THE DEVELOPER'S CONFERENCE

Change Data Streaming Patterns in Distributed Systems

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Today's Objectives

Outbox Pattern

Strangler Fig Pattern

Saga Pattern

... implemented using **Change Data Capture**

Gunnar Morling

- Open source software engineer at Red Hat
  - **Debezium**
  - Quarkus
- **Spec Lead** for Bean Validation 2.0
- Java Champion

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Hans-Peter Grahsl

- Technical Trainer at NETCONOMY
- Independent Engineer & Consultant
- Confluent Community Catalyst
- MongoDB Champion
- @hpgrahsl

Debezium — Log-based Change Data Capture

- **Taps into TX log** to capture INSERT/UPDATE/DELETE events
- Propagated to consumers via **Apache Kafka** and Kafka Connect

Detour: Data Change Events

- Message Key: **table PK**
- Message Value:
  - **Old and new row state**
  - **Metadata** on table, TX id, etc.
  - **Operation type**, timestamp
- Serialized as JSON, Avro, etc.

```
{
    "before": {
        "id": 1,
        "first_name": "Anne",
        "last_name": "Kretchmar",
        "email": "annek@noanswer.org"
    },
    "after": {
        "id": 1,
        "first_name": "Anne",
        "last_name": "Grant",
        "email": "annek@noanswer.org"
    },
    ...
}
```

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```
{
    ...
    "source": {
        "version": "1.6.0.Alpha1",
        "connector": "postgresql",
        "name": "PostgreSQL_server",
        "ts_ms": 1559033904863,
        "snapshot": true,
        "db": "postgres",
        "schema": "public",
        "table": "customers",
        "txId": 555,
        "lsn": 24023128
    },
    "op": "u",
    "ts_ms": 1559033904863
}
```

Outbox Pattern

The Problem: Microservices Data Exchange

- Services need to update their **database,**
- send messages to **other services,**
- and that **consistently**!

Outbox Pattern

"Dual writes" are **prone to inconsistencies**!

Outbox Pattern

Outbox Pattern

Outbox Pattern

Outbox Pattern

Id	AggregateType	AggregateId	EventType	Payload
ec6e	Order	123	OrderCreated	{"id": 123,...}
8af8	Order	456	OrderLineChanged	{"id": 456,...}
...				

Strangler Fig Pattern

The Problem: Migrating Systems

- **Gradually evolve** from old into new
- Support temporary **coexistence**
- **Avoid big bang** cut-over

Strangler Fig Pattern

Strangler Fig Pattern

Strangler Fig Pattern

Strangler Fig Pattern

Strangler Fig Pattern

Strangler Fig Pattern

Strangler Fig Pattern

Benefits

- Incremental migration → **“baby steps”**
- **Pause or stop** migration without losing spent efforts
- Migration steps ideally **reversible**

Rationale: ⚠️ **minimize risk** ⚠️

CDC Close-Up

Enhanced CDC Processing

Enhanced CDC Processing

Enhanced CDC Processing

Saga Pattern

The Problem: Long-running Business Transactions

- Multiple services need to **act collaboratively** to achieve a consistent outcome
- **Without 2-phase commit** protocols
- Ensure **correctness** in case of failures

Saga Pattern

Saga Pattern

Saga Pattern

Demo

Wrap-Up

Takeaways

- **CDC:** a powerful tool in the box for event-driven architectures
- **Debezium:** open-source CDC for a variety of databases
- **Call to Action:**
  Would you like **built-in Saga support**?

Resources

- **Outbox** implementation
  https://debezium.io/blog/2019/02/19/reliable-microservices-data-exchange-with-the-outbox-pattern/
- **Strangler fig** pattern
  https://martinfowler.com/bliki/StranglerFigApplication.html
- **Saga** implementation
  https://www.infoq.com/articles/saga-orchestration-outbox/
- **Demo** repo
  https://github.com/debezium/debezium-examples

Thank You!

Q & A

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