Change Data Streaming Patterns for Microservices With Debezium

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  - **Debezium**
  - Hibernate
- **Spec Lead** for Bean Validation 2.0
- Other projects: **Deptective**, MapStruct

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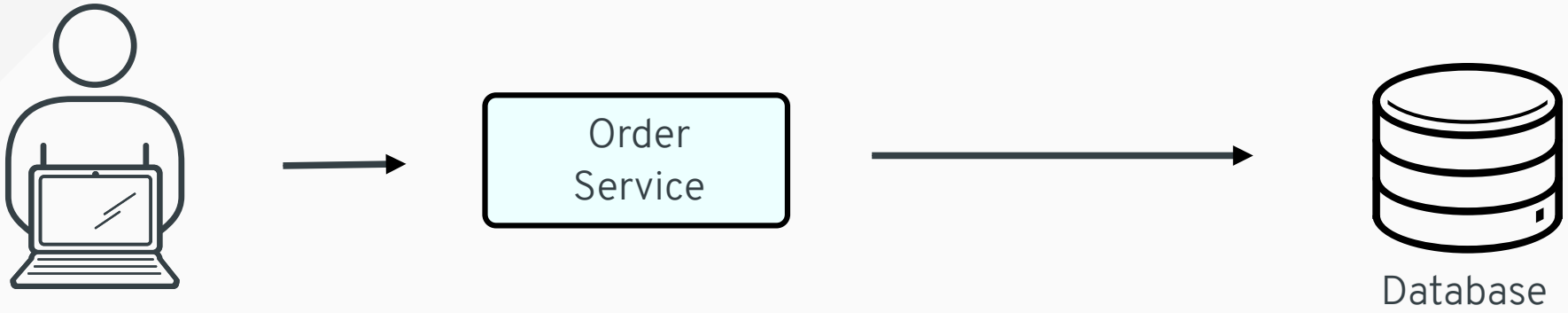
A Common Problem

Updating Multiple Resources



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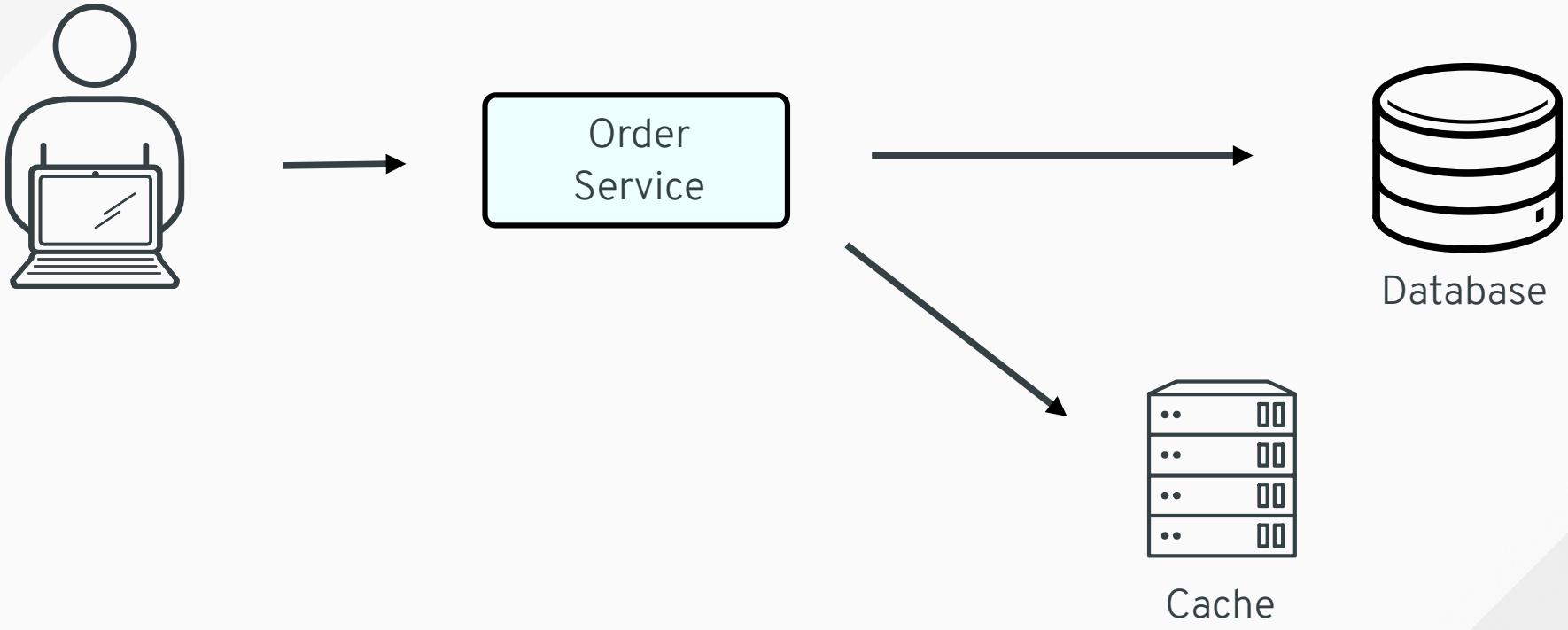

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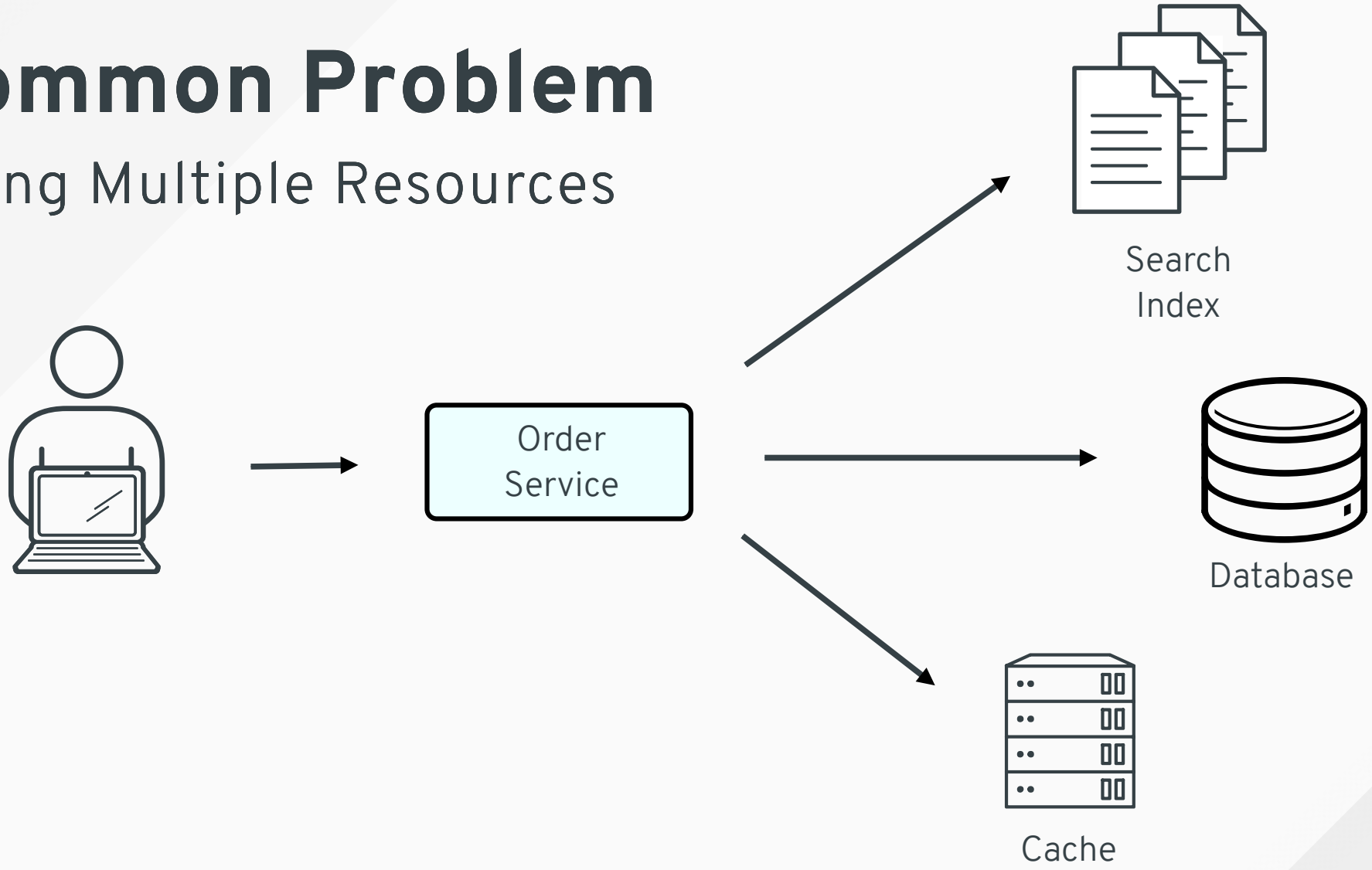

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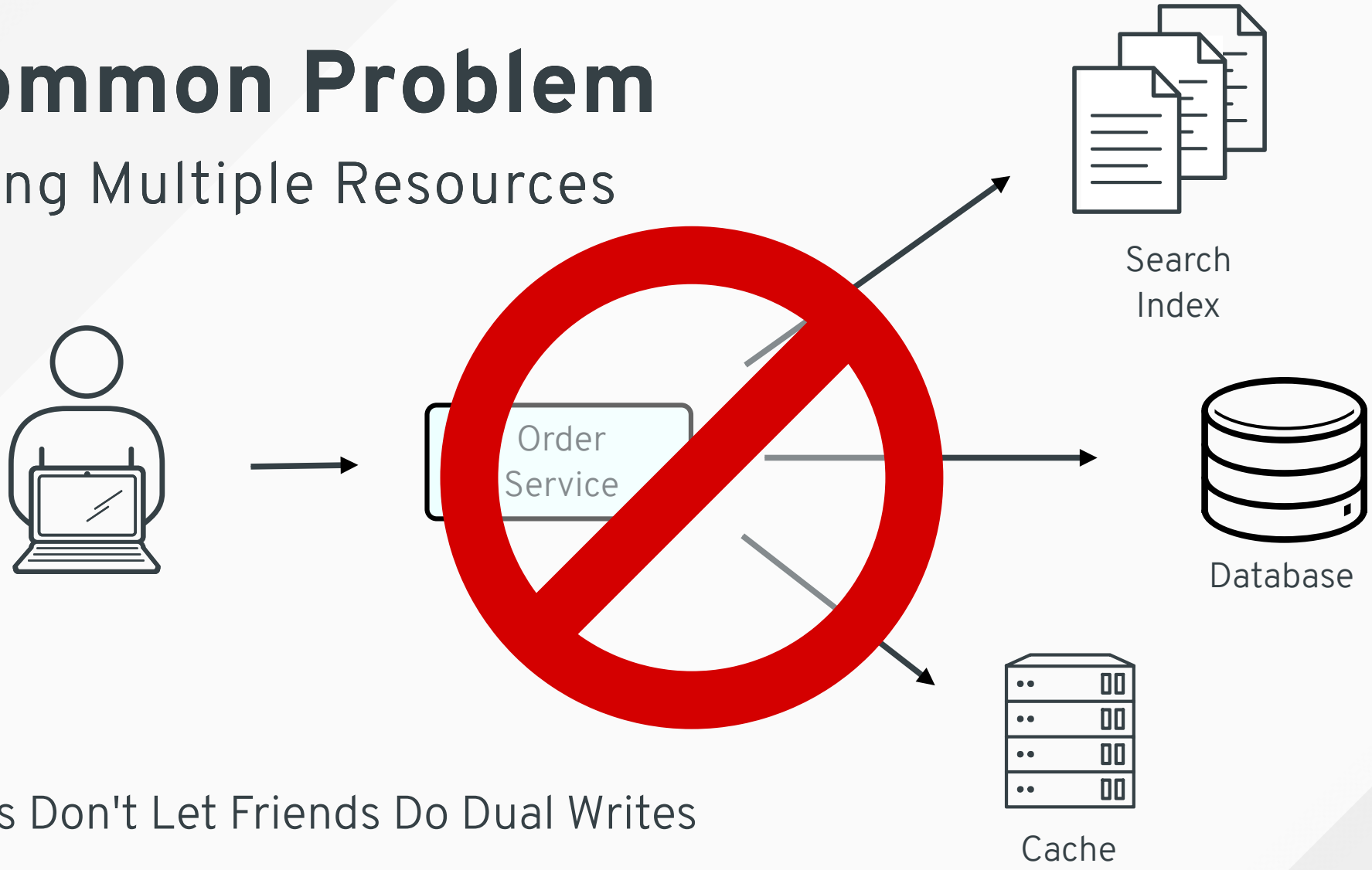
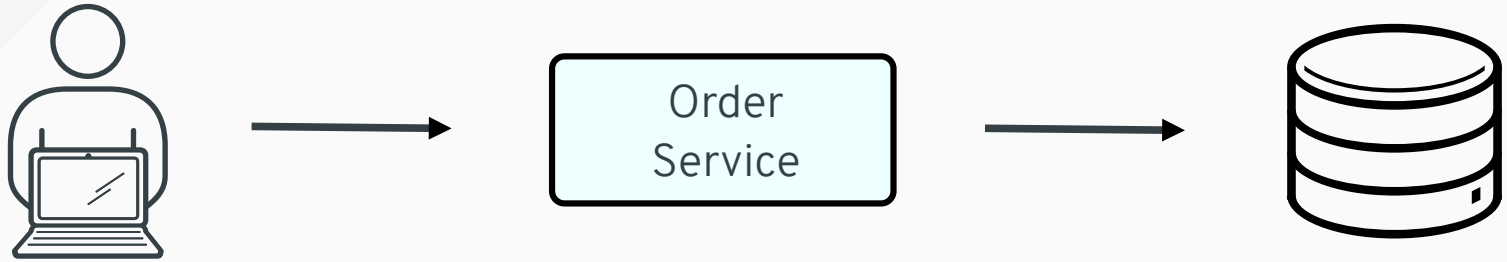


“ Friends Don't Let Friends Do Dual Writes

A Better Solution

Streaming Change Events From the Database



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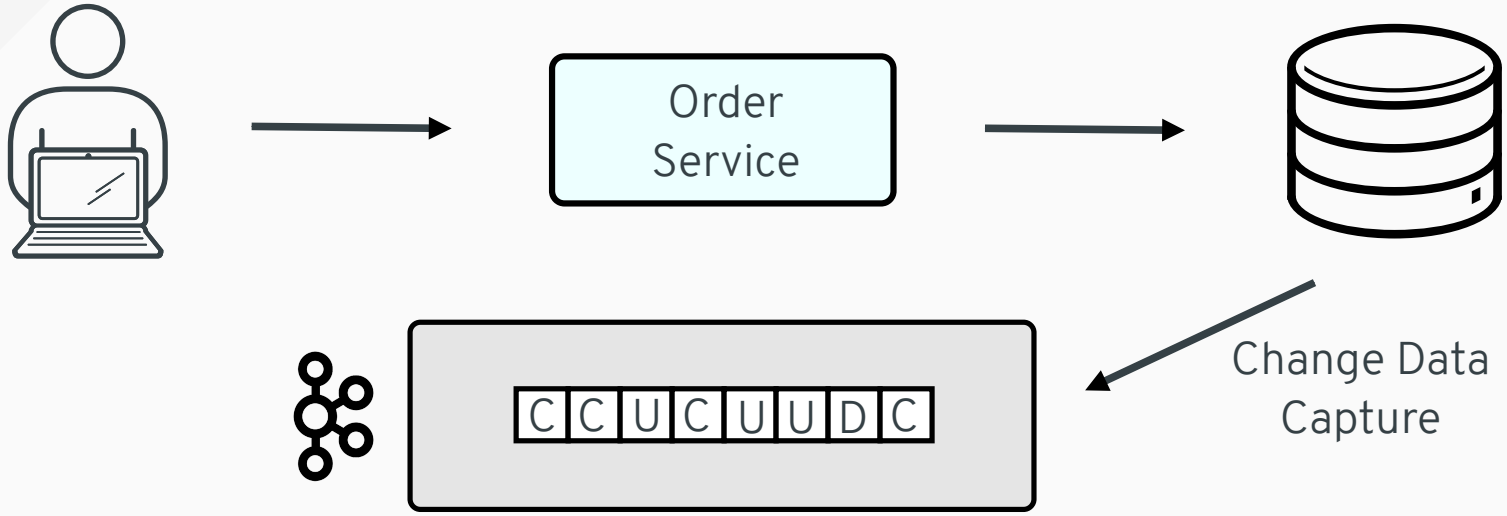
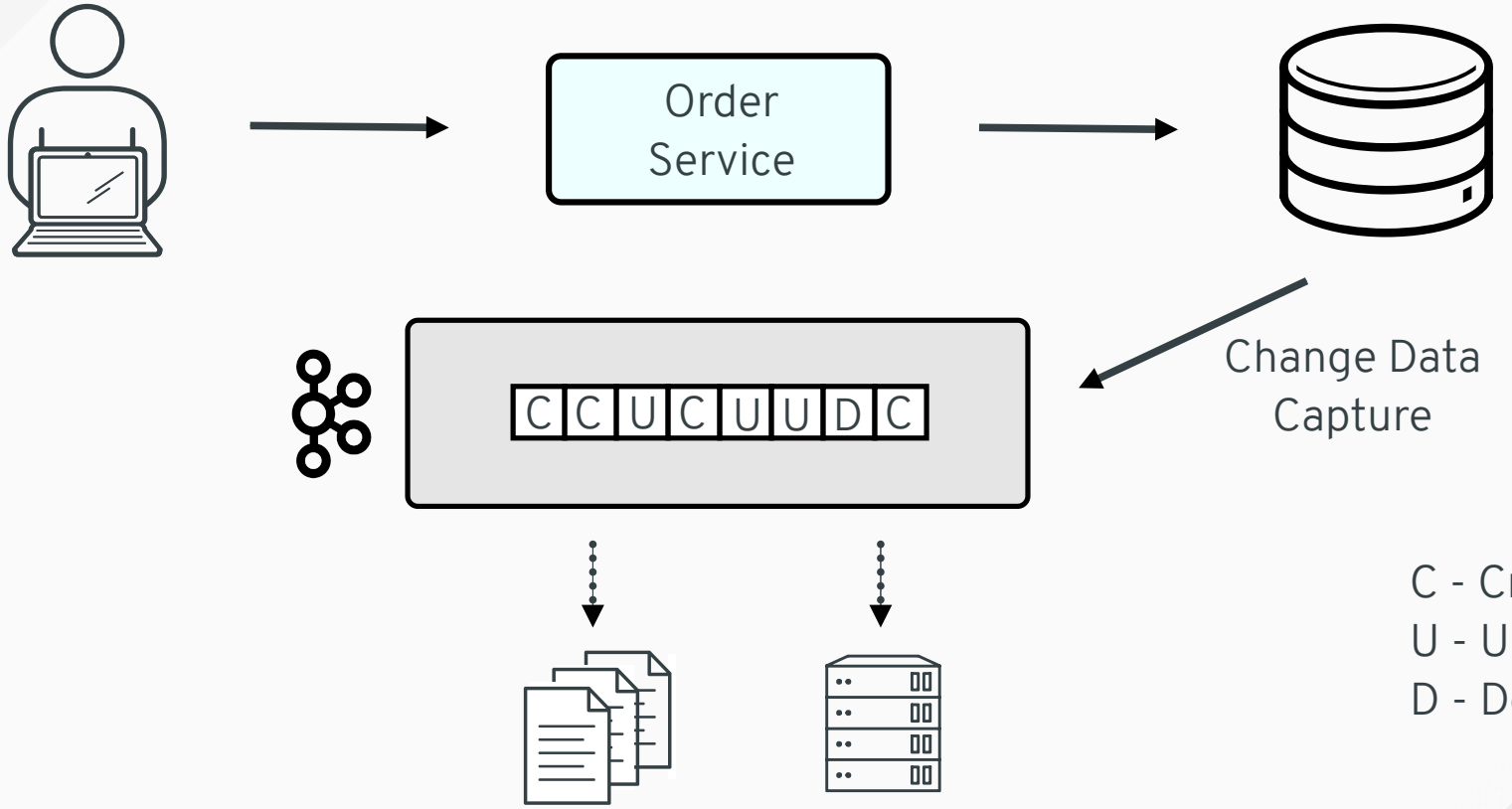


C - Create
U - Update
D - Delete

A Better Solution

Streaming Change Events From the Database

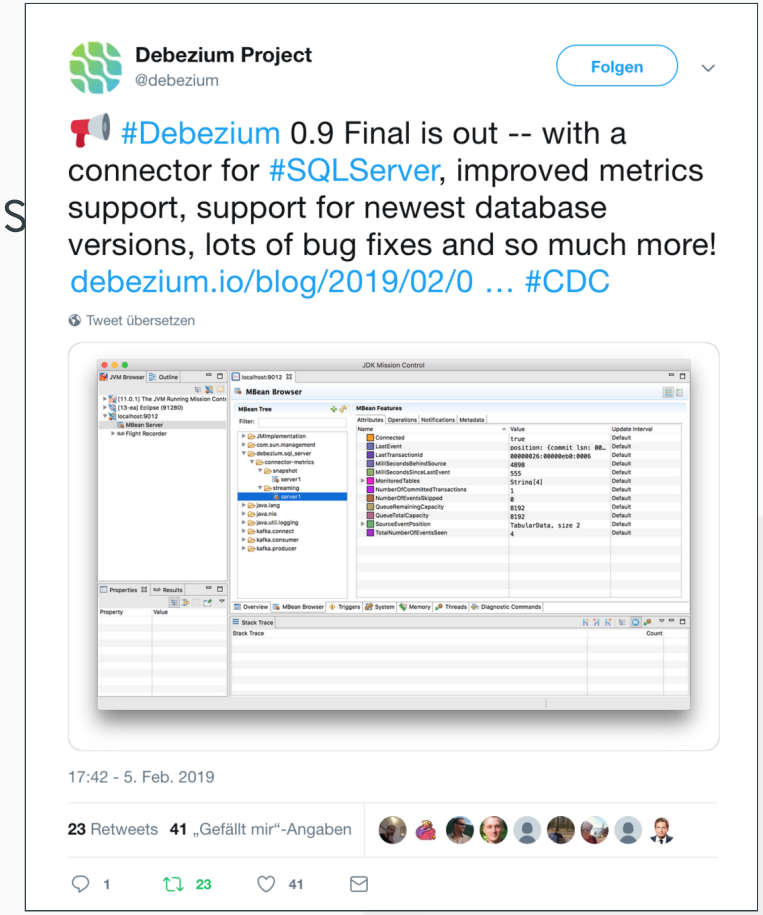



Change Data Capture
With Debezium

Debezium

Change Data Capture Platform

- Retrieves change events from **TX logs** from different DBs
  - Transparent to writing apps
  - Comprehensive **type support** (PostGIS etc.)
  - **Snapshotting**, Filtering etc.
- Fully open-source, very **active community**
- Latest version: 0.9 (based on **Kafka 2.1**)
- Production deployments at multiple companies (e.g. WePay, Trivago, BlaBlaCar etc.)



Advantages of Log-based CDC

Tailing the transaction log

- **All data changes** are captured
- **No polling delay** or overhead
- **Transparent** to writing applications and models
- Can **capture deletes**
- Can capture **old record state** and further meta data
- Different formats/APIs, but Debezium deals with this

Debezium

CDC Use Cases

- Update or invalidate **caches**
- Enable **full-text search** via Elasticsearch, Solr etc.
- Data **replication**
- **Microservices** data exchange
- **Auditing**/historization
- Update **CQRS** read models
- Enable **streaming queries**

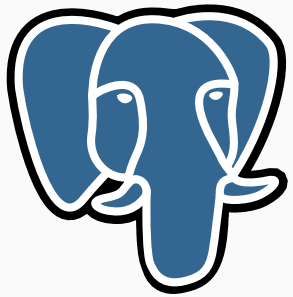
Change Event Structure

- Key (PK of table) and Value
- Payload: **Before** state, **After** state, **Source** info
- Serialization format:
  - JSON
  - Avro (with Confluent Schema Registry)

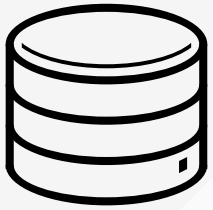
```
{
  "schema": {
    ...
  },
  "payload": {
    "before": null,
    "after": {
      "id": 1004,
      "first_name": "Anne",
      "last_name": "Kretchmar",
      "email": "annek@noanswer.org"
    },
    "source": {
      "name": "dbserver1",
      "server_id": 0,
      "ts_sec": 0,
      "file": "mysql-bin.000003",
      "pos": 154,
      "row": 0,
      "snapshot": true,
      "db": "inventory",
      "table": "customers"
    },
    "op": "c",
    "ts_ms": 1486500577691
  }
}
```

Debezium Connectors

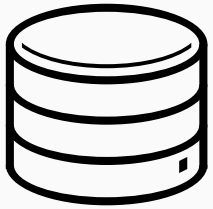
- **MySQL**
- **Postgres**
- **MongoDB**
- **SQL Server**
- **Oracle** (Tech Preview, based on XStream)
- Possible future additions
  - Cassandra?
  - MariaDB?



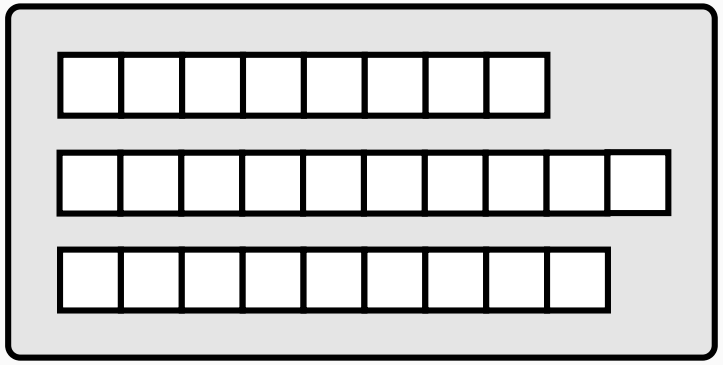
CDC with Debezium and Kafka Connect



MySQL

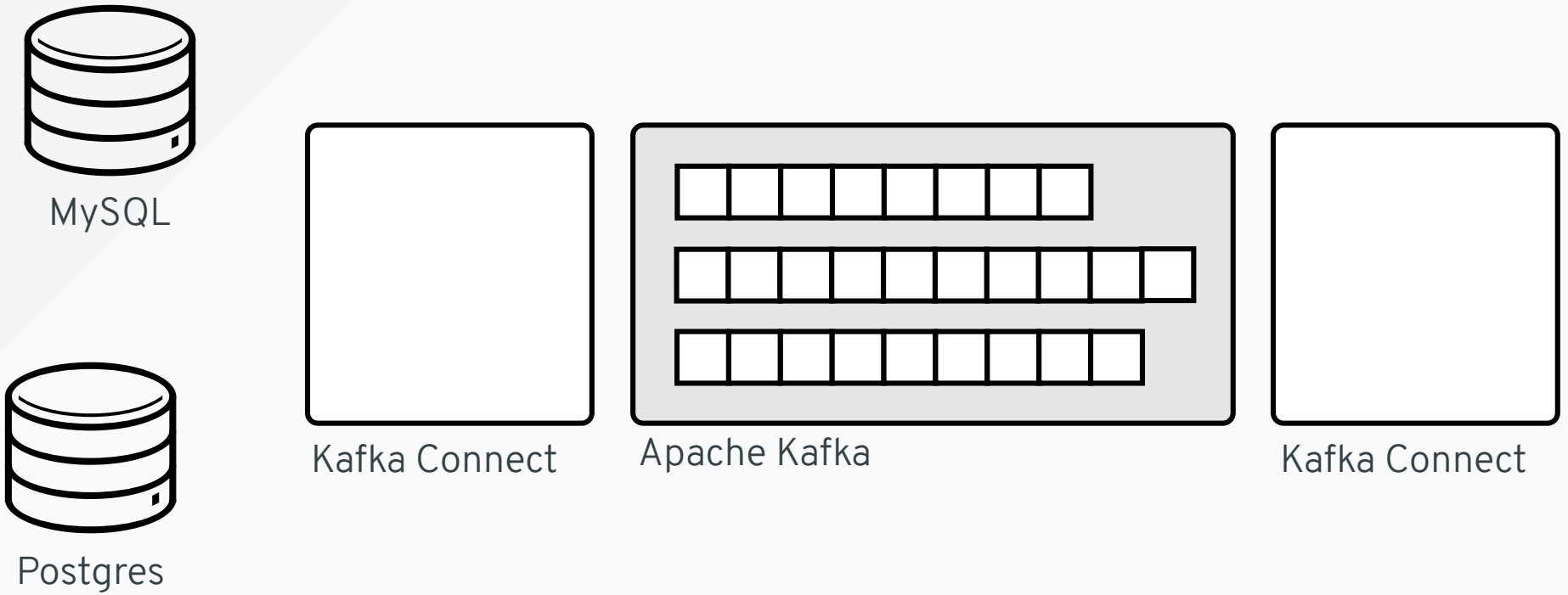


Postgres



Apache Kafka

CDC with Debezium and Kafka Connect



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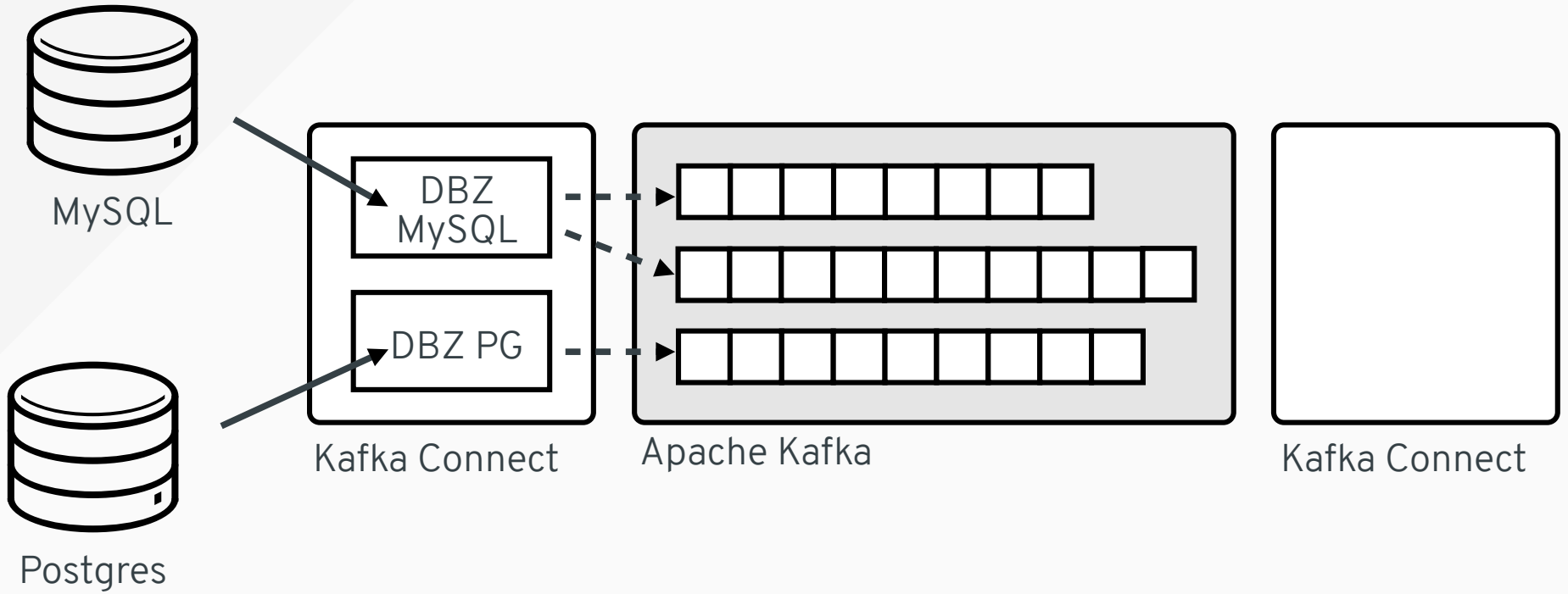

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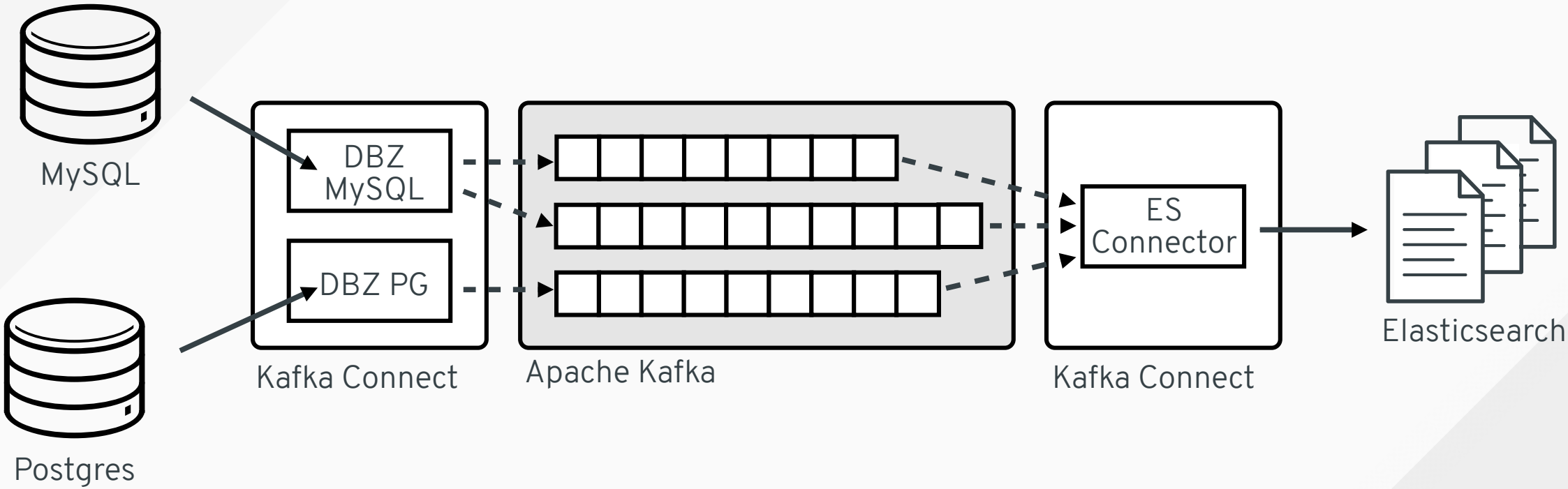
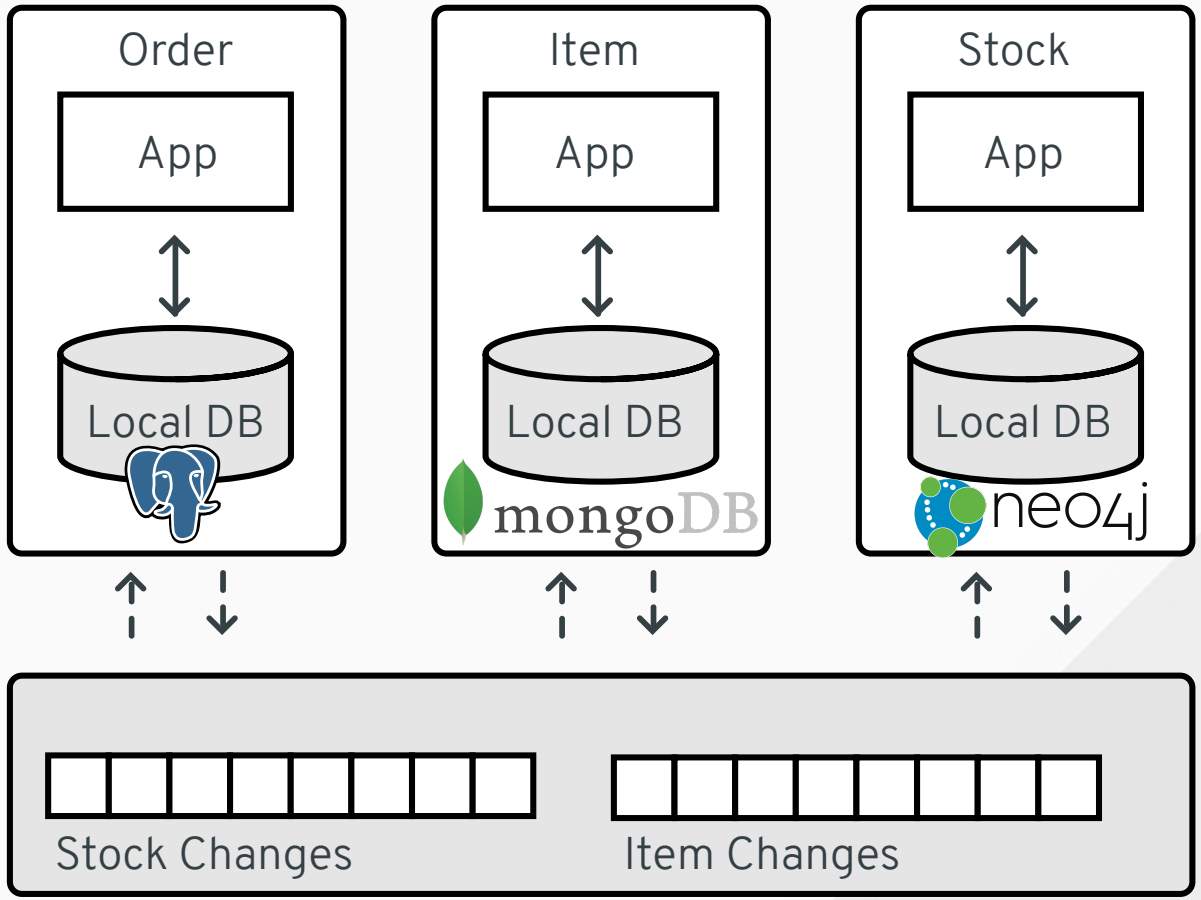



Microservice
CDC Patterns

Pattern: Microservice Data Synchronization

Microservice Architectures

- Propagate data between different services **without coupling**
- Each service keeps **optimised views locally**

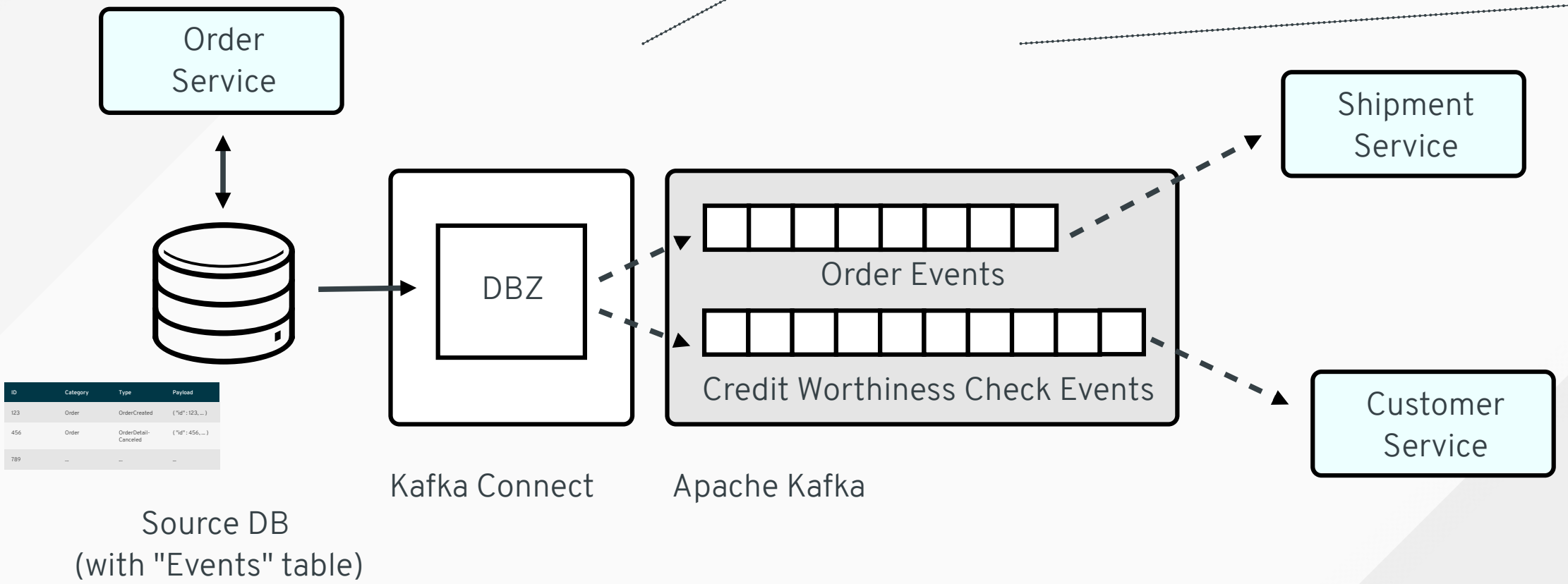


Pattern: Outbox

Separate Events Table

"Outbox" table

Id	AggregateType	AggregateId	Type	Payload
ec6e	Order	123	OrderCreated	{ "id" : 123, ... }
8af8	Order	456	OrderDetailCanceled	{ "id" : 456, ... }
890b	Customer	789	InvoiceCreated	{ "id" : 789, ... }



Pattern: Microservice Extraction

Migrating from Monoliths to Microservices

- **Extract microservice** for single component(s)
- Keep write requests **against running monolith**
- **Stream changes** to extracted microservice
- Test new functionality
- **Switch over**, evolve schema only afterwards

Pattern: Leverage the Powers of SMTs

Single Message Transformations

- **Aggregate** sharded tables to single topic
- **Keep compatibility** with existing consumers
- **Format conversions**, e.g. for dates
- Ensure compatibility with sink connectors
  - Extracting "after" state only
  - Expand MongoDB's JSON structures


Demo

Running Debezium on Kubernetes

AMQ Streams: Enterprise Distribution of Apache Kafka

- Provides
  - **Container images** for Apache Kafka, Connect, Zookeeper and MirrorMaker
  - **Operators** for managing/configuring Apache Kafka clusters, topics and users
  - Kafka Consumer, Producer and Admin clients, Kafka Streams
- Supported by Red Hat
- Upstream Community: **Strimzi**

Summary

- **CDC** enables use cases such as replication, microservices data exchange and much more
- **Debezium:** CDC for a growing number of databases
- **Contributions welcome!**
- Tell us about your **feature requests and ideas!**

Resources

- **Website:** http://debezium.io/
- **Source code**, examples, Compose files etc. https://github.com/debezium
- **Discussion group** https://groups.google.com/forum/#!forum/debezium
- **Strimzi** (Kafka on Kubernetes/OpenShift) http://strimzi.io/
- **Latest news:** @debezium