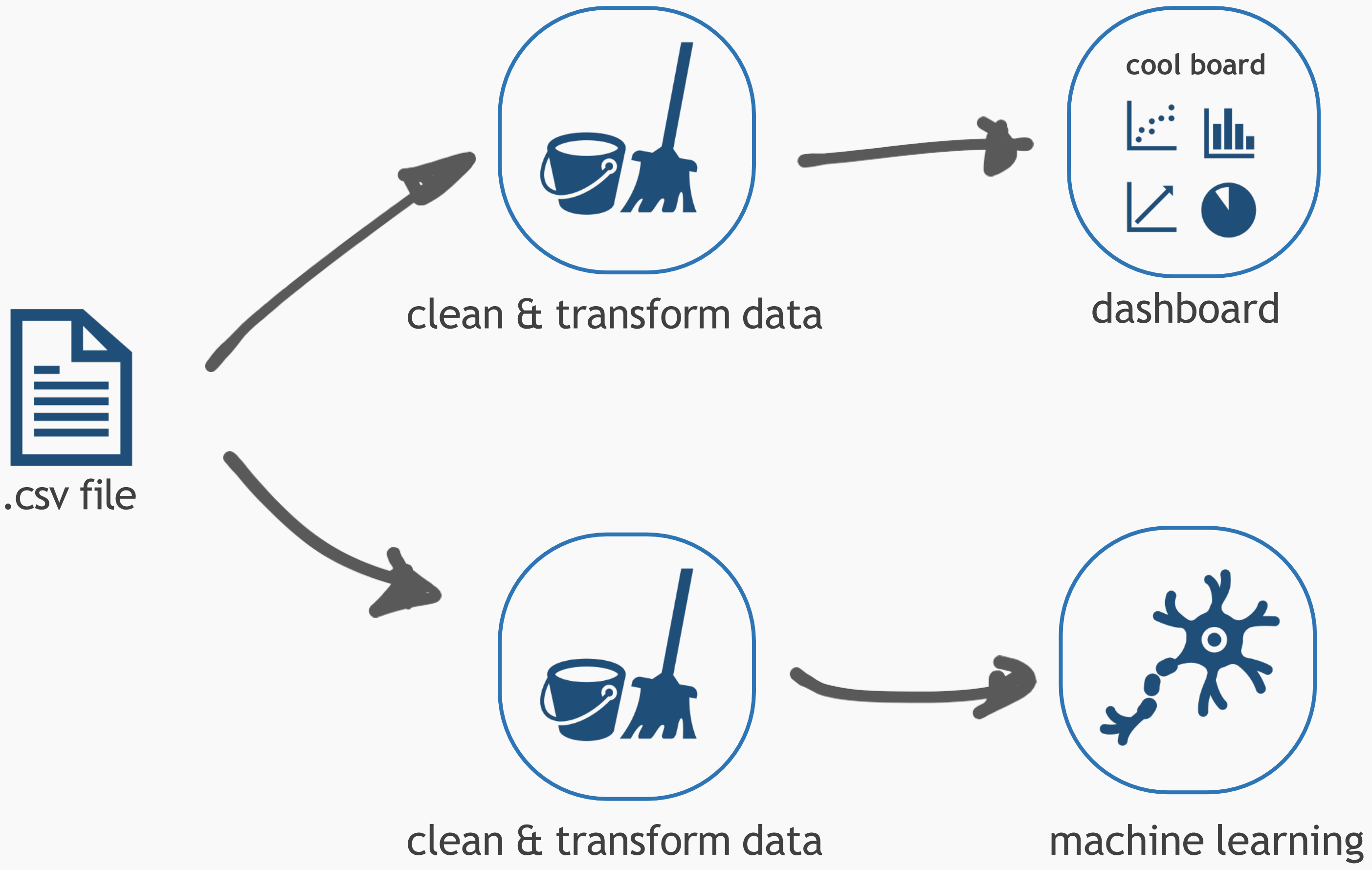
Esoon Ko
IT Högskolan

The need for a **data engineering**

Data so far



.csv file

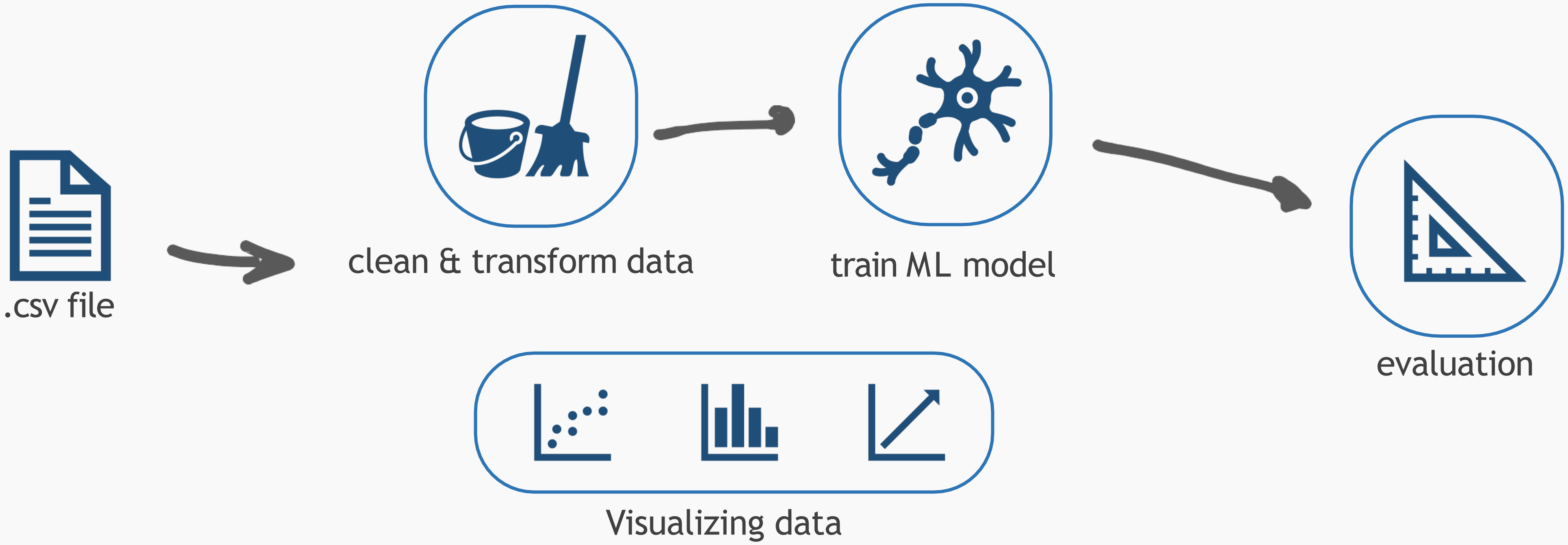
clean & transform data

dashboard

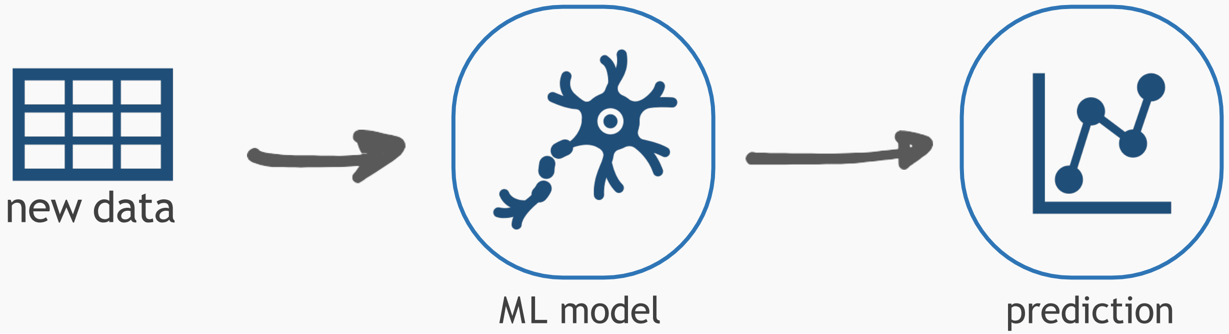
clean & transform data

machine learning

current **ML workflow** simplified – training part



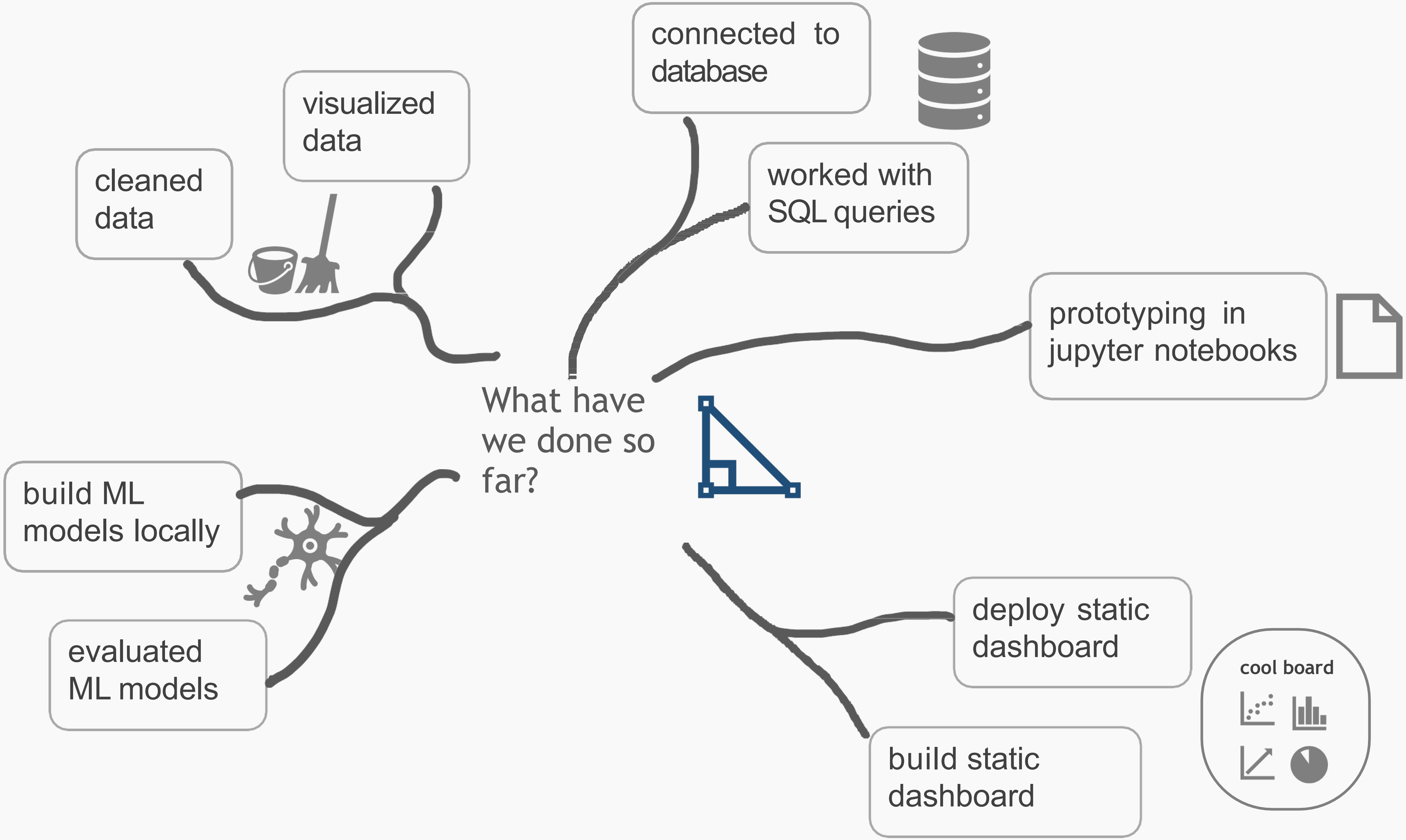
current **ML workflow** simplified – inference part



new data

ML model

prediction



What have we done so far?

cleaned data

visualized data

connected to database

worked with SQL queries

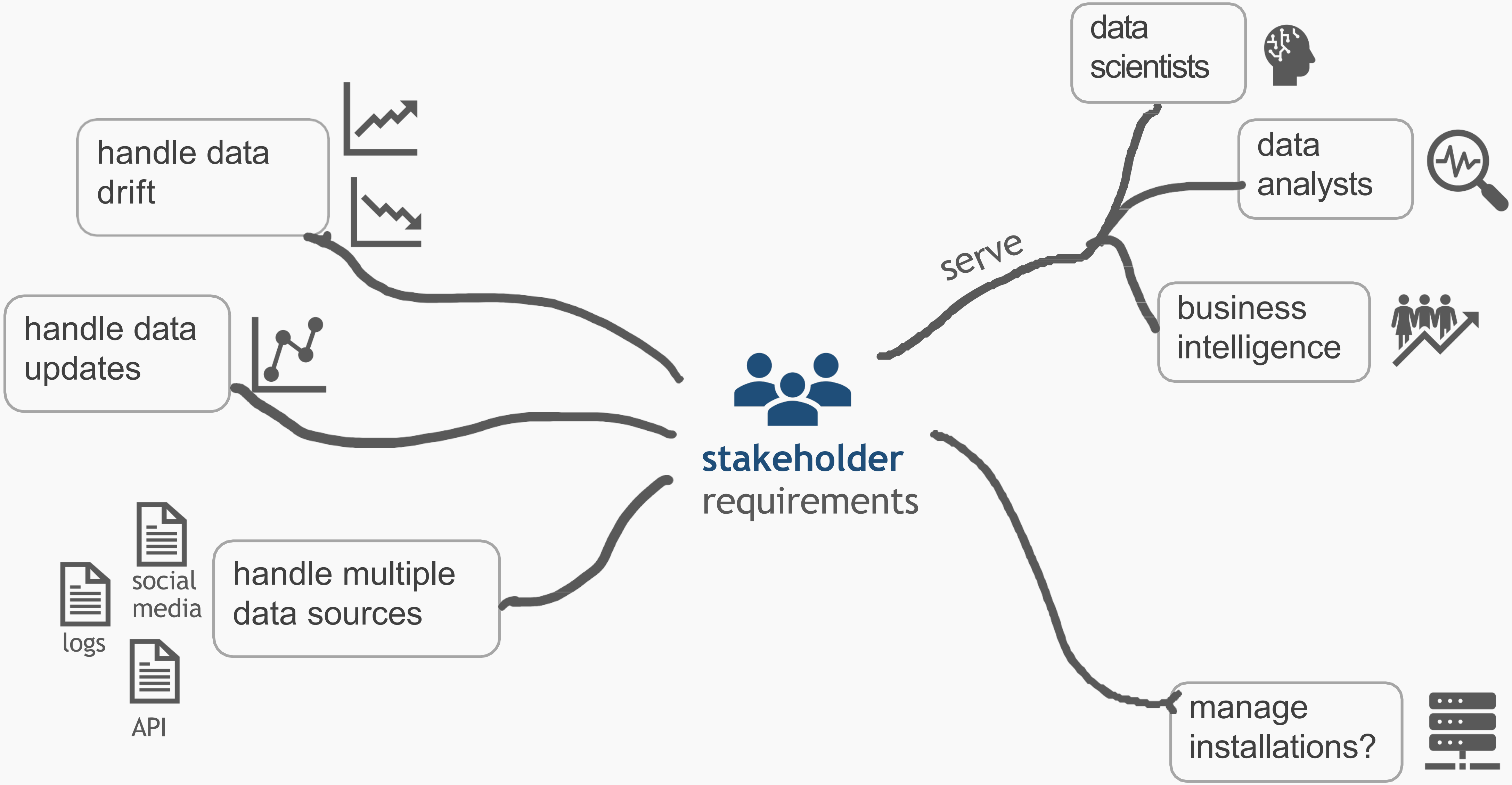
prototyping in jupyter notebooks

build ML models locally

evaluated ML models

deploy static dashboard

build static dashboard



stakeholder
requirements

serve

data scientists

data analysts

business intelligence

manage installations?

handle data drift

handle data updates

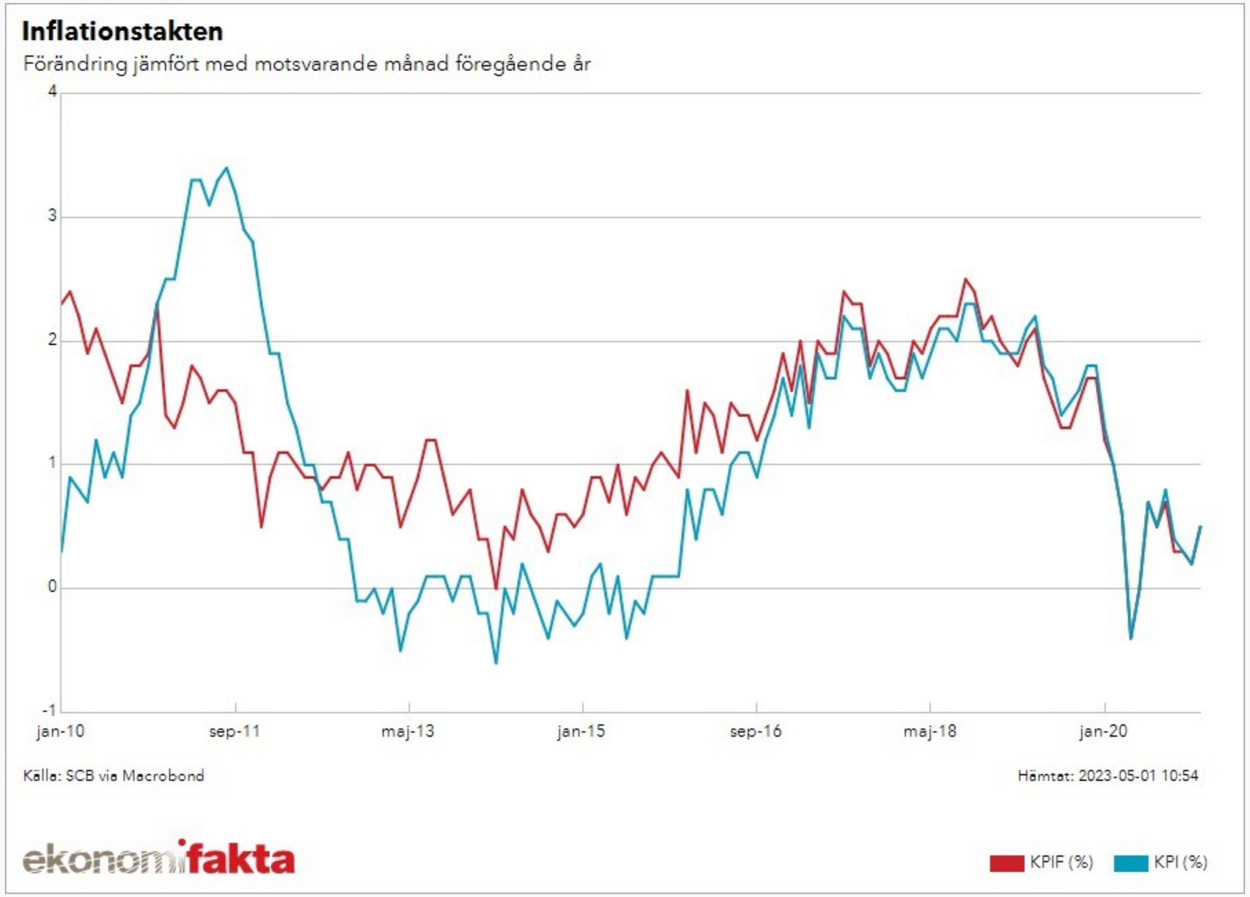
handle multiple data sources

social media

logs

API

example of **data drift**



Inflationstakten

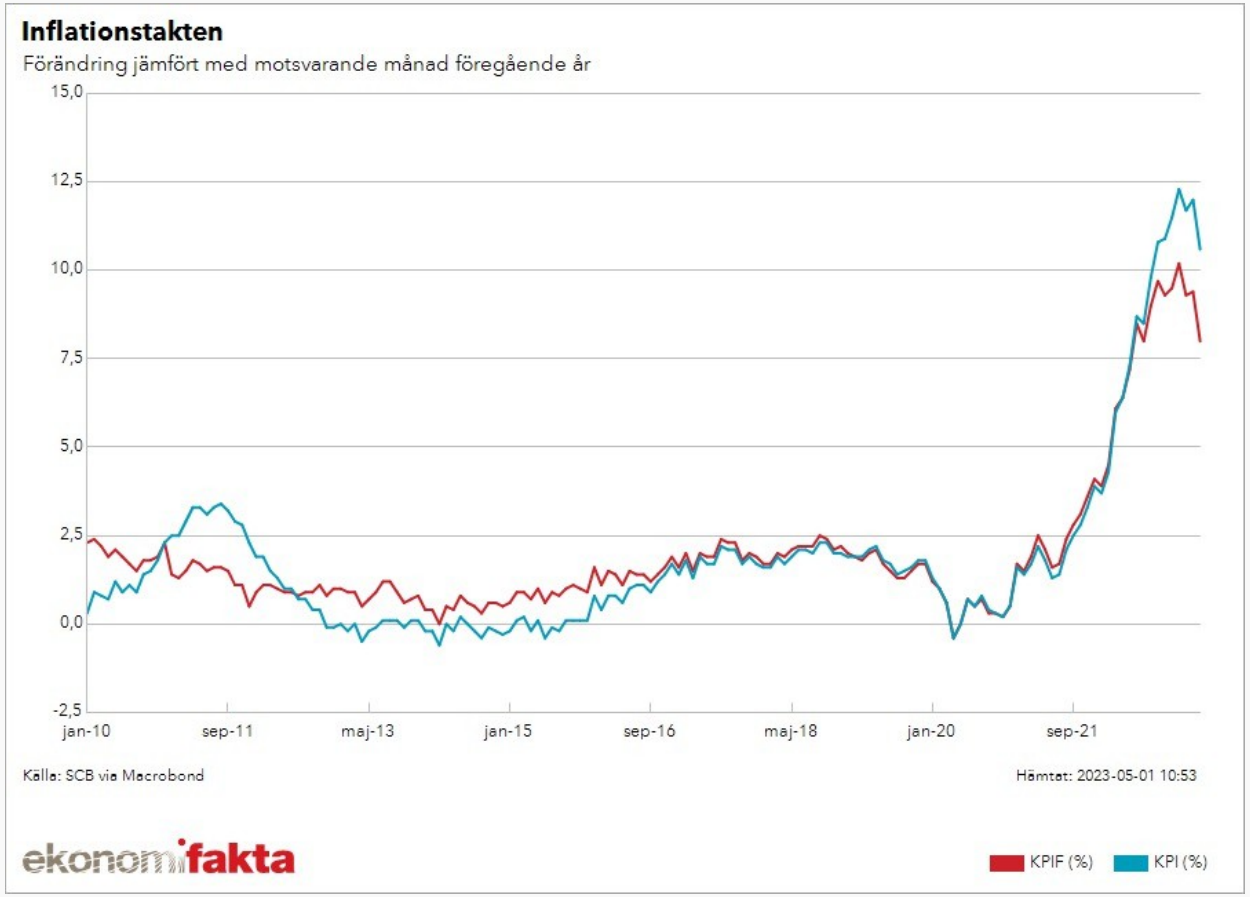
Förändring jämfört med motsvarande månad föregående år

Källa: SCB via Macrobond

Hämtat: 2023-05-01 10:54

train a model on Swedish inflation data 2010-2020

example of **data drift**



data evolved to invalidate the previously trained model

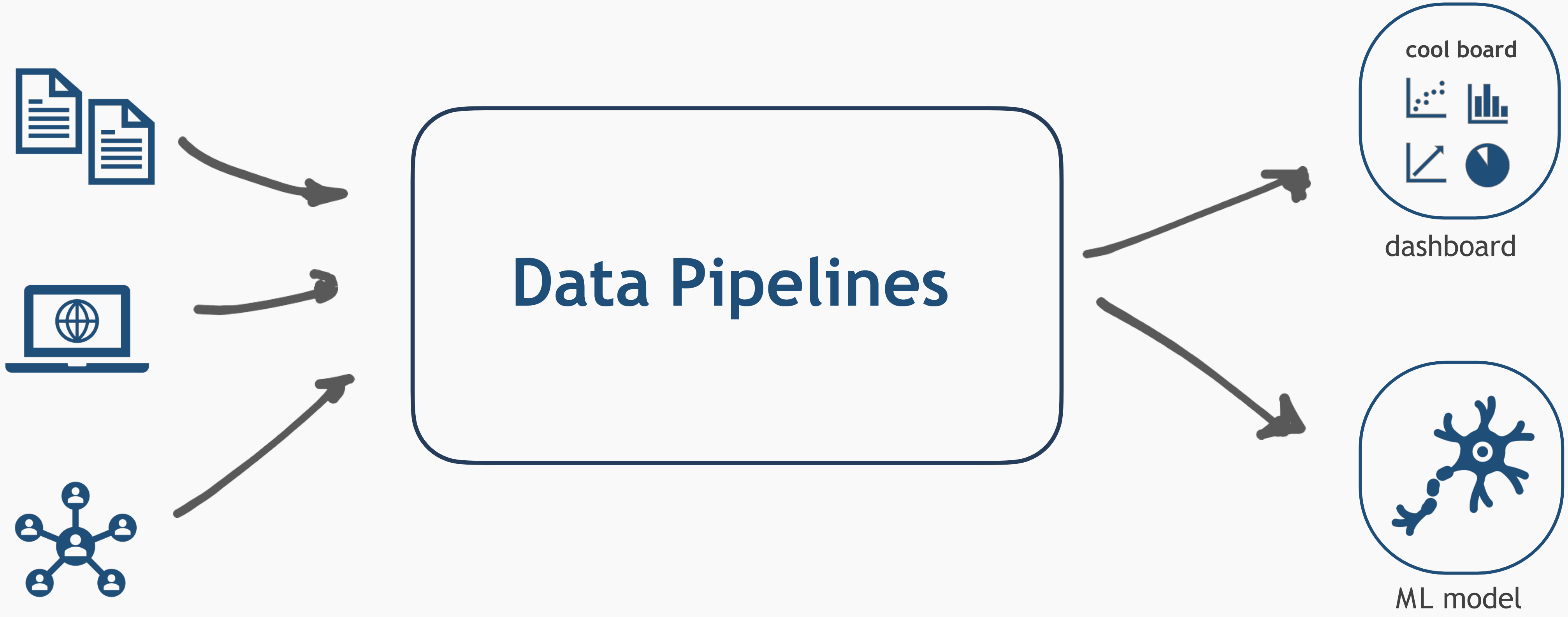
desired wishes after **data updates**

✓ dashboard visualize updated data

✓ ML models have up to date parameters

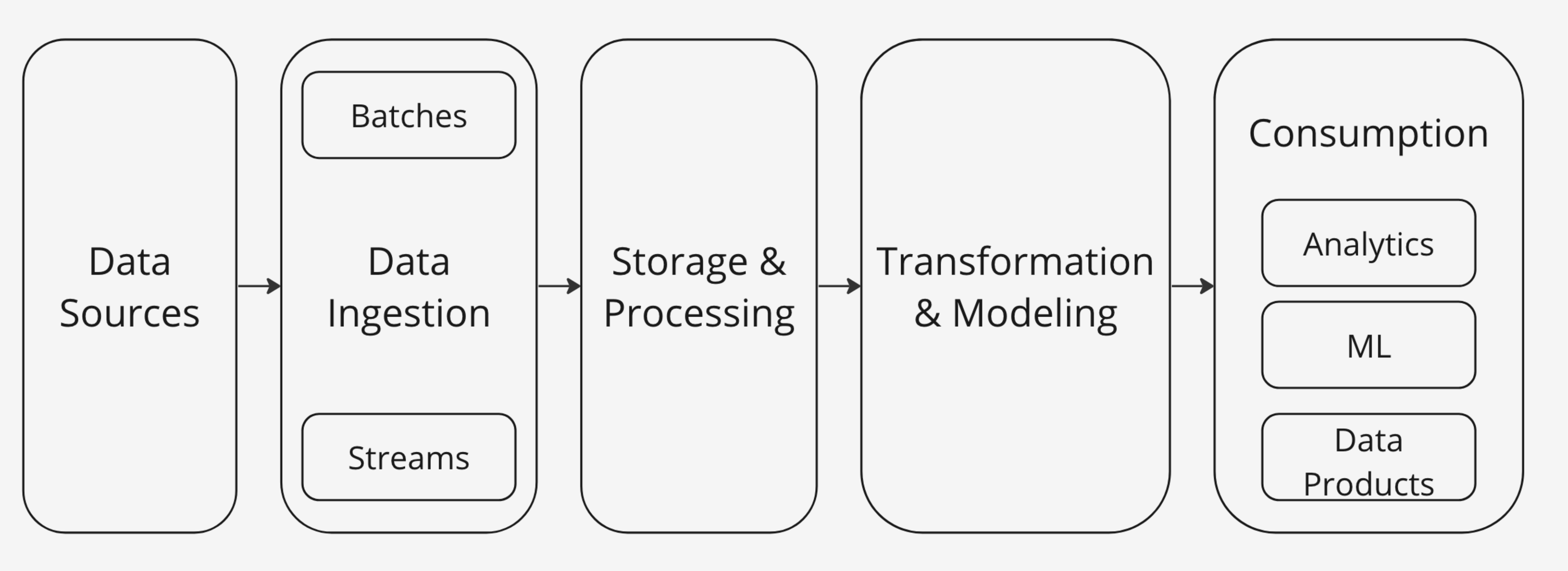
✗ manually run scripts when data is updated

Solution: **Data engineering**



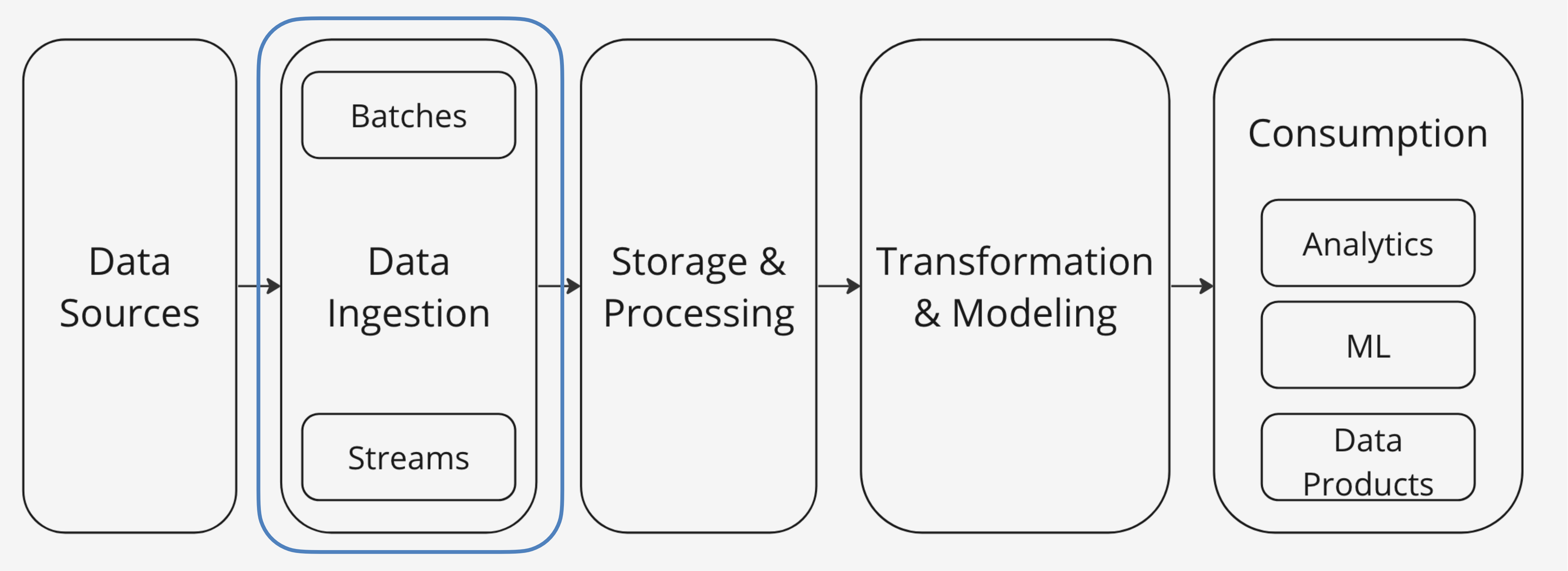
different
data sources

Modern Data Stack/**Data platform**



Data Ingestion

Data is ingested from source into storage.



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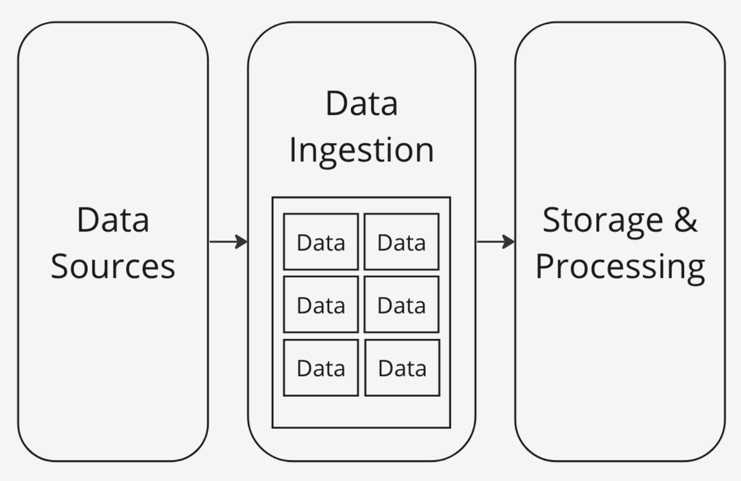

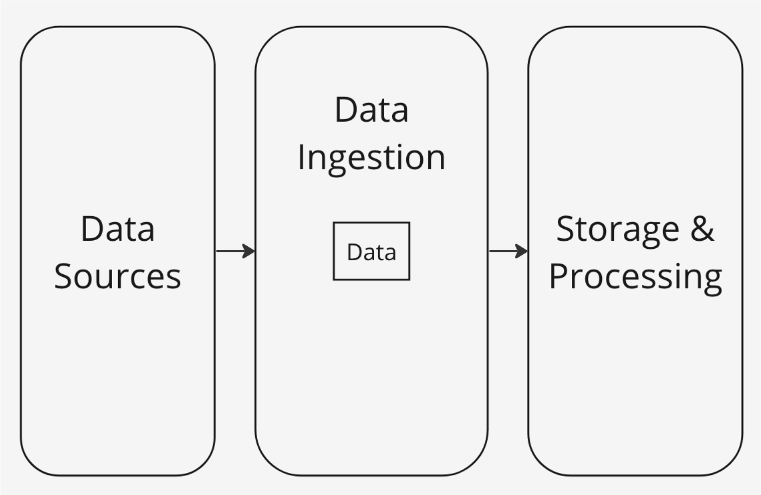

Batch

Data ingestion occurs from a source at a pre-defined time or in pre-defined groupings. Data is often pulled.

Benefits: Suitable for large amount of data that can be ingested in intervals.
Disadvantage: Does not provide data in real time.

Stream

Data is ingested as soon as it is available in the source. Data is often pushed.

Benefits: Receive data in near real time.
Disadvantage: More difficult to process large amount of data that batch ingestion is capable of.

Data Storage & Processing

Where data is stored and processed. We have many possibilities here…
On premise? Cloud?
Data warehouse? Data lake?

Data Warehouse

Data repository that provides data storage and compute, usually leveraging SQL queries for data analytics use cases.

Data Lake

…also a data repository that provides storage and compute. But is able to do it for structured and unstructured data. In most implementation data lakes are cloud storage that works similarly to your local file storage.

Data Transformation

Data transformation usually means cleaning raw data and enriching it in order to make it consumable for analysis or reporting.

Common techniques used in data transformation include:

- Cleaning: This involves removing or correcting errors, inconsistencies, and missing values in the data.

- Normalization: Normalizing data involves scaling it to a common range to eliminate variations in scale that can affect analysis.

- Aggregation: Aggregating data involves summarizing detailed data into a more compact form, often by grouping it based on certain criteria and calculating summary statistics.

- Joining and Merging: Combining data from multiple sources by matching records based on common attributes.

- Derivation: Creating new variables or features from existing ones through calculations or transformations.

- Filtering: Selecting a subset of data based on specific criteria.

Data Modeling

Data modeling involves creating a conceptual representation of the structure and relationships within a dataset. It provides a blueprint for organizing and understanding data, enabling efficient storage, retrieval, and analysis. Data modeling helps ensure that data is organized efficiently, supports accurate analysis, and facilitates communication between stakeholders involved in data management and analysis processes.

Key components of data modeling include:

- Entity-Relationship (ER) Modeling: Identifying the entities (such as objects, people, or events) within a dataset and defining the relationships between them.

- Schema Design: Designing the structure of a database or dataset, including tables, fields, and constraints, based on the data model.

- Normalization: Ensuring that the database design follows normalization principles to minimize redundancy and dependency.

- Data Integrity: Enforcing rules and constraints to maintain the accuracy, consistency, and validity of data.

- Data Flow Diagrams: Visual representations of how data moves through a system or process, depicting inputs, outputs, and transformations.

SO - Basically continuation of the database course!

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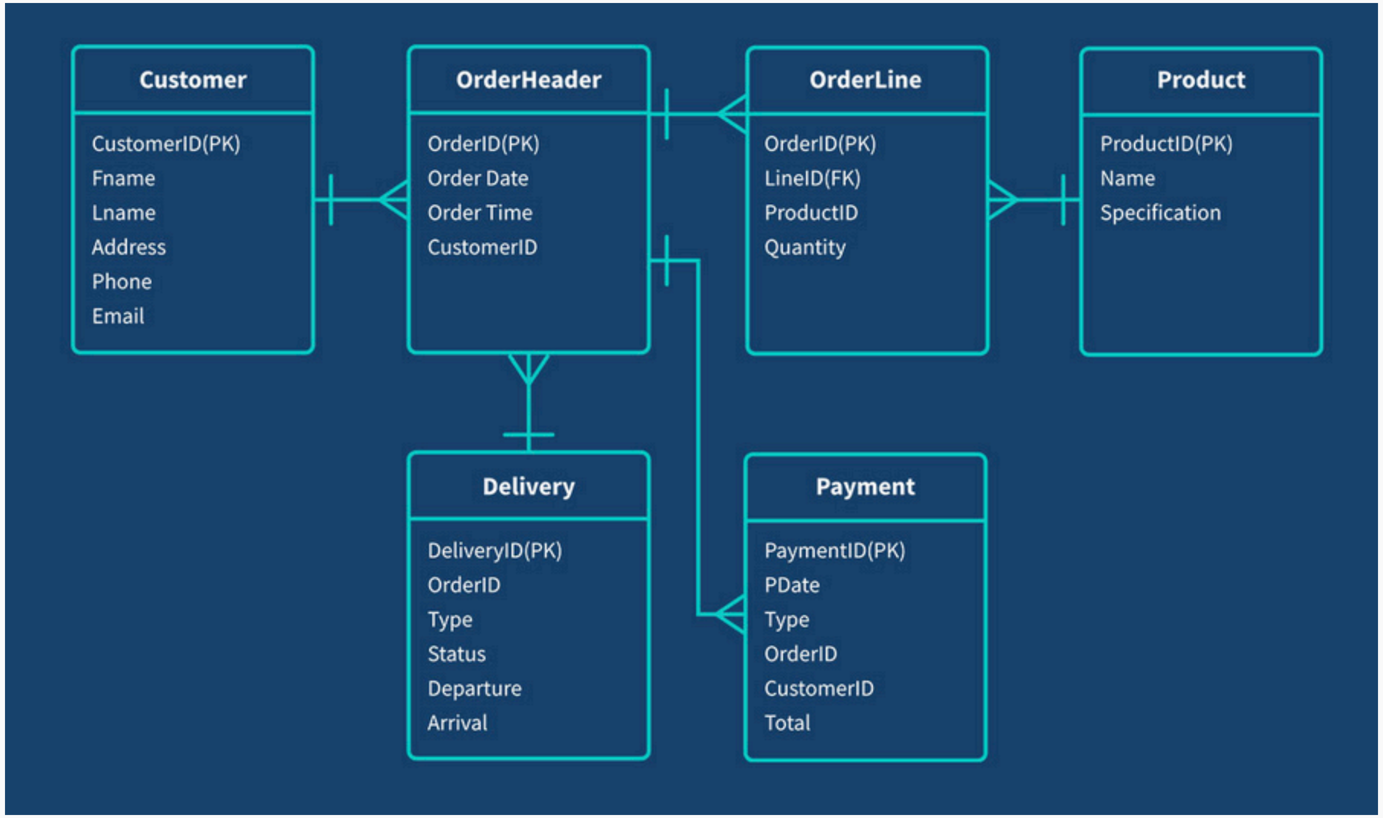


Image taken from “What is data modeling” - Qlik

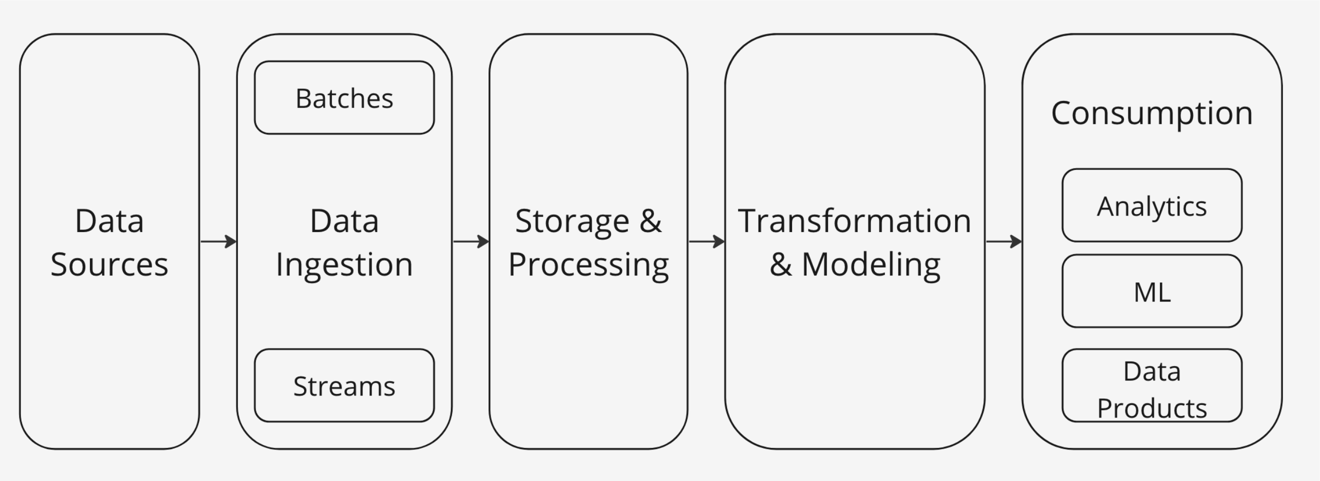
Data Consumption Layer

The data consumption layer, also known as the presentation layer or the access layer, is a crucial component is usually the final layer. Its primary function is to facilitate the access, visualization, and interpretation of data by end-users. Essentially, it serves as the interface between the underlying data sources and the users who need to interact with the data for decision-making, analysis, or reporting purposes.

dashboard

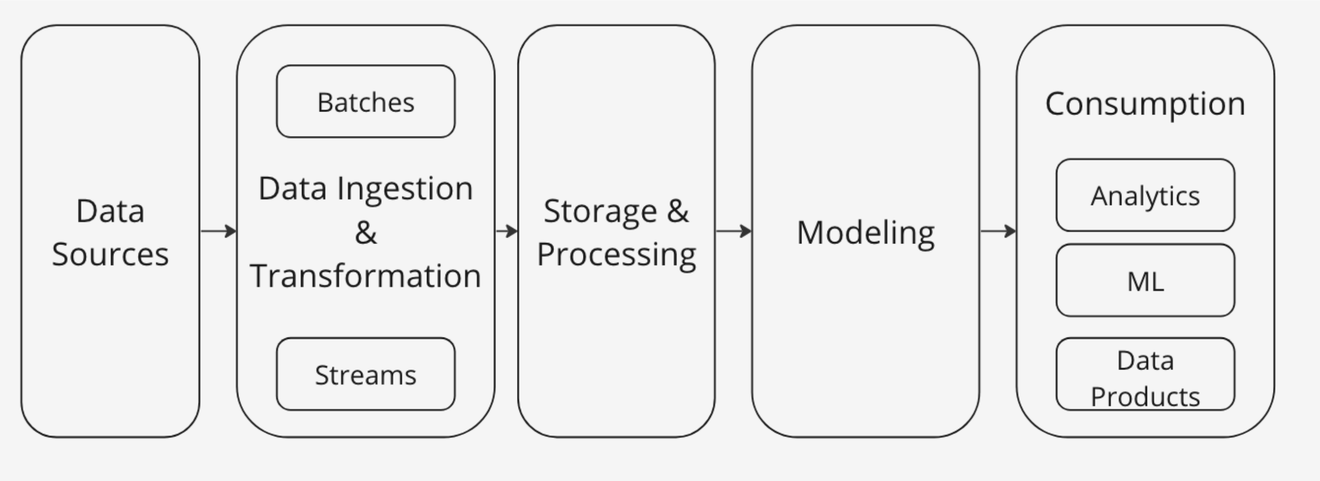
ML model

ELT vs ETL



ELT

ETL



And More!

Other important aspect of the data stack include:
- Data Orchestration
- Data Governance
- Access management
- Semantic layer
- ..and so on and so on

But! We will conclude this introduction here. Now all of you should have a better understanding of the journey your data takes!