Assignments 13

CAP Theorem

Relational database lesson – provide an ACID consistency example:

Key-Value database "Teachers"

key: teacher_name

value: information about the teacher

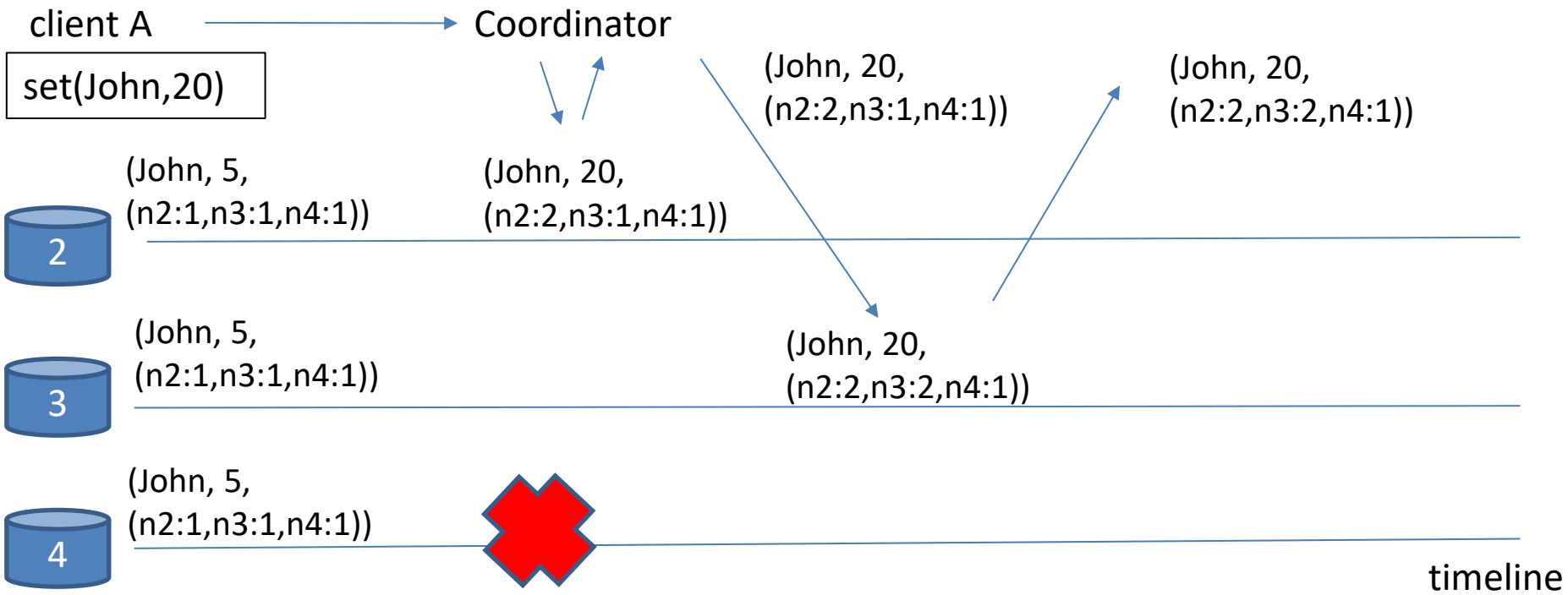
Provide a CAP Consistency example:

Rollback Behavior in MongoDB

In what scenario can a rollback happen in MongoDB?

What is the difference between a rollback in MOngoDB and in a RDBMS like Postgres?

Write Operation P2P - Version Vector (VV)



Write set(John,20) is executed successfully. Node 4 comes back on again and the next write → see next slide is executed.

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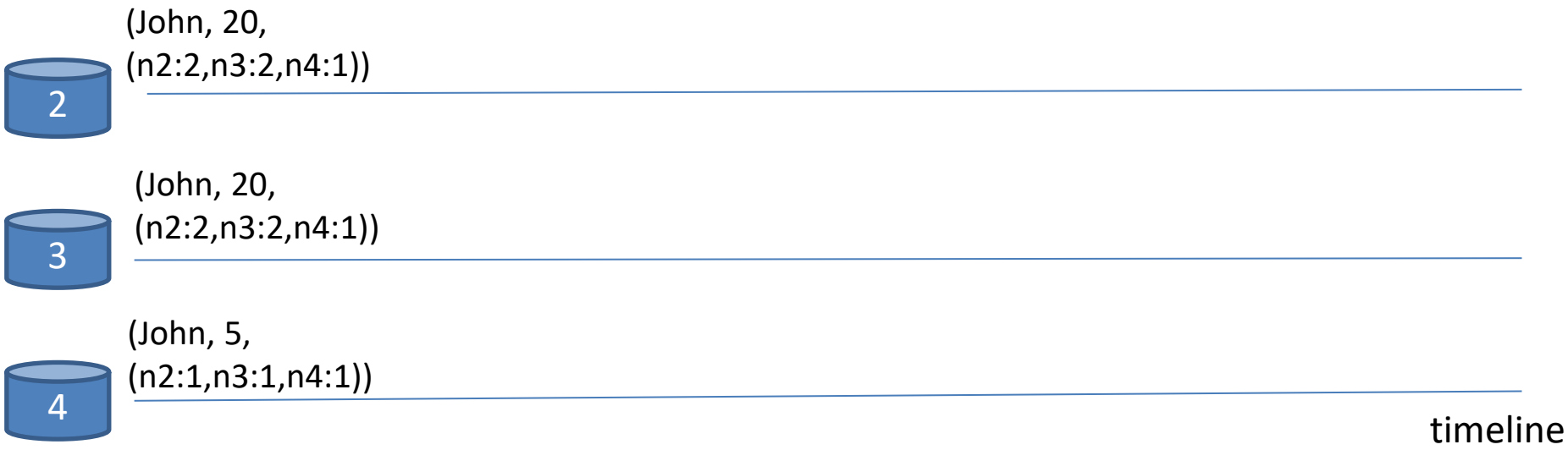
Write Operation P2P - Version Vector (VV)

Write Quorum is majority.
What values do the nodes hold at the end of a successful write? What values do the VV hold?



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State-Based CRDT Counter

Given is a replica set with 3 nodes
that uses a CRDT incrementing and decrementing counter (normal counter where you can add to and subtract)

Counter is initialized 0. Apply the following updates. Write down the CRDT vectors for all nodes.
node1: incr counter by 10
node3: incr counter 50
Sync
node1: decr counter by 50
node2: incr counter 30
sync
node3: incr counter by 20
node3: decr counter by 40
sync

get(counter)
What does the get(counter) return?
What is the value of the state vectors of all nodes after the last sync?

State-Based CRDT Counter

Given is a replica set with 3 nodes
that uses a CRDT incrementing and decrementing counter (normal counter where you can add to and subtract)

The counter carries a certain value.

You want to reset the counter. How would a reset work?

State-Based CRDT Set

Given is a replica set with 3 nodes
that uses a CRDT set datatype with the following sync rules (REDIS)

"CRDT Sets & Redis Enterprise

In a Redis Enterprise CRDT-enabled database, sets operations work under a few additional rules, the two most important of which get applied when merging operations coming from different nodes:

1. Adding wins over deleting.
2. Deleting works only on elements that the replica executing the command has already seen.

   The second rule is sometimes referred to as the “observed remove” rule, meaning that you can delete only items that you were able to observe when the command was issued.

"

Give an example for each of the rules to illustrate how they are executed.

MongoDB Sharding

Let us assume you want to store the pictures taken from the cameras of the Duckey town cars into a MongoDB collection in order to be able to do analysis later. As there are a lot of pictures, you shard the documents. What shard key would you choose? Explain shard key and why you choose it.

Token Ring Sharding

1. In what scenario can a hotspot happen in a token ring hash key distributed P2P database?
2. What mechanism can be used to prevent this?

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