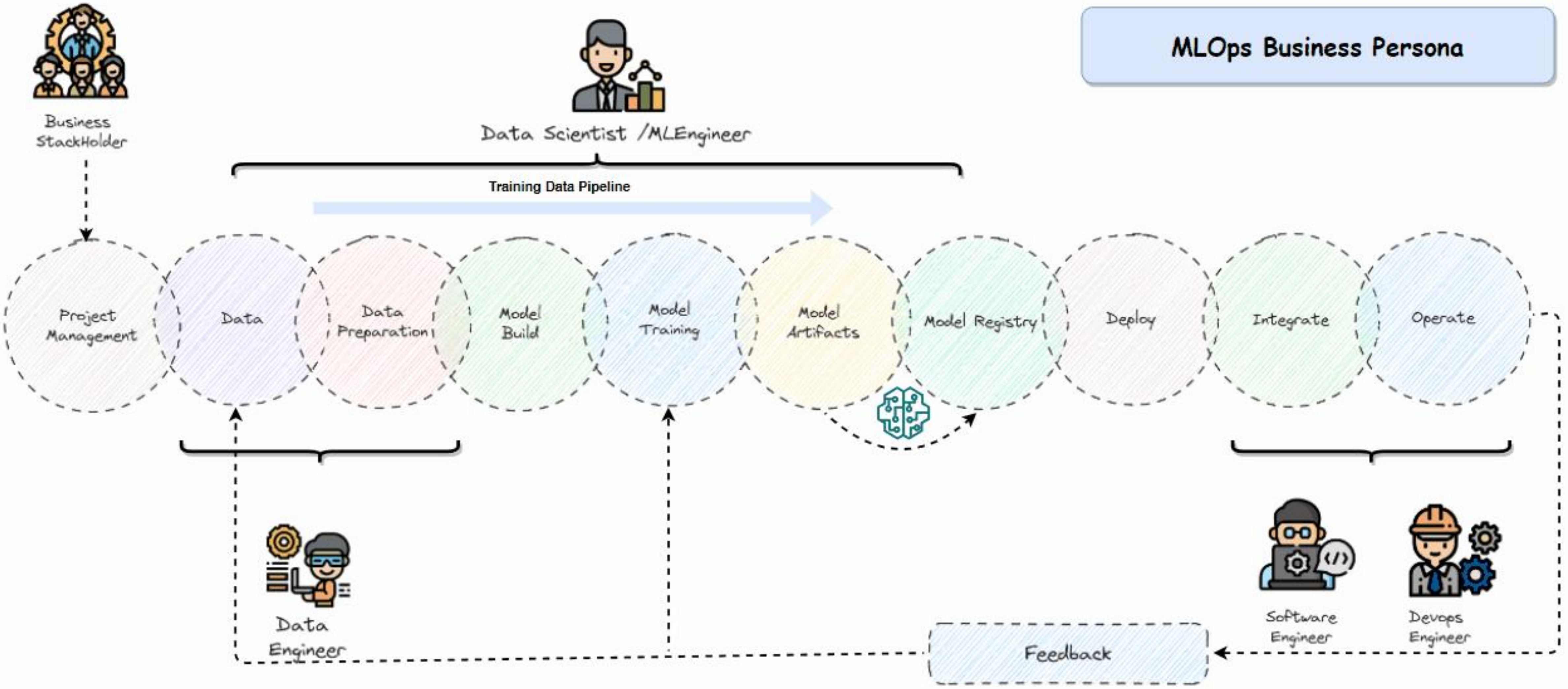
- ✓ *"How do we pipe the data into the model promptly?"*
- ✓ *" How do we collect, store and transform data so models can be retrained consistently?"*
- ✓ *"How do we build an A/B testing environment to test future model iterations?"*

Typical Scenarios

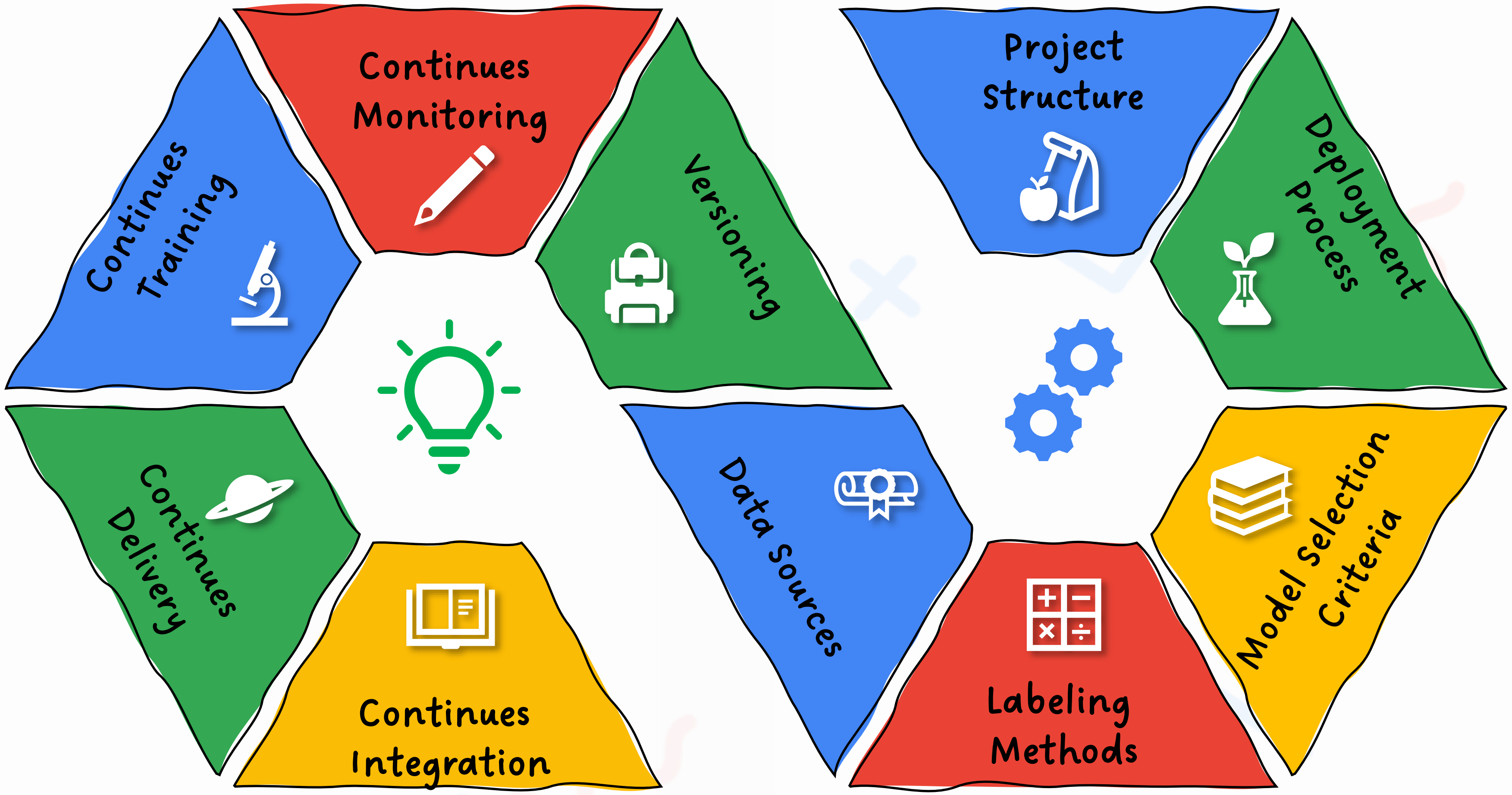
- ✓ *After PoC, bringing your ML models to production*
- ✓ *Migration of existing models into ML Platform*

Continuous delivery (CD):
Automates the deployment of models to production, enabling rapid releases and updates

Persona of MLOps



MLOps Key Principle and Best Practises



MLOps at Your Organization

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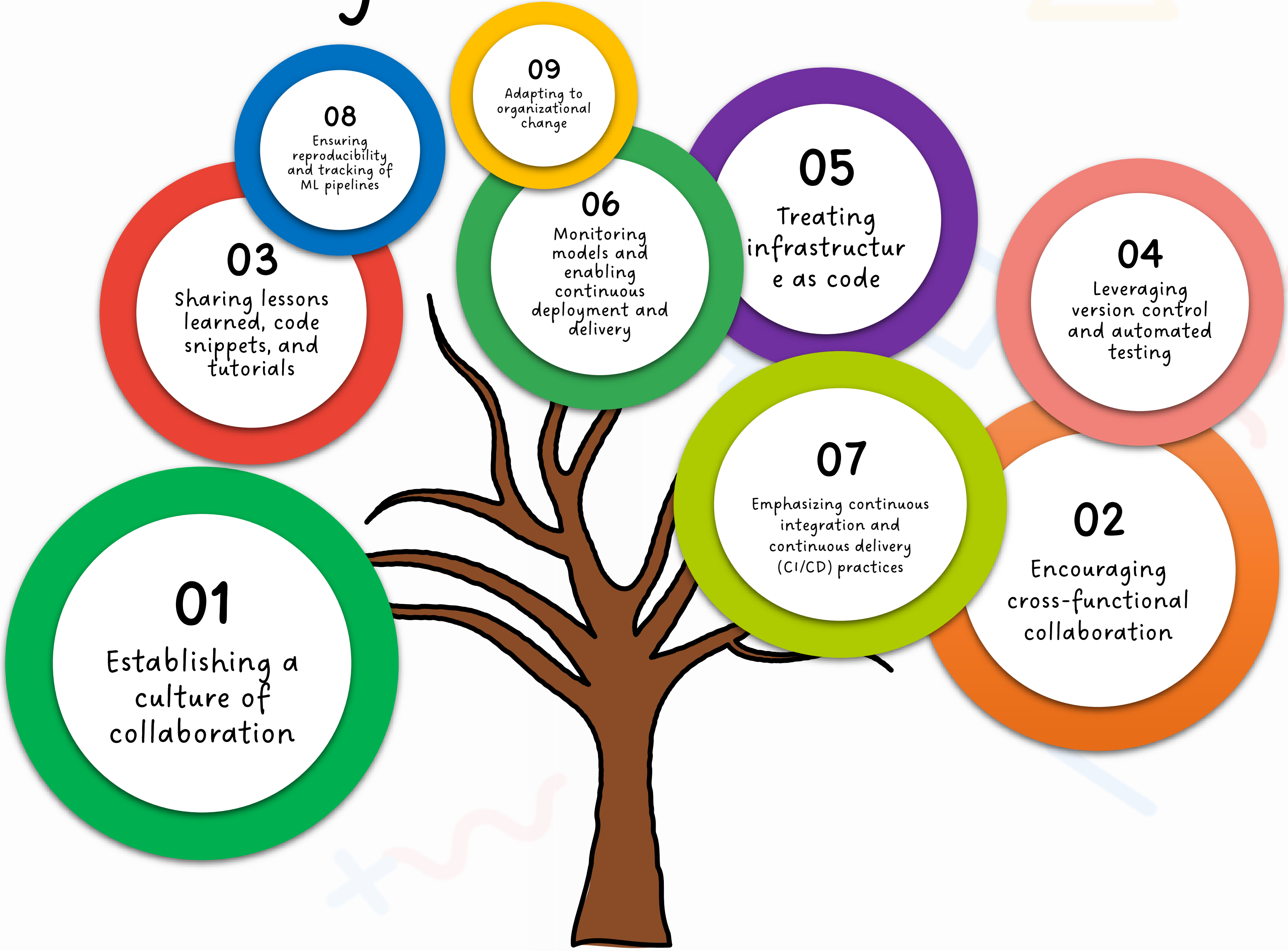
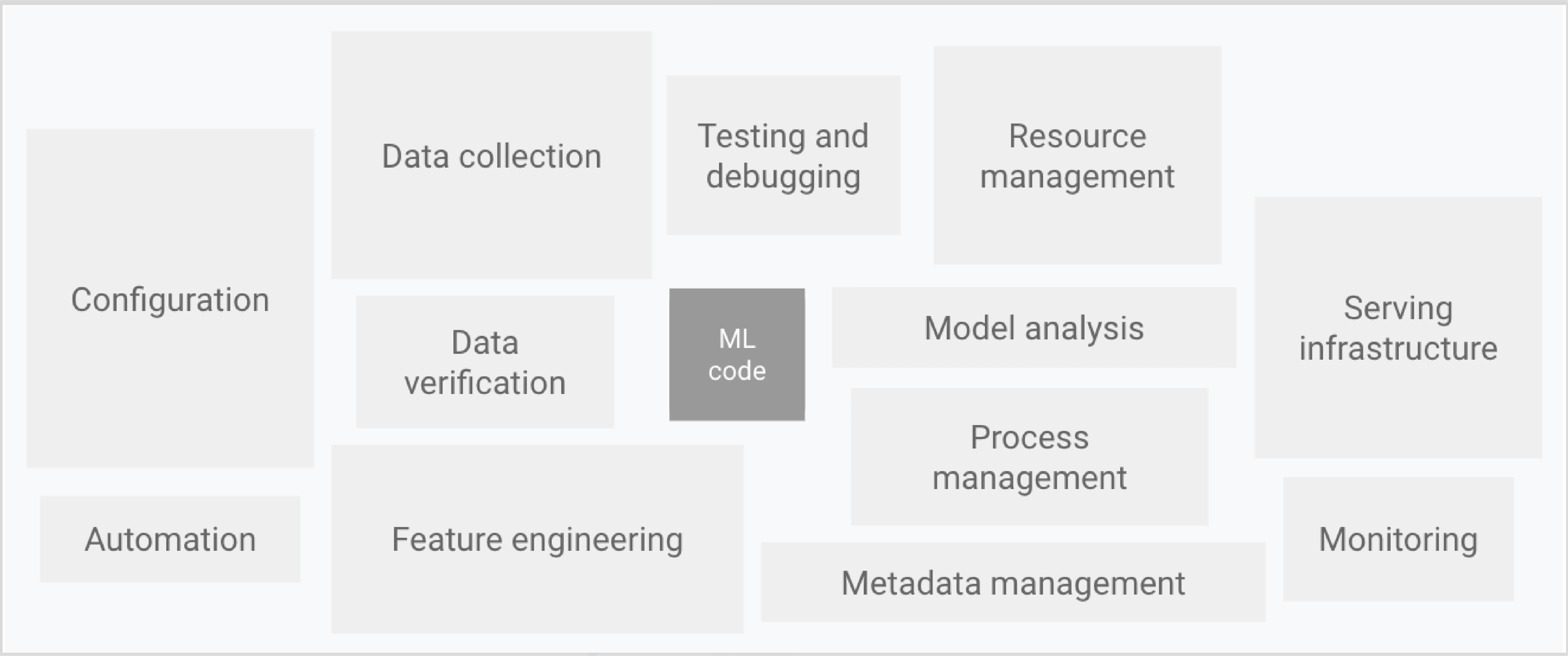


MLOps in an organization

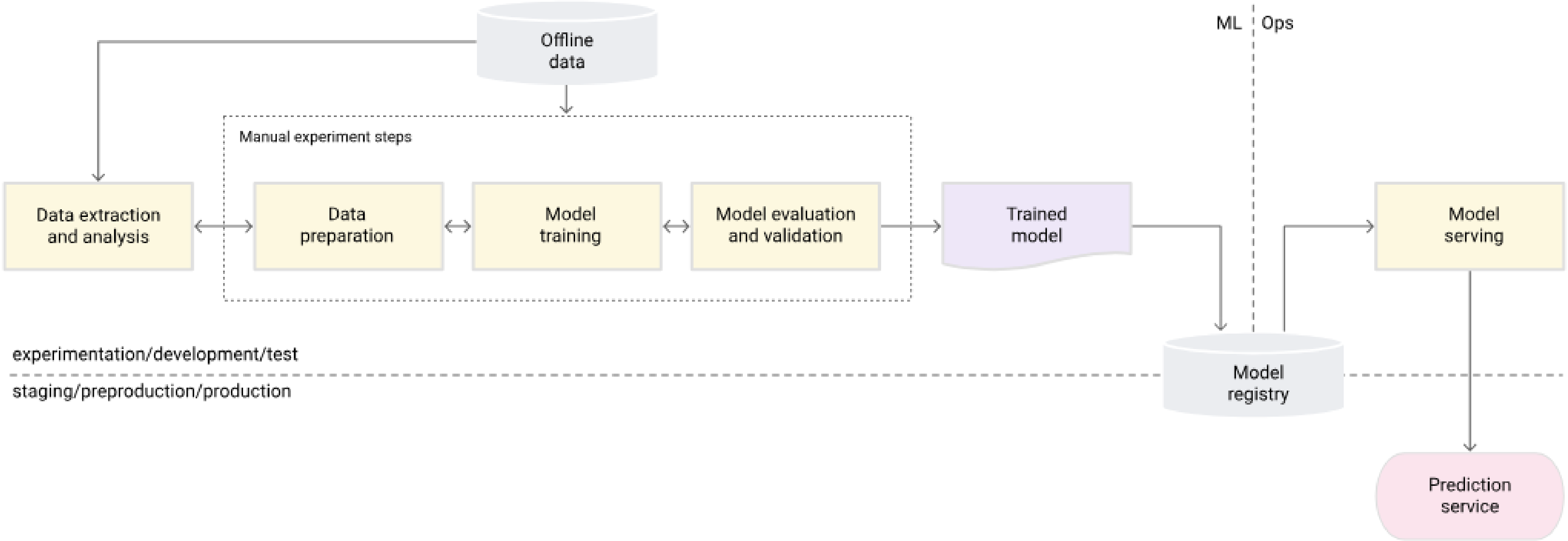
Hidden Technical debt in ML System



[Hidden Technical Debt in Machine Learning Systems](#).

ML Maturity Models

MLOps Level0: Manual Process



MLOps Level1: ML pipeline automation

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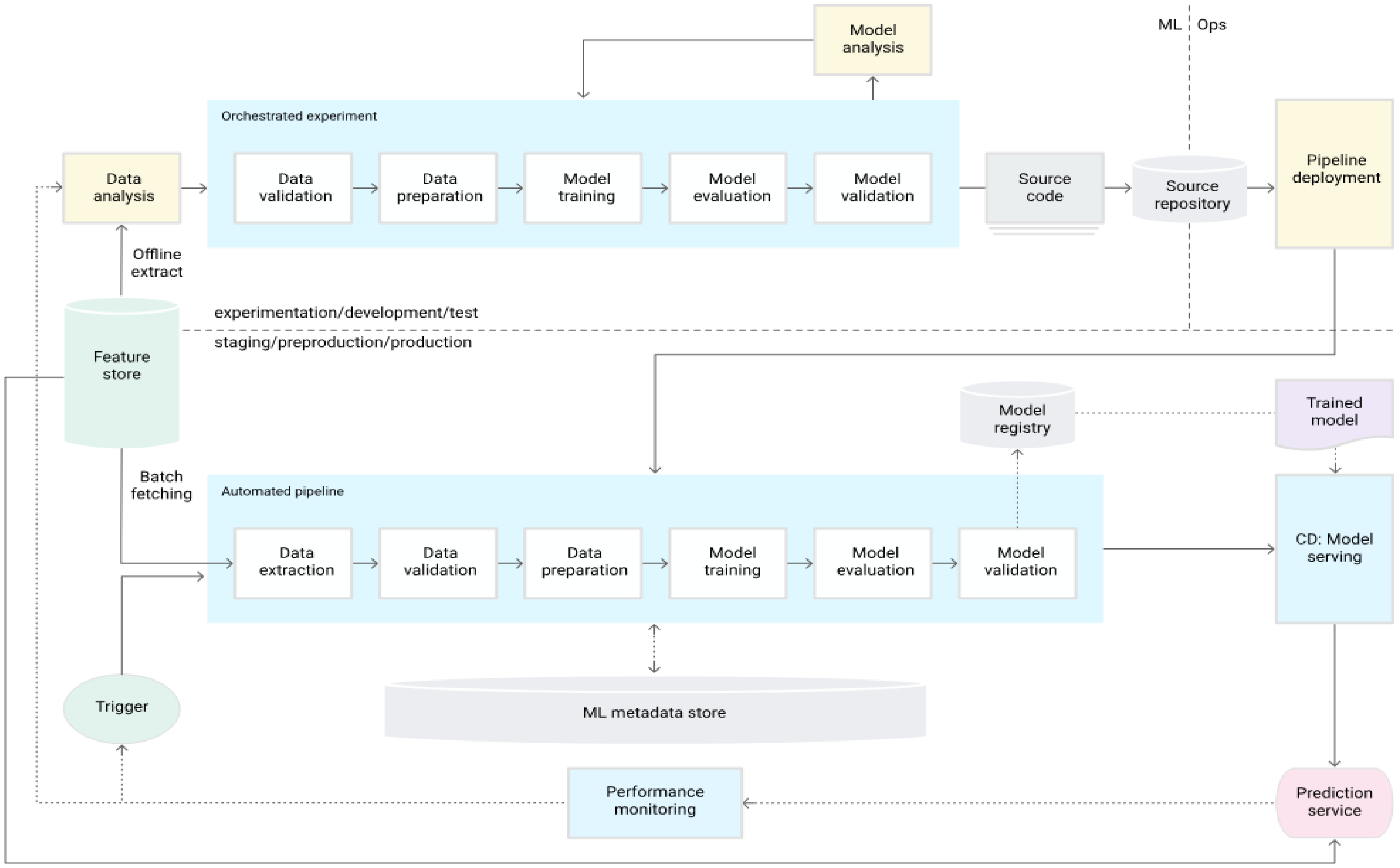

MLOps Level2: ML pipeline automation

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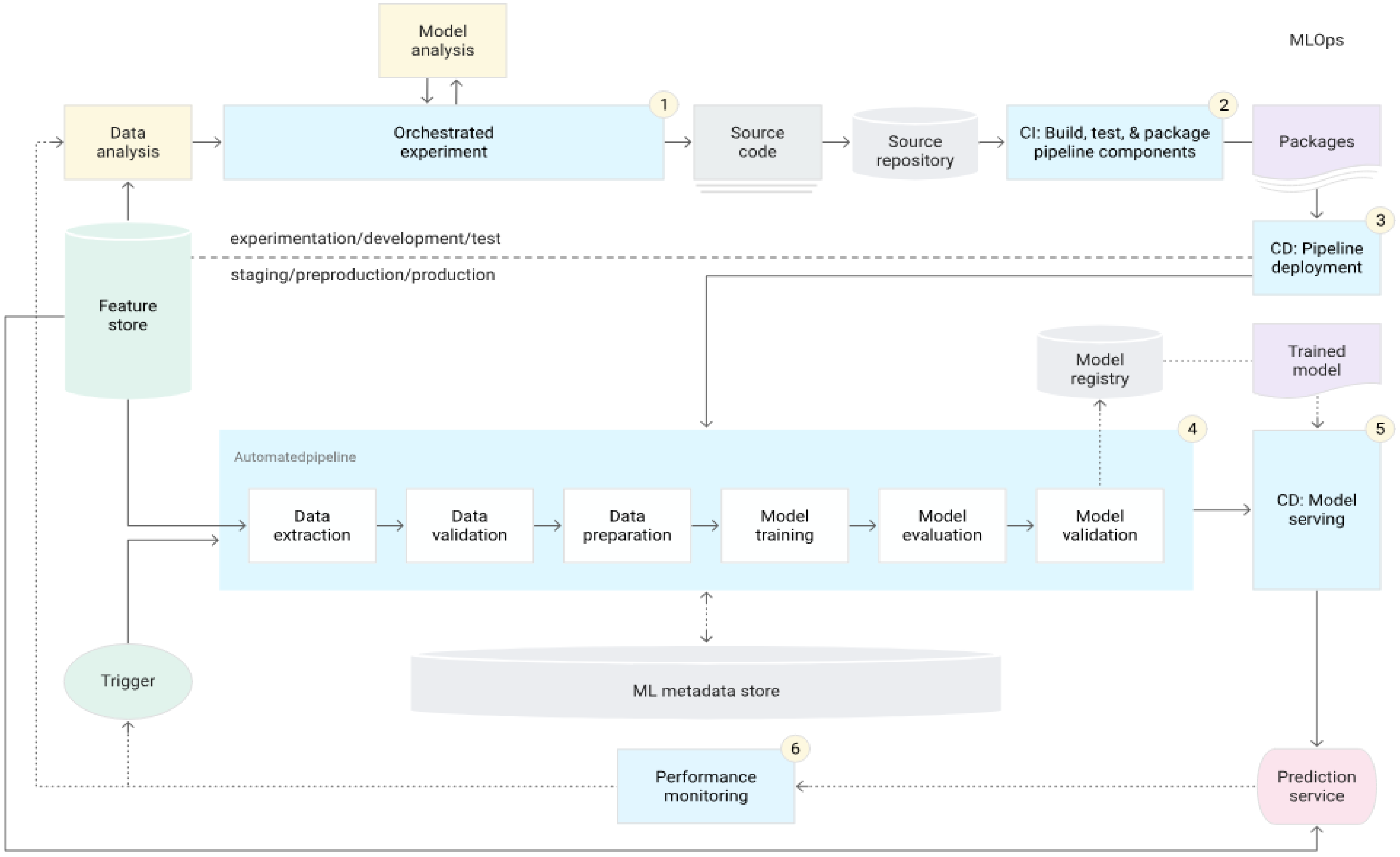

MLOps Architecture and Workflow

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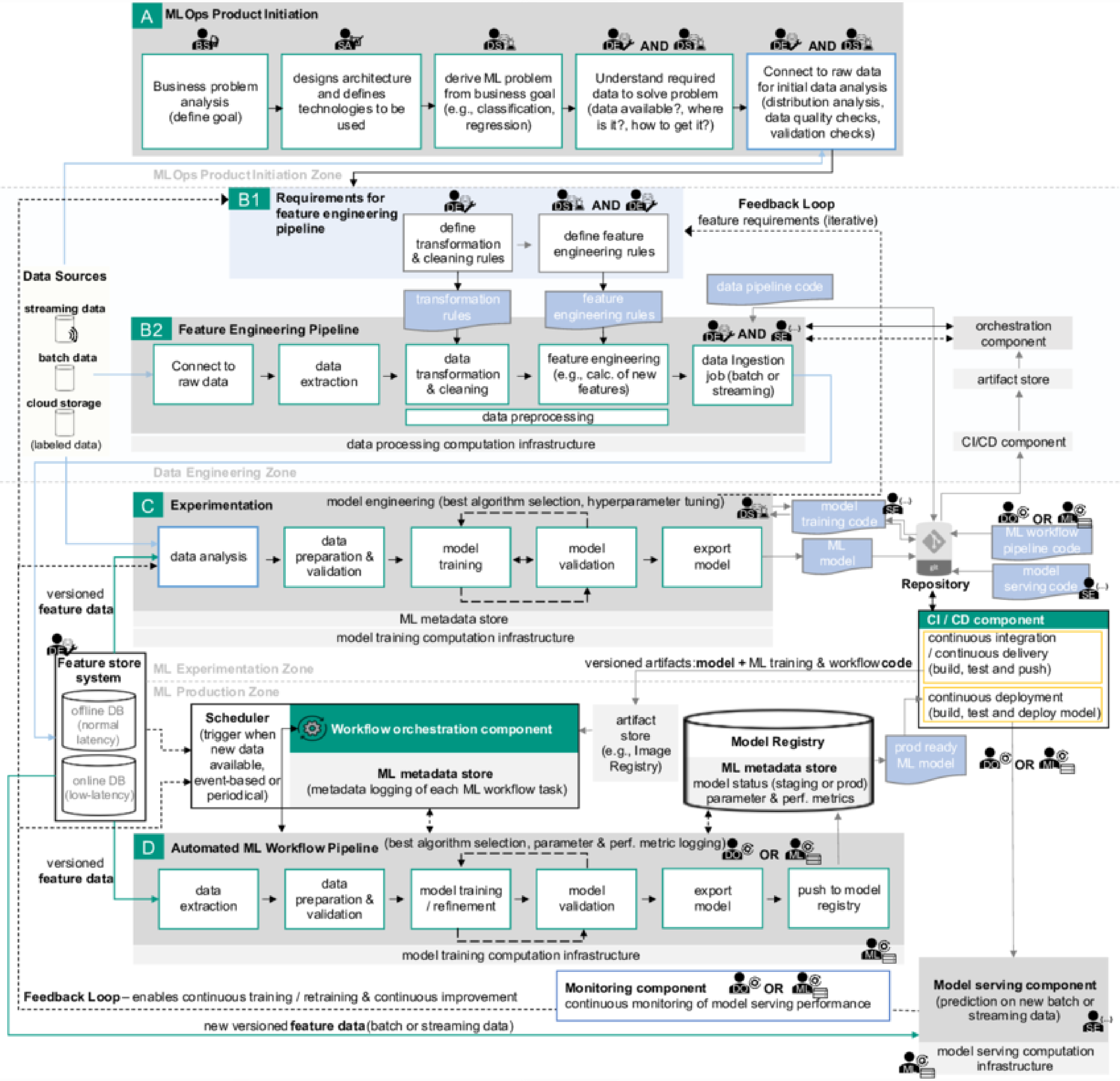

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