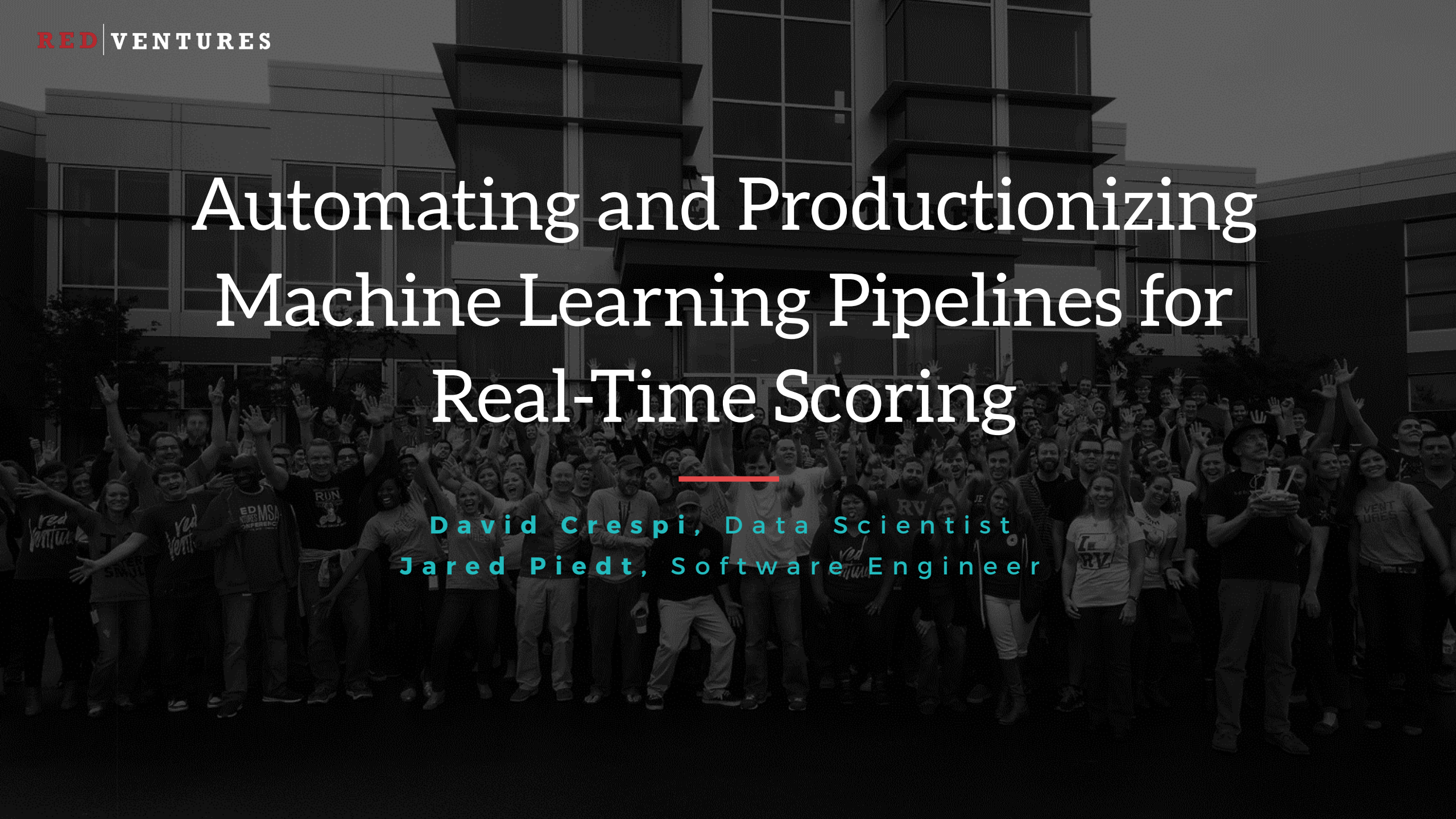


RED VENTURES

Automating and Productionizing Machine Learning Pipelines for Real-Time Scoring

David Crespi, Data Scientist
Jared Piedt, Software Engineer

What we do

- Digital consumer choice platform
- Connect online customers with products and services across high-growth industries:
  - Home services
  - Financial services
  - Healthcare

Bankrate®

the POINTS GUY

MYMOVE™

creditcards.com

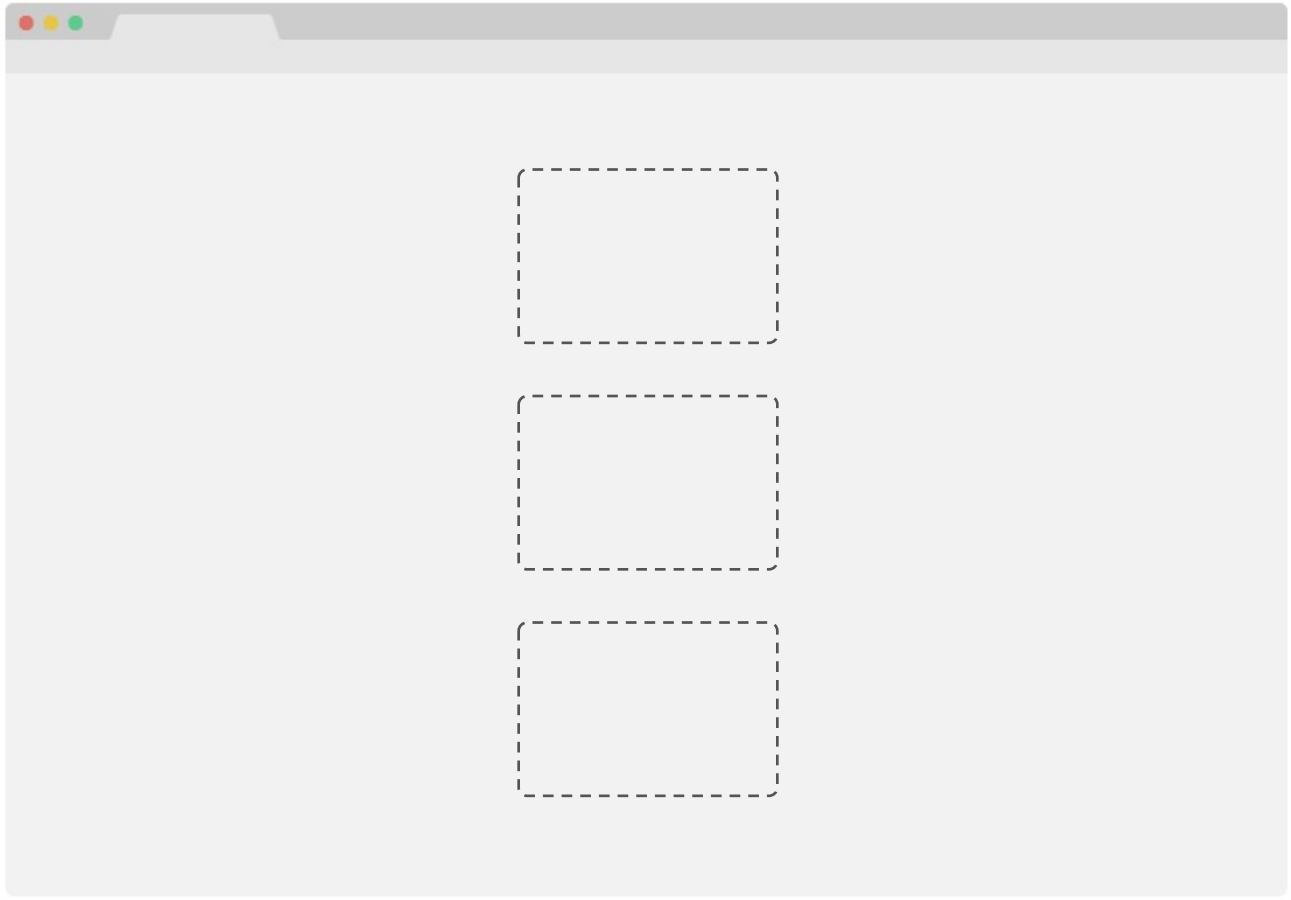
The Simple Dollar

Reviews.com

allconnect®
A really smart move.

How does data science add value?

Product recommendation



Real-Time Predictions

Requirements
1 Speed
2 Consistency

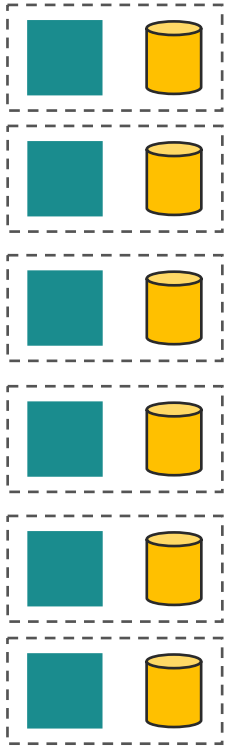
Data Science Process

1. Data Collection
2. Machine Learning Pipelines
3. Model Deployment

Data Science Process

1. Data Collection
2. Machine Learning Pipelines
3. Model Deployment

Old Data Architecture



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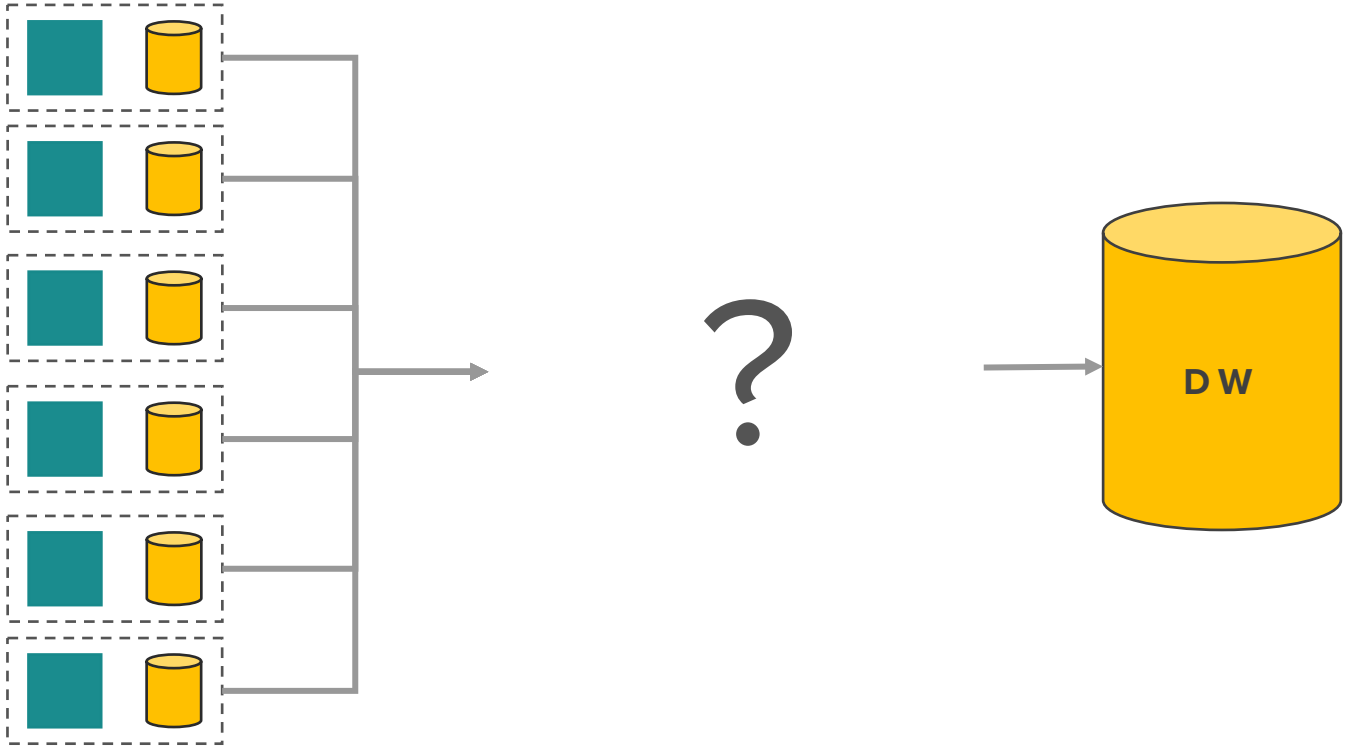

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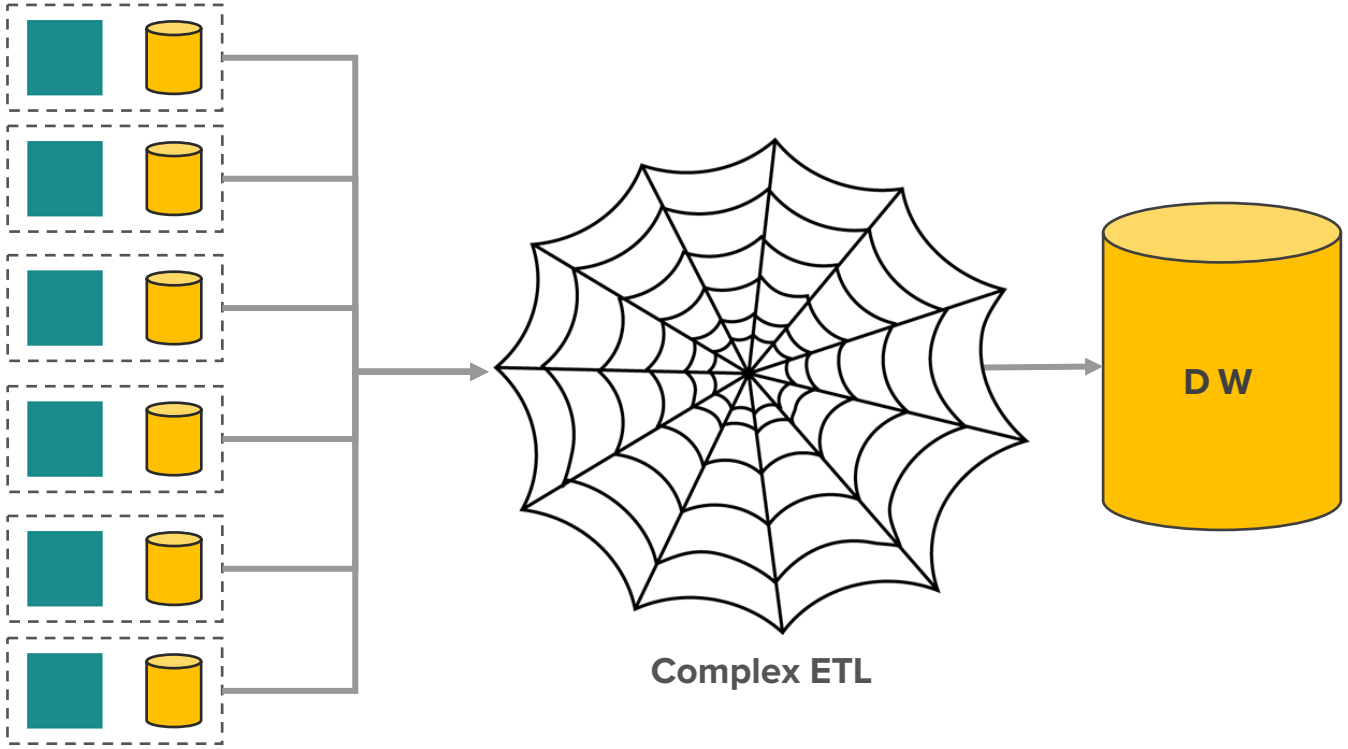
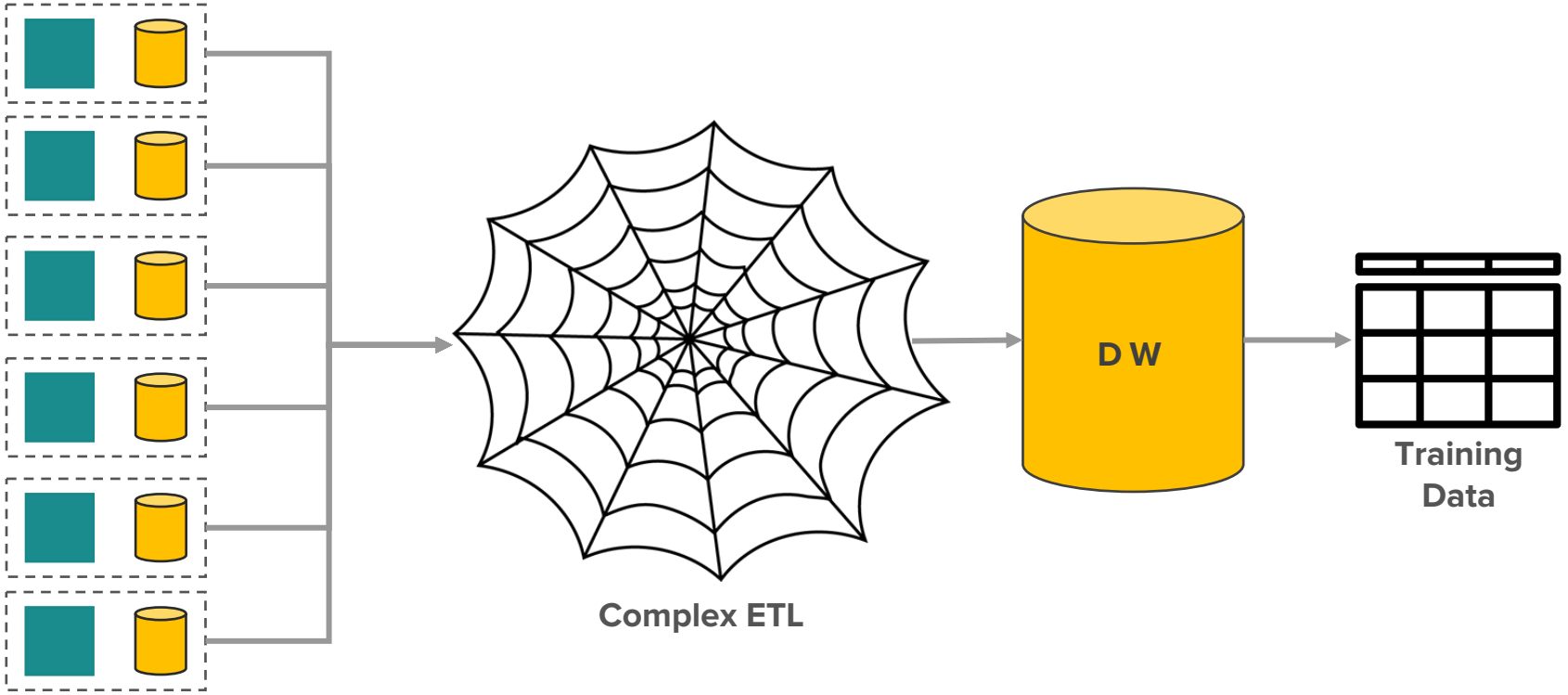
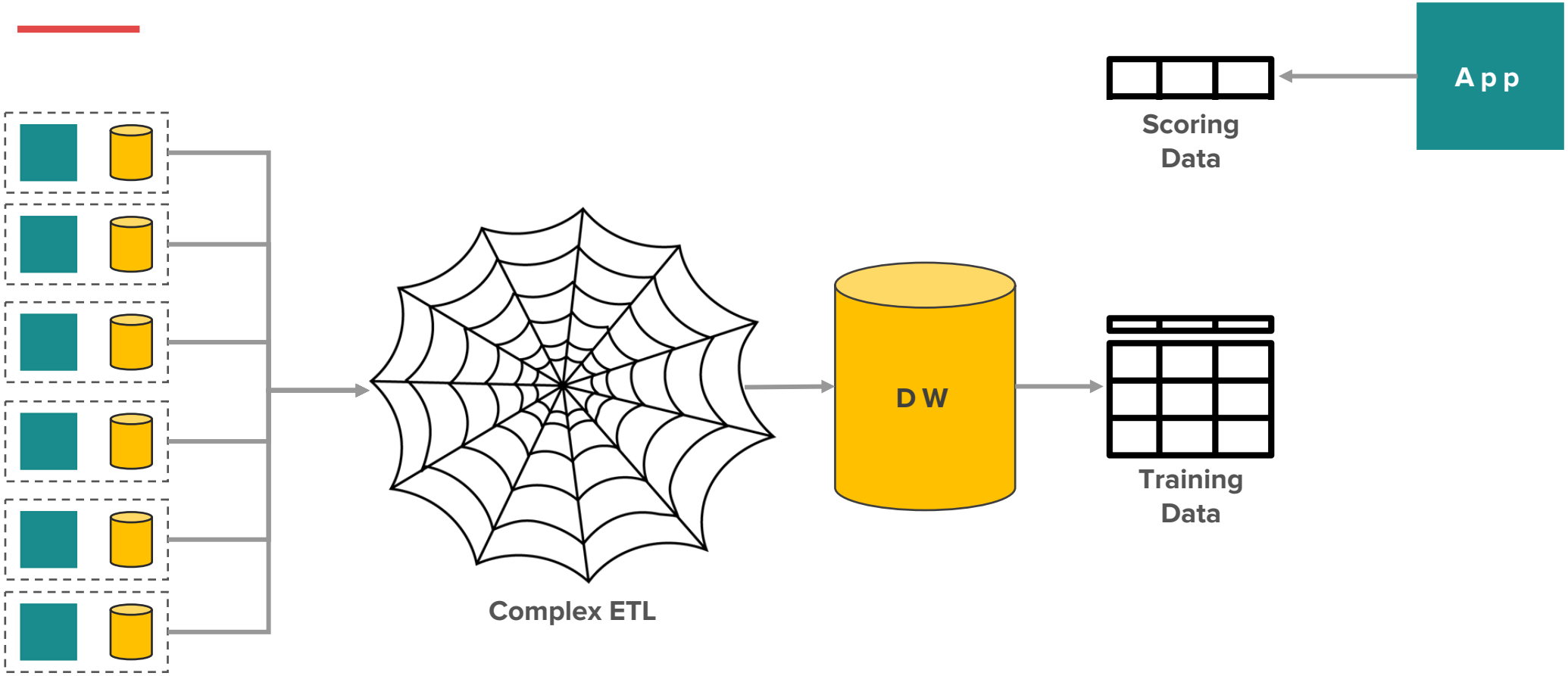


Old Data Architecture



Old Data Architecture



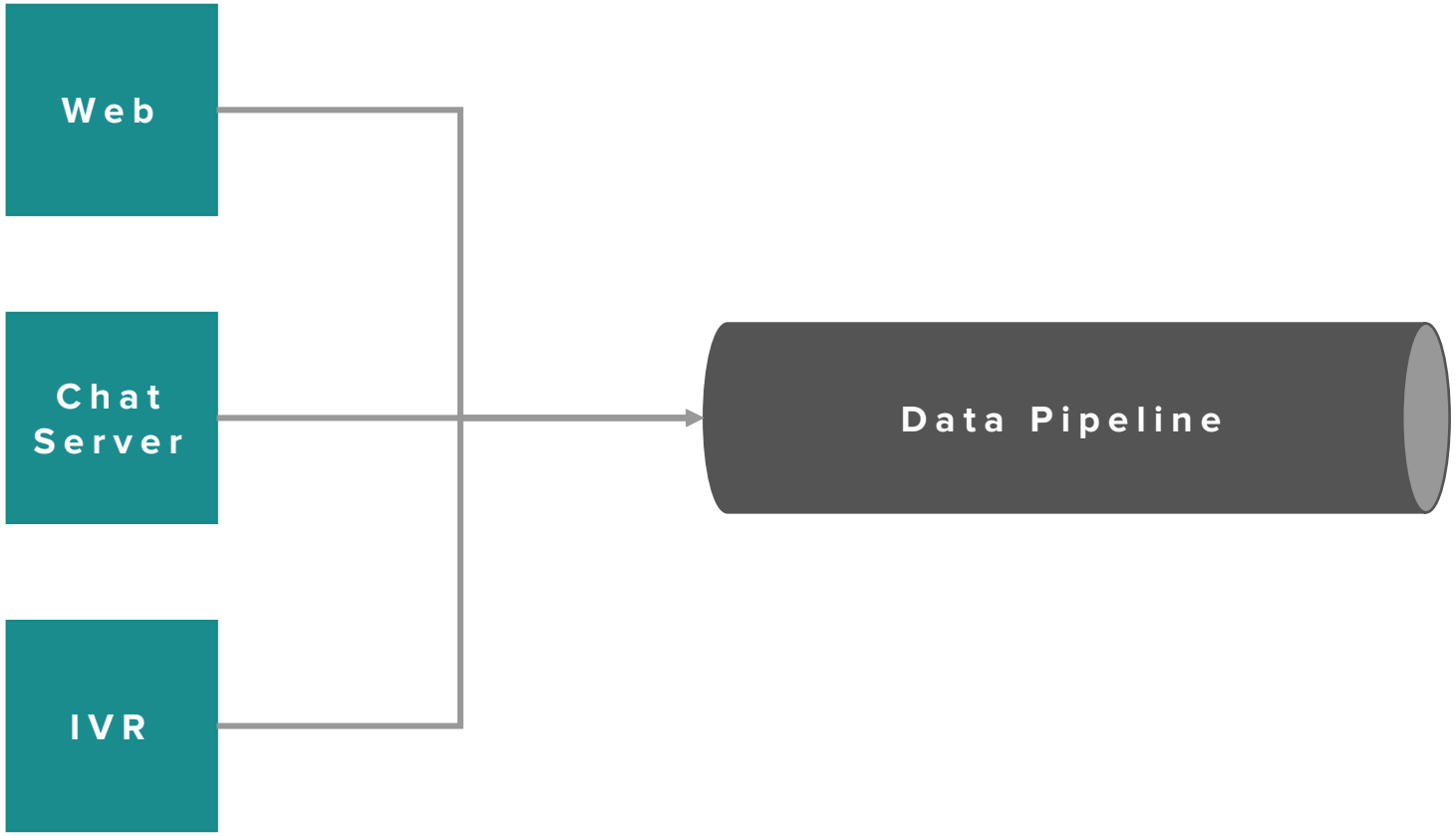
Pain Points

- Duplication of business logic
- Data drift

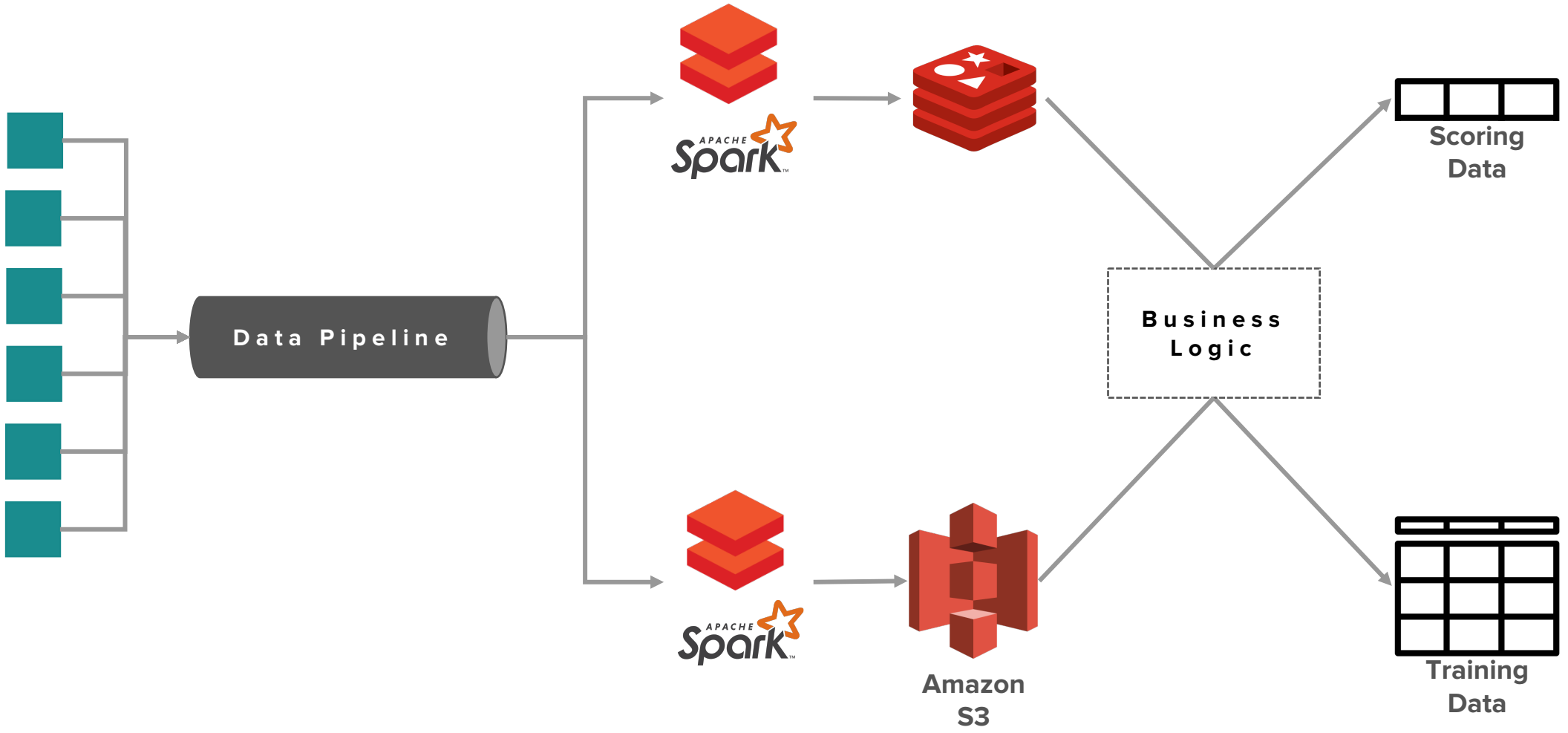
Goals

1. Immutable data
2. Write business logic once
3. Make data available in real-time

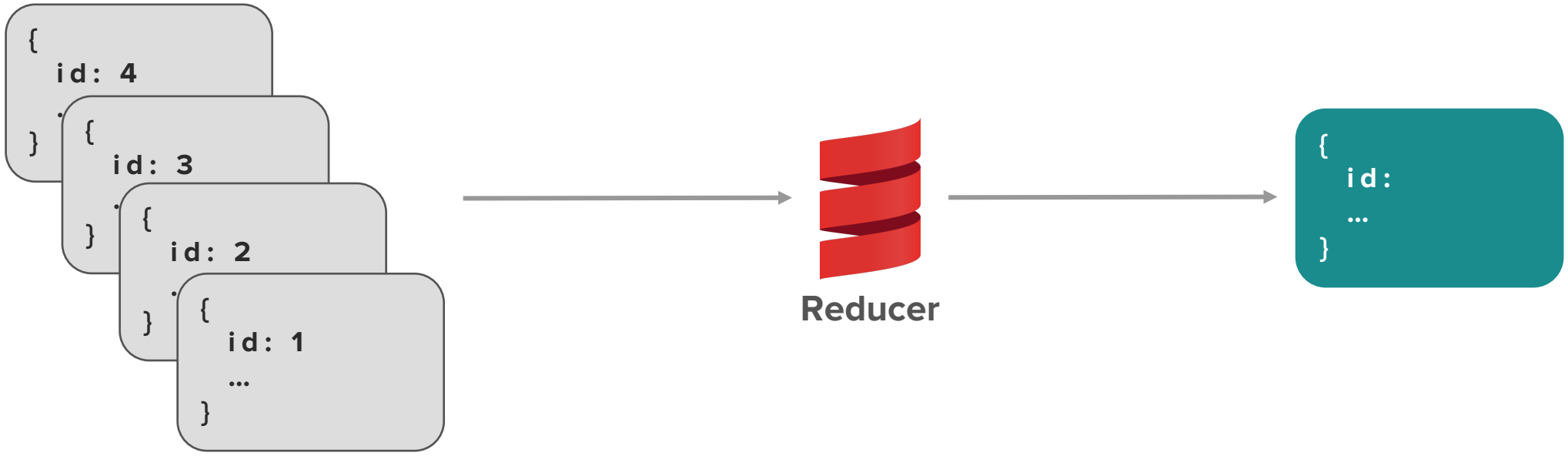
Event-Driven Architecture



New Data Architecture



Projections



Credit Card Recommendation

User Id	Keyword	Page View Count	Card Shown	Clicked
a	best travel cards	2	Travel	1
b	credit cards	3	Cash Back	0
c	top credit cards	1	Cash Back	1
d	credit cards	1	Travel	0

reducer

```
{
    "userId": "",
    "latestSearchKeyword": "",
    "pageViewCount": 0,
    "cardShown": "",
    "clicked": 0
}
```

```
{
    "id": 1,
    "userId": "z",
    "eventType": "Page Viewed",
    "timestamp": "2018-03-01T10:00:00.000Z",
    "data": {
        "url": "www.url.com/?keyword=airline...",
        "path": "/",
        "query": "keyword=airline%20miles%20card",
        "referrer": "www.google.com"
    }
}
```


reducer


```
{
    "userId": "z",
    "latestSearchKeyword": "airline miles card",
    "pageViewCount": 1,
    "cardShown": "",
    "clicked": 0
}
```

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{
    "id": 2,
    "userId": "z",
    "eventType": "Product Viewed",
    "timestamp": "2018-03-01T10:00:00.300Z",
    "data": {
        "type": "Credit Card",
        "name": "Travel"
    }
}
```

reducer

```
{
    "userId": "z",
    "latestSearchKeyword": "airline miles card",
    "pageViewCount": 1,
    "cardShown": "Travel",
    "clicked": 0
}
```

```
{
    "id": 3,
    "userId": "z",
    "eventType": "Product Clicked",
    "timestamp": "2018-03-01T10:02:00.000Z",
    "data": {
        "type": "Credit Card",
        "name": "Travel"
    }
}
```

reducer

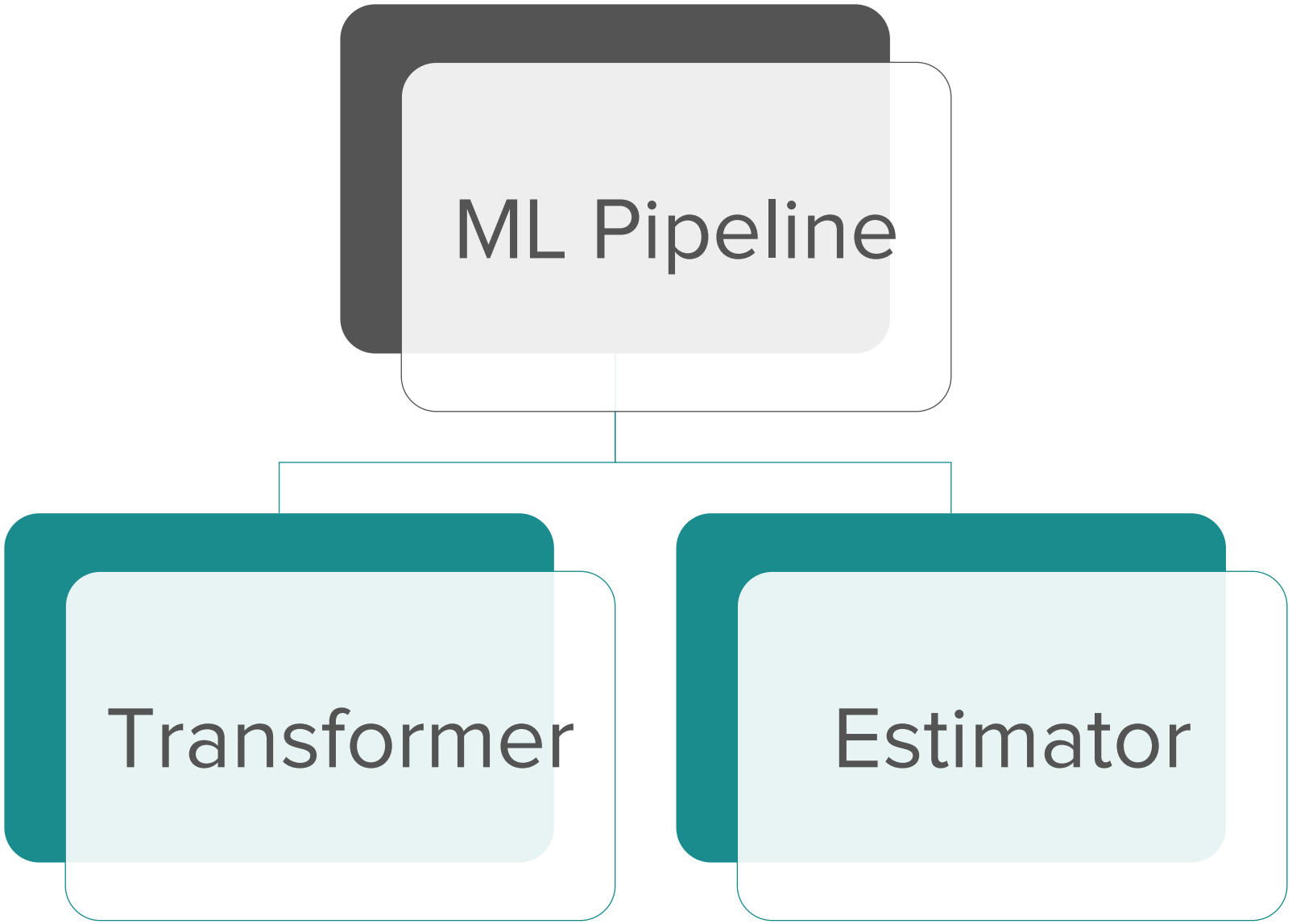
```
{
    "userId": "z",
    "latestSearchKeyword": "airline miles card",
    "pageViewCount": 1,
    "cardShown": "Travel",
    "clicked": 1
}
```

Credit Card Recommendation

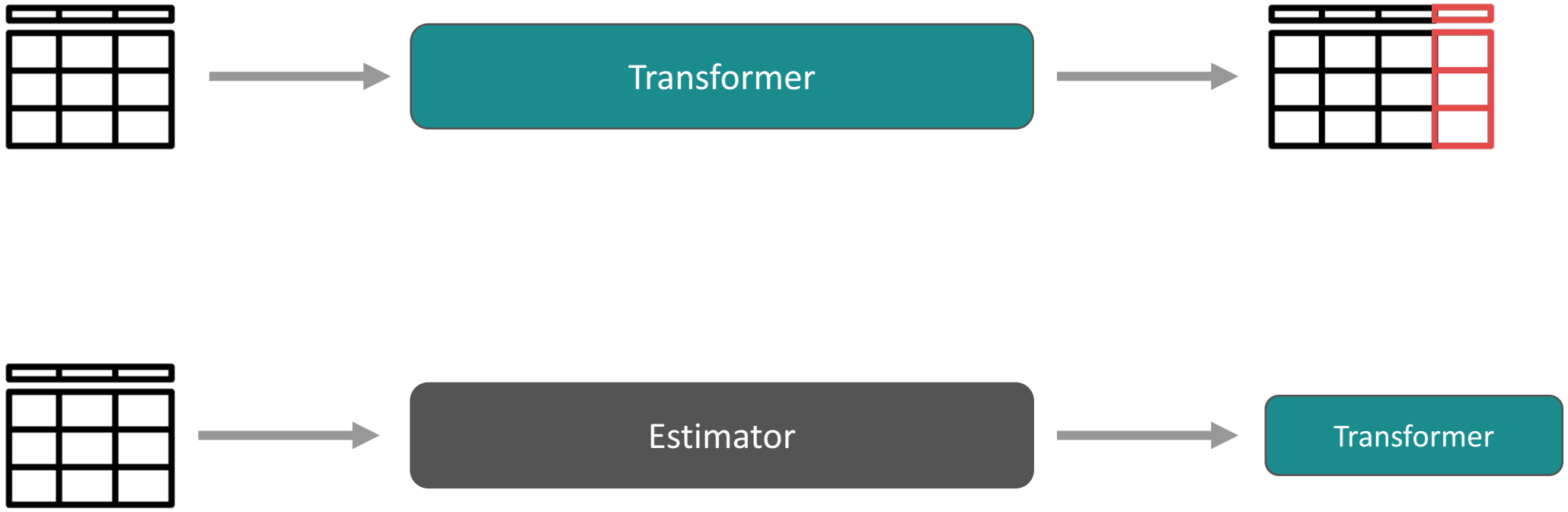
User Id	Keyword	Page View Count	Card Shown	Clicked
a	best travel cards	2	Travel	1
b	credit cards	3	Cash Back	0
c	top credit cards	1	Cash Back	1
d	credit cards	1	Travel	0
z	**airline miles card**	**1**	**Travel**	**1**

Data Science Process

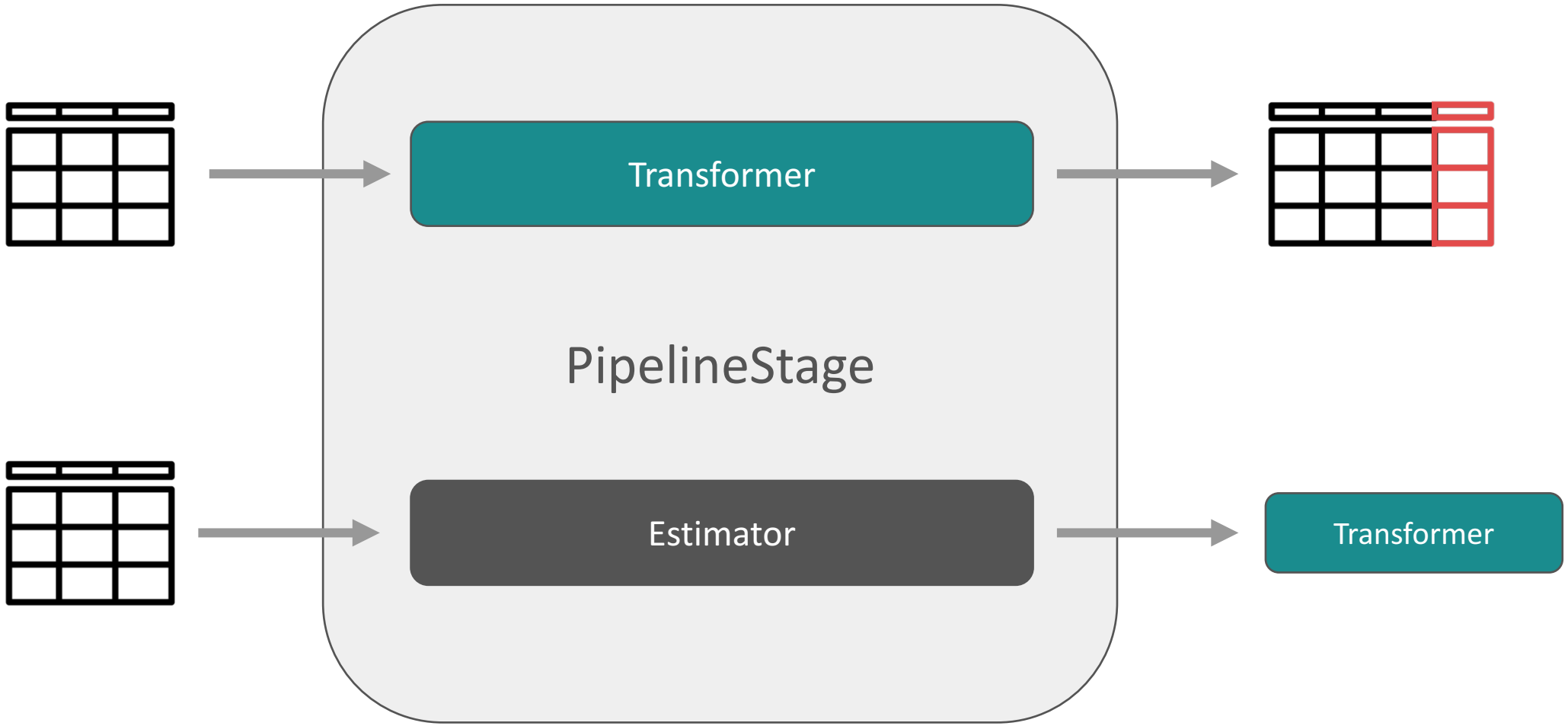
1. Data Collection
2. Machine Learning Pipelines
3. Model Deployment


ML Pipeline
Transformer
Estimator

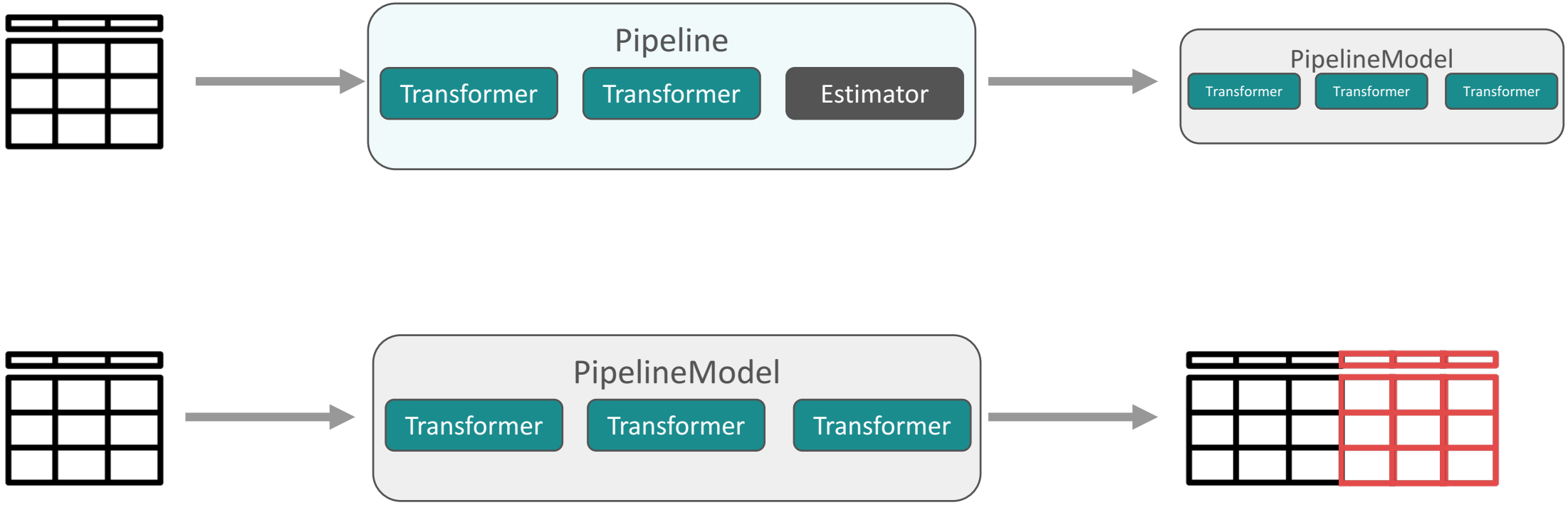
Spark: Estimators and Transformers



Spark: Estimators and Transformers

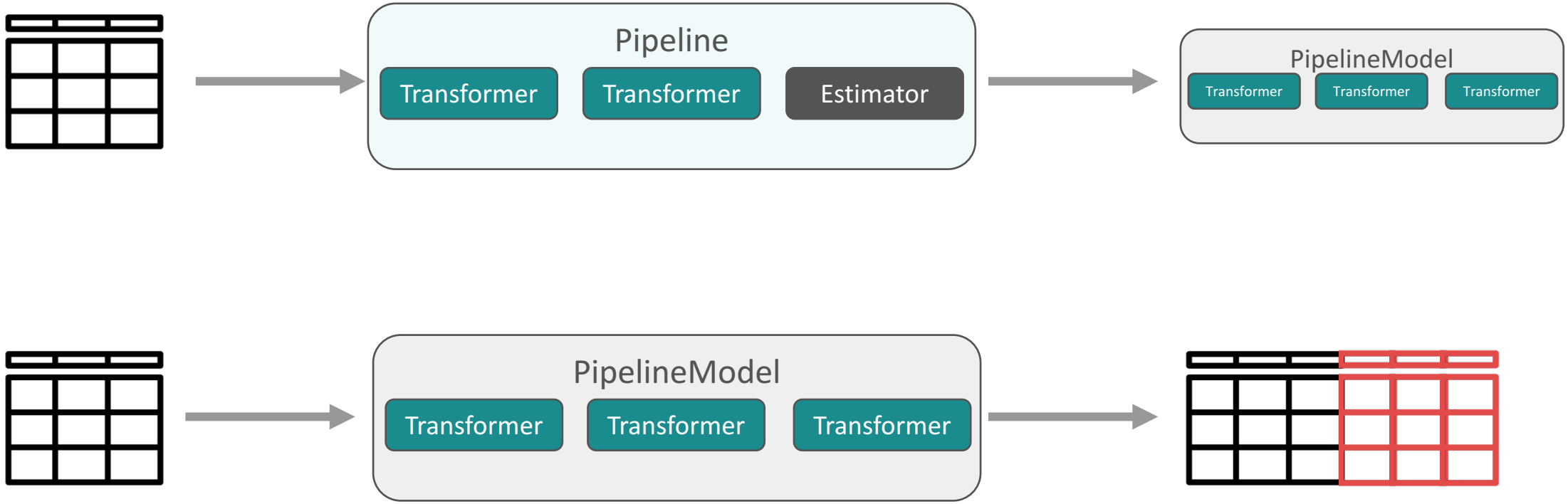


Spark: Estimators and Transformers

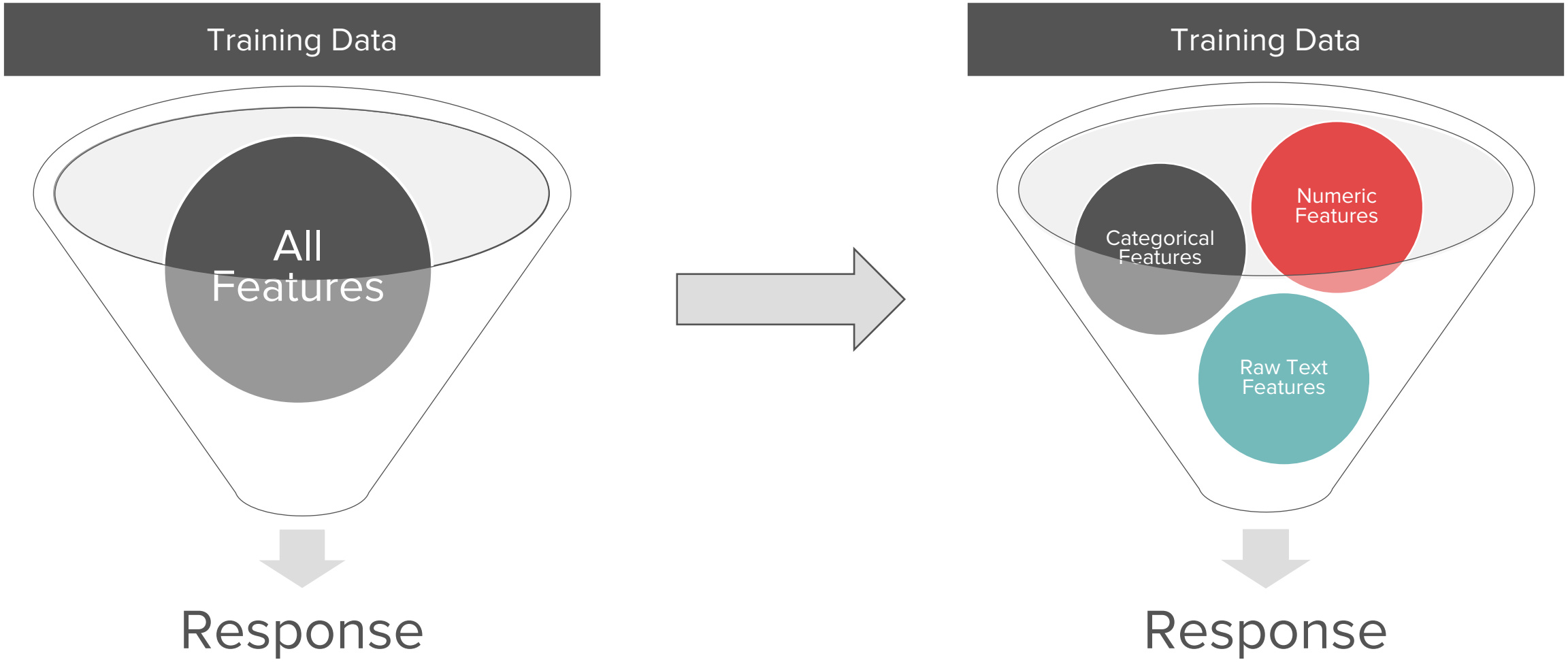


How do ML algorithms fit in?

Spark: Estimators and Transformers



Generalizing Data Science

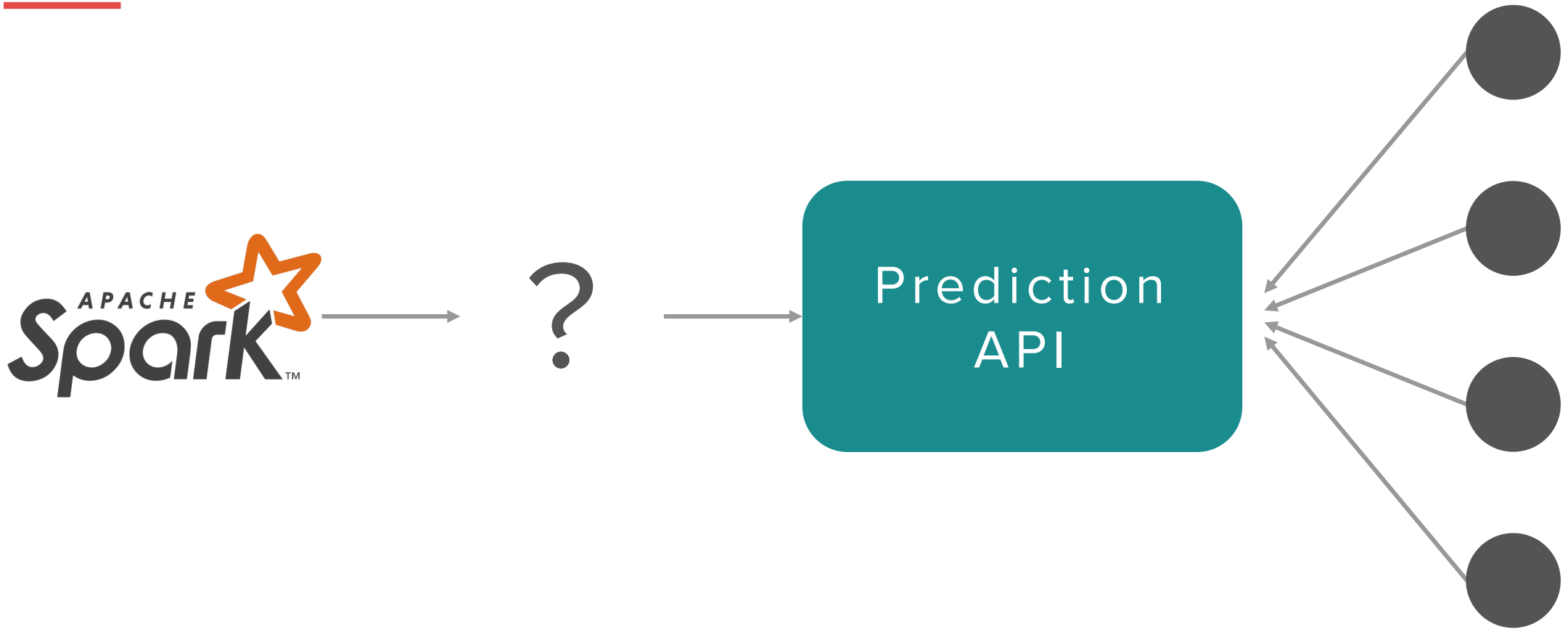


We fit our pipeline… now what?

Data Science Process

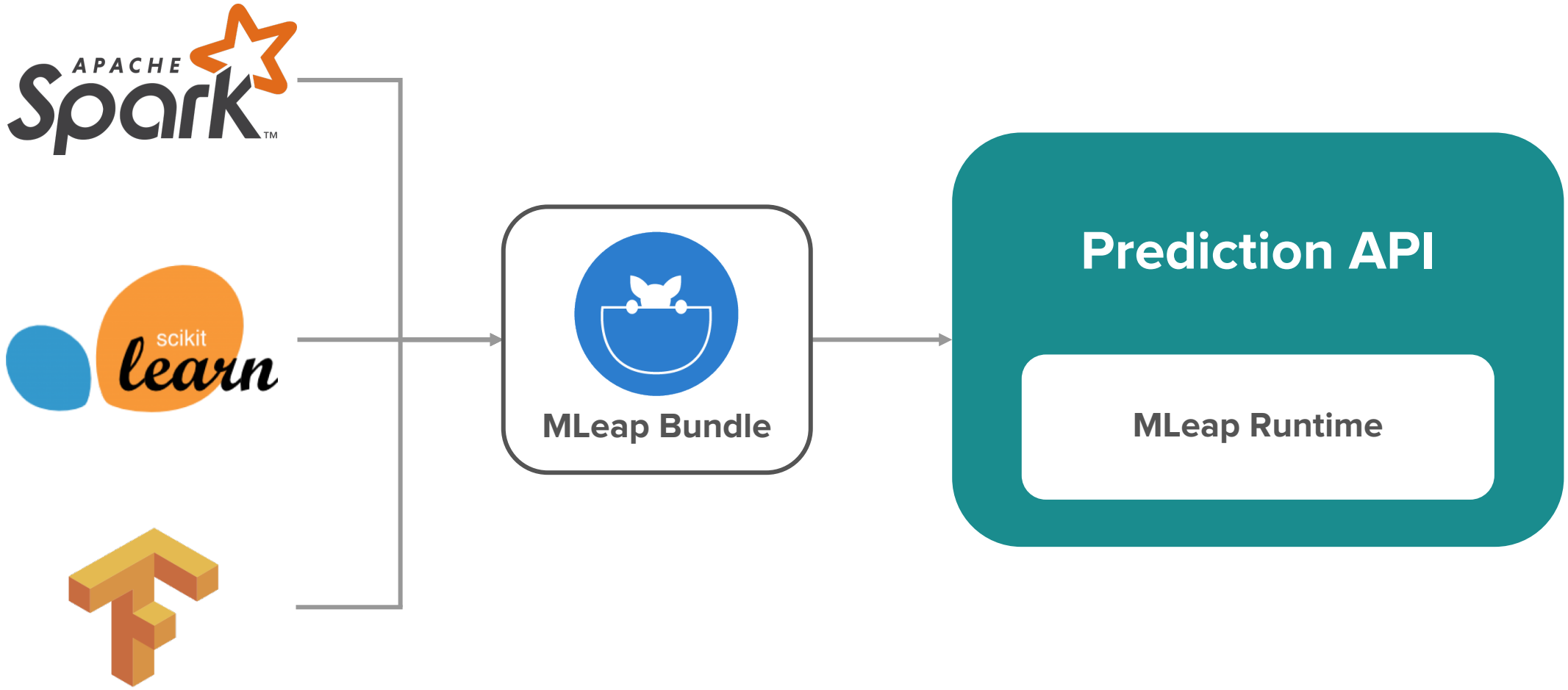
1. Data Collection
2. Machine Learning Pipelines
3. Model Deployment

Real-time scoring paradigm

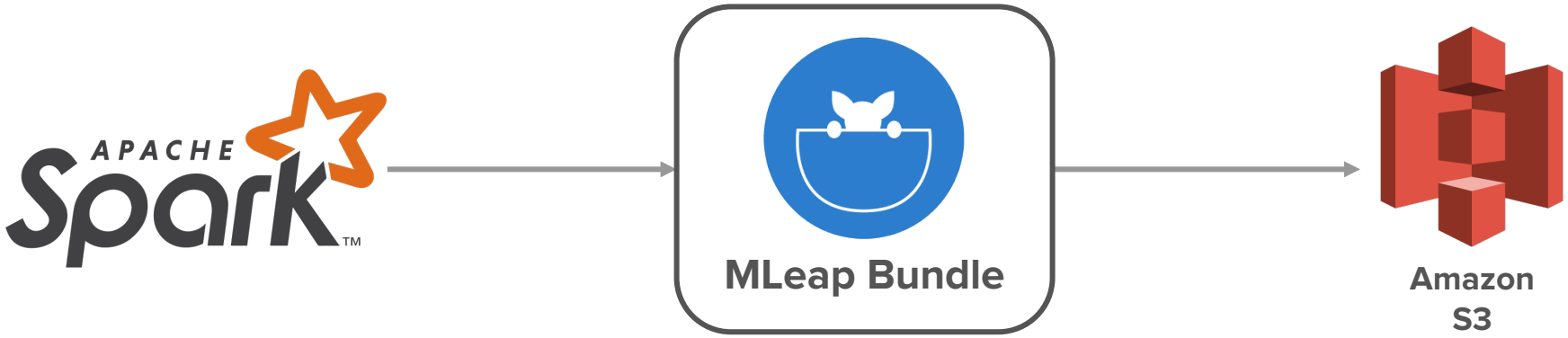


Model evaluation in real-time – with Spark

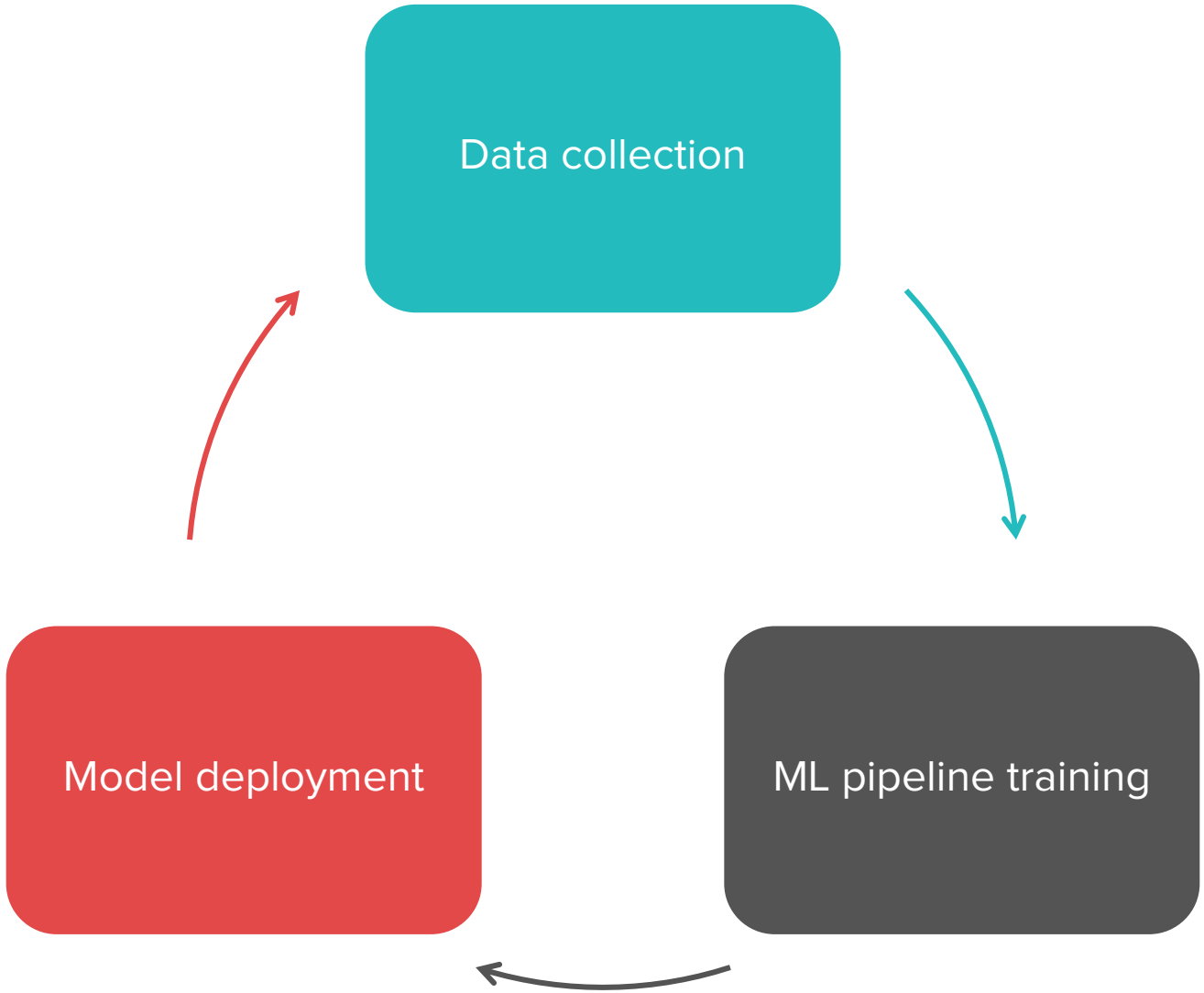
Model evaluation in real-time – with MLeap



Model deployment



Prediction API


Data collection
ML pipeline training
Model deployment

Recap

1. Data Collection
2. Machine Learning Pipelines
3. Model Deployment

New capabilities

>

New algorithms

300+

Real-Time Scoring Models

1

# of people required to productionize model

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