

# Advanced Architecture Patterns

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Micro-Services

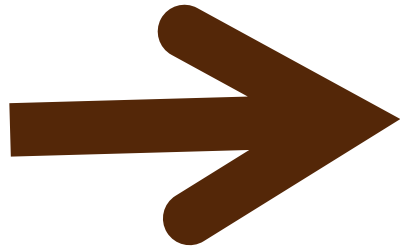
Event Sourcing

CQRS

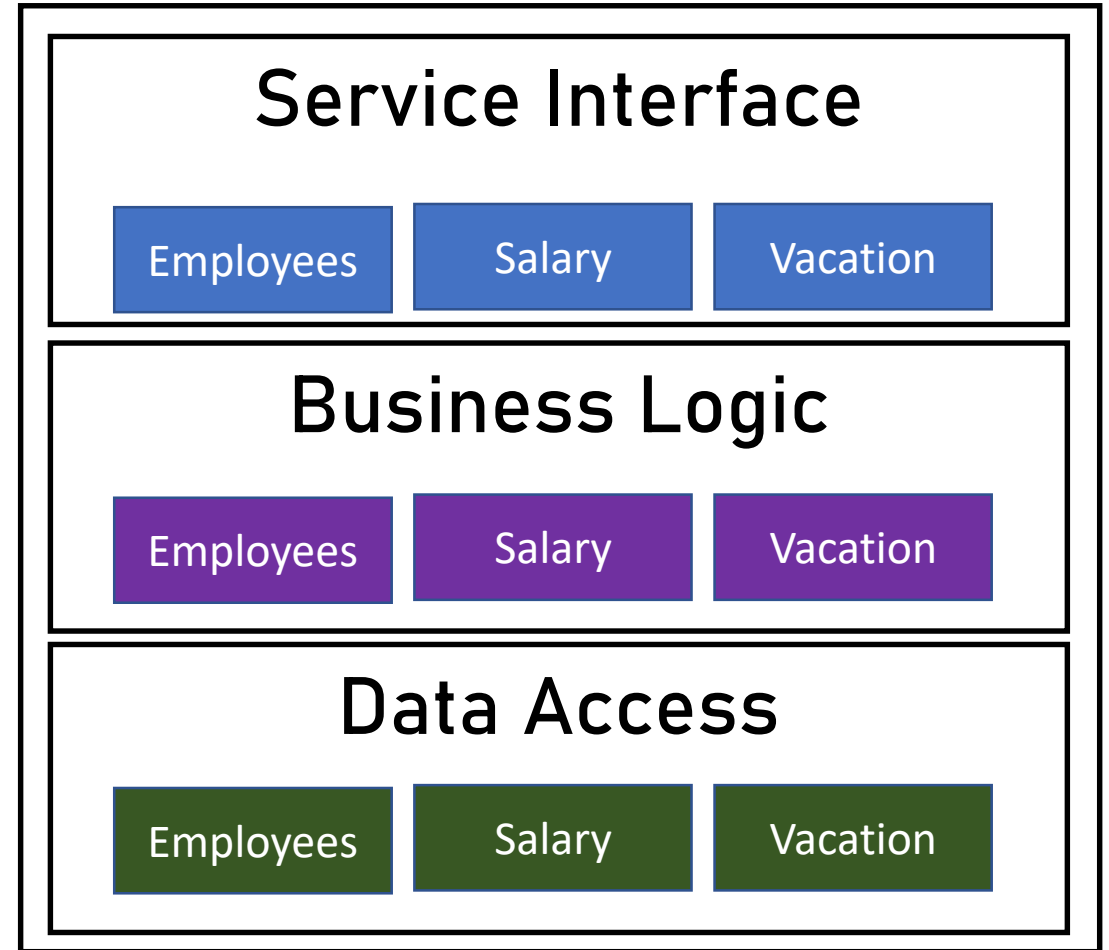
# Micro Services

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*“An architecture in which various functionalities are implemented as separate, loosely coupled services that interact with each other using standard, lightweight protocol”*



## Single Process



A single exception may  
crash the whole process

Updates impact  
components

Limited to one d  
platform

Unoptimized compute  
resources

# Micro Services to the Rescue!

## Single Process

### Service Interface

Vacation

### Business Logic

Vacation

### Access

Employees

Salary

Vacation

Data Store

A single exception may  
crash the whole process

With Micro Services...

Each service runs in its own  
process and does not impact other  
services

Updates impact all the  
components

With Micro Services...

Each service can be updated  
separately

Limited to one dev  
platform

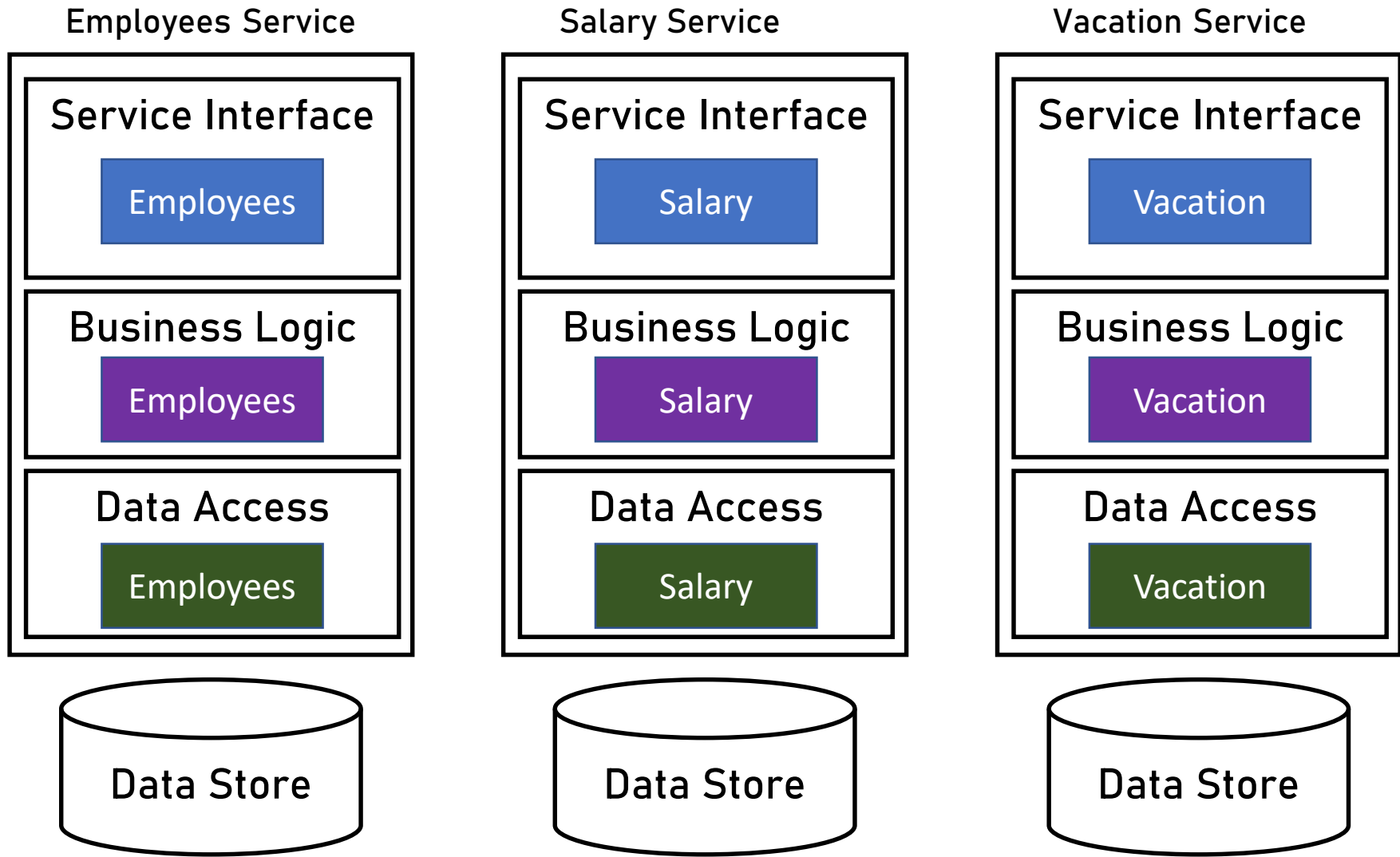
With Micro Services...

Each service can be implemented  
using different platform

Unoptimized compute  
resources

With Micro Services...

Each service can be optimized  
separately

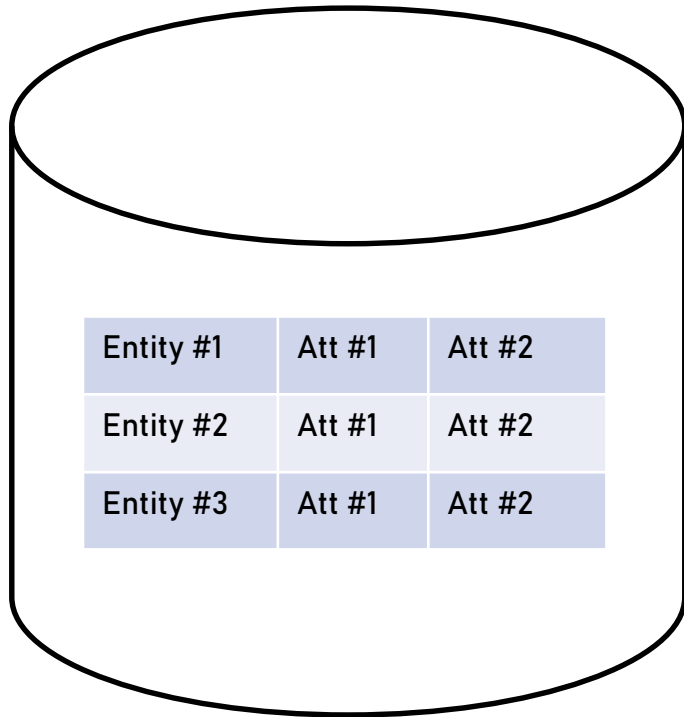


- Complex monitoring
- Complex architecture
- Complex testing

# Event Sourcing

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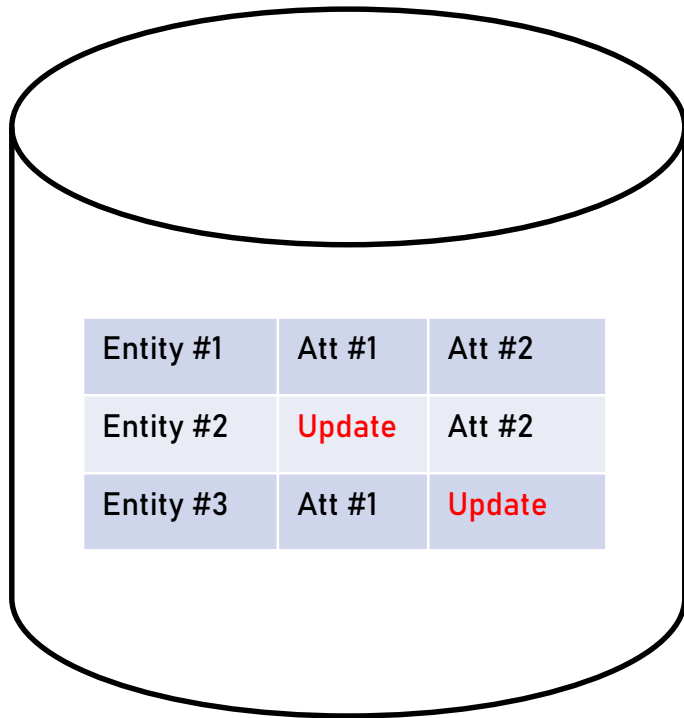
## Traditional Database



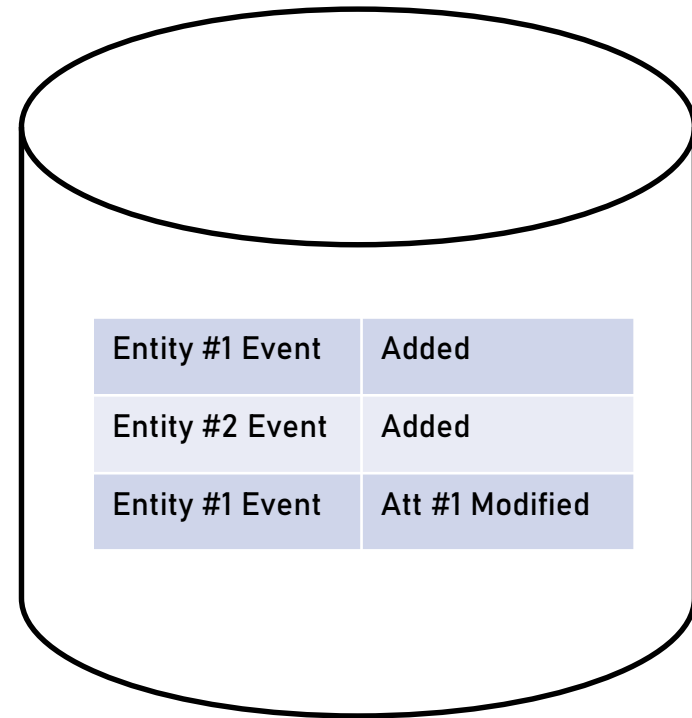


# Event Sourcing

Traditional Database



Event Sourcing





# FIRST BANK OF WIKI

1425 JAMES ST, PO BOX 4000  
VICTORIA BC V8X 3X4 1-800-555-5555

## CHEQUING ACCOUNT STATEMENT

Page : 1 of 1

JOHN JONES  
1643 DUNDAS ST W APT 27  
TORONTO ON M6K 1V2

Statement period	Account No.
2003-10-09 to 2003-11-08	00005- 123-456-7

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	



# Use When History Matters





# Event Sourcing

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## Pros

Tracing

Simple Data Model

Performance

Reporting

## Cons

No Unified View

Storage Usage

# CQRS

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Command

Query

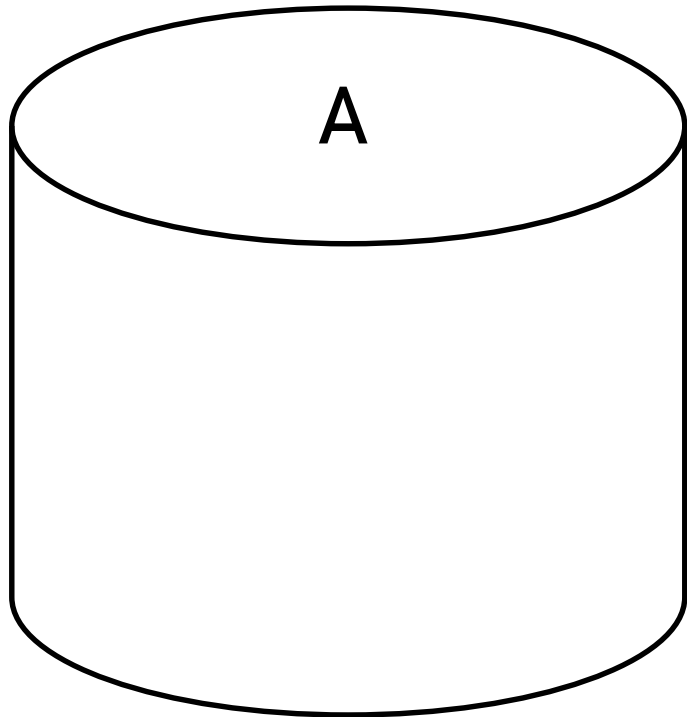
Responsibility

Segregation

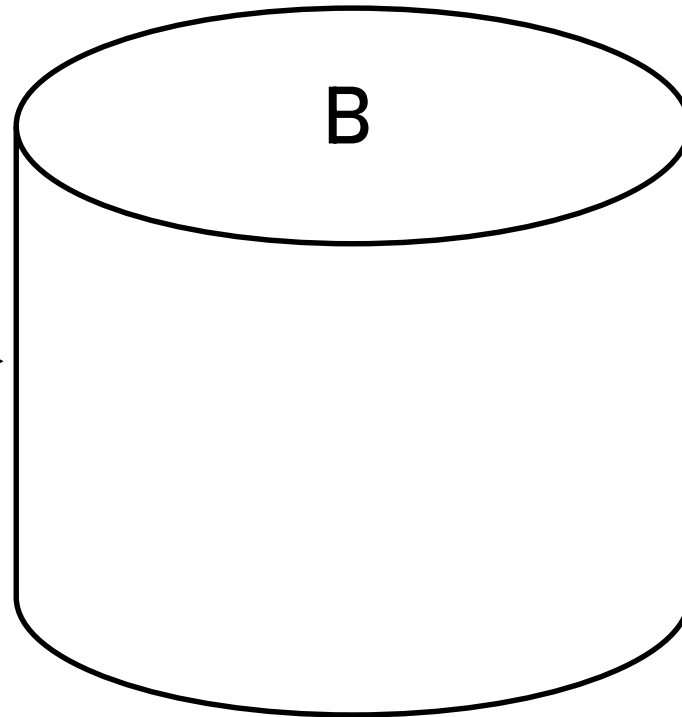
# CQRS

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Data Storage



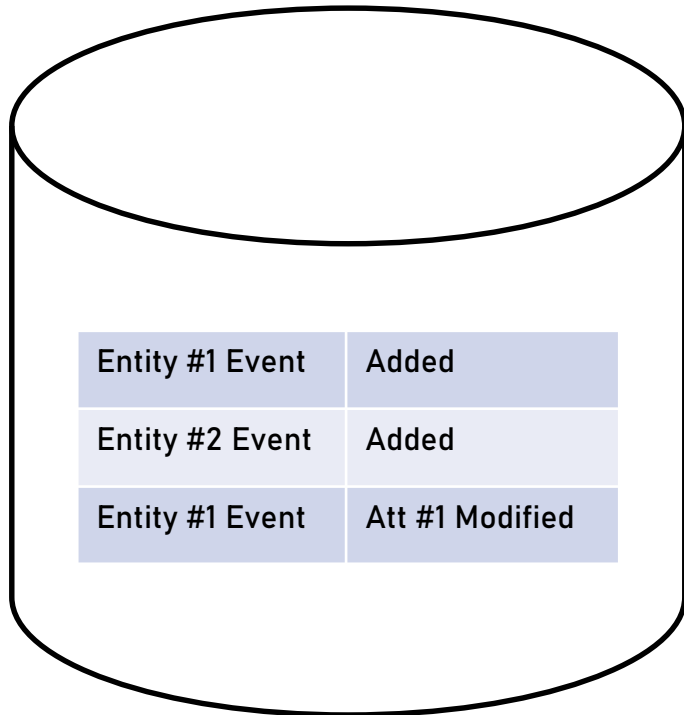
Data Retrieval



Sync  
Service

# CQRS

## Event Sourcing Database

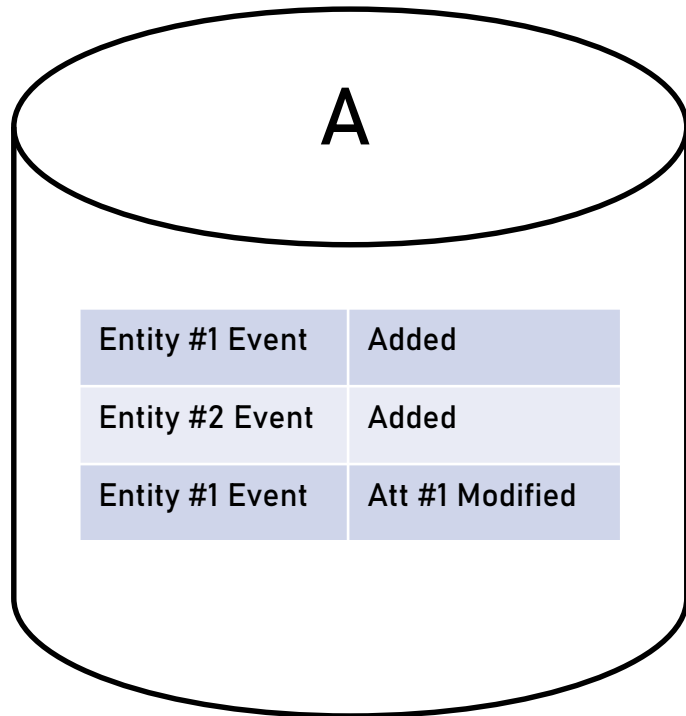


Performance

No Unified View

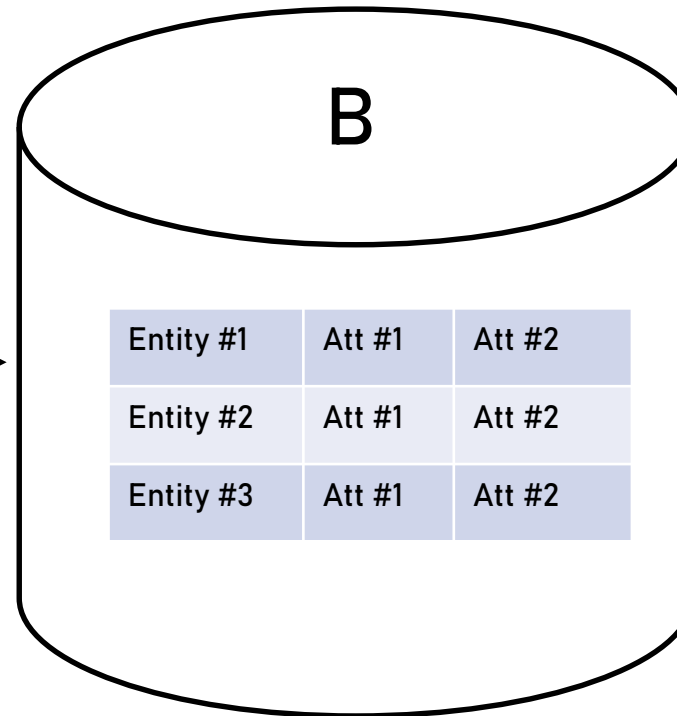
# CQRS

Events Storage



Sync  
Service

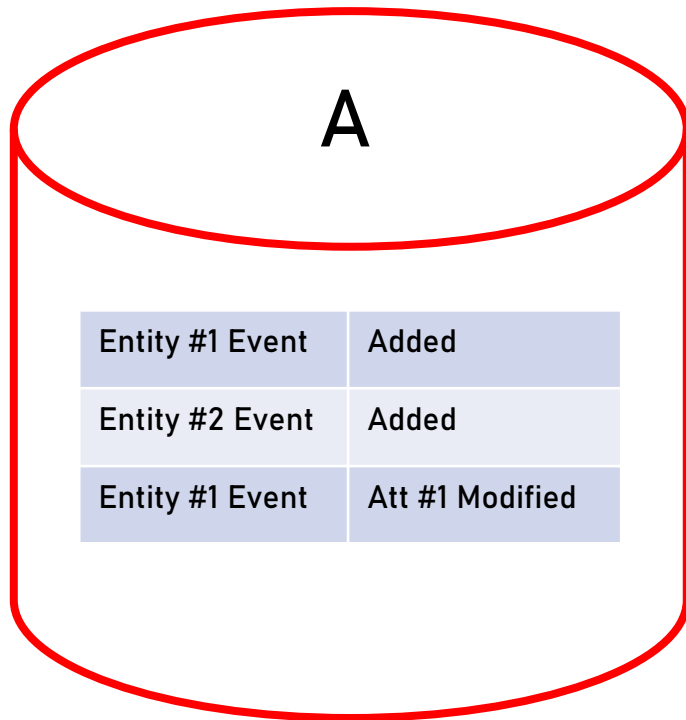
Entities Retrieval





# CQRS

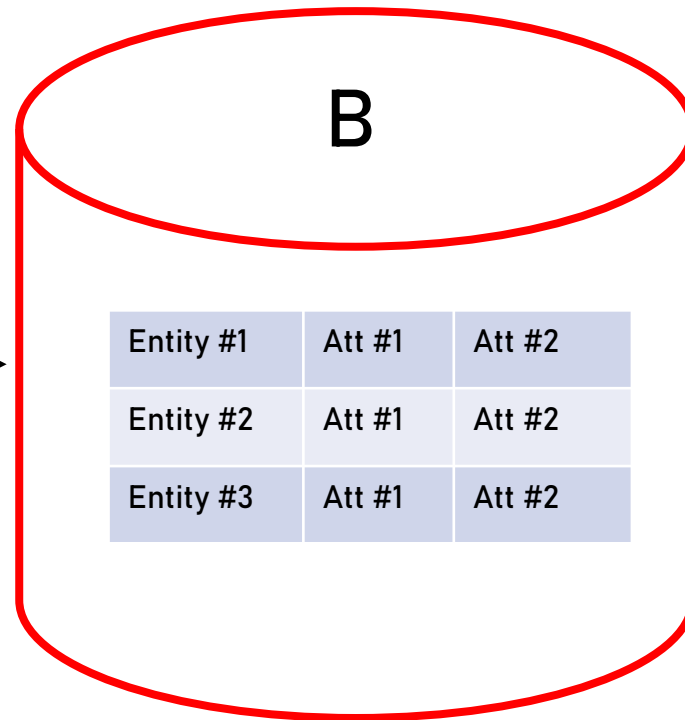
## Events Storage



Sync  
Service

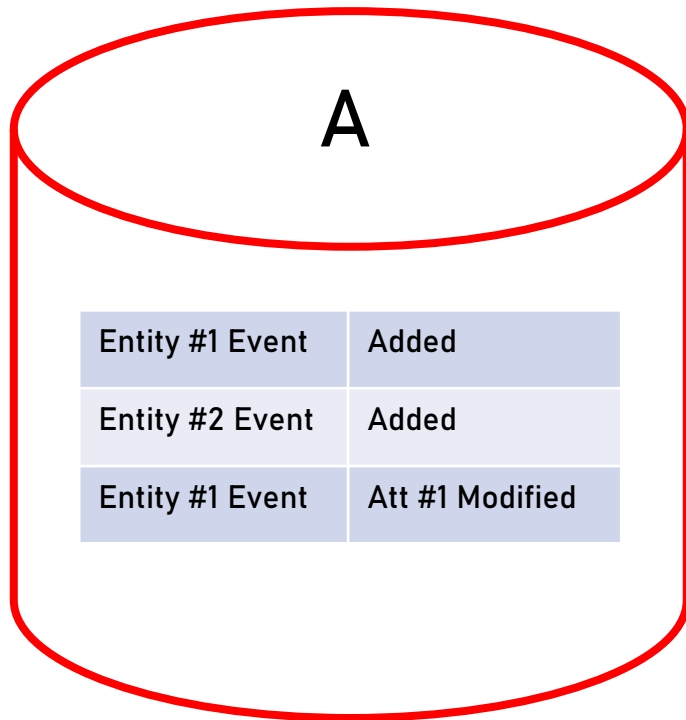
The diagram shows a central box labeled 'Sync Service' with an arrow pointing from the Events Storage (A) cylinder to the Entities Retrieval (B) cylinder.

## Entities Retrieval

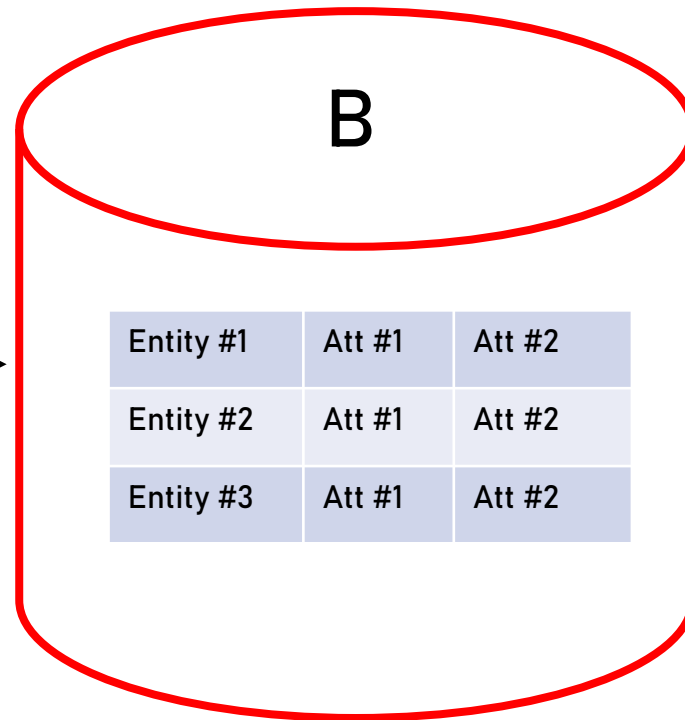


# CQRS

## Events Storage



## Entities Retrieval



# CQRS

## Events Storage

## Entities Retrieval

Useful with high frequency updates that require near real-time query capabilities

Entity #1 Event	Added
Entity #2 Event	Added
Entity #1 Event	Att #1 Modified

Sync  
Service

Entity #1	Att #1	Att #2
Entity #2	Att #1	Att #2
Entity #3	Att #1	Att #2

# Summary

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- Advanced Patterns:
  - Micro Services
  - Event Sourcing
  - CQRS
- Only use when relevant!