Event Sourcing and CQRS

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Event Sourcing and CQRS

- Event Driven Architecture is mainly about services

- Events can be used as the basic building blocks of data too

- Event Sourcing and CQRS offer a pattern to store data as events

Problems with Traditional DBs

- Traditional databases hold data about current state of entity

  - This is true for SQL and NoSQL databases

Problems with Traditional DBs

- Example: Employees table

emp_id	first_name	last_name	address	role	date_join
1	John	Smith	Beverly Hills 90210	Development Manager	2009-04-23
2	Sarah	Jones	42nd st. NYC	Sales	2019-01-30
3	Britney	Flyn	Marigold Lane, Boca Raton	HR	2022-05-19

Problems with Traditional DBs

emp_id	first_name	last_name	address	role	date_join
1	John	Smith	Beverly Hills 90210	Development Manager	2009-04-23
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- This table doesn't tell us:

  - What was John's previous role?

  - When did Sarah move to NYC?

  - Did any of the employees change his/her name?

Problems with Traditional DBs

- Traditional databases hold data about current state of entity

- There is no way to see historical data of entities

- Data is a "snapshot" of a point in time

- Especially problematic with…

Problems with Traditional DBs

Date	Description	Ref.	Withdrawals	Deposits	Balance
2003-10-08	Previous balance				0.55
2003-10-14	Payroll Deposit - HOTEL			694.81	695.36
2003-10-14	Web Bill Payment - MASTERCARD	9685	200.00		495.36
2003-10-16	ATM Withdrawal - INTERAC	3990	21.25		474.11
2003-10-16	Fees - Interac		1.50		472.61
2003-10-20	Interac Purchase - ELECTRONICS	1975	2.99		469.62
2003-10-21	Web Bill Payment - AMEX	3314	300.00		169.62
2003-10-22	ATM Withdrawal - FIRST BANK	0064	100.00		69.62
2003-10-23	Interac Purchase - SUPERMARKET	1559	29.08		40.54
2003-10-24	Interac Refund - ELECTRONICS	1975		2.99	43.53
2003-10-27	Telephone Bill Payment - VISA	2475	6.77		36.76
2003-10-28	Payroll Deposit - HOTEL			694.81	731.57
2003-10-30	Web Funds Transfer - From SAVINGS	2620		50.00	781.57
2003-11-03	Pre-Auth. Payment - INSURANCE		33.55		748.02
2003-11-03	Cheque No. - 409		100.00		648.02
2003-11-06	Mortgage Payment		710.49		-62.47
2003-11-07	Fees - Overdraft		5.00		-67.47
2003-11-08	Fees - Monthly		5.00		-72.47
	*** Totals ***		1,515.63	1,442.61	

- Event Sourcing and CQRS try to solve this problem

Event Sourcing

- A data store pattern in which every change in the data is captured and saved

- Database stores list of changes for the entity, not the entity itself

- No updates or deletes, just inserts

- Every row documents a change in a property/ies of the entity

- In this pattern, the database is called Event Store

Event Sourcing

- Instead of this:

emp_id	first_name	last_name	address	role	date_join
1	John	Smith	Beverly Hills 90210	Development Manager	2009-04-23
2	Sarah	Jones	42nd st. NYC	Sales	2019-01-30
3	Britney	Flyn	Marigold Lane, Boca Raton	HR	2022-05-19

Event Sourcing

- ## We have this:

event_id	timestamp	event
1	2009-04-23	Employee John Smith joined
2	2009-04-23	Address of John Smith updated to Hott Street, Clinton
3	2009-04-23	Role of John Smith updated to Junior Developer
4	2013-05-22	Address of John Smith updated to Beverly Hills 90210
5	2017-09-12	Role of John Smith updated to Development Manager
6	2019-01-30	Employee Sarah Jones joined
7	2019-01-30	Role of Sarah Jones updated to Sales
8	2021-07-05	David Richer left the company

- Specific columns are up to you, depends on the system requirements
- Note there's a lot more information than in the regular table

Event Sourcing

- How can we view the current state of an entity?

- By replaying the events rela eve

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Event Sourcing

Pros

Cons

- Extremely easy to view historical data

- Simple database structure

- Simple database operations (no updates, no concurrency)

- Very fast inserts

- Viewing current entity state is cumbersome and slow

- Large database capacity (many records per entity)

CQRS to the Rescue!

CQRS

- Stands for:
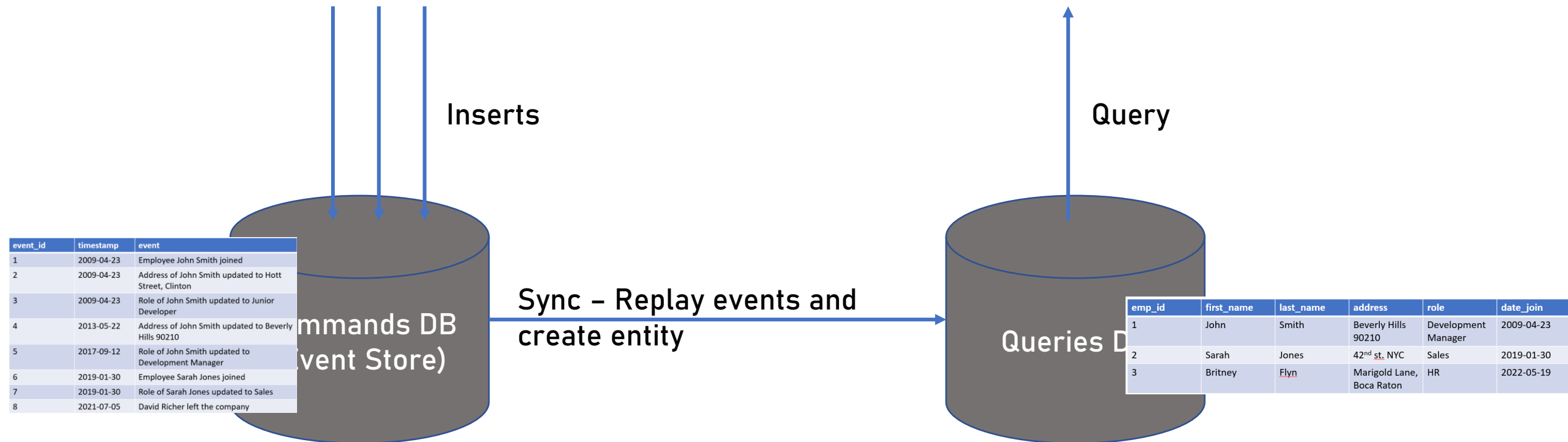
Command and Query Responsibility Segregation

CQRS

- Means:
  - Separating the commands (updates / inserts / deletes) from the queries
  - Each one of them in a separate database
  - Commands database is implemented as Event Store to improve performance and simplicity
  - Queries database stores entities
  - Database are synced using a central synchronization mechanism

CQRS

Inserts

Query

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vent Store)

Sync – Replay events and create entity

Queries D

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CQRS

Pros	Cons

Pros

- Combines Event Sourcing pros with traditional entity query

- No performance hit when querying entities

Cons

- Entity data is not updated in real-time

- Difficult to set-up and maintain

When to Use Event Sourcing & CQRS

- When access to historical data is extremely important

  - Regulation, finance, healthcare etc.

- When data is large and replaying events is not feasible

- When performance is critical (inserts or queries)