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Designing Machine Learning Platform

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极客时间

重拾极客精神·提升技术认知

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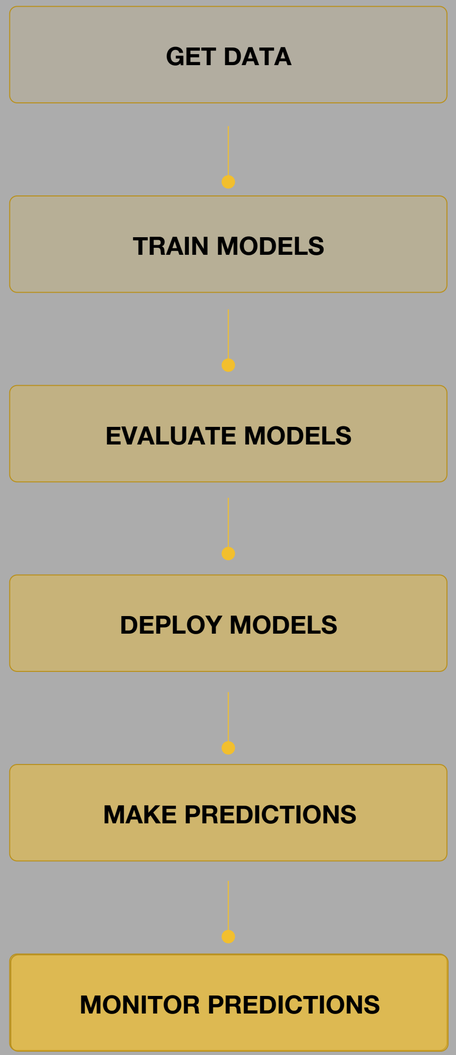
Agenda

- How ML works
- ML platform
- ML Case Study
- Key Challenges: Deep dive
- System Architectures

The Life Cycle of a Model

- Data
  - Data sources, batch or streaming, data aggregation...
- Training in various environments
  - Fast iteration, traditional ML vs DL, training environments ...
- Model evaluations
  - Standard evaluation vs. customized evaluation
- Model deployment
  - Versioning, production
- Inference
  - Batch predictions vs online predictions, scaling out, SLA ...
- Monitoring
  - Signal selection



ML PLATFORM MISSION

Enable engineers and data scientists across the company to easily build and deploy machine learning solutions at scale

Design of ML Platform

- ML as a Service
- Scalable infrastructure for training and serving
- Workflow tools for prototyping, iteration, and productionization
- Model and data serving with full monitoring for batch and real-time
- Scope
  - Traditional ML & Deep Learning
  - Supervised, Unsupervised and Semi-supervised
  - Online learning

Having trouble? → GO TO OLD UI

BACK TO PROJECTS

EATS_ETD_Prediction

OWNER	TEAM	DOCUMENTATION	TIER	ROLLOUT
ntle, alexnik, nico, myz	eats_core	+ Add	3	

Data Sources

Models

Deployments

Predictions

DATA SOURCES

+ ADD DATA SOURCE

Dynamic Data Source

SETTINGS ...

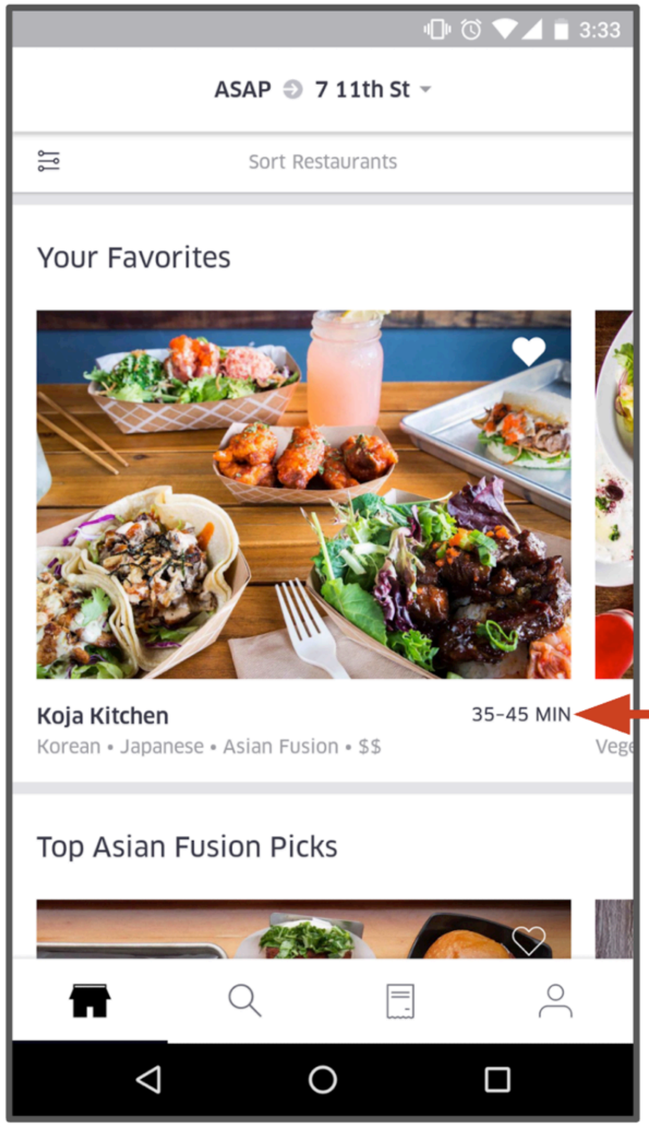
Type: DYNAMIC

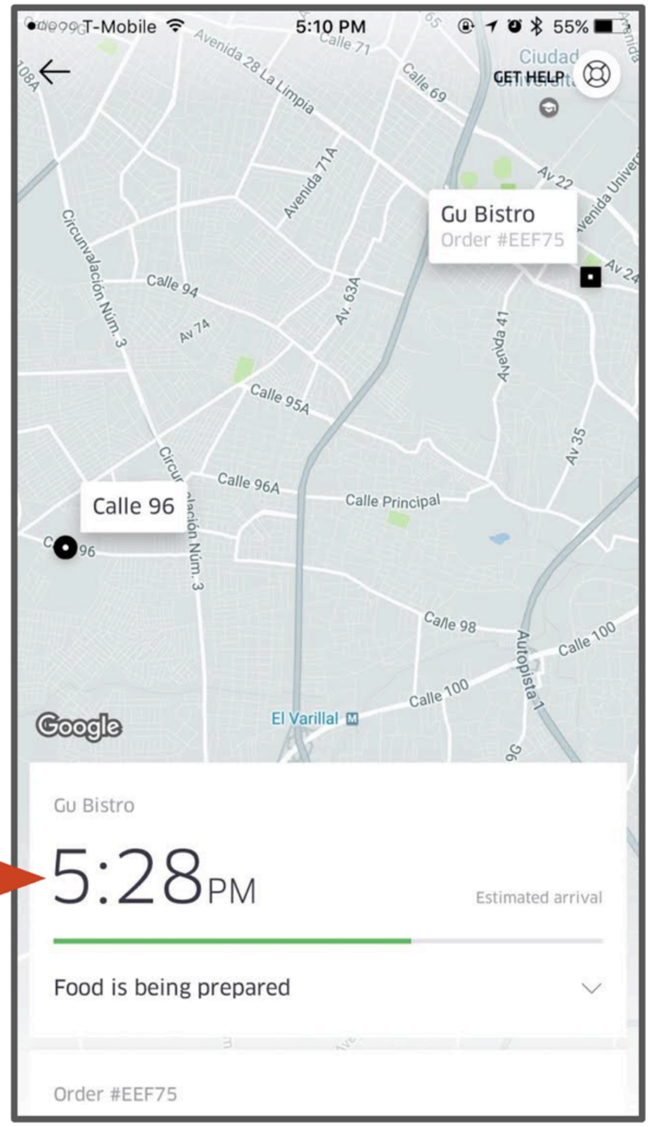
Source: SQL Pipeline

Data Type: spark_sql

Example Use Case: UberEATS

MEAL DELIVERY TIME





Uber EATs Delivery Time Models

- Features
  - Curated features
  - Request Level Features – *user's current location*
- Models
  - Several models for different stages of order
  - GBDT Regression
  - Different versions of each for experimentation

Key Challenges

- Guarantee same data for batch training and online scoring
- Train and deploy separate model per city
- One-click deploy & easy scale out
- Live monitoring of model performance

Challenge 1:

Same data for train & predict

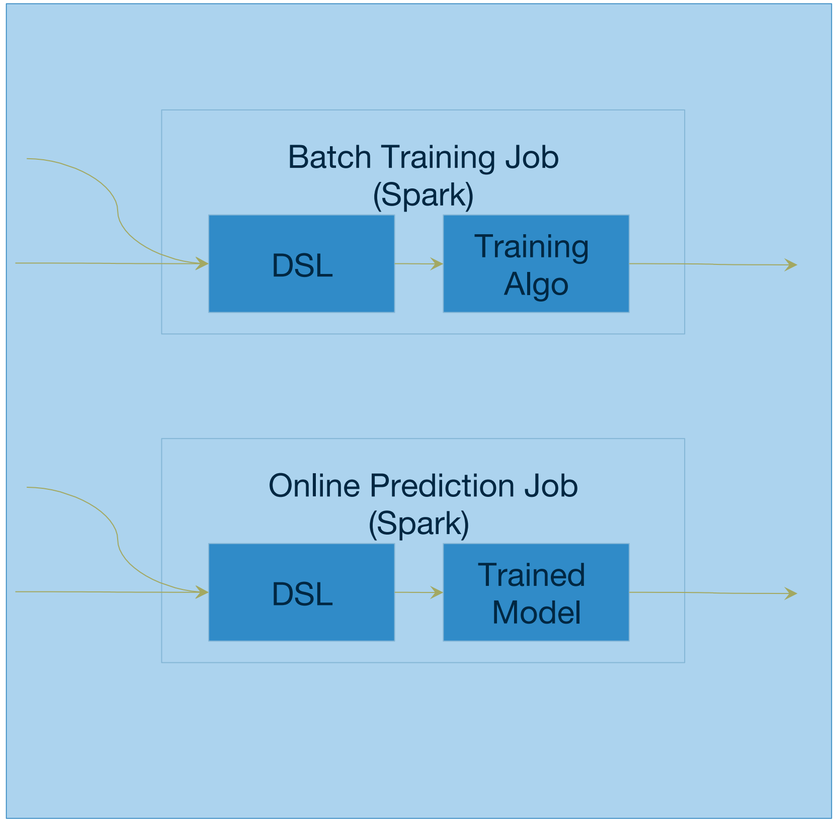
Data Sources: Problems

	Request Level Features	Aggregated Feature	Near Realtime Aggregated Feature
Training	Batch	Batch	Batch
Online scoring	Given by user	Curated in batch Consumed by query	Curated in streaming, consumed by query

Generation Pattern: Batch and streaming
Consuming Pattern: Batch and query

Data Sources (Solutions)

- Data Storage
  - Spark for batch jobs
  - Cassandra for online jobs
  - Streaming jobs
- Data Accessors
  - Own DSL
  - Access basis features, curated features, and column stats
- Data Transformation
  - Standard transformation functions + UDFs



Challenge 2:

Partition Model

PROBLEM

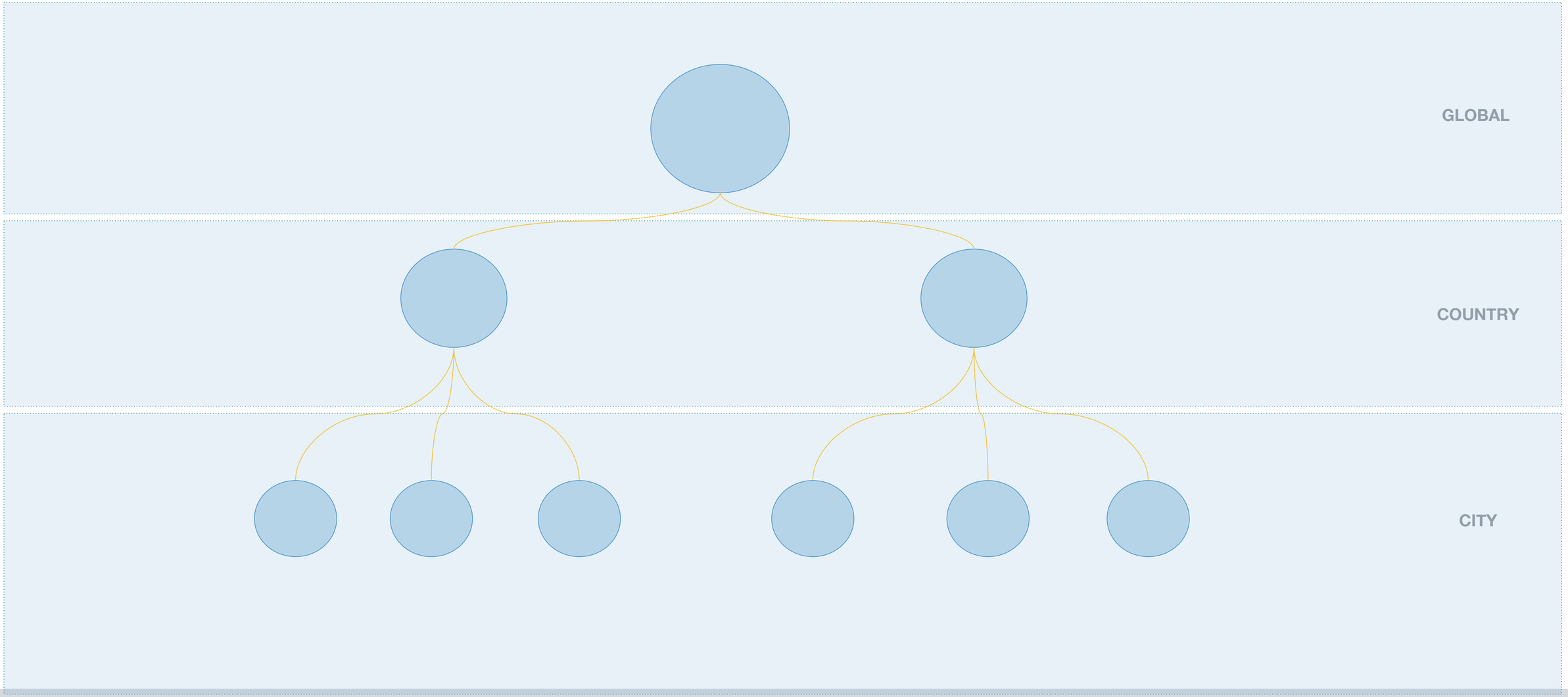
- Often you want to train a model per city
- Hard to train and deploy a few hundred individual models

SOLUTION

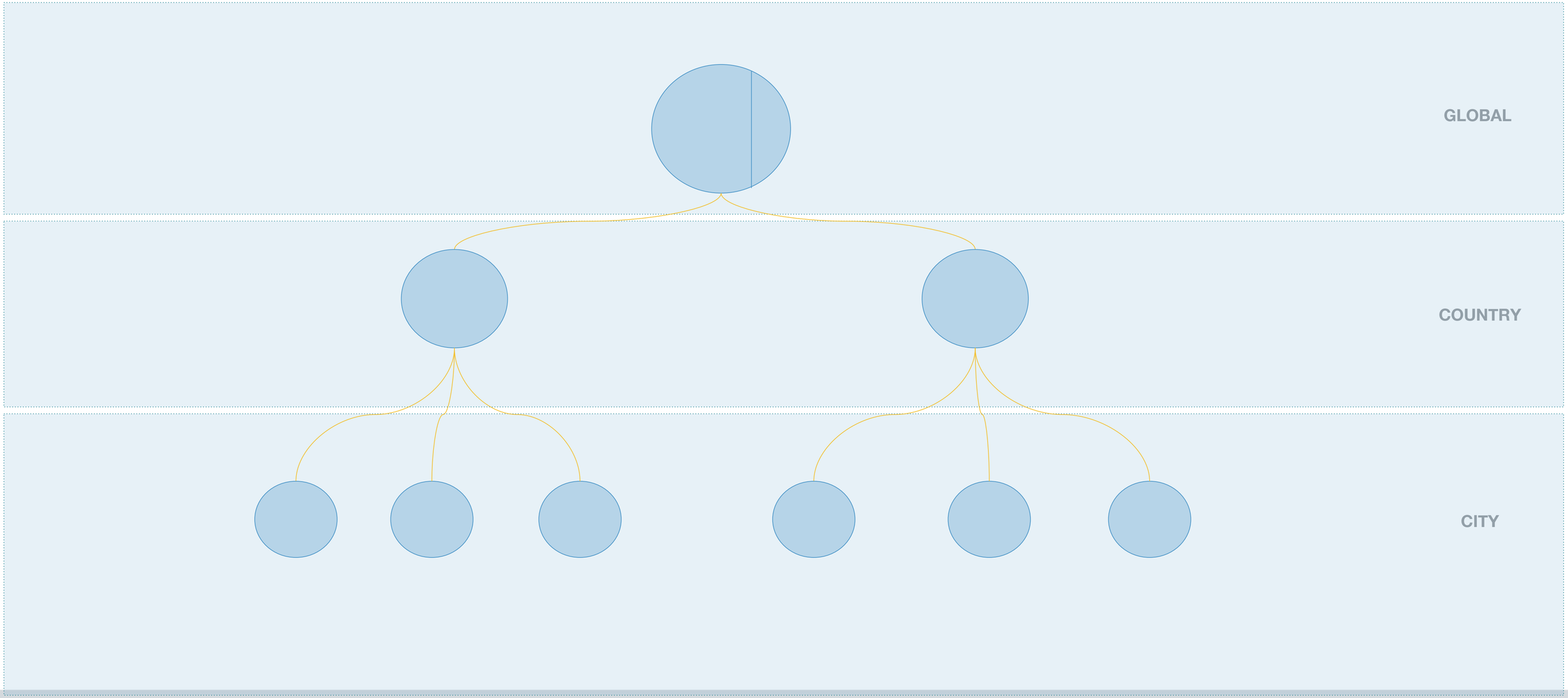
- Let users define hierarchical partitioning scheme
- Automatically train model per partition
- Manage and deploy as single logical model

1

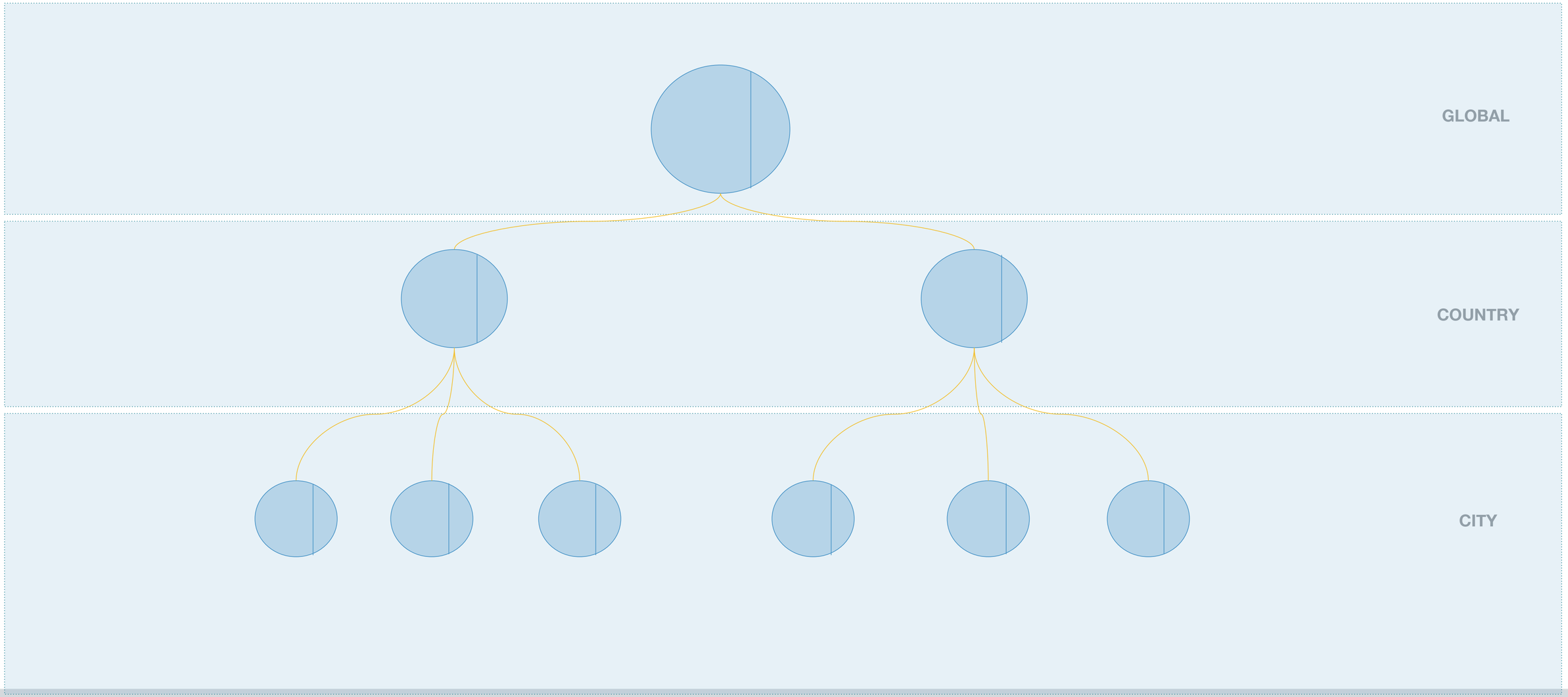
Define partition scheme



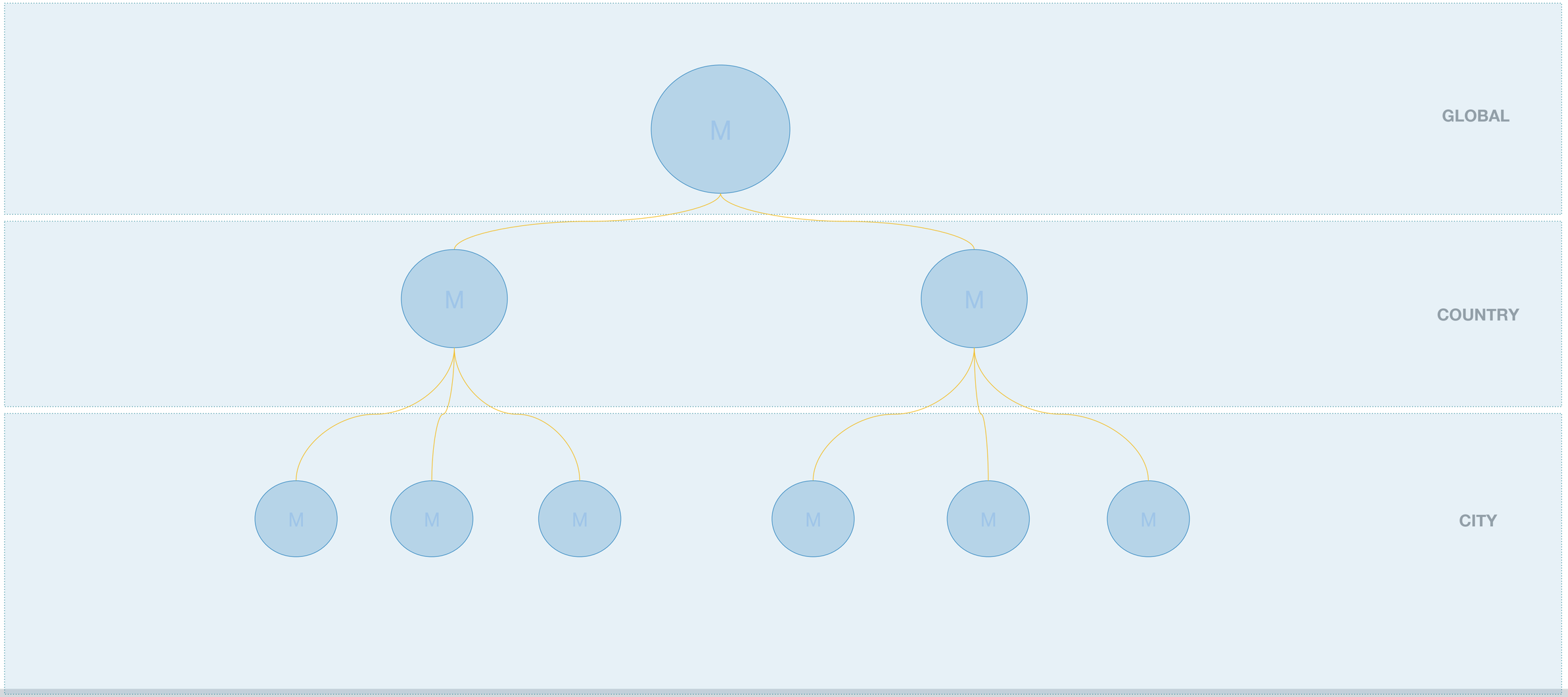
Make train / test split



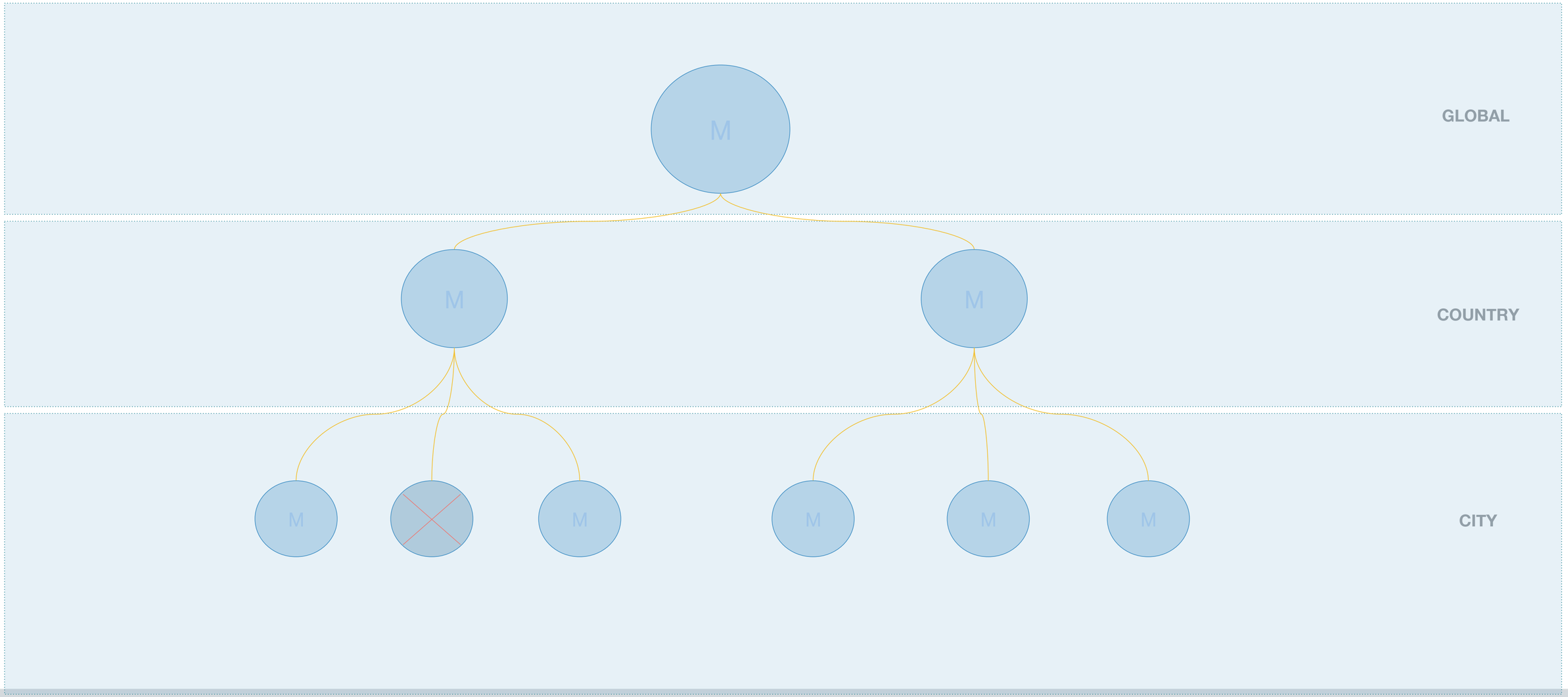
Keep same split and partition for each level



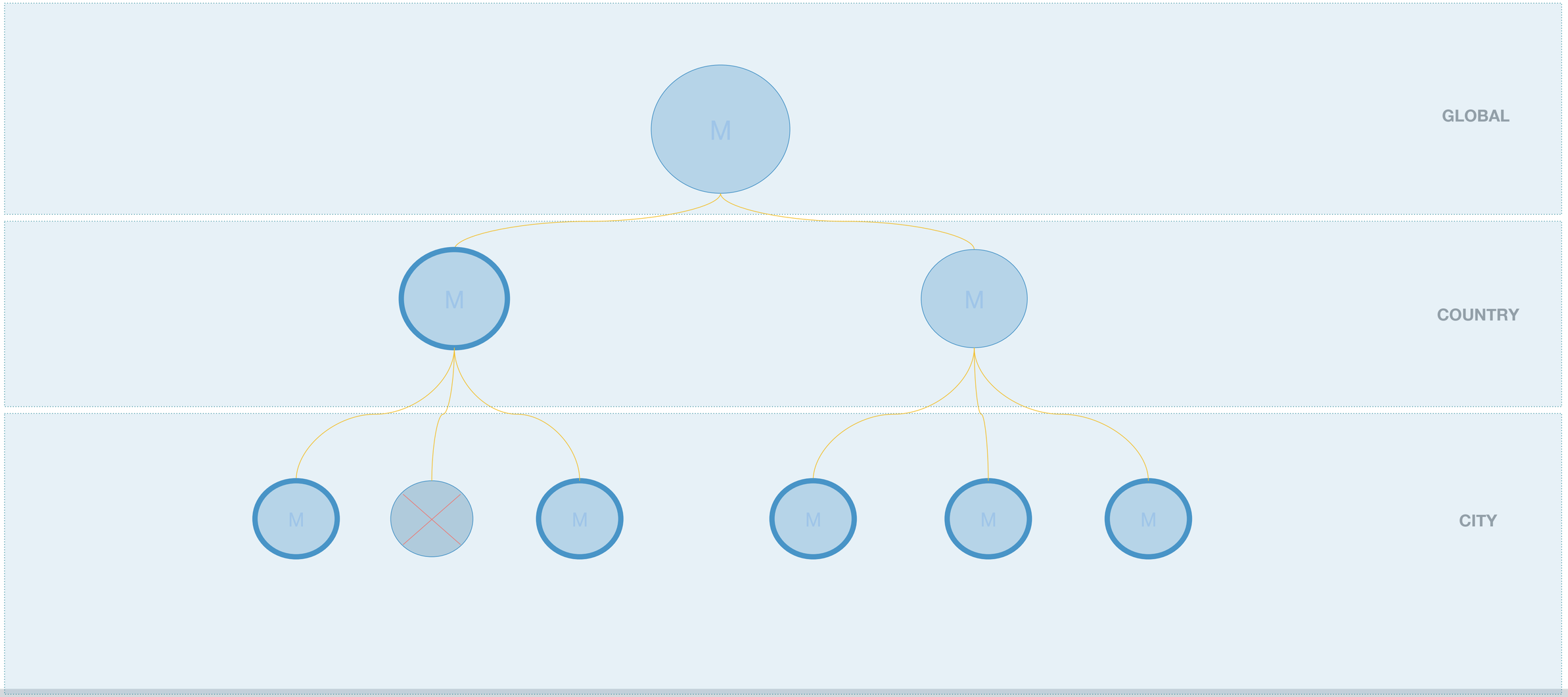
Train model for every node



Prune bad models



At serving time, route to best model for each node



Challenge 3:

One-click deploy and scale out

REALTIME PREDICT SERVICE

- Predict service
  - RPC service container for one or more models
  - Scale out in Docker on Mesos
  - Single- or multi-tenant deployments
  - Connection management and batched/parallelized queries to Cassandra
  - Monitoring & alerting
- Deployment
  - Each model is packed individually
  - One click deploy across DCs via standard deployment infrastructure
  - Health checks and rollback

Challenge 4:

Live model performance monitoring

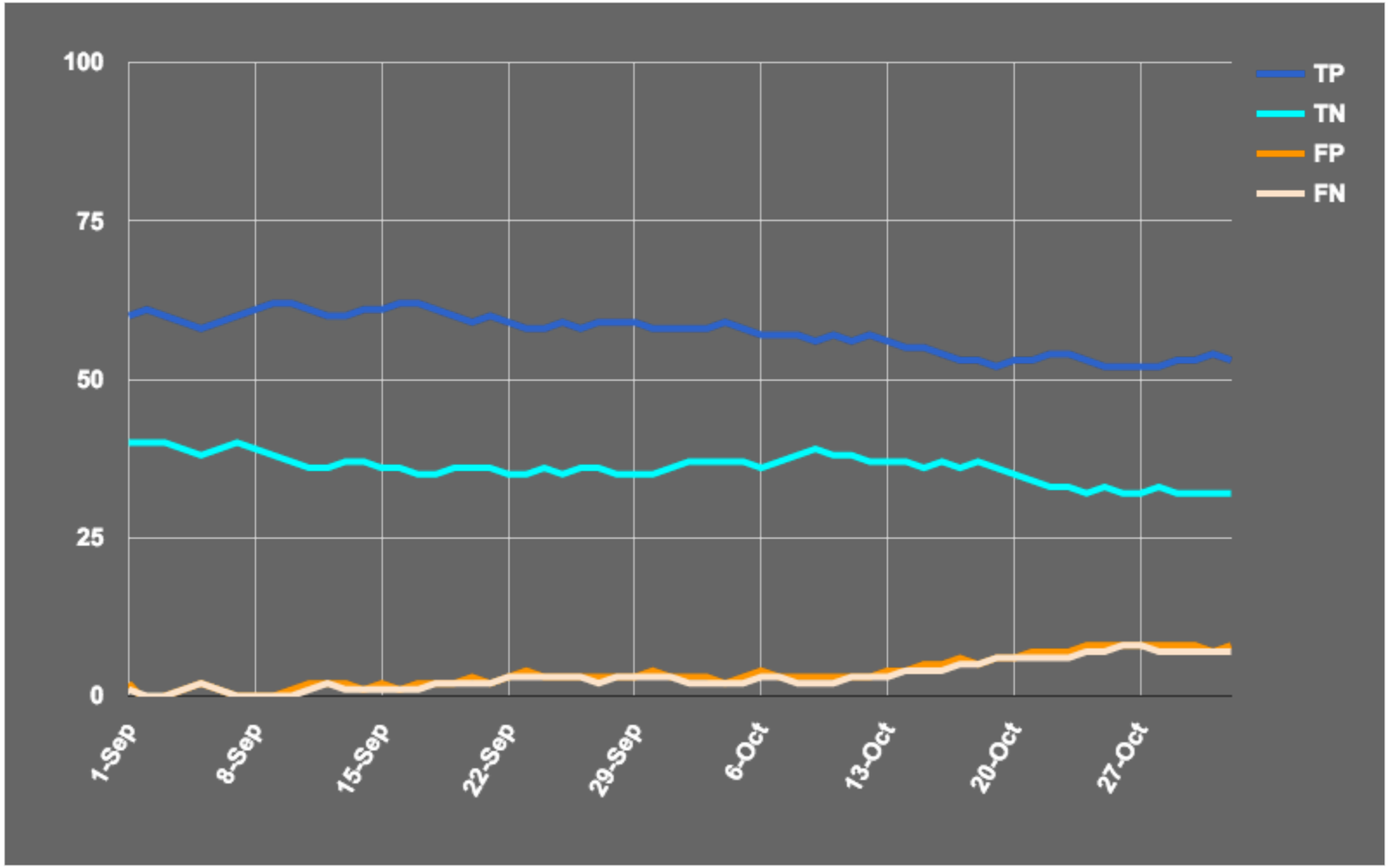
LIVE PREDICTION MONITORING

Problem

- Ensure deployed model is making good predictions

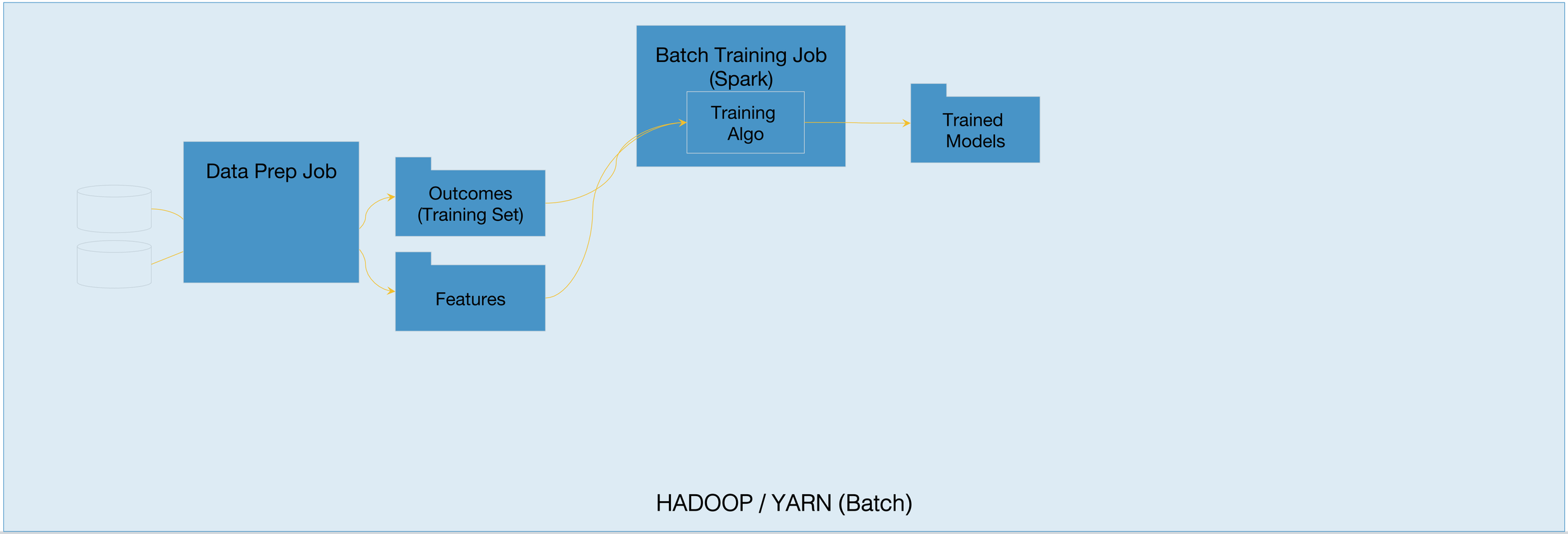
Solution

- Log predictions
- Join logged predictions to actual outcomes
- Publish metrics for monitoring and alerting
- Optionally hold back logged predictions



System Architecture

GET DATA | TRAIN MODELS | EVAL MODELS | DEPLOY, PREDICT & MONITOR



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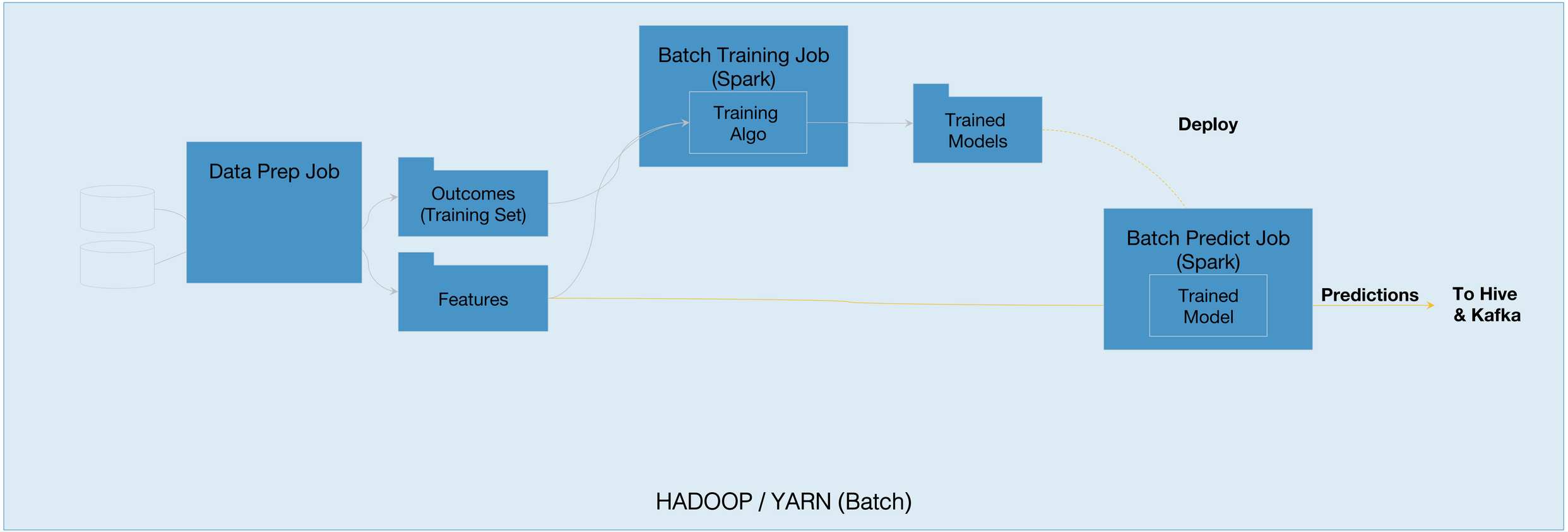

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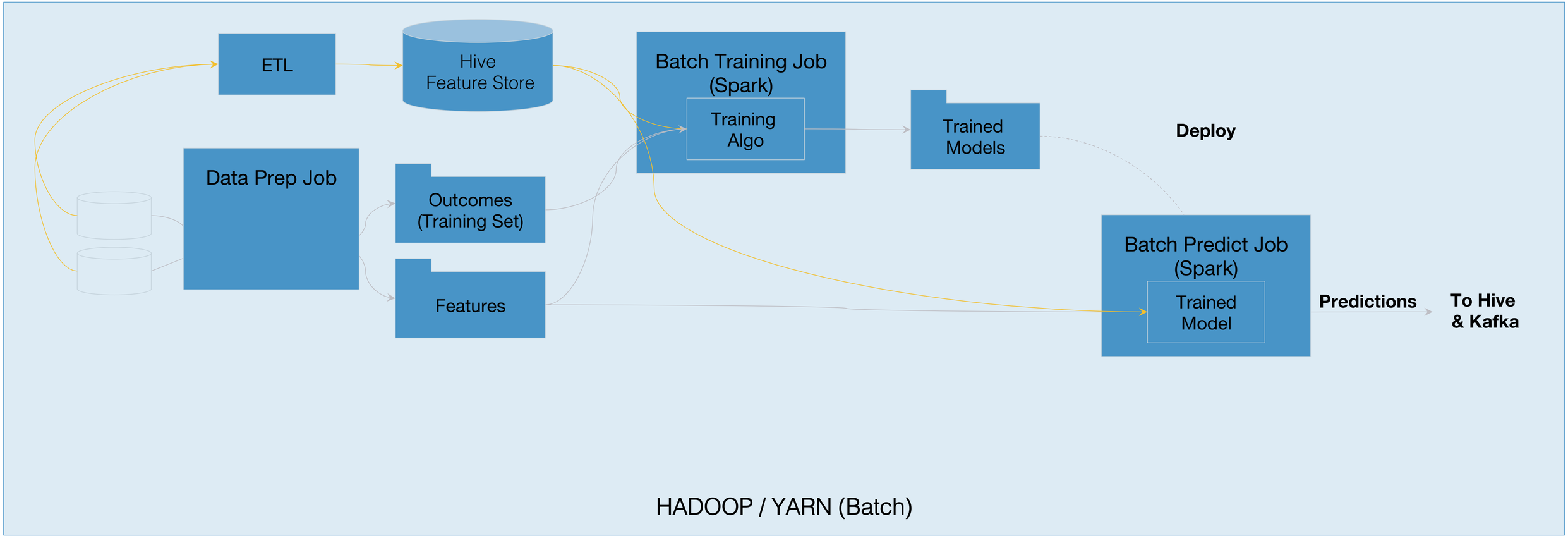

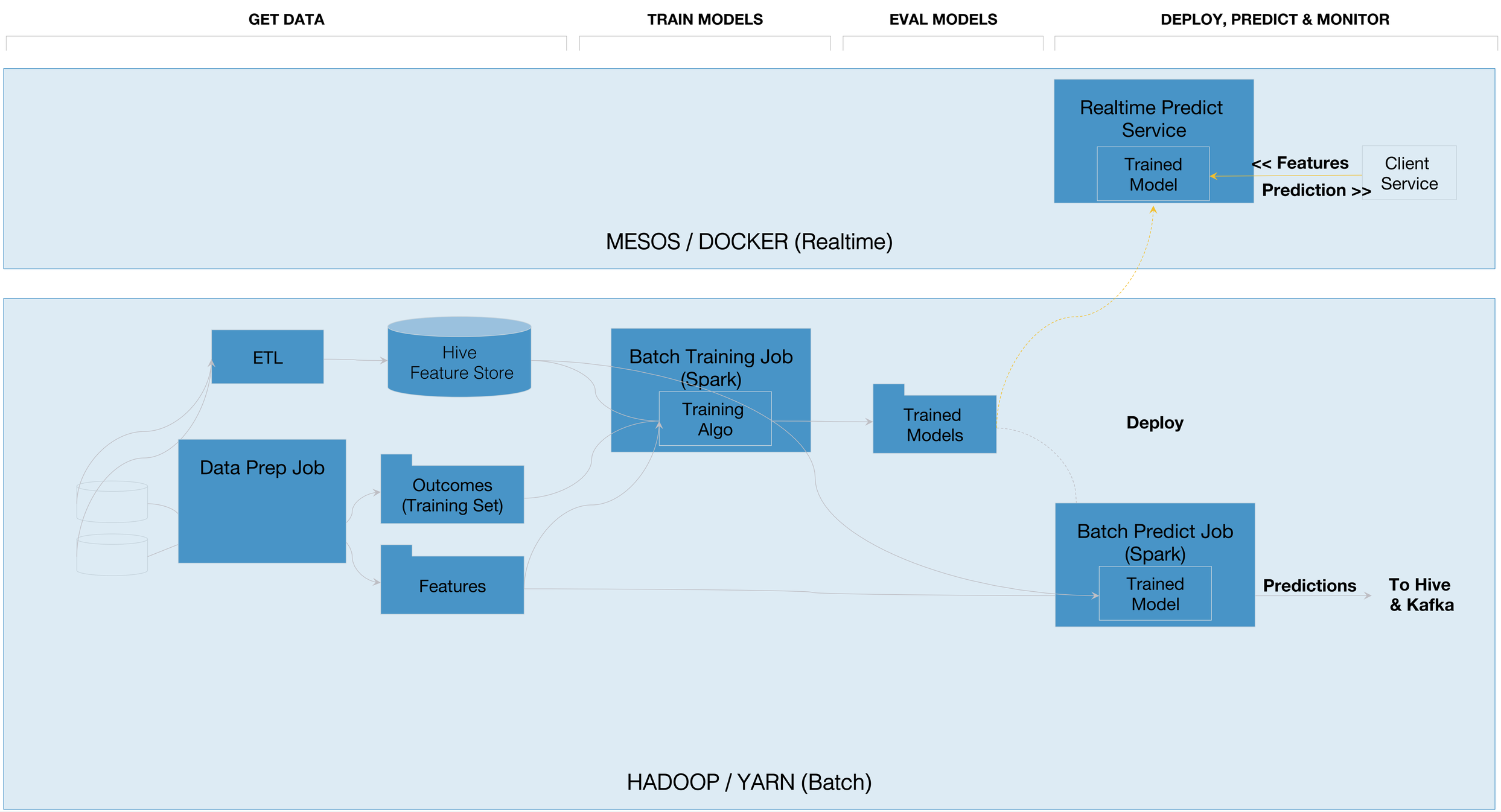
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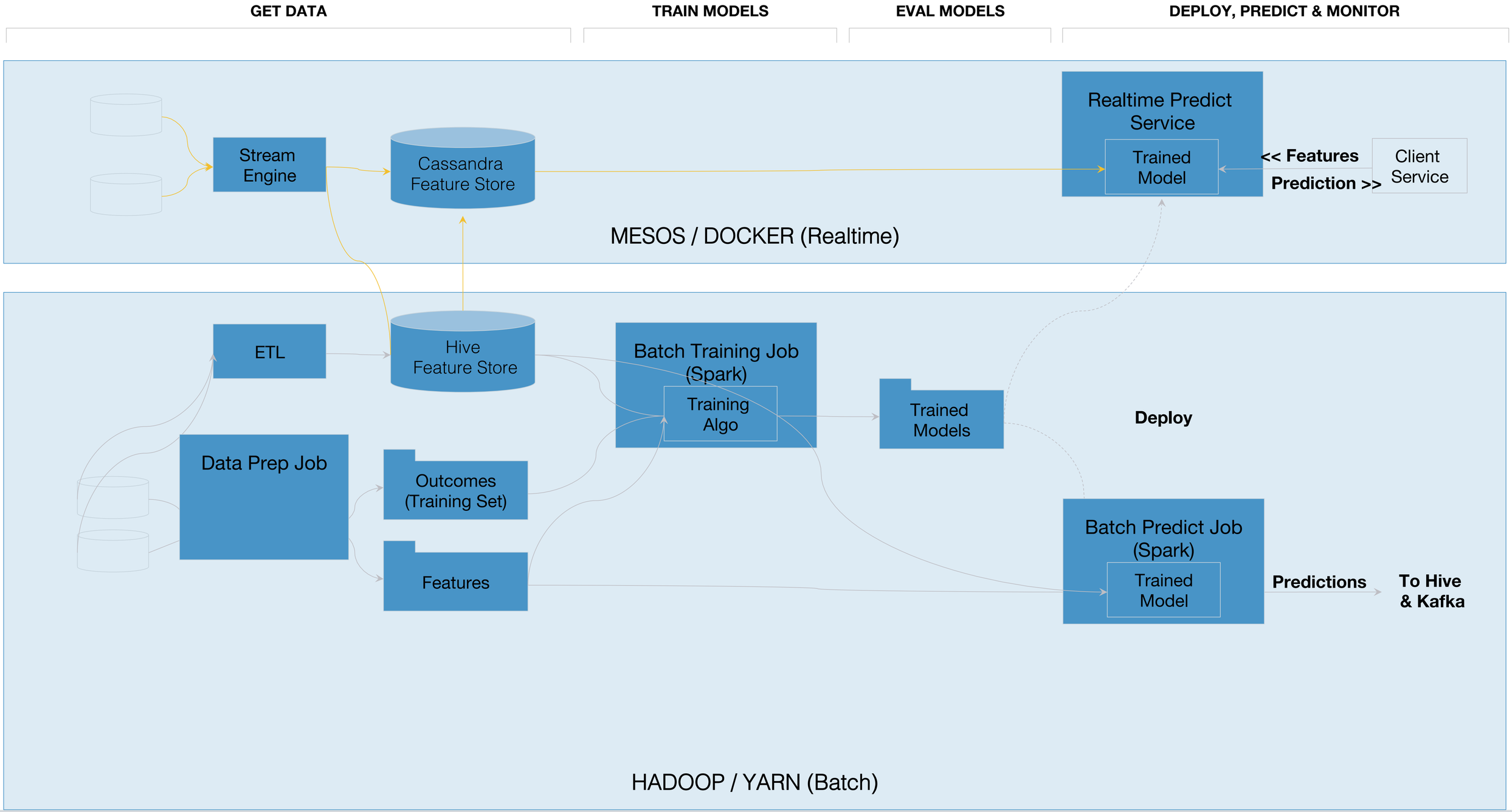
TRAIN MODELS
EVAL MODELS
DEPLOY, PREDICT & MONITOR
Realtime Predict Service
Trained Model
<< Features
Prediction >>
Client Service
MESOS / DOCKER (Realtime)
ETL
Hive Feature Store
Batch Training Job (Spark)
Training Algo
Trained Models
Deploy
Data Prep Job
Outcomes (Training Set)
Features
Batch Predict Job (Spark)
Trained Model
Predictions
To Hive & Kafka
HADOOP / YARN (Batch)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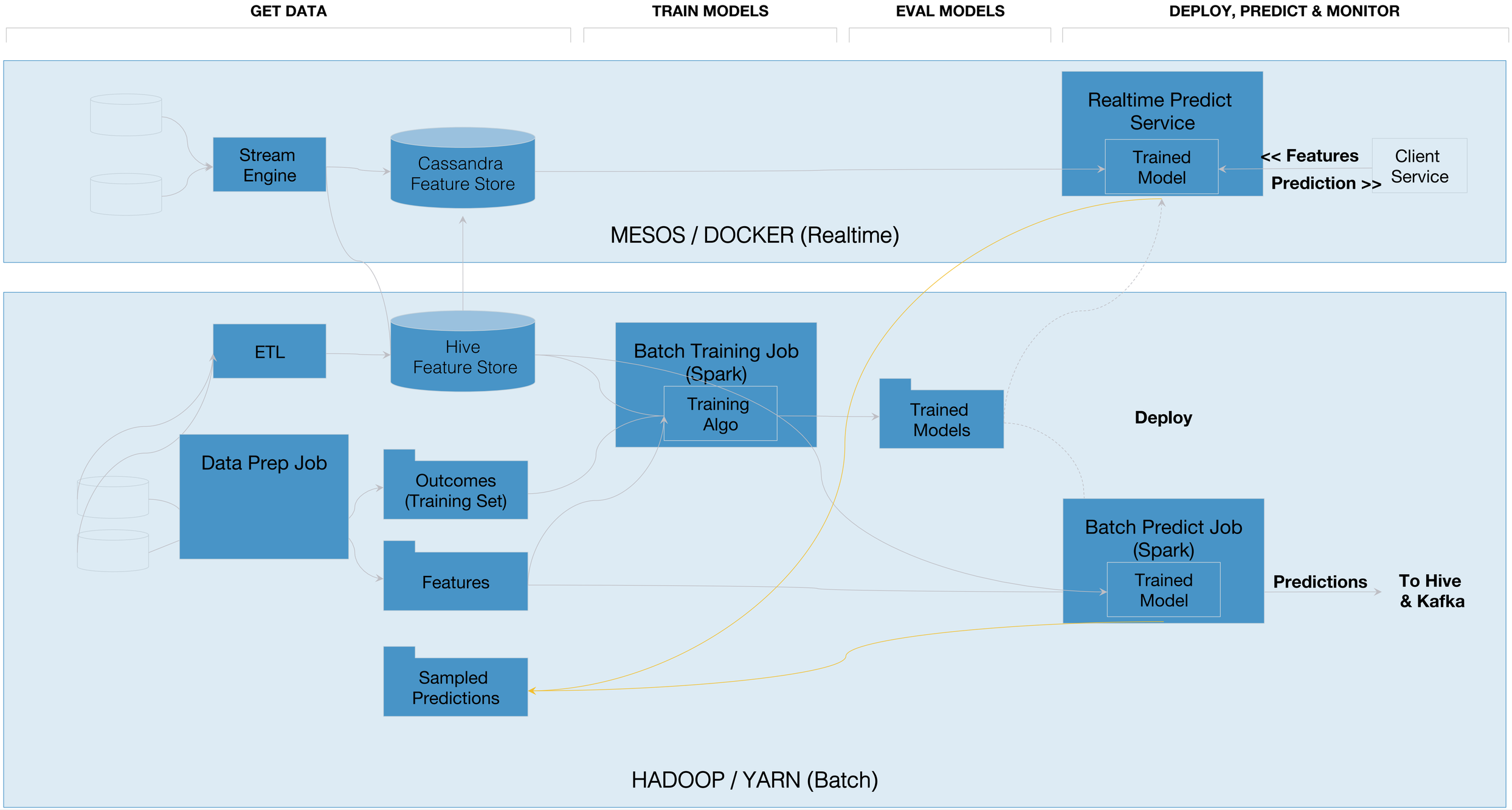
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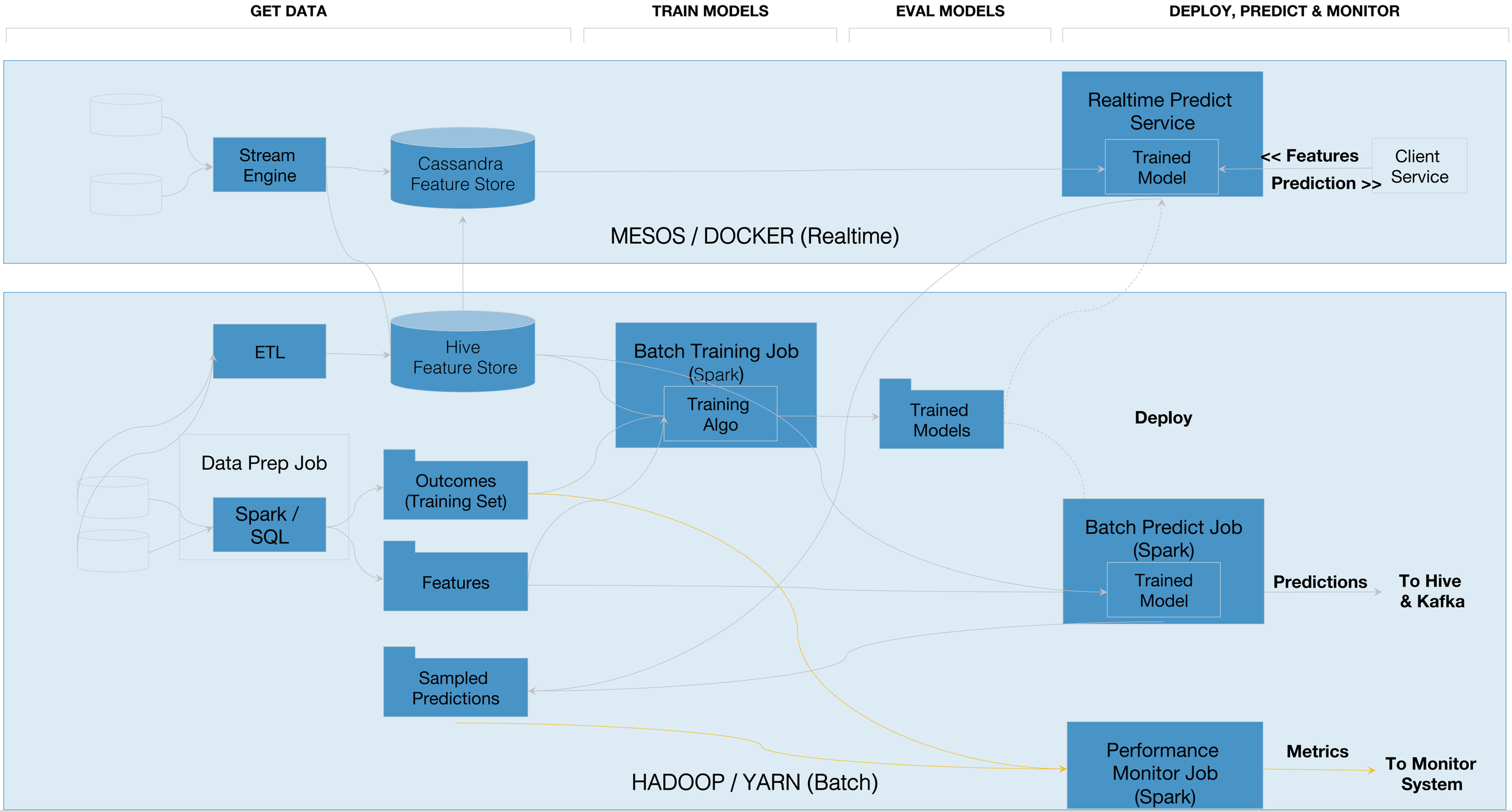
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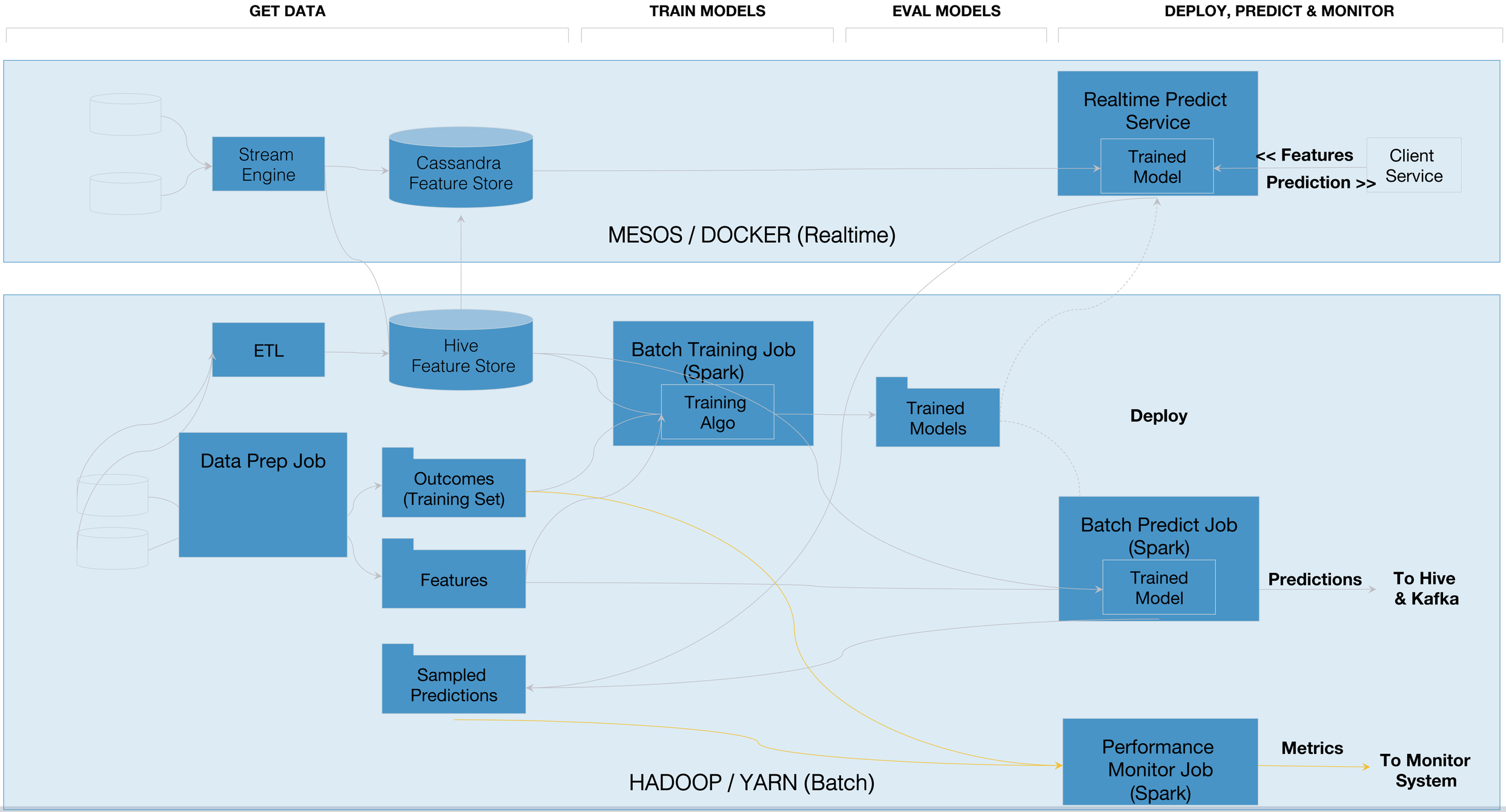
Metrics
To Monitor System
HADOOP / YARN (Batch)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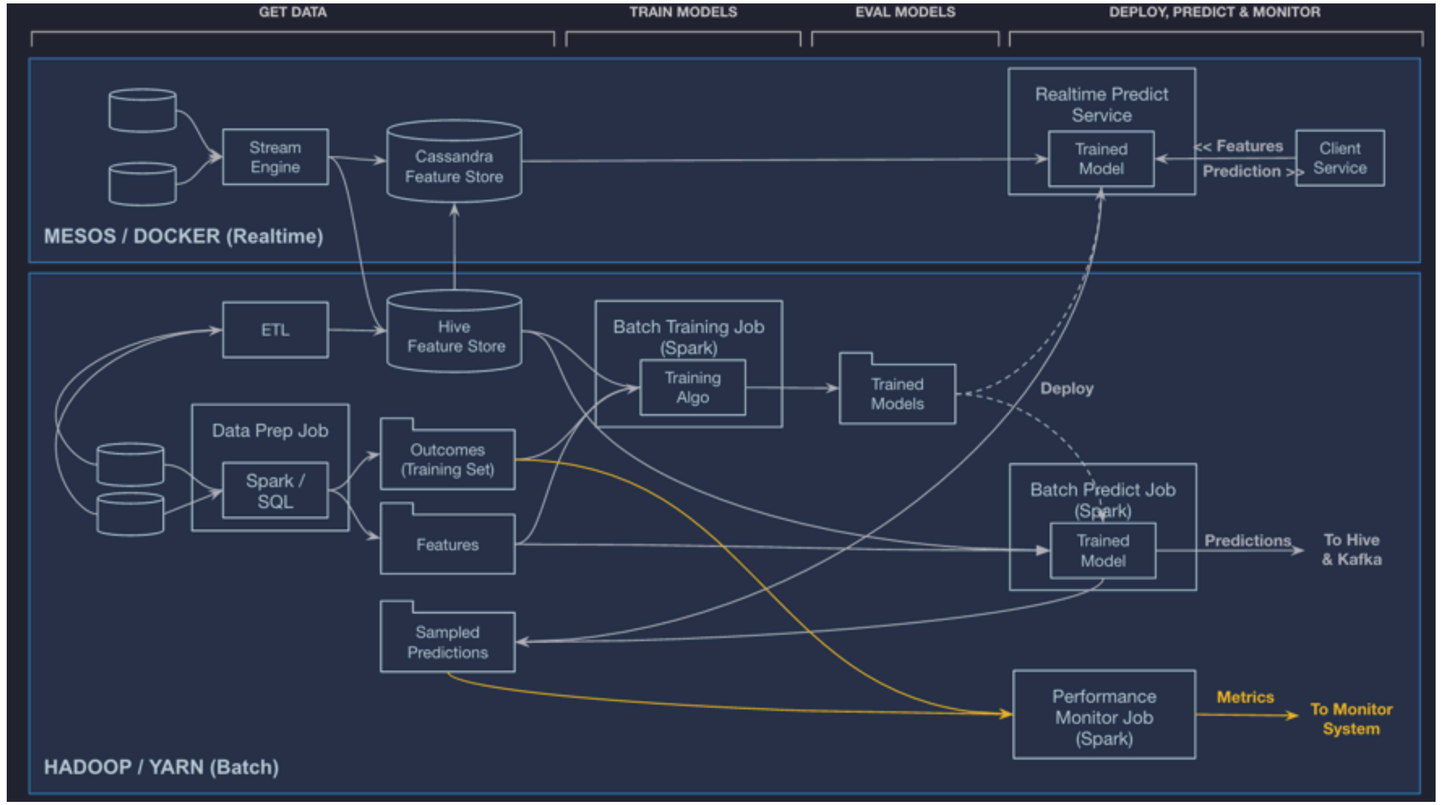
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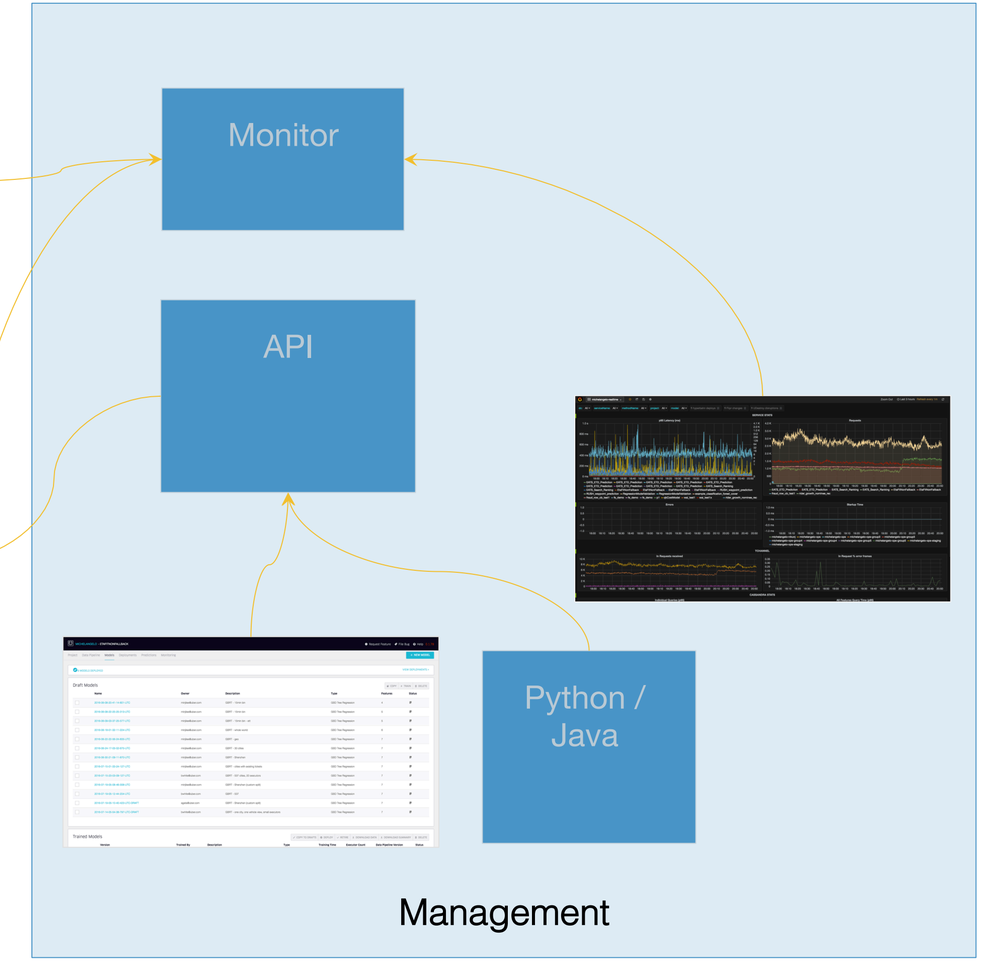
Monitor
API
Python / Java
Management

Thanks!

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