AT82.02

DATA MODELING AND MANAGEMENT

UNIT 4-1 TRANSACTION PROCESSING & CONSISTENCY MODELS

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DS&AI

What is a **Transaction**?

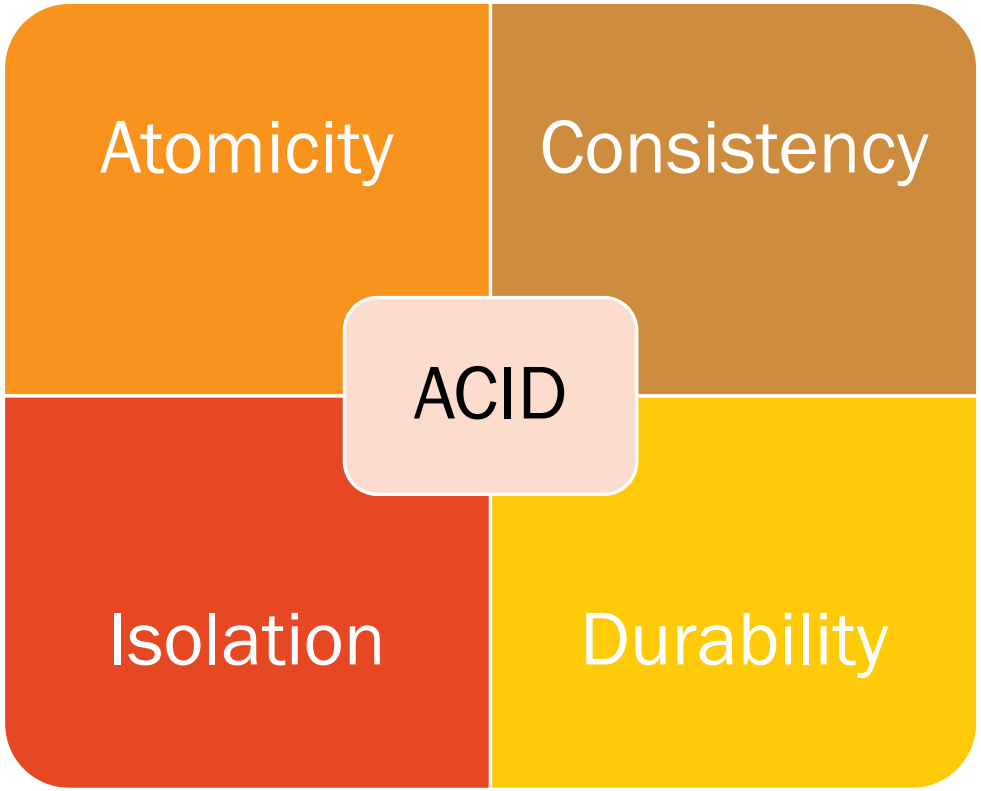
A transaction is …

A sequence of actions that read from and/or write to a database.

It could be any combination of CRUD operations.

What is **ACID** Model?

ACID Transactions:



ACID

Atomicity	• A transaction is an atomic unit of processing; it is either performed in its entirety or not performed at all.
Consistency	• An execution of the transaction must take the database from one consistent state to another.
Isolation	• A transaction should not make its updates visible to other transactions until it is committed.
Durability	• Once the transaction is complete, it will persist as complete and cannot be undone.

*One of the biggest changes from a centralized relational database to a cluster-oriented NoSQL database is the concept of "**consistency**".*

- *Relational databases focuses on the concept of* ***strong consistency***
- *In NoSQL, we will consider various different forms and degrees of consistency*

Several Forms of Consistency

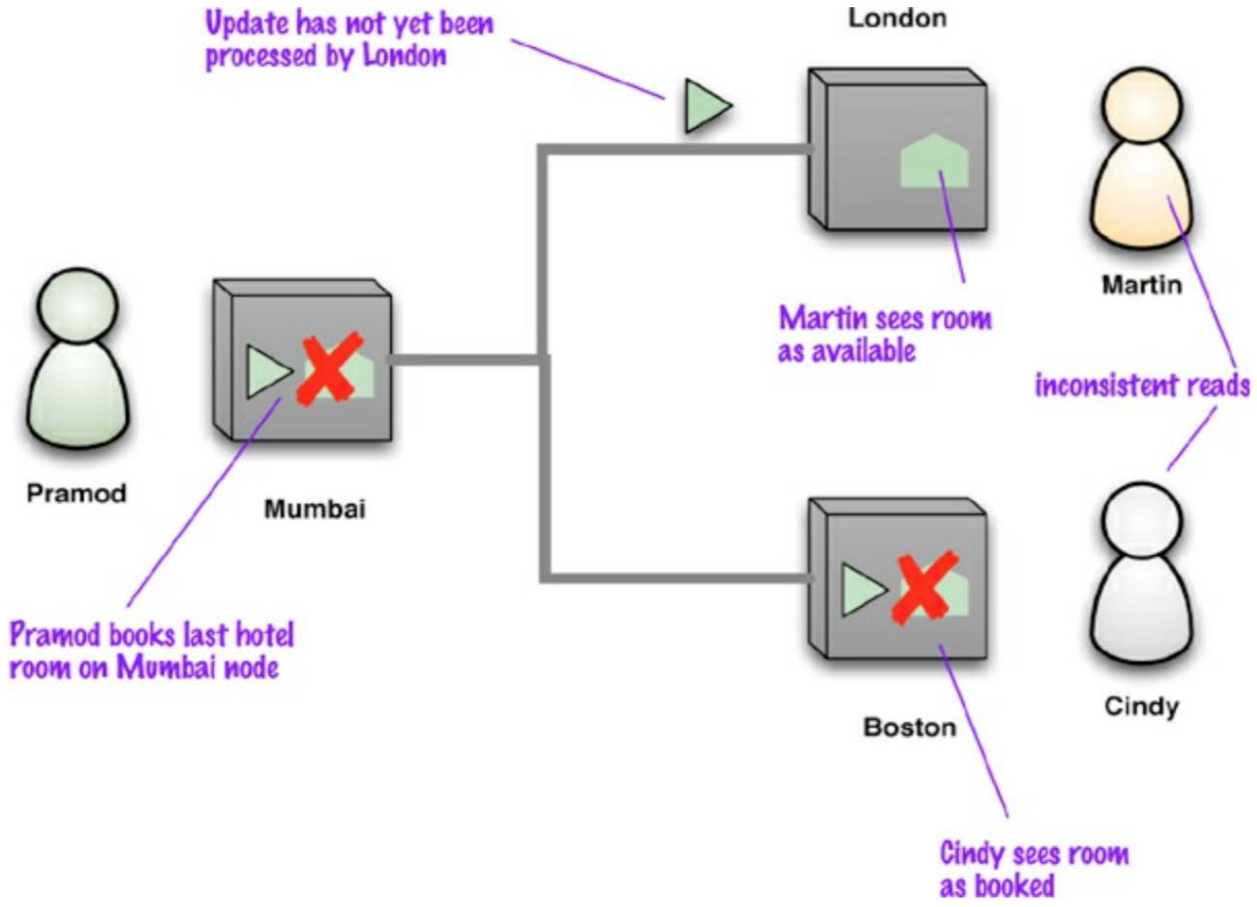
Update Consistency

- write-write conflict: two transactions/users update the same data item at the same time
- lost update problem

Read Consistency

- read-write conflict
- inconsistent read
- dirty read

Several Forms of Consistency



Replication Consistency

- Ensuring the same data item has the same value when read from different replicas

Several Forms of Consistency

Eventual Consistency

Nodes may have replication inconsistencies, but if there are no further updates, eventually all nodes will be updated to the same value.

Inconsistency window

The length of time an inconsistency is present.

Meaning that different people will see different things at the same time.

Ex: you may post a message using one node, then refresh your browser, but the refresh goes to a different node, which hasn't received your post yet -- look like the post was lost.

Several Forms of Consistency

User-perceived Consistency

The time expected by the customer to see the updated value.

Read-your-write Consistency

Once you've made an update, you are guaranteed to continue seeing the update.

Session Consistency

Within a user's session, there is read-your-writes consistency

The user may lose consistency should their session end, or should the user access the system from different computers.

Degrees of Consistency

Strong Consistency

- After the update completes, any subsequent access (by A, B or C) will return the updated value.

Weak Consistency

- The system does not guarantee that subsequent accesses will return the updated value. A number of conditions need to be met before the value will be returned. Often this condition is the passing of time, i.e., the inconsistency window.

Eventual Consistency

- The system guarantees that if no new updates are made, eventually (after the inconsistency window closes) all accesses will returned the last updated value.

Whether inconsistency is acceptable and which degree of consistency is acceptable depends foremost on the client application.

Consistency Relaxation

Inconsistency can be tolerated for two reasons:	For improving read and write performance under highly concurrent conditions and
	For handling partition cases where a majority model would render part of the system unavailable even though the nodes are up and running.

BASE Transactions

BASE Transactions

Basic **A**vailability

- Indicates that the system *does* guarantee availability, in terms of the CAP theorem
- Fulfills request, even in partial consistency

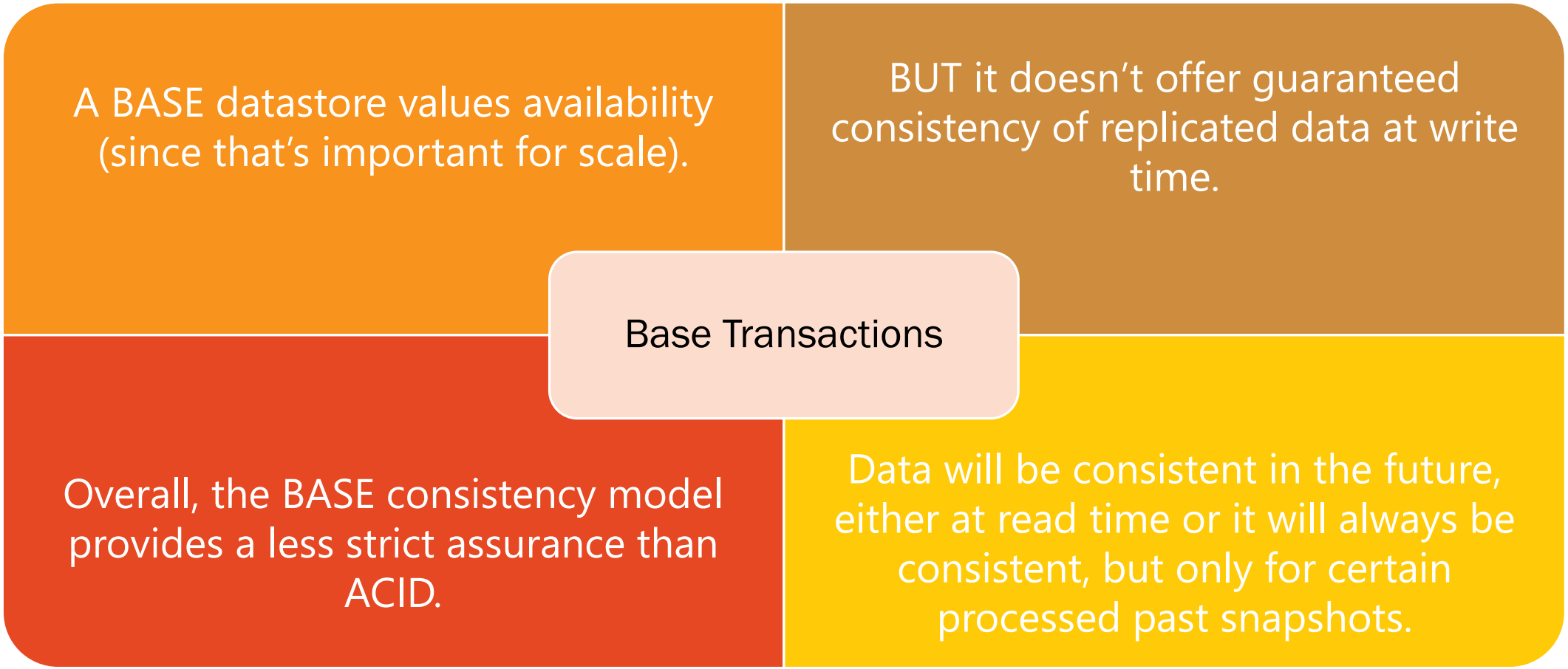
Soft state

- Indicates that the state of the system may change over time, even without input. This is because of the eventual consistency model.
- Data consistency is the developer's problem and should not be handled by the database.

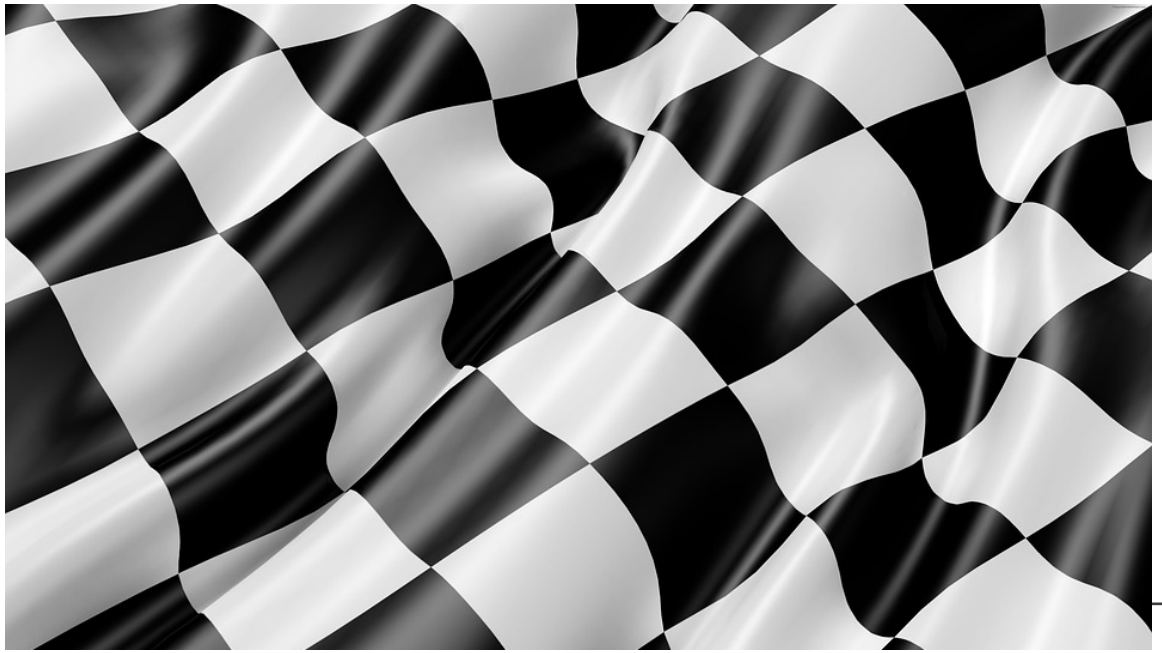
Eventual consistency

- At some point in the future, data will converge to a consistent state; delayed consistency, as opposed to immediate consistency of the ACID properties

BASE Transactions



- P. Sadalage and M. Fowler: NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley Professional, 2013



Thank you.

Let’s Summarize!