Difference between SAGA Pattern and 2 Phase Commit in Microservices?

Understanding the Pros and Cons of SAGA Pattern and 2 Phase Commit for Distributed Transactions in Microservices

Soma · Follow
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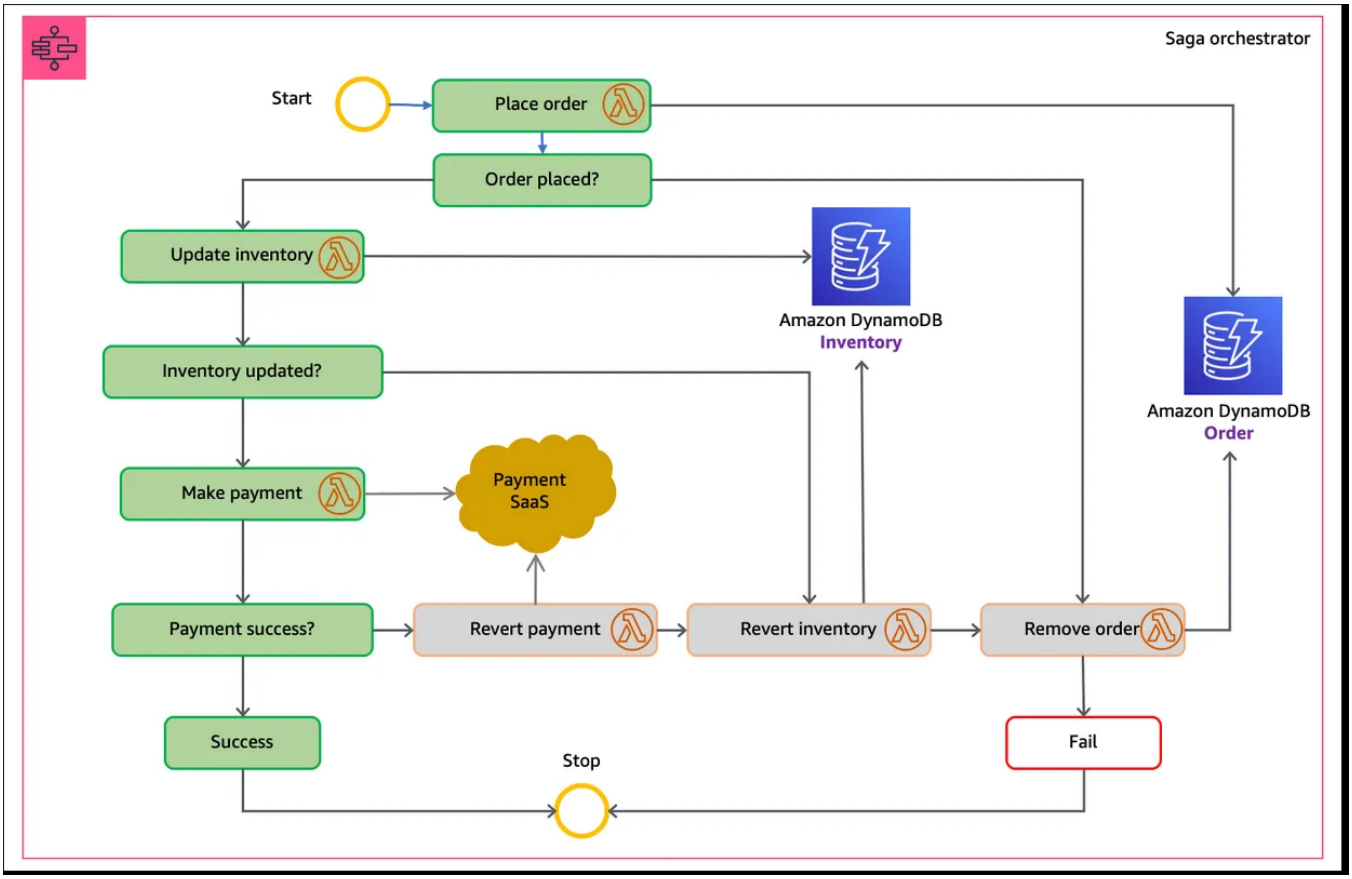

Hello folks, in my last interview for a senior Java developer position, I was asked this question, *"what is difference between SAGA and 2 Phase Commit? Which one will you prefer and why?"*, while I have **fair idea of both SAGA Pattern and 2 Phase commit** as I have not only used them but also written about them, but I think interview

pressure got me and I couldn't explain the difference as well I could, at least that's what I felt.

I haven't heard from them after that so I think, I probably not going to receive any offer and it was any way very senior position of managing their suite of Microservices and architecture new strategic solution, which I felt will require a lot of communication with stack-holders and very less coding, something not desirable at this moment, I would like to remain hands-on with coding.

Anyway, let's come back to the questions so that you can answer this question better when you see in your next Java Interview.

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Difference in SAGA Pattern vs 2 Phase Commit

While both the Saga pattern and Two-Phase Commit (2PC) are used to maintain data consistency in distributed systems, but they differ in their approaches.

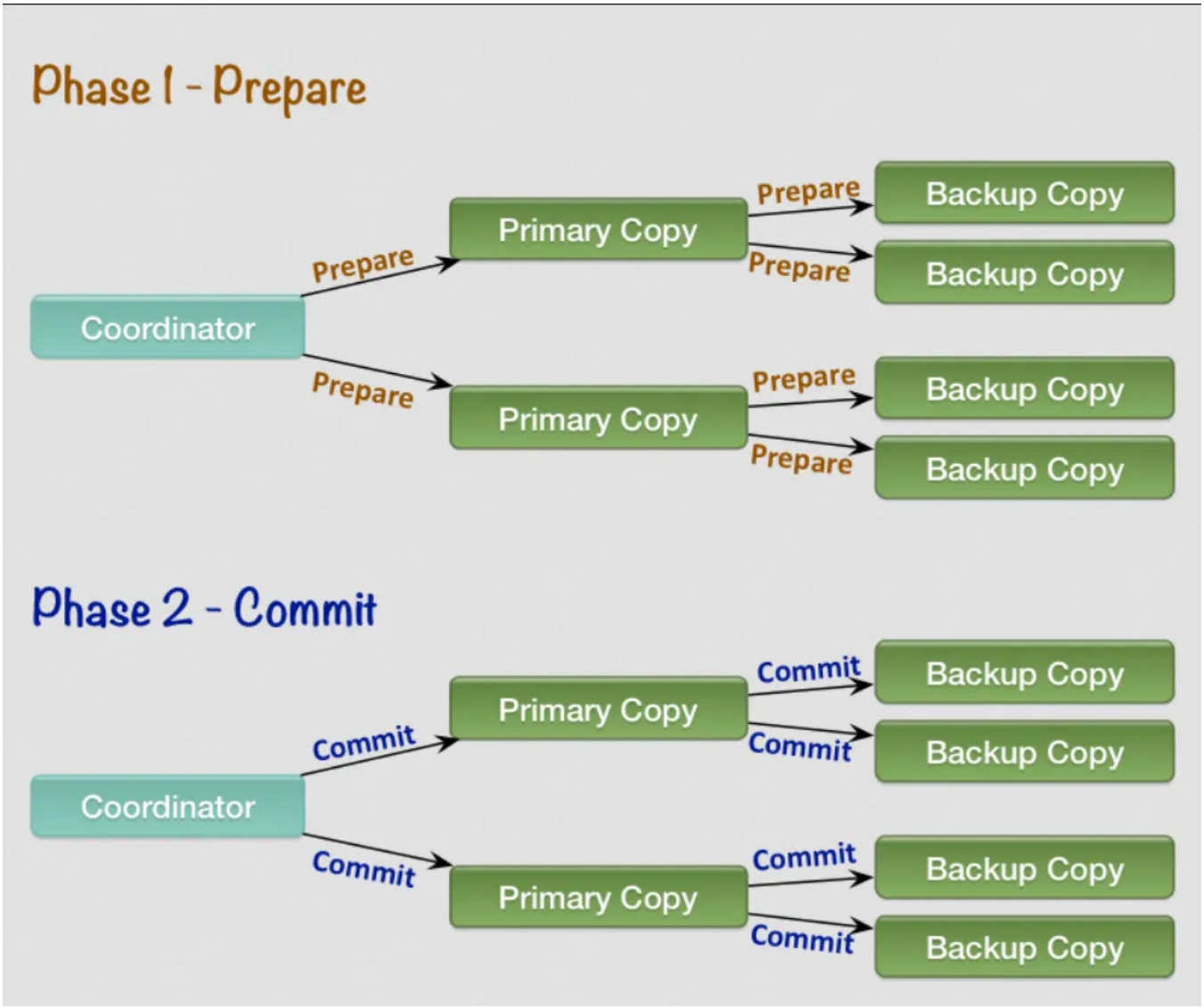
The Two-Phase Commit (2PC) protocol is a distributed algorithm used to ensure that all nodes in a distributed **system agree to commit or abort a transaction.**

2PC works by coordinating transactions between a coordinator node and multiple participant nodes. The coordinator sends a request to the participants to prepare for the transaction, and once all participants respond with a positive acknowledgement, the coordinator sends a commit message to each participant to **commit the transaction.**

If any participant fails to respond or sends a negative acknowledgement, the coordinator sends an abort message to all participants, and the transaction is rolled back.

2PC guarantees that all nodes will commit or abort a transaction, but it can be slow and vulnerable to failure.

Here is a nice diagram which illustrate **how 2 Phase commit works:**

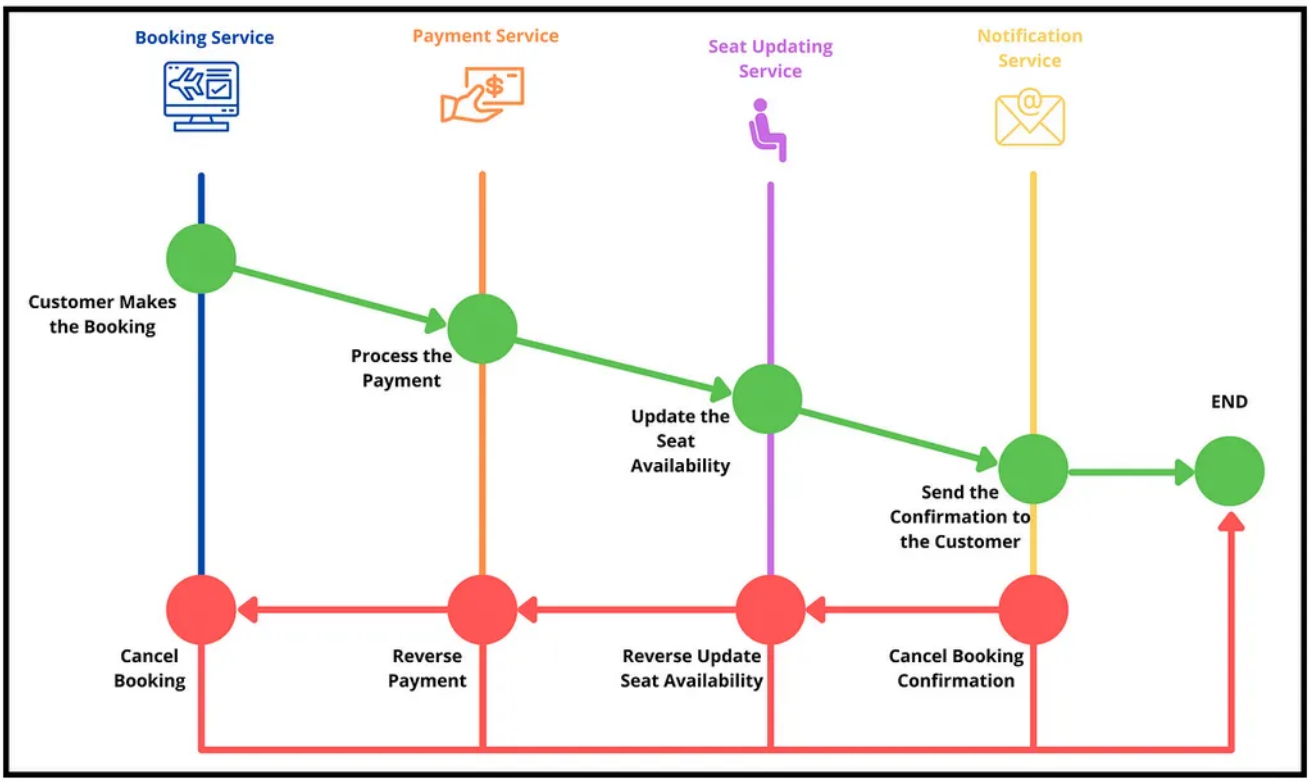


On the other hand, SAGA Pattern is a Microservices design pattern for **managing long-lived transactions in a distributed system.** A saga is a sequence of local transactions, where each local transaction updates the state of a single service, and each service has its own database.

Each local transaction is an atomic operation that either completes successfully or compensates for its effects. If a local transaction fails, the saga executes a compensating transaction that undoes the effects of the failed transaction.

The saga pattern allows for more flexibility than 2PC and can better handle complex, long-lived transactions, but it requires careful design to ensure data consistency.

Here is a nice diagram which shows **how SAGA Pattern works:**



When to use SAGA and 2 PC commit in Design?

This is the second part of the question which slightly hard to answer because we only know that both are used to manage distributed transaction in microservices but there are more to it.

The 2PC protocol is **useful in situations where all participants of the distributed transaction must commit or roll back the transaction together.** It ensures **atomicity** and **consistency** of the transaction but can lead to *blocking and performance issues in highly distributed systems*.

Therefore, it's typically used in *scenarios with a small number of participants,* where the latency and scalability limitations of 2PC can be managed.

In contrast, **SAGA pattern is useful in situations where the transaction is too large to be managed by a single 2PC protocol.** SAGA breaks the transaction down into smaller, local transactions that can be independently managed by each microservice.

This allows for greater scalability, fault tolerance, and performance in highly distributed systems. SAGA is typically used in complex, long-running business processes that involve multiple microservices, where a transaction rollback would be expensive or not feasible.

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That's all about **difference between SAGA Pattern and 2 Phase commit in Microservice architecture.** In summary, 2PC is a distributed protocol that coordinates transaction commits, while the Saga pattern is a design pattern for

managing long-lived transactions by breaking them down into a sequence of local transactions that can be compensated for if necessary.

2 Phase commit is more appropriate for *scenarios with a small number of participants,* where the latency and scalability limitations of 2PC can be managed, while **SAGA pattern is useful in situations where the transaction is too large to be managed by a single 2PC protocol**

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Database Support	Supports various databases through dialects	Depends on the JPA implementation used	Depends on the JPA implementation used
Transaction Management	Provides its own transaction management	Depends on the JPA implementation used	Depends on the JPA implementation used
Query Language	Hibernate Query Language (HQL)	JPQL (Java Persistence Query Language)	JPQL (Java Persistence Query Language)
Caching	Provides first-level and second-level caching	Depends on the JPA implementation used	Depends on the JPA implementation used
Configuration	XML, annotations, or Java-based configuration	XML, annotations, or Java-based configuration	XML, annotations, or Java-based configuration
Integration	Can be used independently or with JPA	Works with any JPA-compliant implementation	Works with any JPA-compliant implementation

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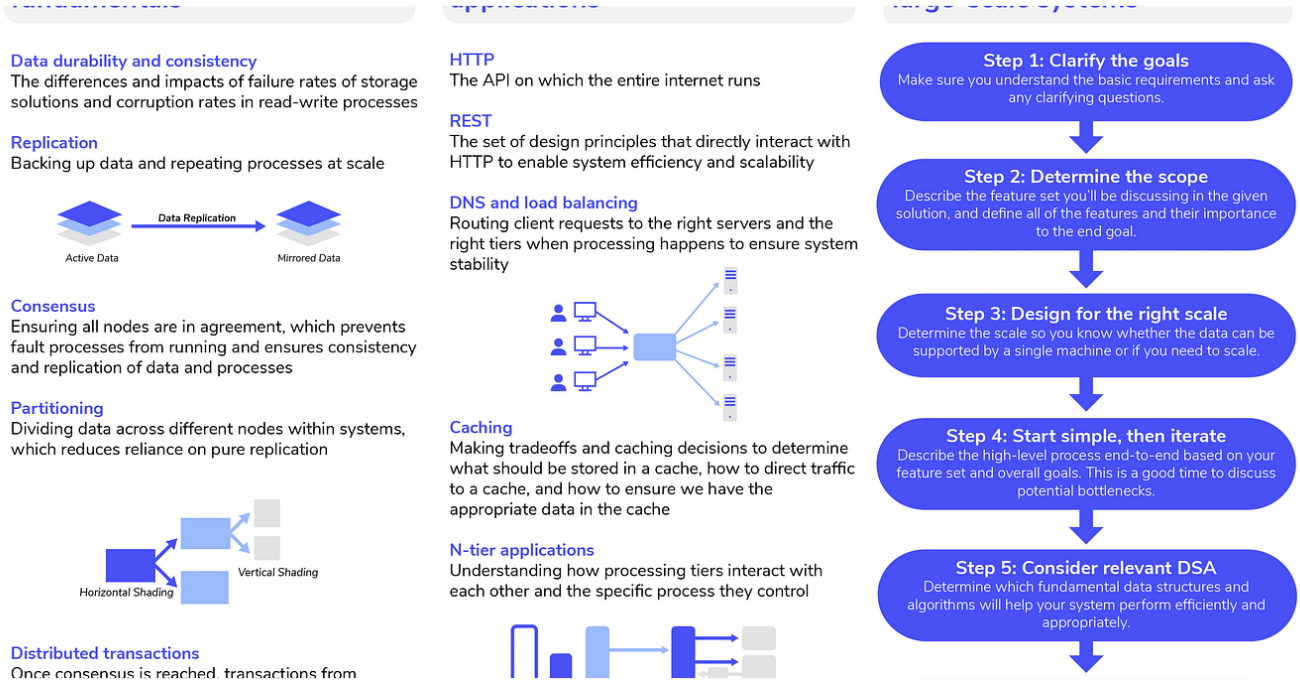

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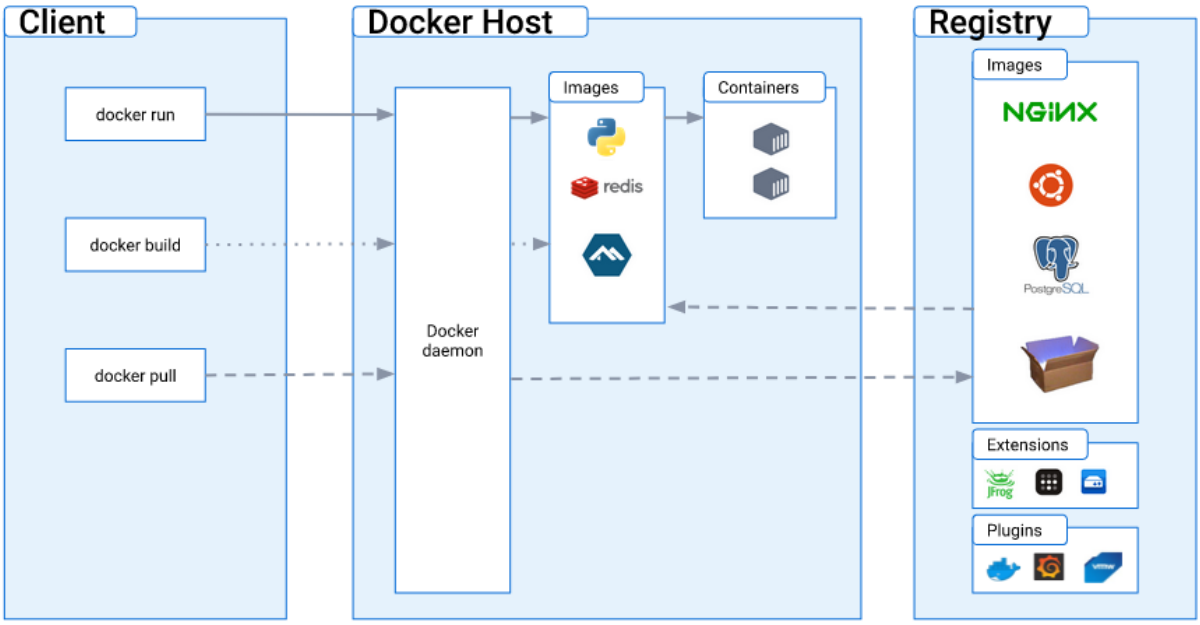

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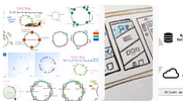

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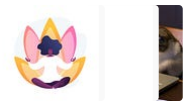

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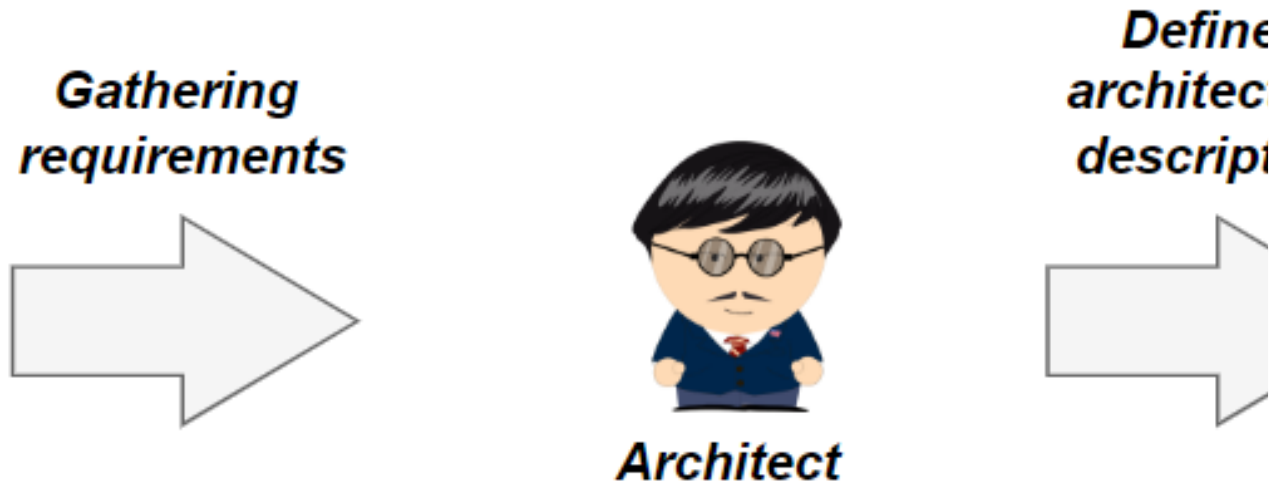

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