

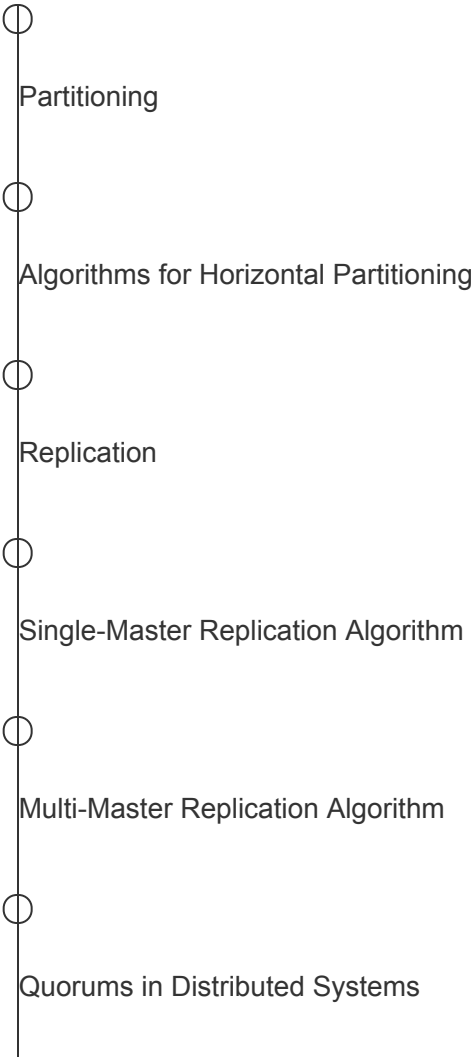
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# Distributed Systems

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## Introduction to Distributed Systems

### Basic Concepts and Theorems





○	Safety Guarantees in Distributed Systems
○	ACID Transactions
○	The CAP Theorem
○	Consistency Models
○	CAP Theorem's Consistency Model
○	Isolation Levels and Anomalies
	Prevention of Anomalies in Isolation Levels
○	Consistency and Isolation
○	Hierarchy of Models
○	Why All the Formalities?
○	Quiz

## Conclusion

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# Prevention of Anomalies in Isolation Levels

In this lesson, we will identify which isolation level prevents which anomalies.

### We'll cover the following

- Isolation level that prevents all of the anomalies
- Other isolation levels

## Isolation level that prevents all of the anomalies#

There is one isolation level that prevents all of these anomalies: the **serializable** one.

Like the consistency models presented in the Consistency Models lesson, this level provides a more formal specification of what is possible, e.g., which execution histories are possible. More specifically, it guarantees that the result of the execution of concurrent transactions is the same as that produced by some serial execution of the same transactions. This means that we can only analyze serial executions for defects. If all the possible serial executions are safe, then any concurrent execution by a system at the serializable level will also be safe.

However, serializability has performance costs since it intentionally reduces concurrency to guarantee safety.

# Other isolation levels#

Isolation levels other than the serializable ones are less strict and provide better performance via increased concurrency at the cost of decreased safety.

These models allow some of the anomalies we described previously. The following illustration contains a table with the most basic isolation levels, along with the anomalies they prevent.

Isolation levels and prevented anomalies

	Dirty Writes	Dirty Reads	Fuzzy Reads	Phantom Reads	Lost Updates	Repetable Reads
Read Uncommitted	not possible	possible	possible	possible	possible	possible
Read Committed	not possible	not possible	possible	possible	possible	possible
Snapshot Isolation	not possible	not possible	not possible	possible	not possible	not possible
Repeatable Read	not possible	not possible	not possible	possible	not possible	not possible
Serializability	not possible	not possible	not possible	not possible	not possible	not possible

These isolation levels originated from the early relational database systems that were not distributed. Still, they are applicable in distributed datastores too.

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Isolation Levels and Anomalies

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Consistency and Isolation

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