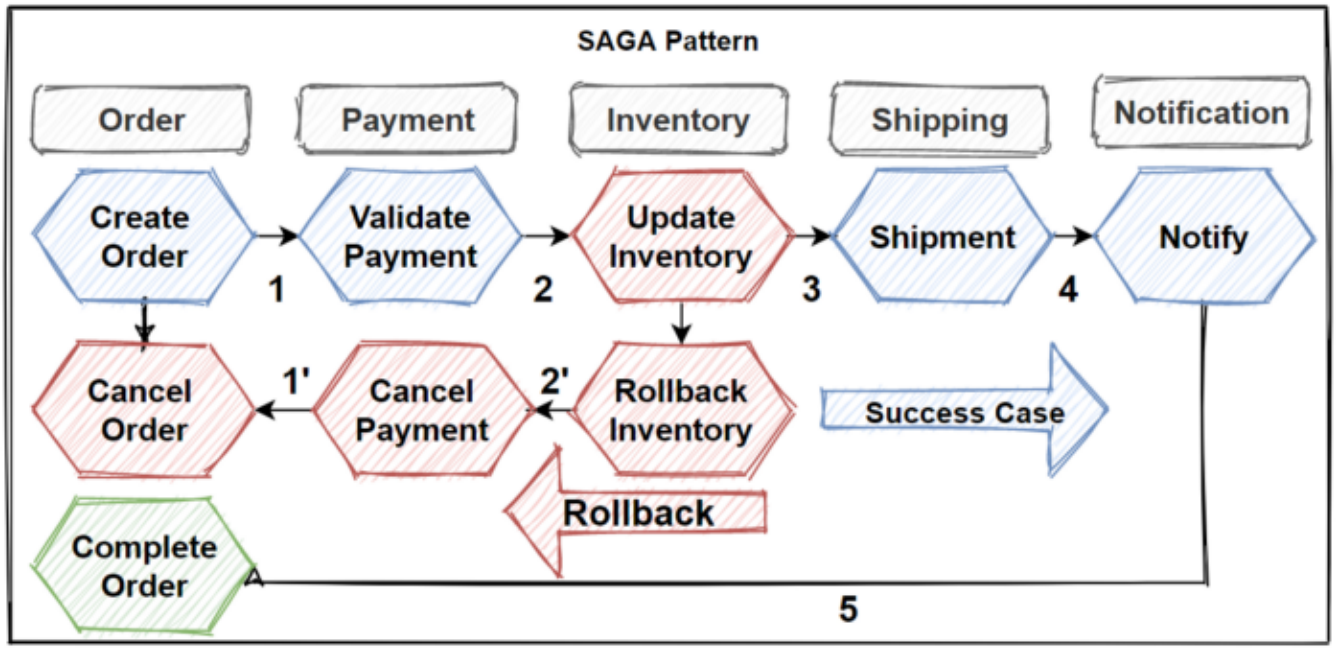
# Saga Pattern for Microservices Distributed Transactions

In this article, we are going to talk about **Design Patterns** of Microservices architecture which is **The Saga Pattern**. As you know that we learned **practices** and **patterns** and add them into our **design toolbox**. And we will use these **pattern** and **practices** when **designing e-commerce microservice architecture**.




By the end of the article, you will learn where and when to **apply Saga Pattern** into **Microservices Distributed Architecture** with designing **e-commerce application** system.

### Step by Step Design Architectures w/ Course

**I have just published a new course — Design Microservices Architecture with Patterns & Principles.**

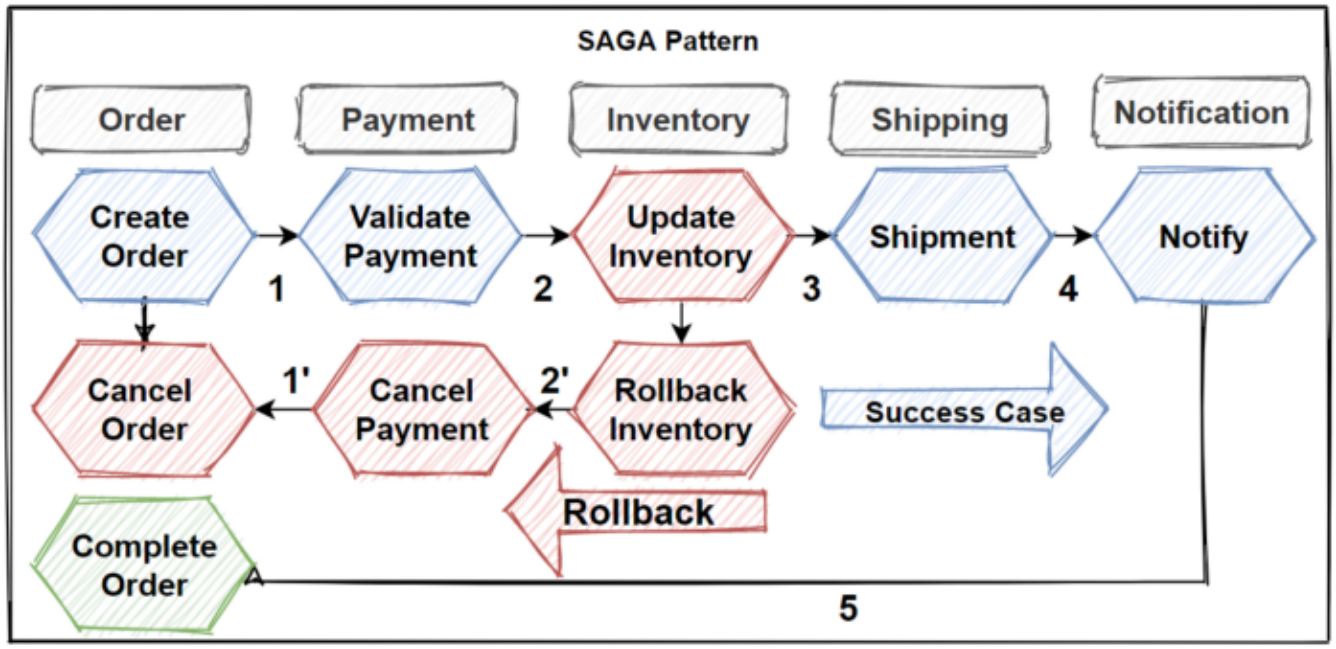
In this course, we're going to learn **how to Design Microservices Architecture** with using **Design Patterns, Principles** and the **Best Practices.** We will start with designing **Monolithic** to **Event-Driven Microservices** step by step and together using the right architecture design patterns and techniques.

## Saga Pattern for Distributed Transactions

The **saga** design pattern is provide to manage data consistency across microservices in **distributed transaction** cases. Basically, saga patterns offers to create a **set** of **transactions** that **update microservices sequentially**, and publish events to trigger the next transaction for the next microservices.

If one of the step is failed, than **saga patterns** trigger to **rollback transactions** which is basically do reverse operations with **publishing rollback** events to previous microservices.

By this way it is manage **Distributed Transactions** across microservices.
As you know that its used some principles inside of the **Saga pattern** like publish/subscribe pattern with brokers or API Composition patterns.




The saga pattern **provides transaction management** with using a sequence of local transactions of microservices. Every microservices has its own database and it can able to manage local transaction in atomic way with **strict consistency**.

So saga pattern **grouping** these **local transactions** and **sequentially** invoking one by one. Each local transaction updates the database and publishes an event to trigger the next local transaction.

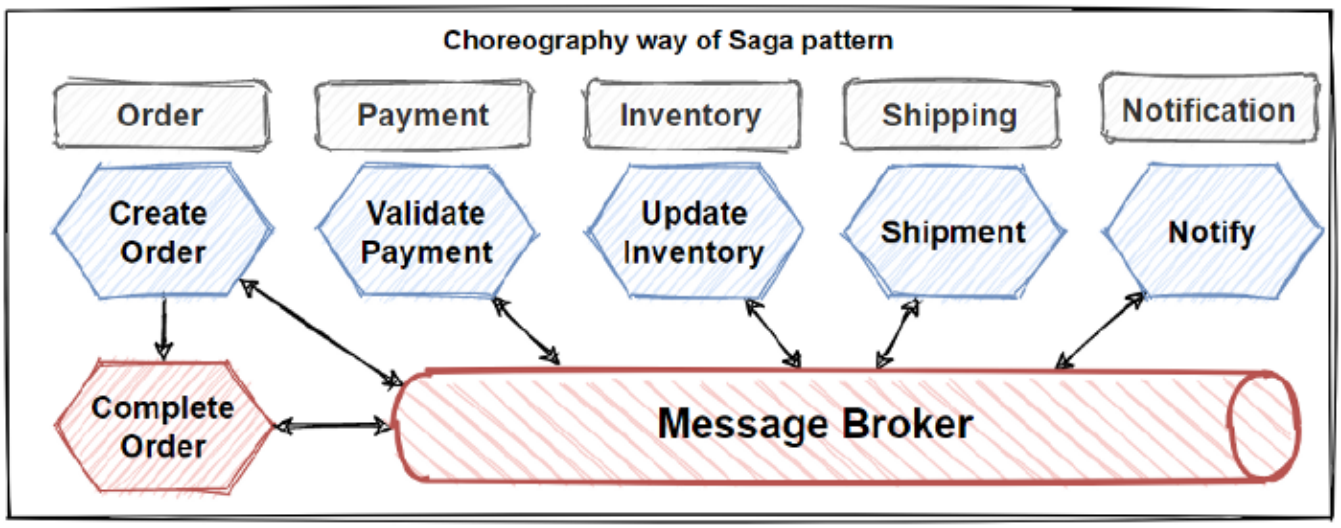
If one of the step is **failed**, than saga patterns **trigger** to **rollback transactions** that are a set of compensating transactions that rollback the changes on previous microservices and restore data consistency.

There are two type of saga implementation ways, These are "**choreography**" and "**orchestration**".

Let me explain **Choreography** way of Saga pattern.

## Choreography Saga Pattern

Choreography provides to coordinate sagas with applying publish-subscribe principles. With choreography, each microservices run its own local transaction and publishes events to **message broker system** and that trigger **local transactions** in other microservices.



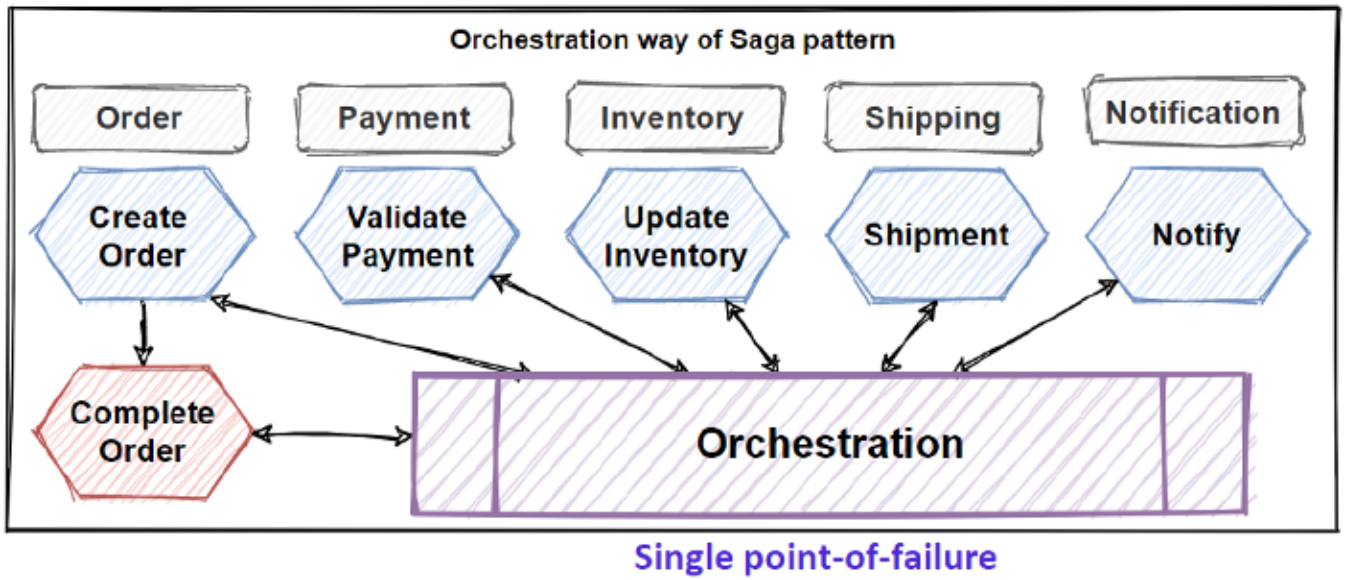

This way is good for simple workflows if they don't require too much microservices transaction steps.

But if **Saga Workflow** steps increase, then it can become confusing and hard to manage transaction between saga microservices.
Also **Choreography** way **decouple** direct **dependency** of microservices when managing transactions.

## Orchestration Saga Pattern

Another Saga way is Orchestration. **Orchestration** provides to coordinate sagas with a **centralized** controller microservice. This centralized controller microservice, orchestrate the **saga workflow** and invoke to execute local microservices transactions in sequentially.

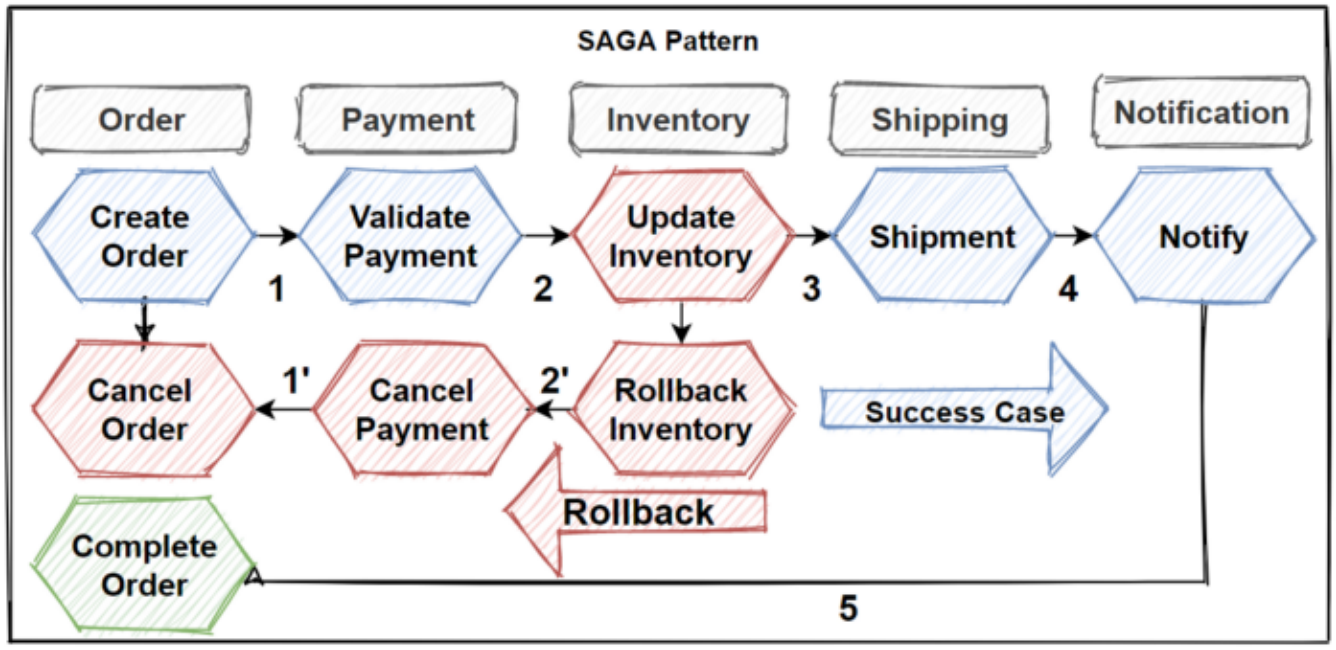
The orchestrator microservices execute **saga transaction** and manage them in centralized way and if one of the step is failed, then executes rollback steps with compensating transactions.




Orchestration way is good for complex workflows which includes lots of steps. But this makes **single point-of-failure** with centralized controller microservices and need implementation of complex steps.

## Rollback of Saga Pattern

The below image shows a failed transaction with the Saga pattern.




The **Update Inventory** operation has failed in the Inventory microservice. So when it failed to one step, The **Saga** invokes a set of **compensating** transactions to rollback the inventory operations, cancel the payment and the order, and return the data for each microservice back to a **consistent state**.

We should careful about when using **saga pattern** in distributed microservices architecture. If our use case required **data consistency** across several microservices, and required rollback when one of the step is failed, than we should use **Saga pattern**.

So we should **evolve our architecture** with applying **other Microservices Data Patterns** in order to **accommodate business adaptations** faster time-to-market and handle larger requests.

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