
MLOPS
VOLVO
MLOps
community

LeonardAukea

Driving ML Engineering & Operations

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Purpose 📝

> Transform the company to become a machine learning powerhouse where, machine learning & AI is a major differentiator and a core component in  's business 🧬

MLOPS

Objective: Shorten the development cycles and increase deployment velocity, in order to reduce friction and delays in the AI value stream. Doing so, in a robust and secure manner. (roughly speaking)

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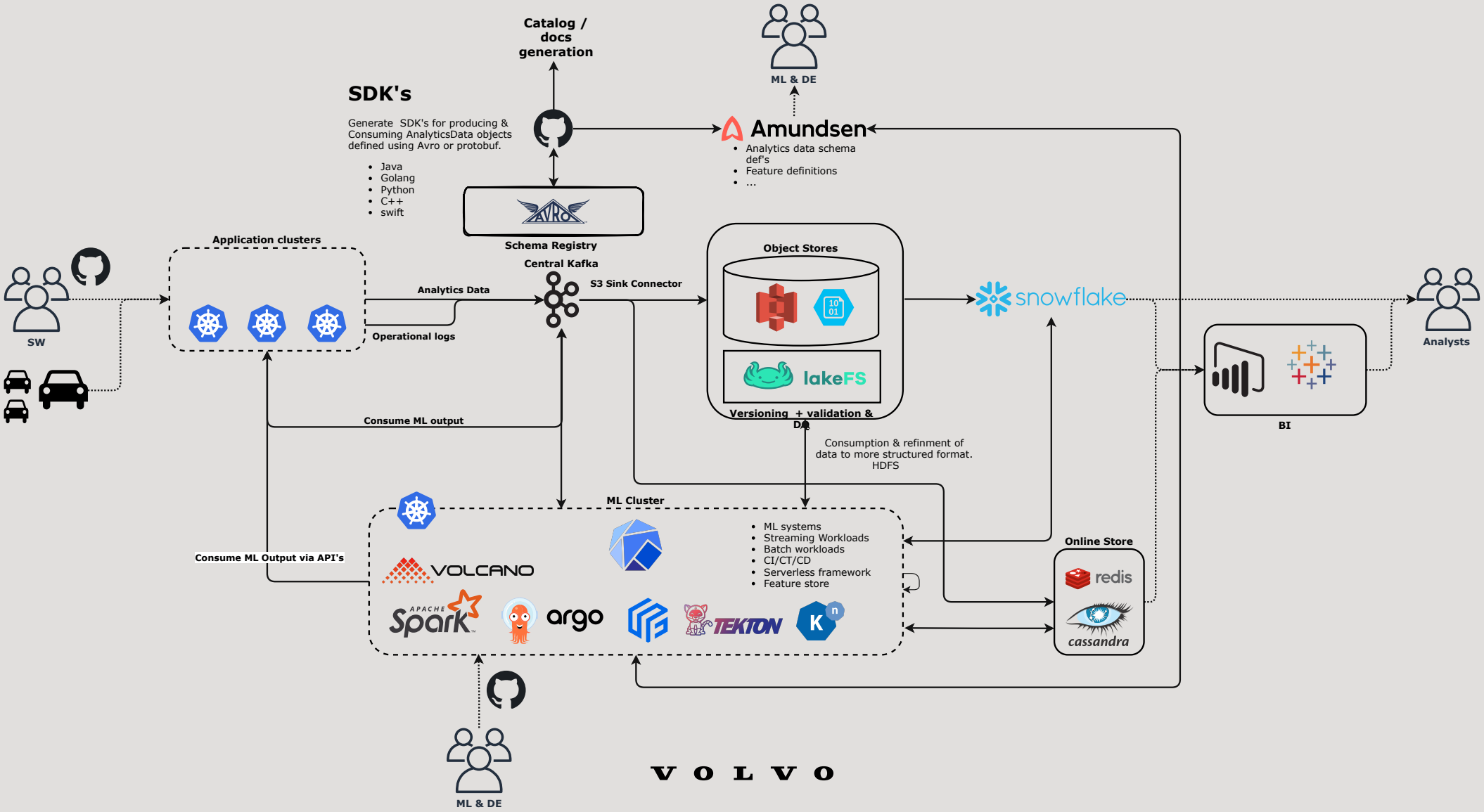
Approach 🤔

- Cloud Native Infra
- Glue infra with gitflow
- Template's & reusability
- Centralized knowledge platform
- Some SW expectations from ML practitioners
- Abstract ML practices into design patterns
- Evangelize and follow up adoption of good principles

Dedicated ML Clusters



Automation 

> The level of automation of the Data, ML Model, and Code pipelines determines the maturity of the ML process.

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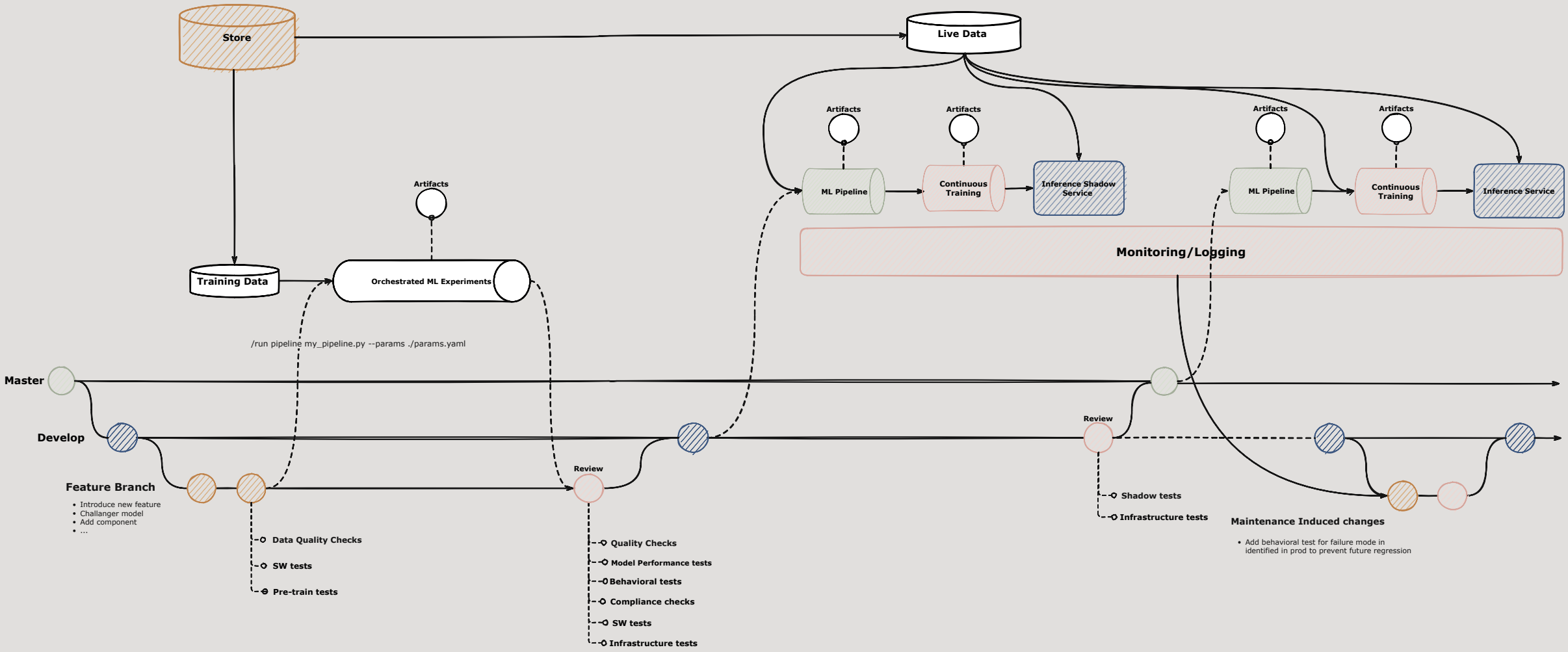
Store
Live Data
Artifacts
Artifacts
Artifacts
Artifacts
ML Pipeline
Continuous Training
Inference Shadow Service
ML Pipeline
Continuous Training
Inference Service
Monitoring/Logging
Artifacts
Training Data
Orchestrated ML Experiments
/run pipeline my_pipeline.py --params ./params.yaml
Master
Develop
Feature Branch
• Introduce new feature
• Challanger model
• Add component
• ...
Data Quality Checks
SW tests
Pre-train tests
Review
Quality Checks
Model Performance tests
Behavioral tests
Compliance checks
SW tests
Infrastructure tests
Review
Shadow tests
Infrastructure tests
Maintenance Induced changes
• Add behavioral test for failure mode in identified in prod to prevent future regression

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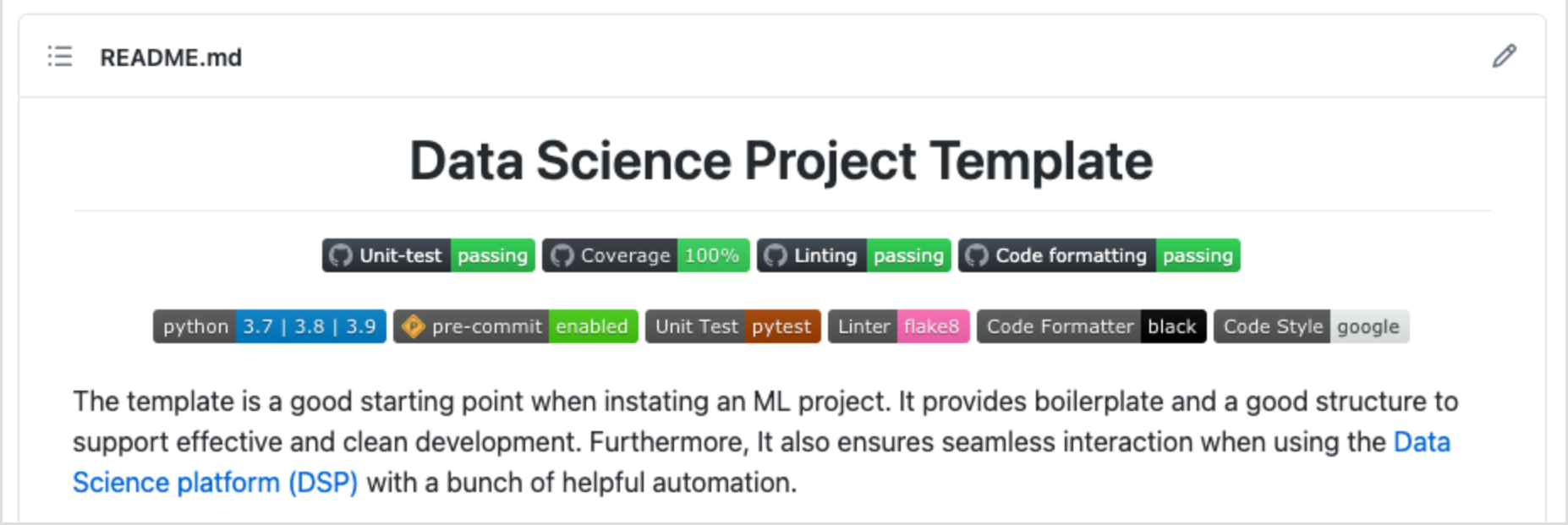
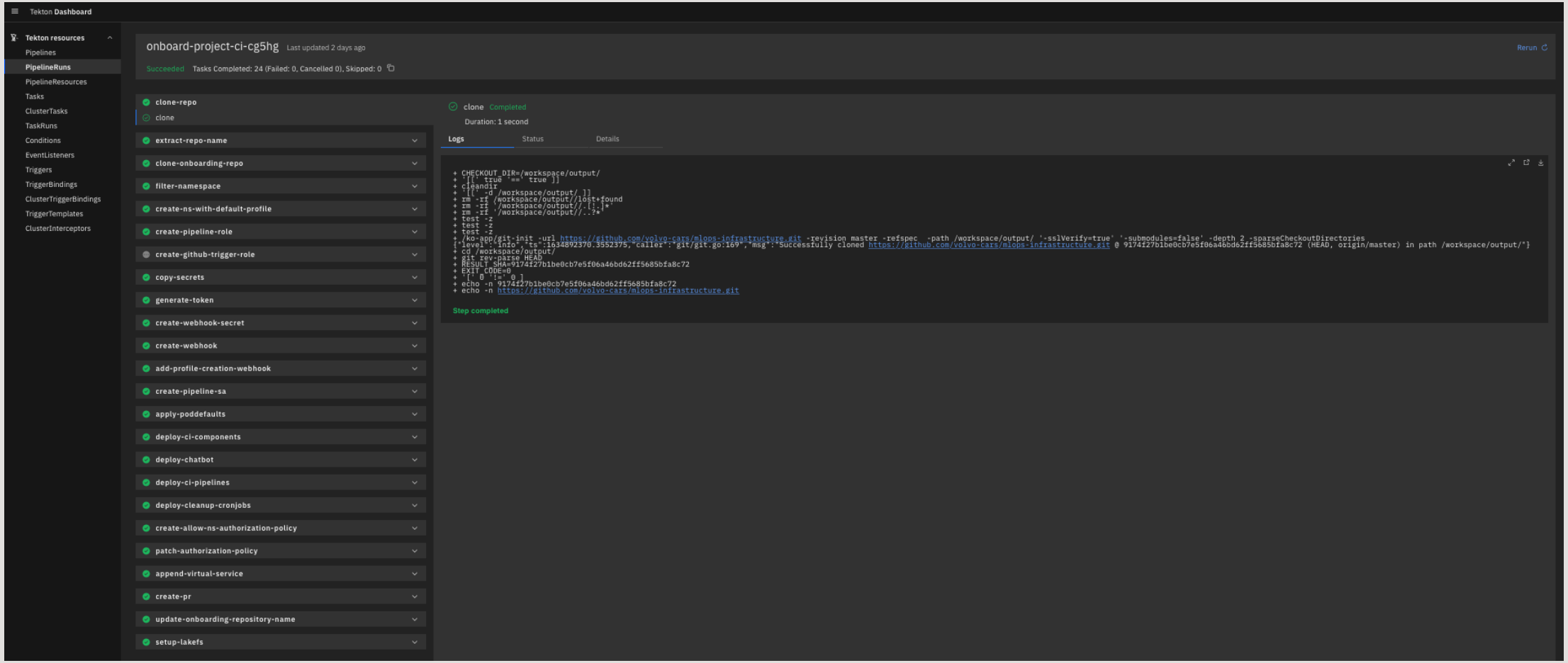
The template



profiles.yaml

```yaml
profiles:
  name: project-name
  admins:
    - john.doe@volvocars.com
  contributors:
    - jane.doe@volvocars.com
    - john.smith@volvocars.com
```

Onboarding CI



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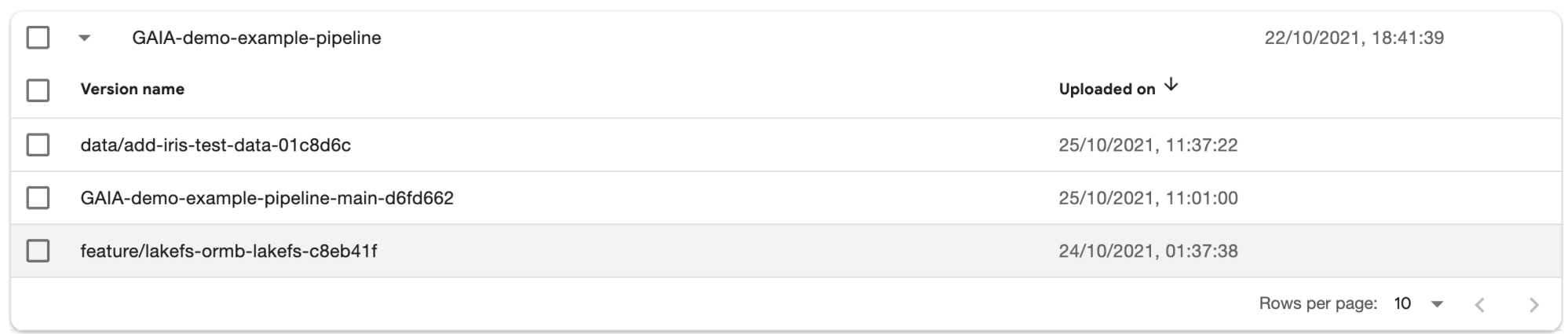
/workflows

```
.
├── README.md
├── components
│   ├── docker-compose.yaml
│   ├── lakefs-download-file
│   │   ├── Dockerfile
│   │   ├── component.yaml
│   │   ├── requirements.txt
│   │   └── src
│   │       └── download.py
│   └── train-ormb-component
│       ├── Dockerfile
│       ├── README.md
│       ├── component.yaml
│       ├── requirements.txt
│       └── src
│           └── train.py
└── iris_pipeline.py
```

Pipeline versioning



	GAIA-demo-example-pipeline	22/10/2021, 18:41:39
	Version name	**Uploaded on** ↓
	data/add-iris-test-data-01c8d6c	25/10/2021, 11:37:22
	GAIA-demo-example-pipeline-main-d6fd662	25/10/2021, 11:01:00
	feature/lakefs-ormb-lakefs-c8eb41f	24/10/2021, 01:37:38

Rows per page: 10

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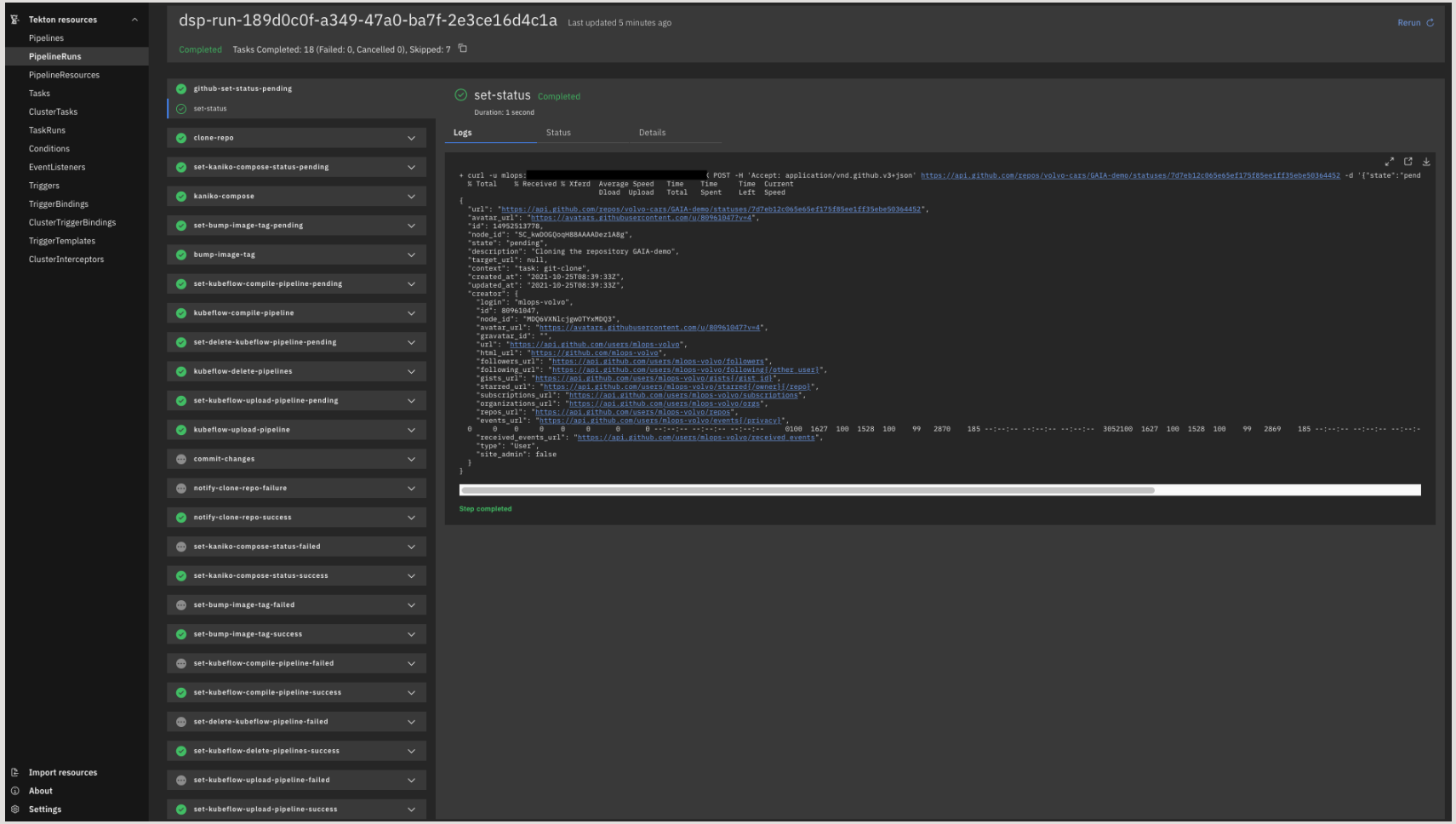
Commit CI



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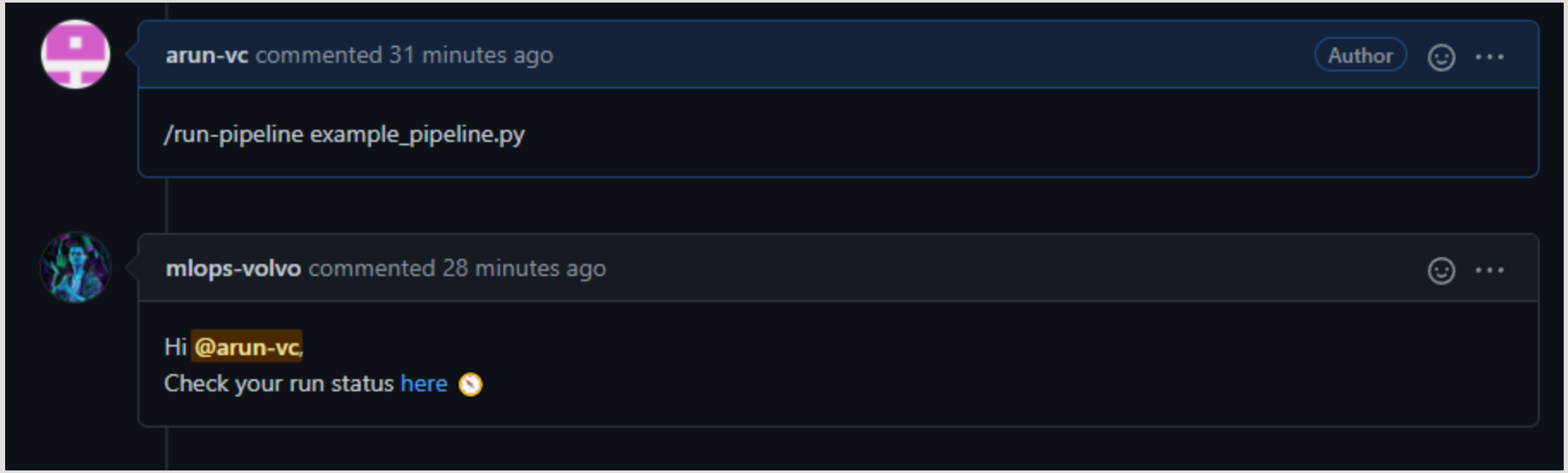
Trigger pipeline with github comment



`/run-pipeline example_pipeline.py`

Run an optionally parameterised `kubeflow` pipeline.

Parameters

- **kubeflow-pipeline-file** – Required
  `kubeflow` pipeline name.
  E.g. `/run-pipeline iris_pipeline.py`
- **params** – Optional
  Parameters to pass to the `kubeflow` pipeline.
  E.g. `/run-pipeline example_pipeline.py params={"name":"x","value":"206"}, {"name":"seed","value":"3007"}`

Once completed, a comment will be added to the PR which contains a 'run status' link for that particular `/run pipeline` command which will direct you to the relevant pipeline run.

Versioning Models/Data

ORMB +  + 

 lakeFS + 

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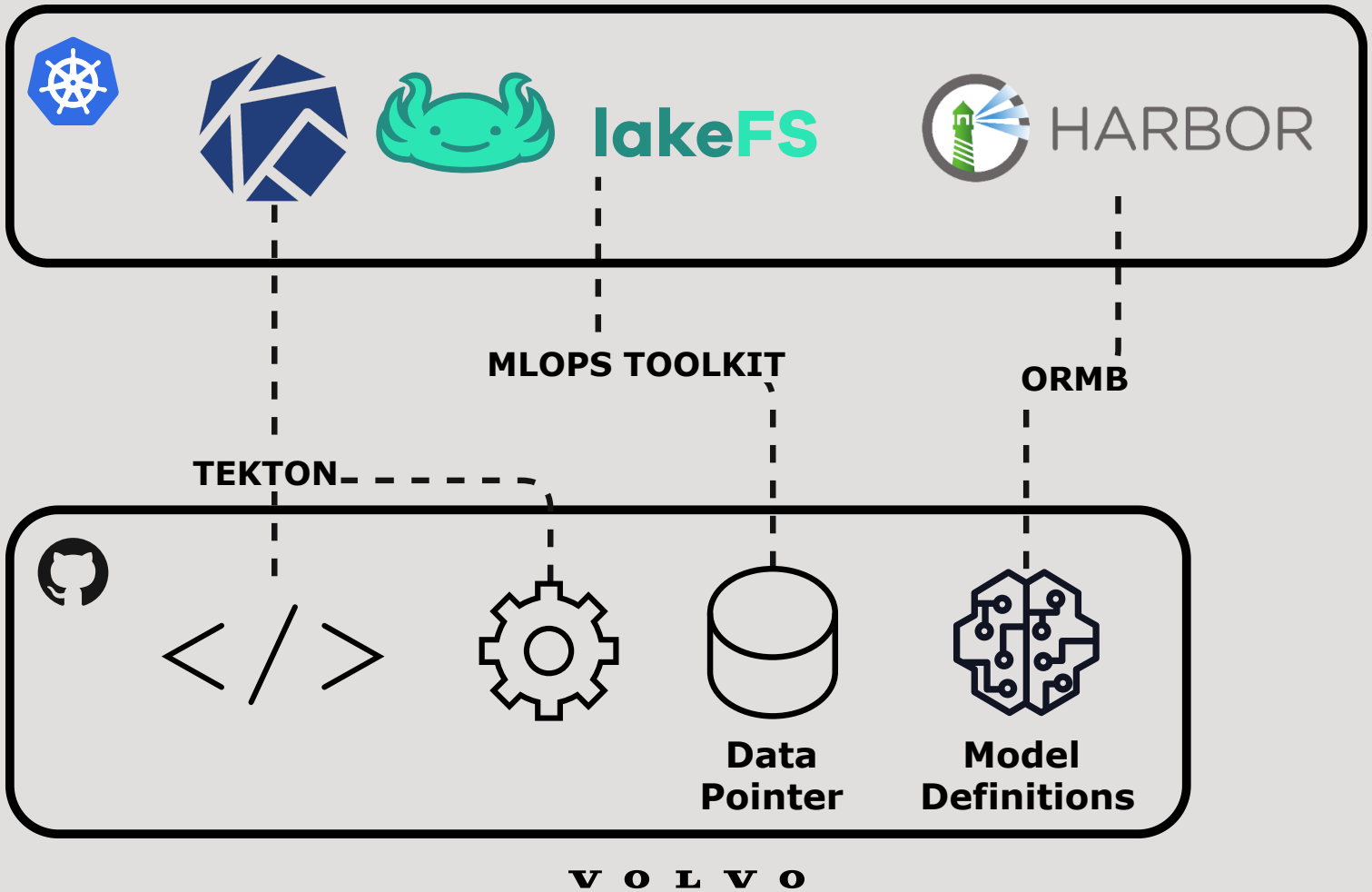
Versioning


lakeFS
HARBOR
MLOPS TOOLKIT
ORMB
TEKTON
Data Pointer
Model Definitions

Continuous Monitoring

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Is it enough for ML?

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Roadmap

- Improved monitoring capabilities
- Feature store integration (Feast)
- Feast + LakeFS ??
- Extend **mlops-tookit**
  - Generate pipeline & components from `/src`
- Federated learning approaches

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Challenges

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Having the right skills?

> You can’t be an AI expert these days and not have some grounding in software engineering. – Grady Booch


n
git

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Data Scientist+

- Git
- CI/CD
- Container basics
- SW/ML testing
- SW/ML design patterns

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“Do machine learning like the great engineer you are, not like the great machine learning expert you aren’t. – Martin Zinkevich”

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Treat ML like our cars
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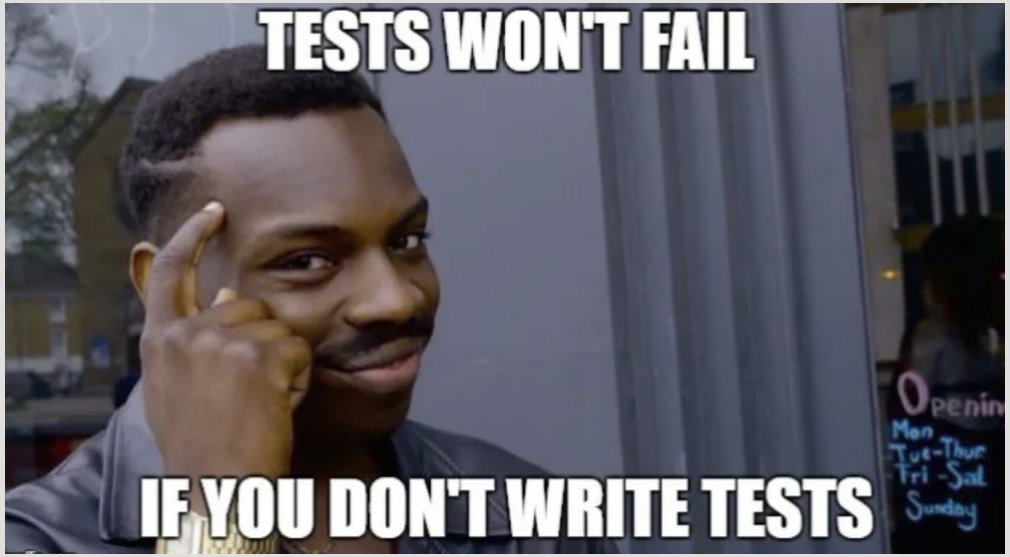
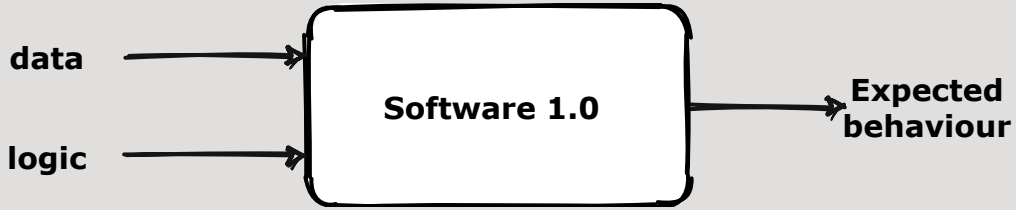
What are the key differences between SW & ML?



Software 1.0

Software tests help ensure that this **written logic** aligns with the actual expected behavior.



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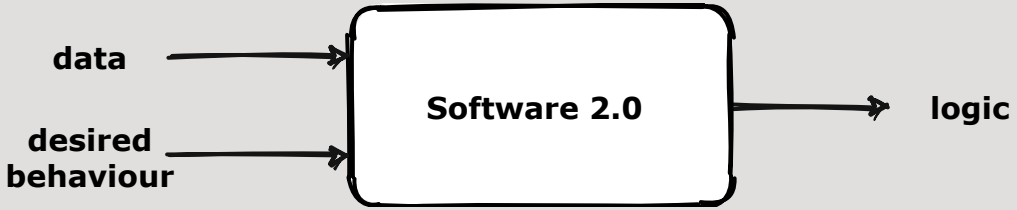
Conventions

- Don't merge code unless all tests are passing
- Always write tests for newly introduced logic when contributing code
- When contributing a bug fix, be sure to write a test to capture the bug and prevent future regressions.

Software 2.0

Objective: Learned logic consistently reflecting the desired behavior.



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Evaluation

- Performance of an established metric on a validation dataset
- Plots
- Operational statistics
- Examples where the model was most confidently incorrect

Compare performance between models and make relative judgments

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Conventions

- Save hyper-params used in training
- Promote models which offer an improvement over the existing model (or baseline)

Testing vs. Evaluation

- **Model evaluation** covers metrics and plots which summarize performance on a validation or test dataset.
- **Model testing** involves explicit checks for behaviors that we expect our model to follow.

Terminology

- **Failure modes** - Scenarios where model fails
- **Behavioral Regression** Decrease in performance on specific examples

Revised Conventions

- Save hyper-params used in training
- Promote models which offer an improvement over the existing model (or baseline) **and passes existing model regression tests.**
- Don't merge unless all tests are passing **(code, model, data)**

Revised Conventions cont.

- Always write tests for newly introduced (logic, **data, models)** when contributing code
- When contributing a bug fix, be sure to write a test to capture the bug and prevent future regressions.
- **When a failure mode in your ML system is identified, be sure to write a behavioral regression test for the specific examples.**

The Red Team 🚨

- Break the system
- Monitor production ML systems
- Identification of failure modes
- Track/prevent behavioral regressions for specific failure modes

MLOps is an engineering practice

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The Bibles

- [1]Rules of Machine Learning: Best Practices for ML Engineering - Martin Zinkevich
- [2]Engineering best practices for ML - SE[4]ML

[1]Rules of Machine Learning: Best Practices for ML Engineering - Martin Zinkevich

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Svet Penkov 🙏

> Rule #4: Define the **operational domain** for your ML system

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“Doing ML without MLOps is like trying to win a formula 1 race without a pit crew”

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Thanks for listening and don't be a stranger 🙏

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We are Hiring 💼

📪 leonard.aukea@volvocars.com

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References

- [1]Rules of Machine Learning: Best Practices for ML Engineering - Martin Zinkevich
- [2]Engineering best practices for ML - SE[4]ML
- [3]Effective testing for machine learning systems - Jeremy Jordan

Links

- https://tekton.dev/
- https://github.com/kleveross/ormb
- https://lakefs.io/
- https://www.kubeflow.org/
- https://github.com/kserve/kserve
- https://github.com/google/ml-metadata
- https://feast.dev