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INTELLIGENCE IN ACTION: AI-DRIVEN NETWORKS

Checkpoint 3

Projeto em Informática 2024/2025

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1. PREVIOUS PLAN

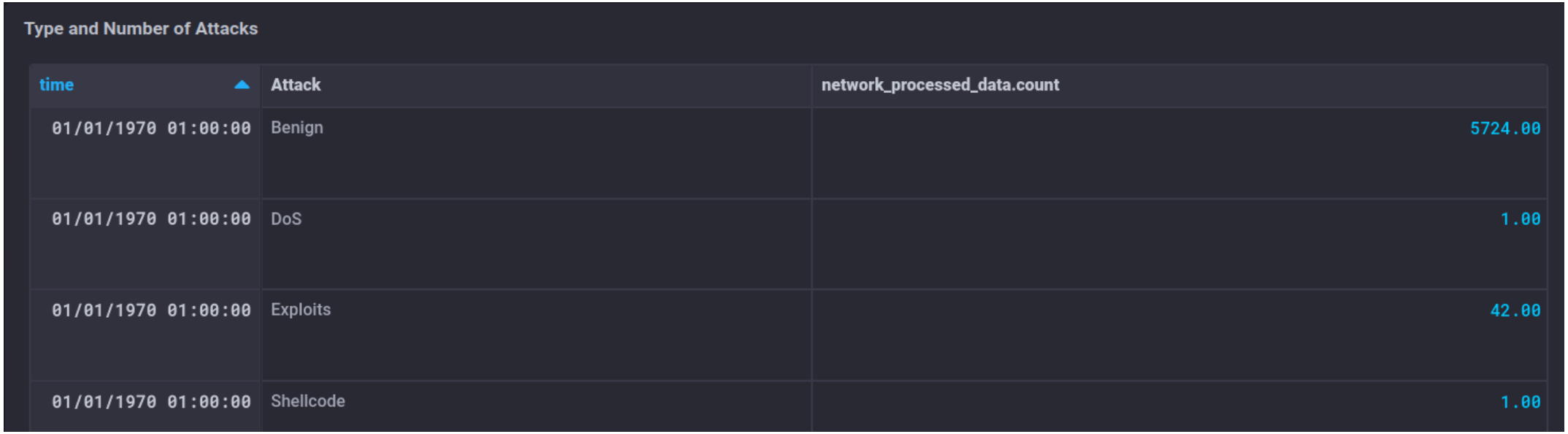
PREVIOUS CHECKPOINT PLAN

- Complete the model(s) deployment and Integrate them in the pipeline. ✓
- Assess whether it's feasible to have enough data for a good attack classification model. ✓
- Assess whether to cold start the system or prepopulate the ML databases with sample data. ✓
- Integration of the pipeline into the 5G network (implementation of border APIs) ✓

2. ML WORK DONE

WORK DONE ML

- Increased the pipeline speed massively again so we could have more readily available data (Again).
- Integrated both the Binary Model (detect attack) and Classifier Model (attack type).
- Applied SMOTE and Undersampling techniques **automatically**, depending on data volume to increase accuracy.
- Displayed both model's inferences in the Chronograf dashboard.

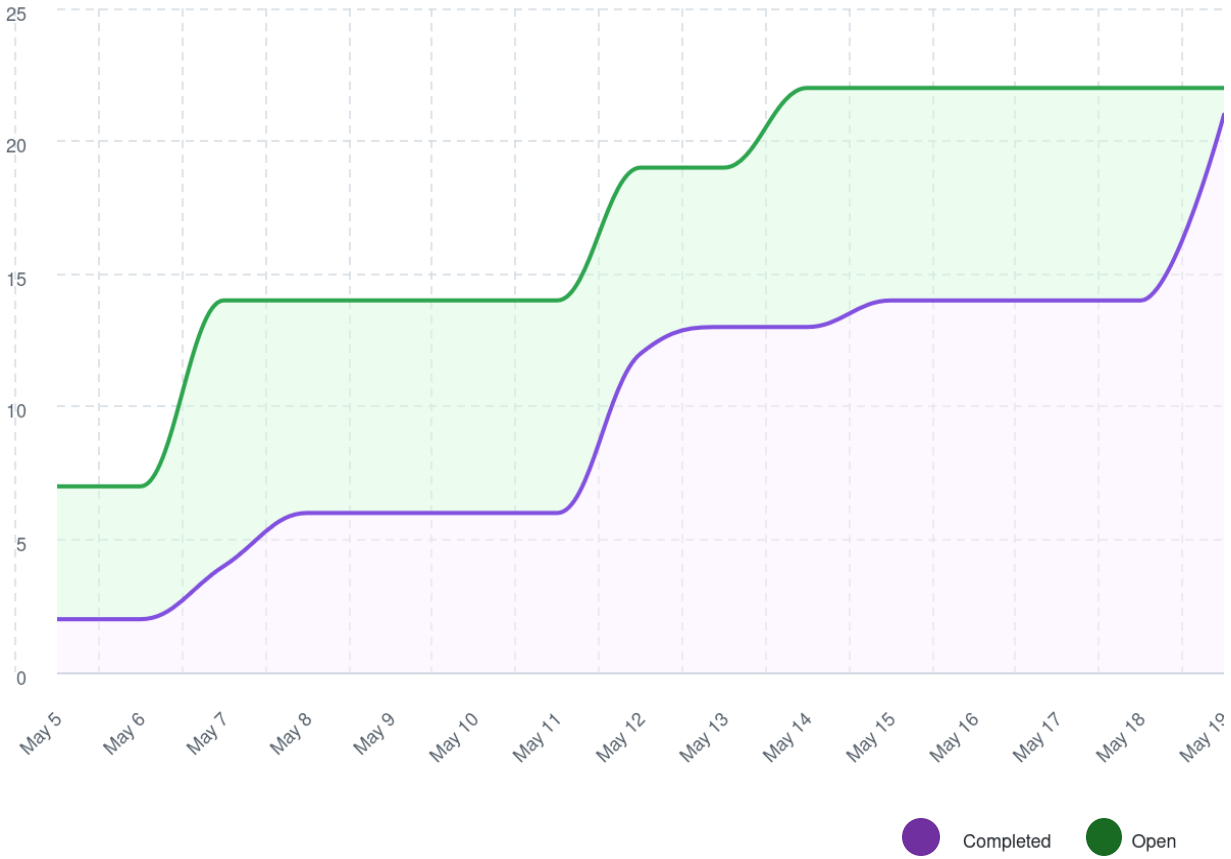


Type and Number of Attacks

time	Attack	network_processed_data.count
01/01/1970 01:00:00	Benign	5724.00
01/01/1970 01:00:00	DoS	1.00
01/01/1970 01:00:00	Exploits	42.00
01/01/1970 01:00:00	Shellcode	1.00

WORK DONE ML

- **Automatized** ML training, testing and deployment as new data arrives.
- Obtained good F1 Score results -> starts low but converge to 99% as overall data volume increases.
- Decided to **cold start** the system instead of pre-populating.
- Defined the **retraining strategy** to account for data drift and for new attack types.



3. ML PROBLEMS

ML Problems

- **Bias** was found and fixed on the binary ML Model.
- F1 Score **decreased**, but it is still converging to 99% over time.
- Define the best strategy for retraining and redeployment.

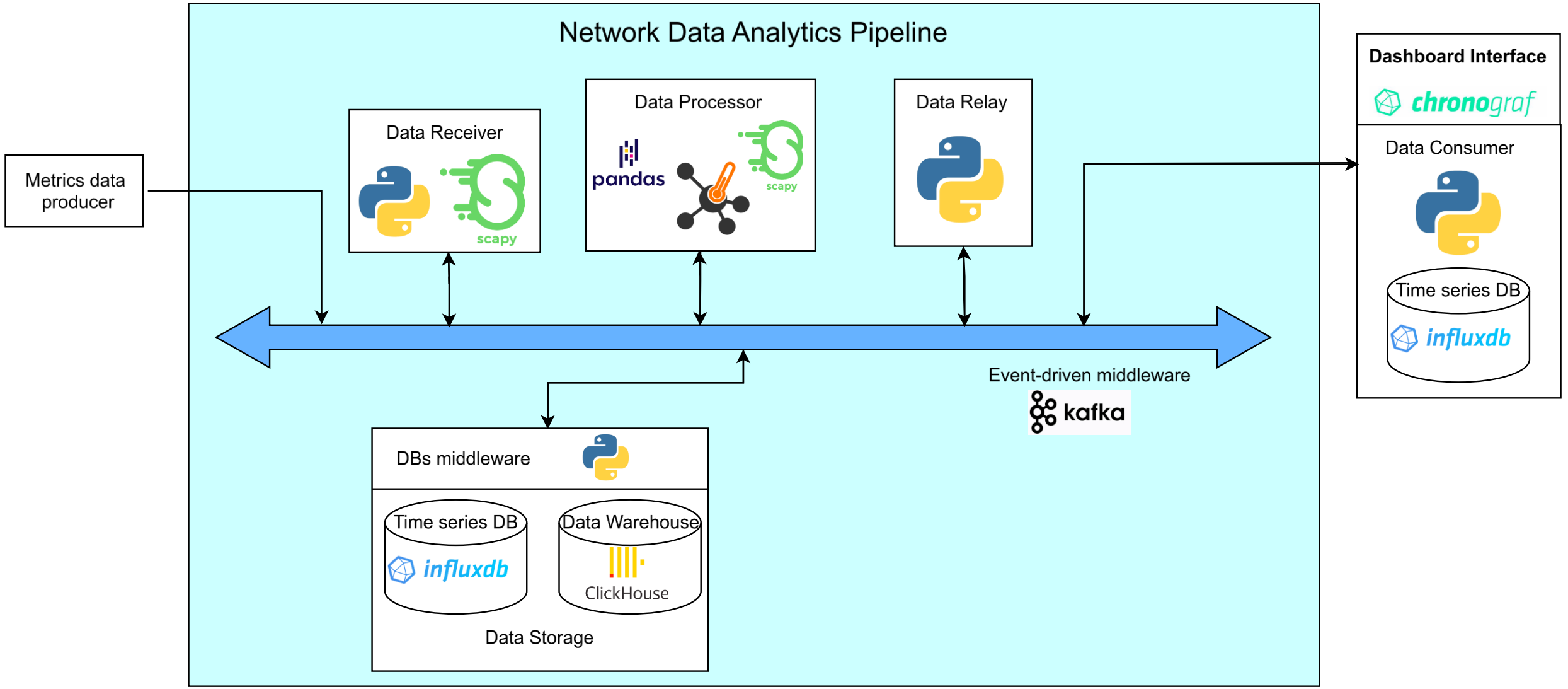
4. PLAN

PLAN

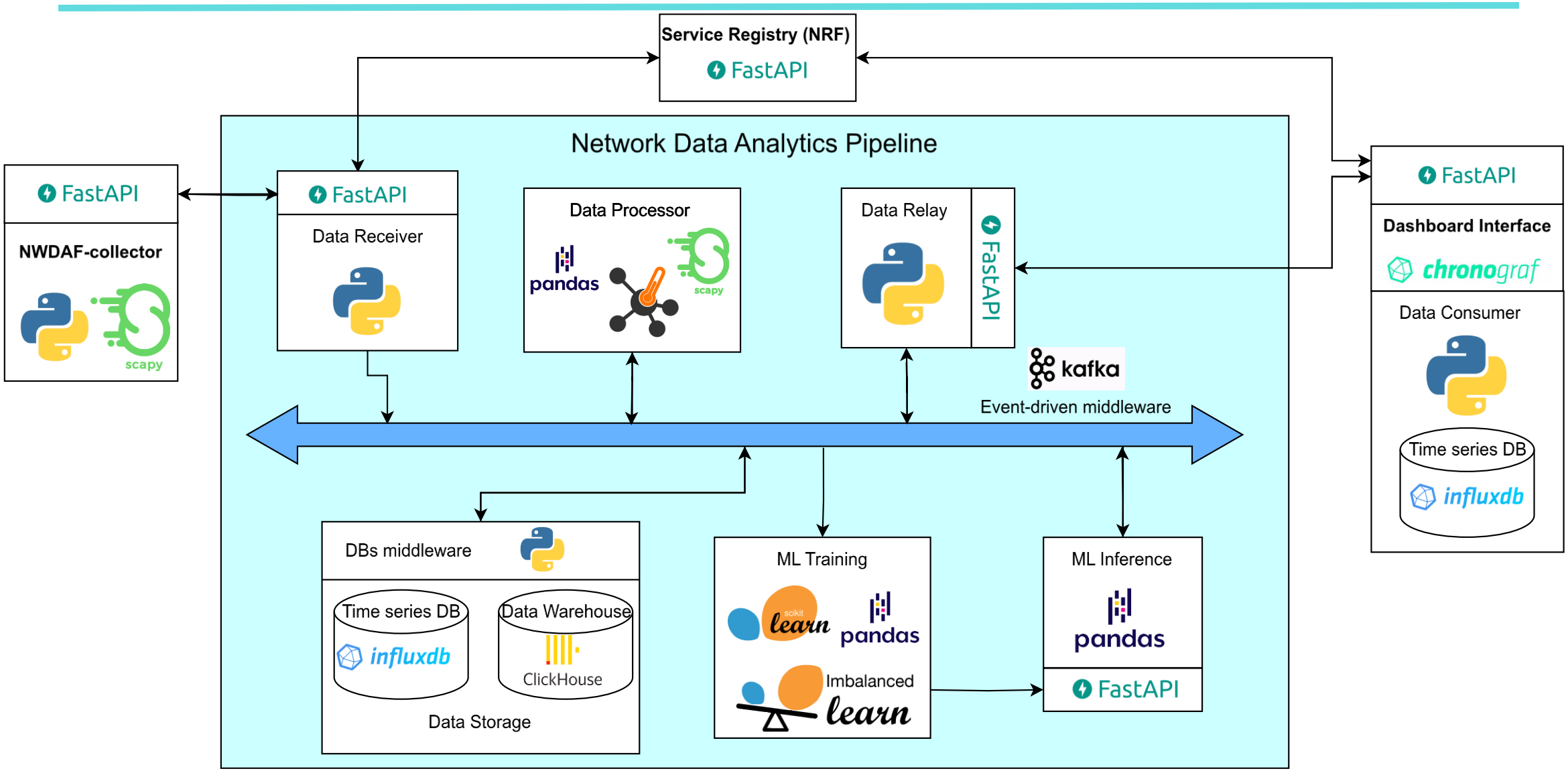
- Develop the additional **retraining triggers** (ex: retrain, when new type of attack is detected).
- Apply **hyperparameter tuning**, to optimize results.
- Save each model F1 Score over time and **plot the data** to analyze results evolution.
- Support NWDAF **model training requests** via API.
- Deploy the project using **kubernetes**.

5. 5G Core Integration

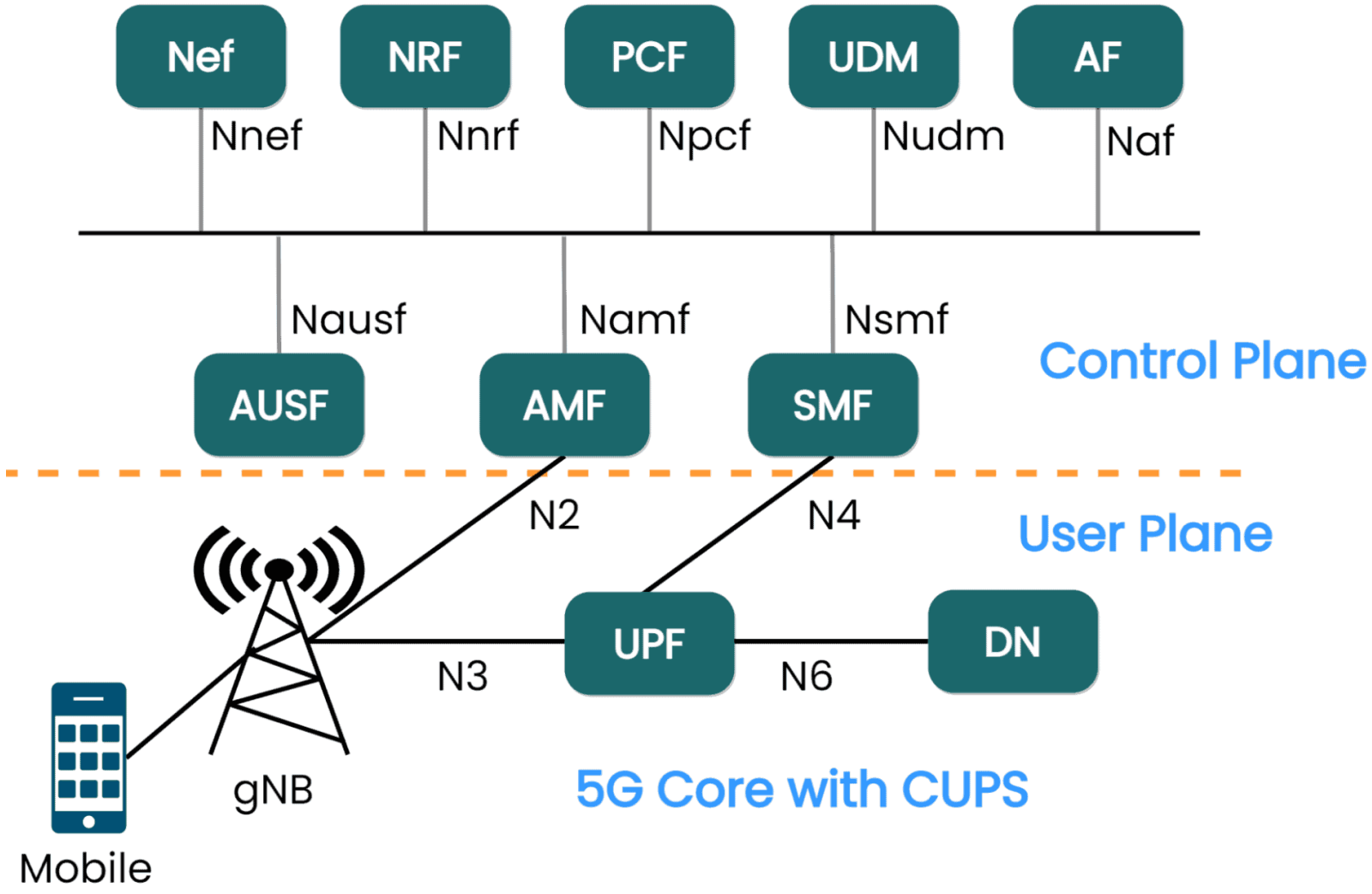
Architecture (OLD)



Architecture

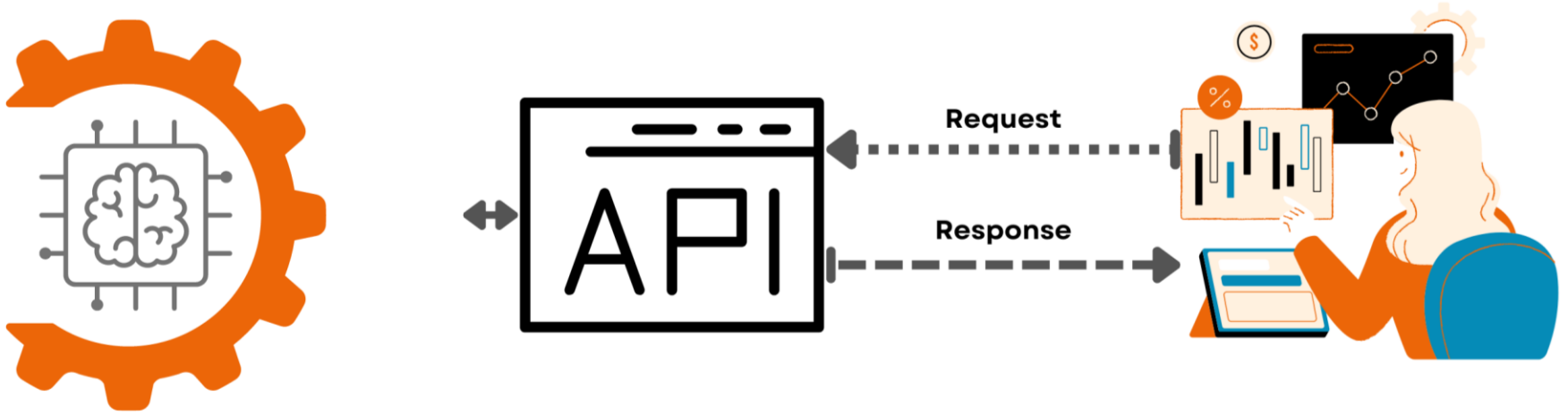


5G Integration



5G Integration Future Work

- In the NWDAF architecture, model training can be carried out at the request of the network operator via **API**.
- Implement an API for model training, to choose the model to train when it's possible.
- This API will expose the model training **evaluation metrics**.



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Or click here.

THANK YOU