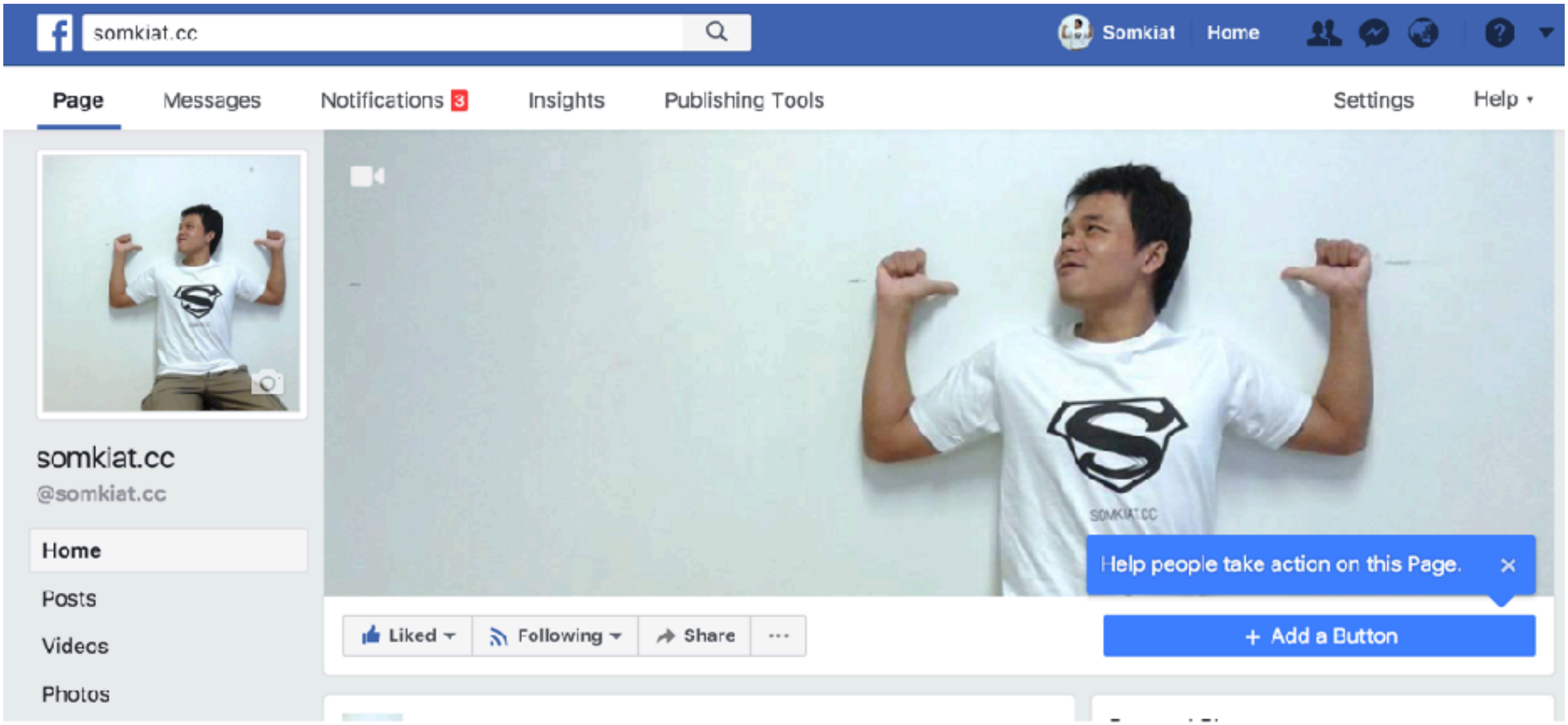
สยามชำนาญกิจ
SIAM CHAMNAN KIT

NoSQL Design Workshop



NoSQL

Database Ranking

422 systems in ranking, September 2023

Rank Sep 2023	Rank Aug 2023	Rank Sep 2022	DBMS	Database Model	Score Sep 2023	Score Aug 2023	Score Sep 2022
1.	1.	1.	Oracle	Relational, Multi-model	1240.88	-1.22	+2.62
2.	2.	2.	MySQL	Relational, Multi-model	1111.49	-18.97	-100.98
3.	3.	3.	Microsoft SQL Server	Relational, Multi-model	902.22	-18.60	-24.08
4.	4.	4.	PostgreSQL	Relational, Multi-model	620.75	+0.37	+0.29
5.	5.	5.	MongoDB	Document, Multi-model	439.42	+4.93	-50.21
6.	6.	6.	Redis	Key-value, Multi-model	163.68	+0.72	-17.79
7.	7.	7.	Elasticsearch	Search engine, Multi-model	138.98	-0.94	-12.46
8.	8.	8.	IBM Db2	Relational, Multi-model	136.72	-2.52	-14.67
9.	↑ 10.	↑ 10.	SQLite	Relational	129.20	-0.72	-9.62
10.	↓ 9.	↓ 9.	Microsoft Access	Relational	128.56	-1.78	-11.47
11.	11.	↑ 13.	Snowflake	Relational	120.89	+0.27	+17.39
12.	12.	↓ 11.	Cassandra	Wide column, Multi-model	110.06	+2.67	-9.06
13.	13.	↓ 12.	MariaDB	Relational, Multi-model	100.45	+1.80	-9.70
14.	14.	14.	Splunk	Search engine	91.40	+2.42	-2.65
15.	↑ 16.	↑ 16.	Microsoft Azure SQL Database	Relational, Multi-model	82.73	+3.22	-1.69
16.	↓ 15.	↓ 15.	Amazon DynamoDB	Multi-model	80.91	-2.64	-6.51

https://db-engines.com/en/ranking

Relational Database

422 systems in ranking, September 2023

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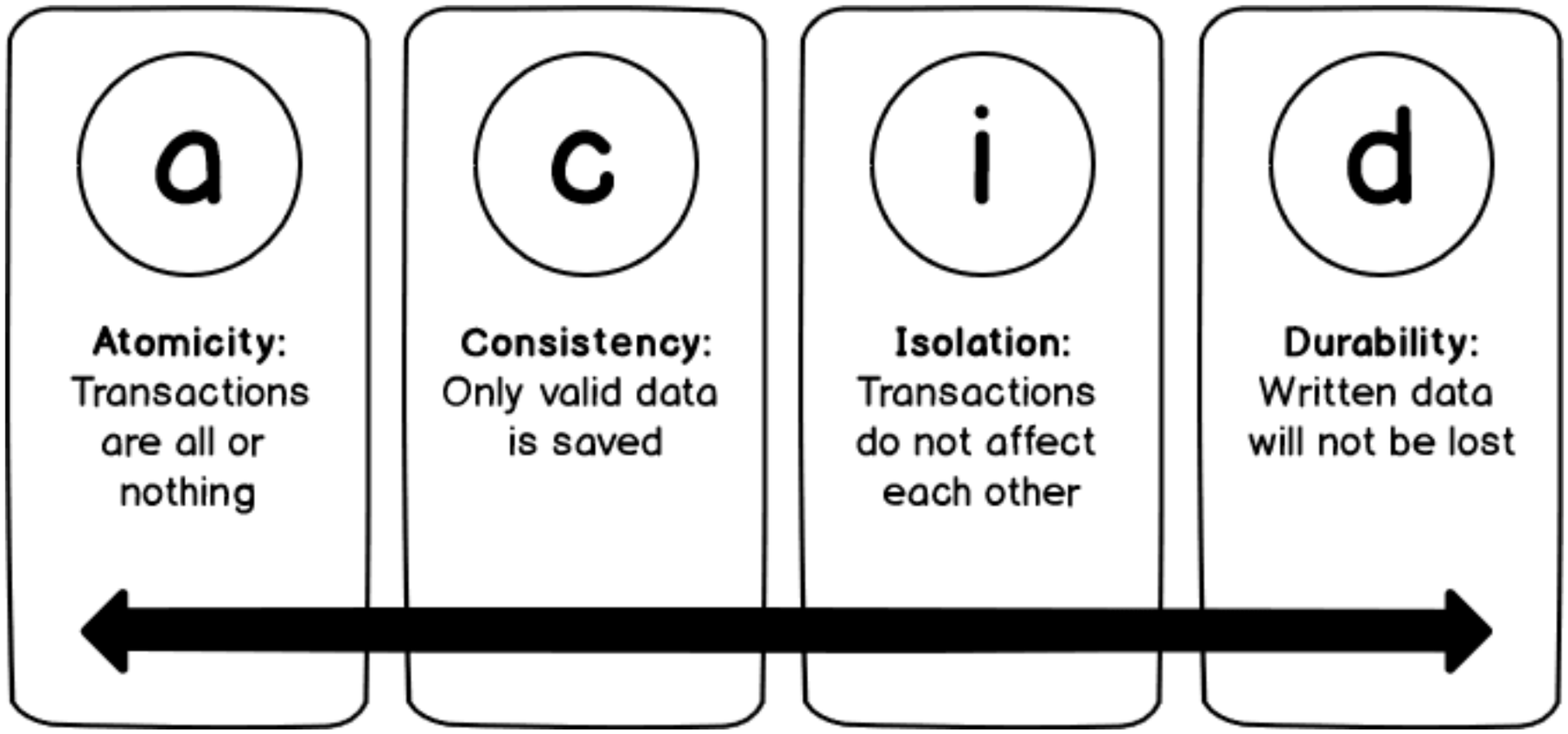
https://db-engines.com/en/ranking

Relational Database

```
SELECT *
FROM SOME_TABLE
WHERE 1=1
HAVING ...
GROUP BY ...
```

A.C.I.D



Other Database Models

422 systems in ranking, September 2023

Rank Sep 2023	Rank Aug 2023	Rank Sep 2022	DBMS	Database Model	Score Sep 2023	Score Aug 2023	Score Sep 2022
1.	1.	1.	Oracle	Relational, Multi-model	1240.88	-1.22	+2.62
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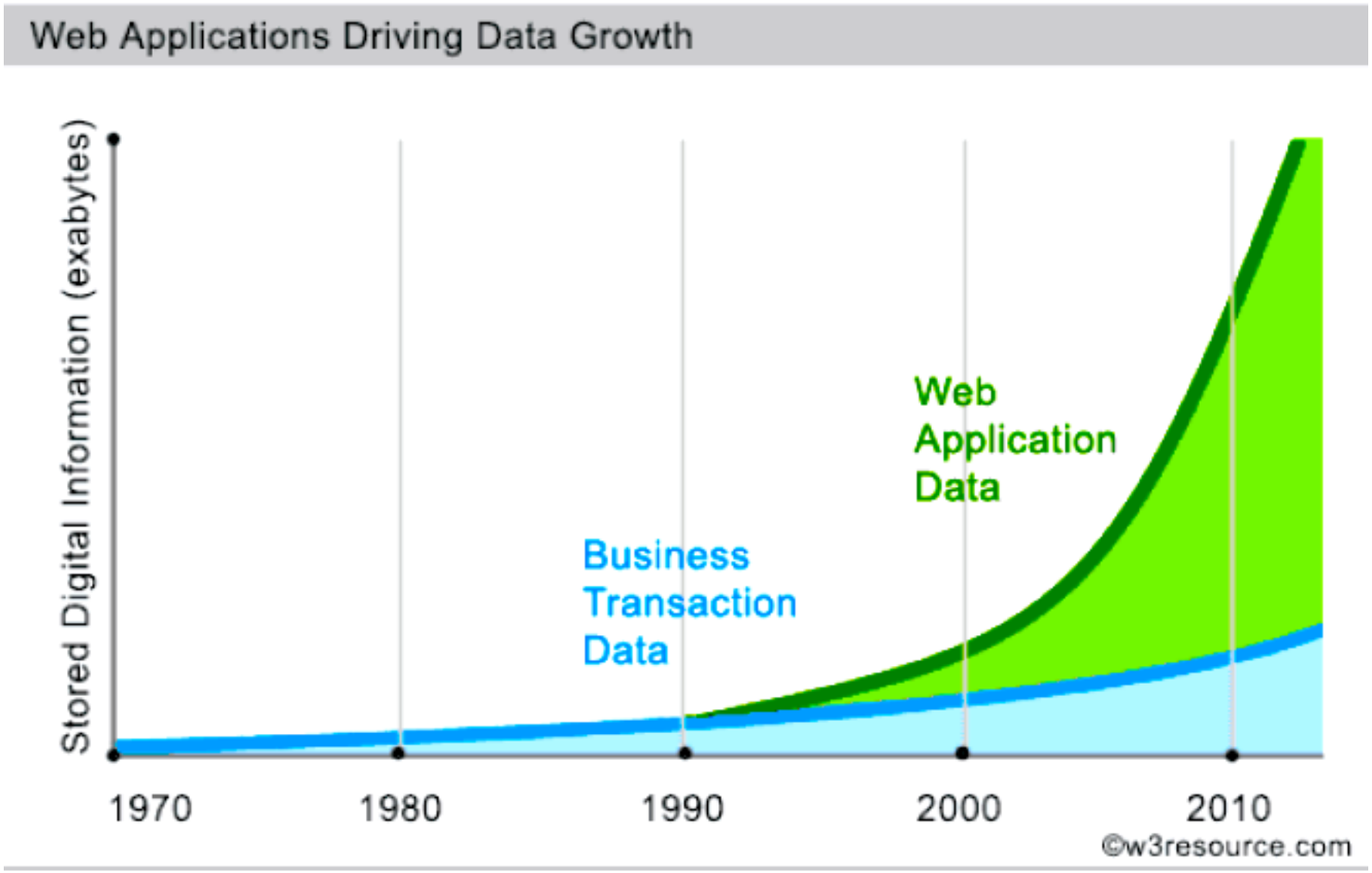
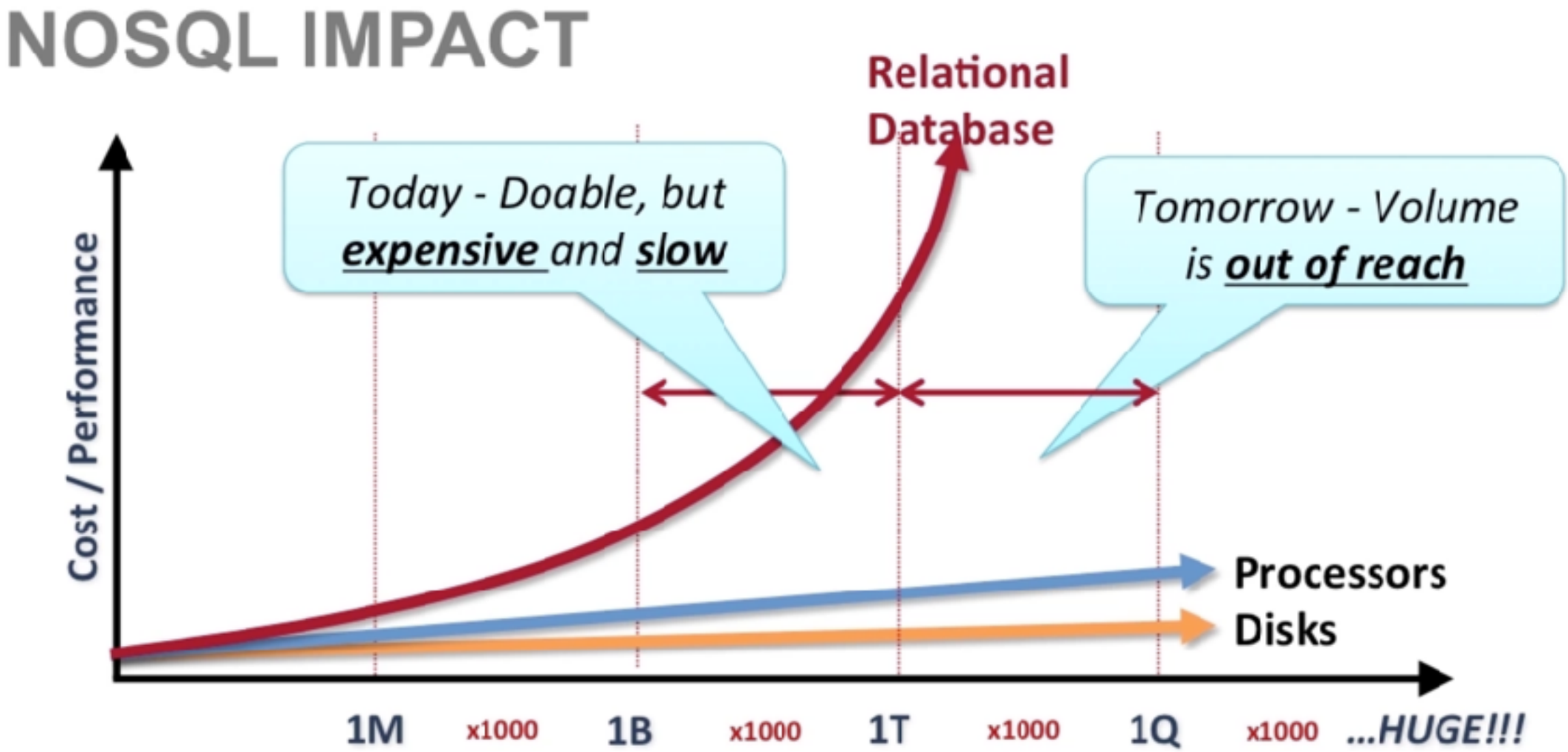
https://db-engines.com/en/ranking

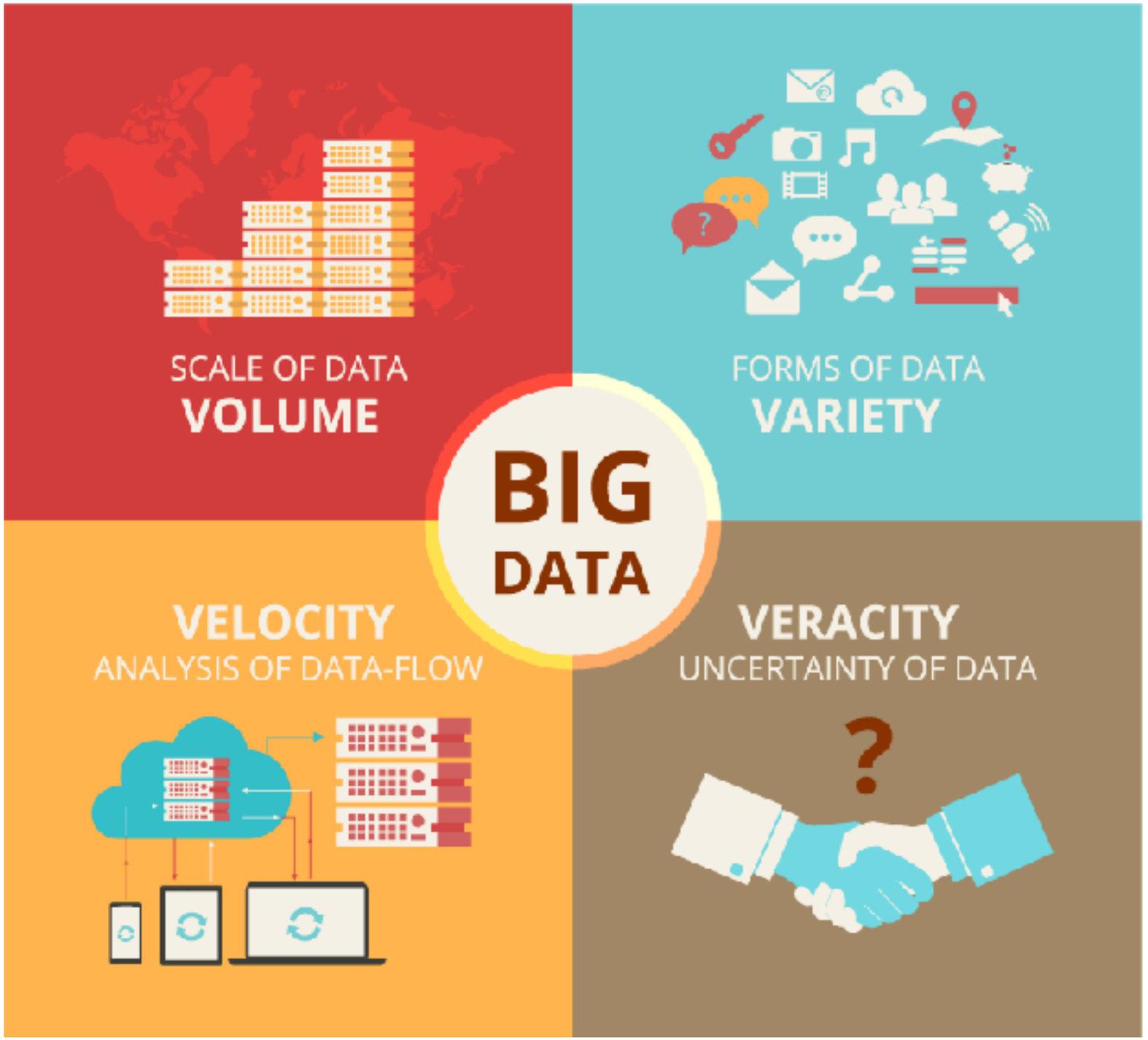
Why ?

Growth of Data !!



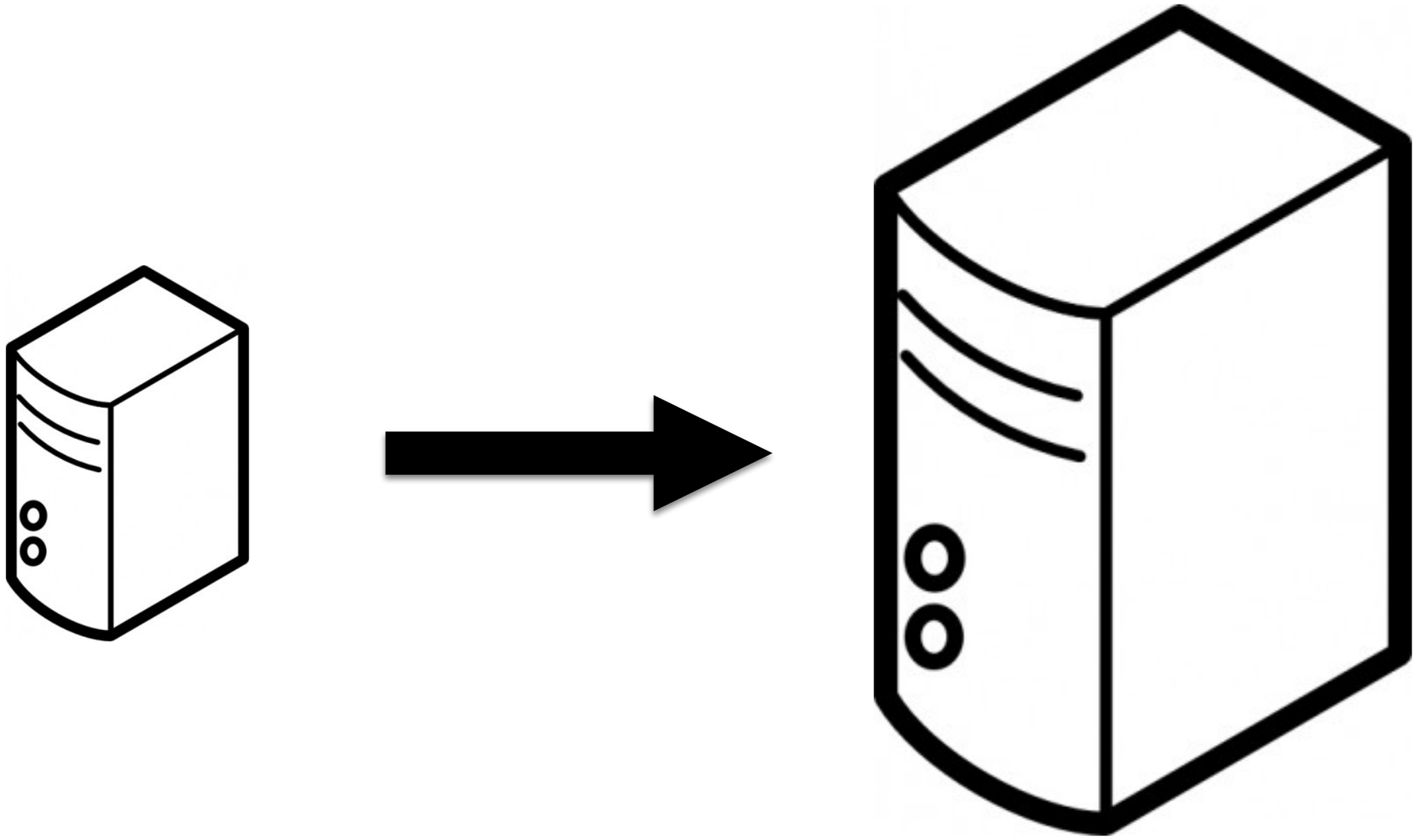
Impact with database !!



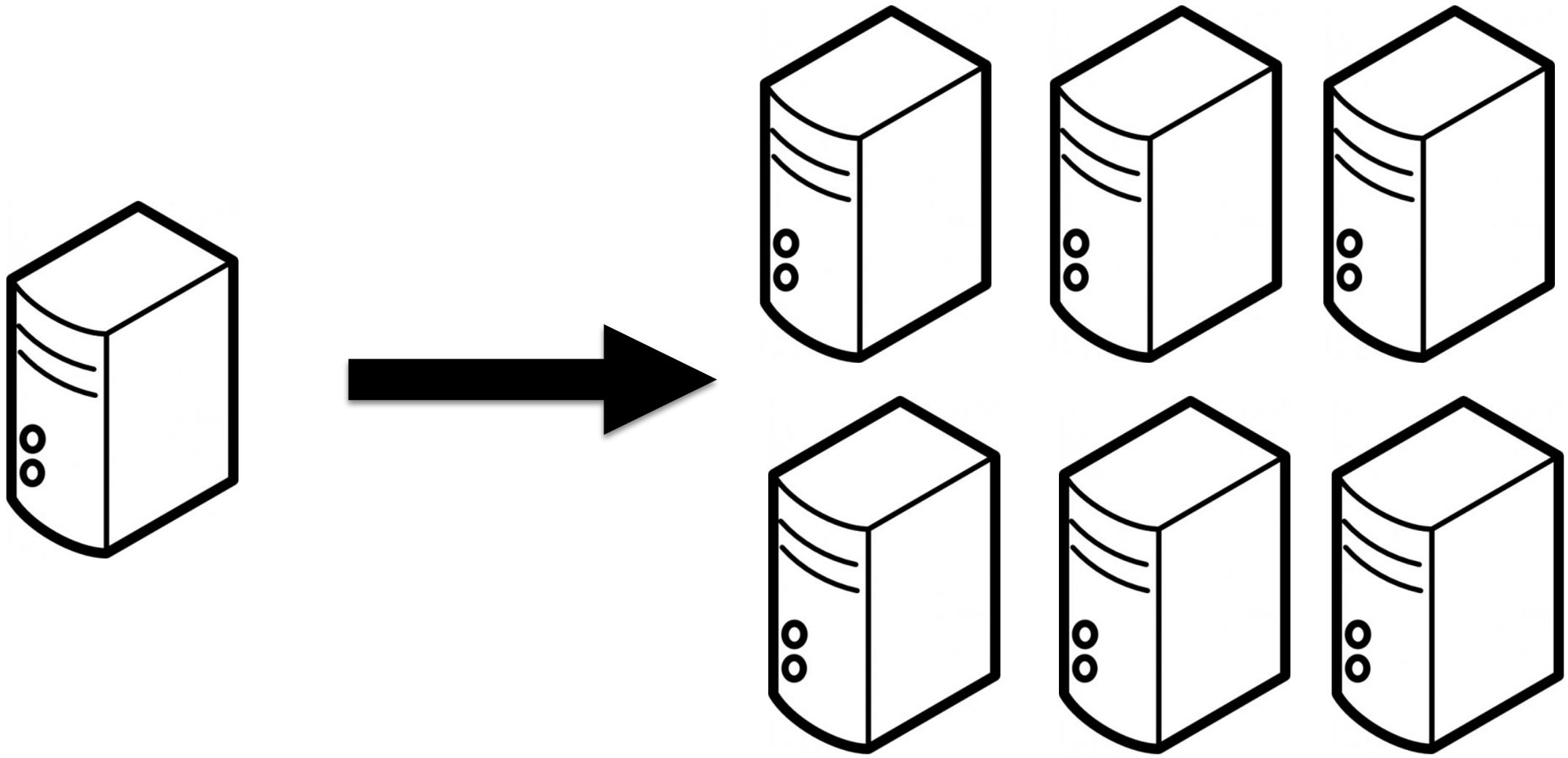


How to scale ?

Scale Up



Scale Out



Performance vs Cost ?

Need new way ?

Bigtable

DynamoDB

“NoSQL”

Eventbrite

Search for events

Browse Events

This event has ended

NOSQL meetup

Last.fm
Thursday, June 11, 2009 from 10:00 AM to 5:00 PM (PDT)
San Francisco, CA

Ticket Information

TYPE	REMAINING	END		QUANTITY
Free ticket	Sold Out	Ended	Free	**Sold Out**

Share NOSQL meetup

Share Tweet Like Be the first of your friends to like this.

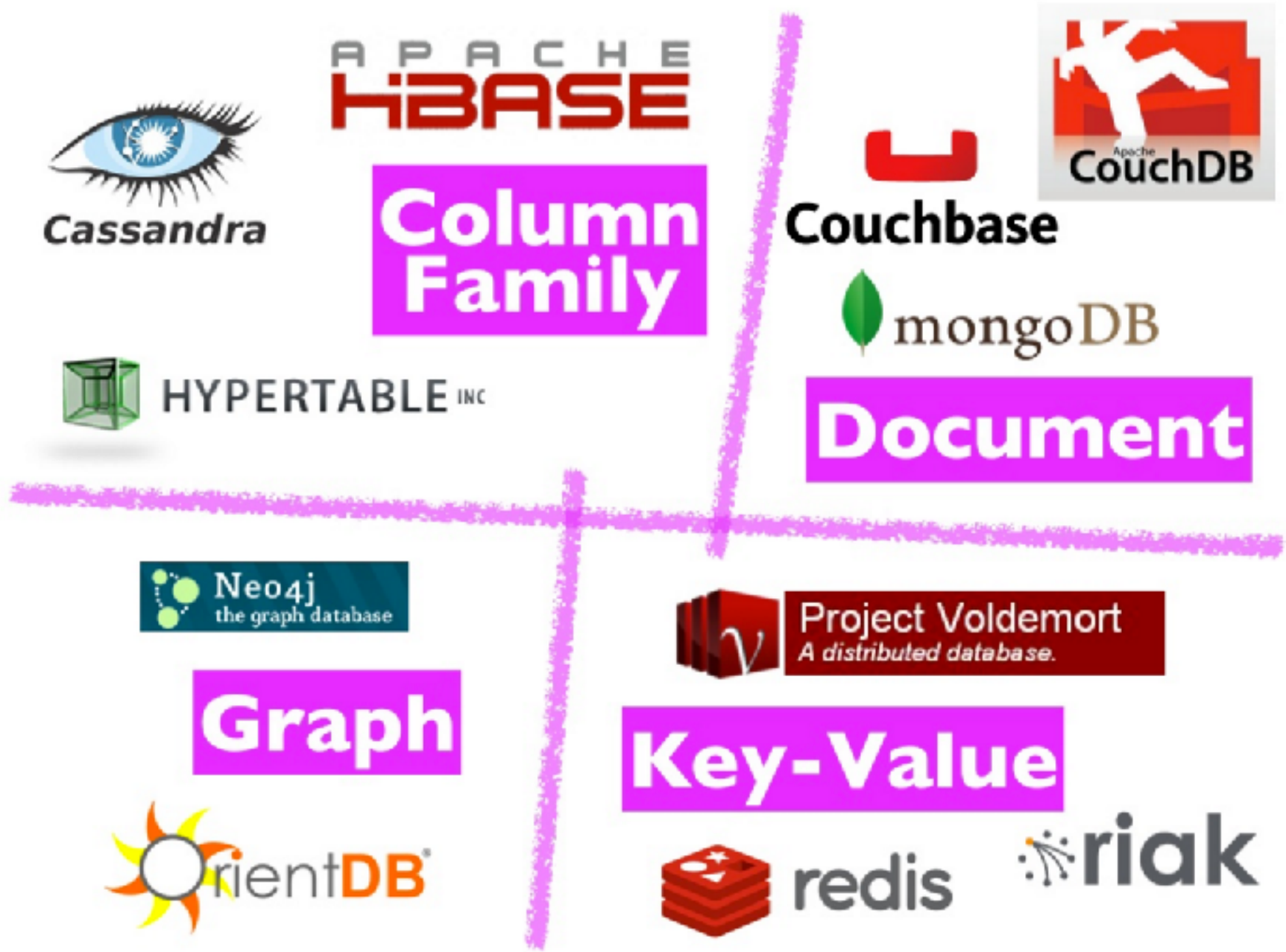
What is NoSQL ?

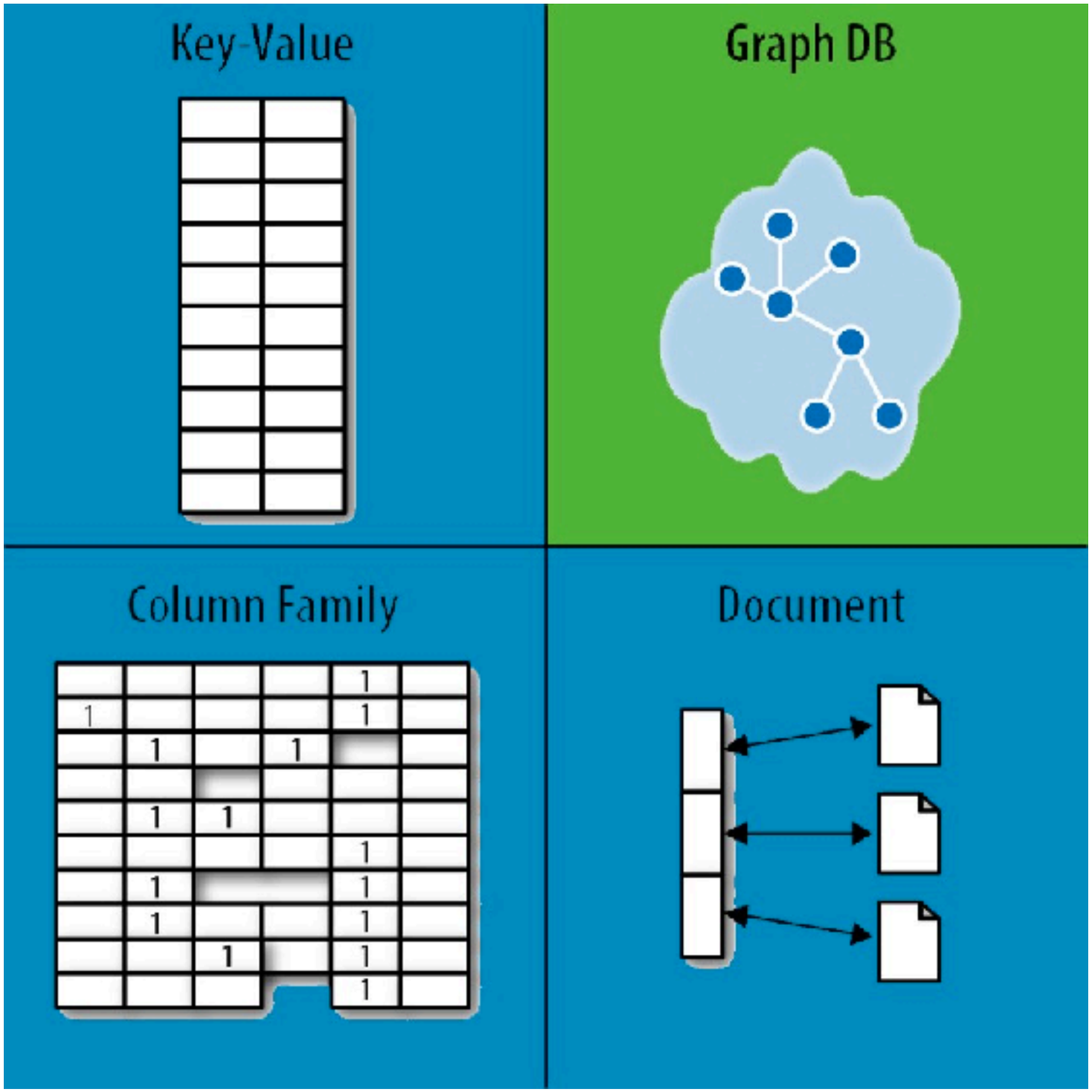
No SQL
Not Only SQL
Non-relational

Properties of NoSQL

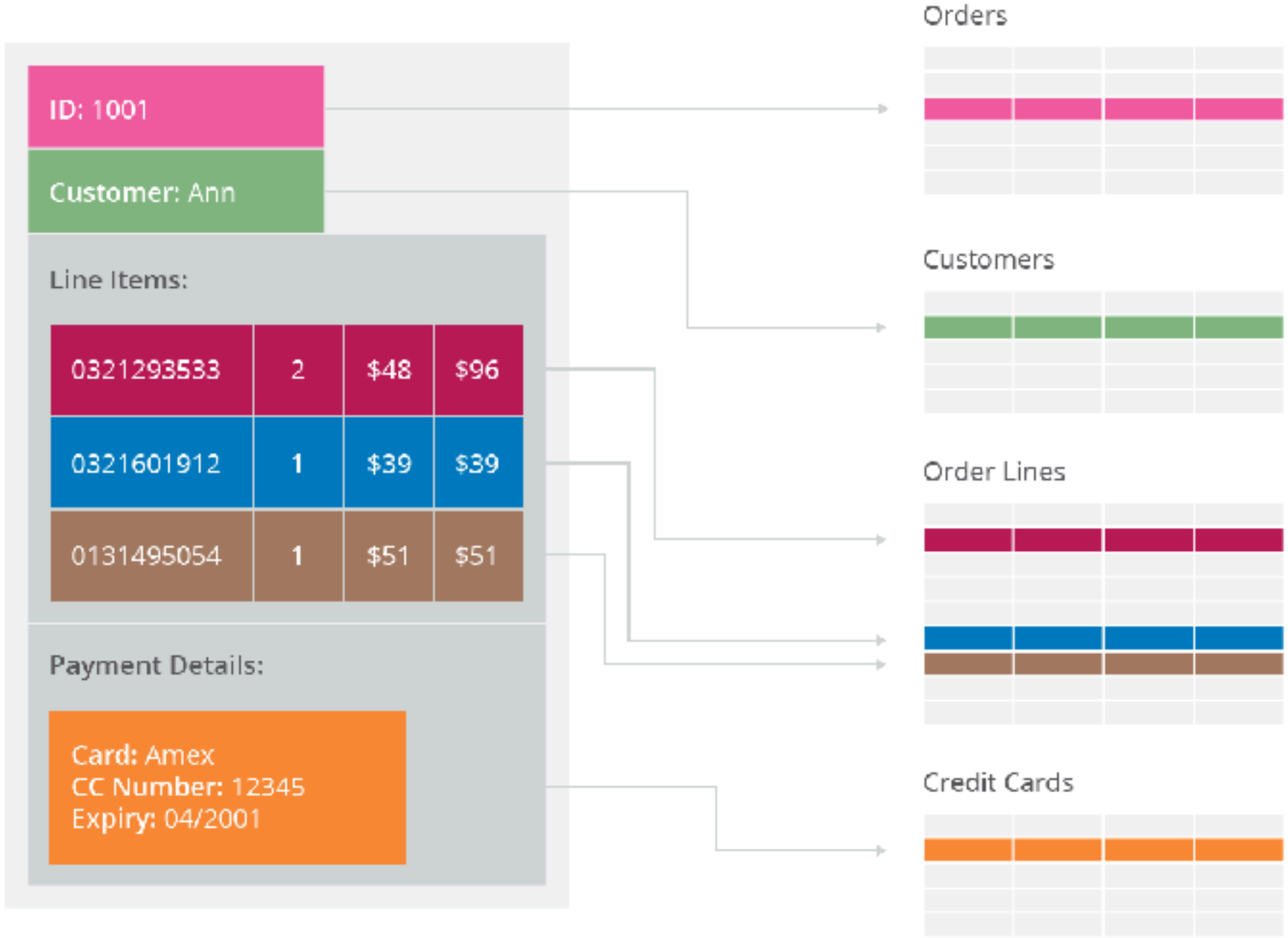
Non-relational (no join)
Open source
Cluster friendly (distributed system)
Schema-less / Dynamic schema
For new web app/application

Non-relational ?



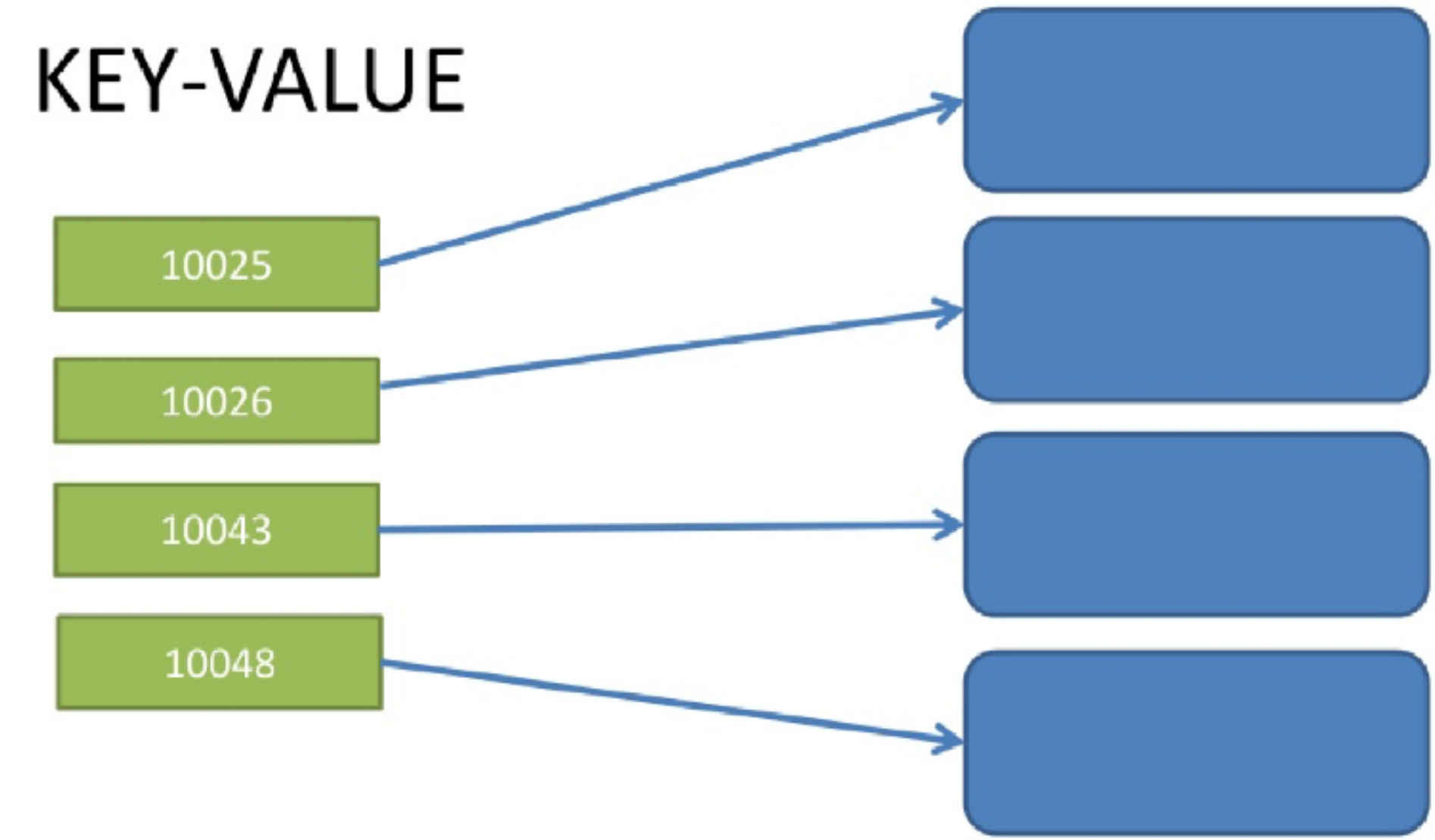


Why ?

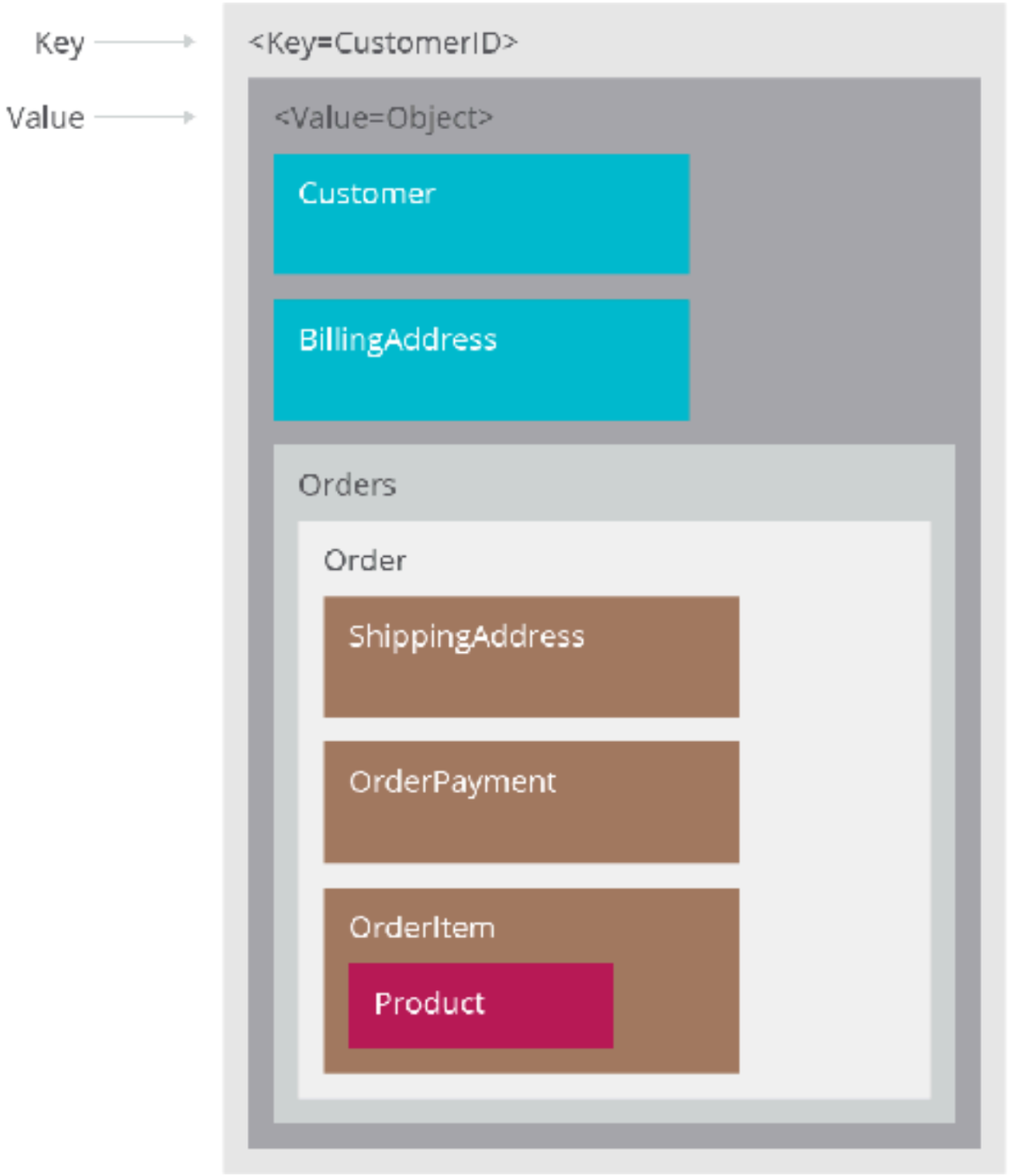


https://www.thoughtworks.com/insights/blog/nosql-databases-overview

Key-value



Key-value



Key-value use cases

Store session information
User profiles
Preferences
Shopping cart data
Caching data

Key-value tools

Document

<Key=CustomerID>

```
{
   "customerid": "fc986e48ca6"
   "customer":
   {
   "firstname": "Pramod",
   "lastname": "Sadalage",
   "company": "ThoughtWorks",
   "likes": [ "Biking","Photography" ]
   }
   "billingaddress":
   { "state": "AK",
      "city": "DILLINGHAM",
      "type": "R"
    }
}
```

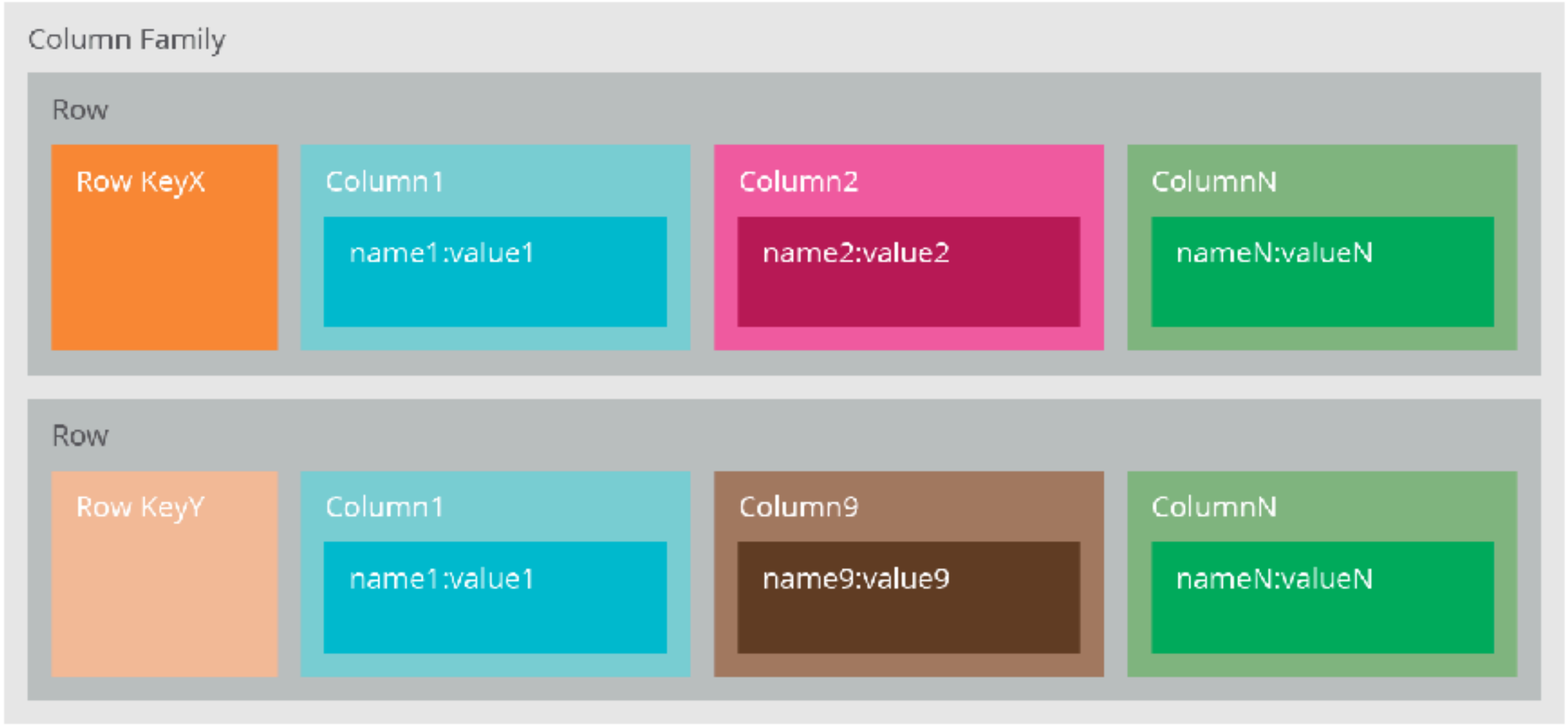
Key

Key-value use cases

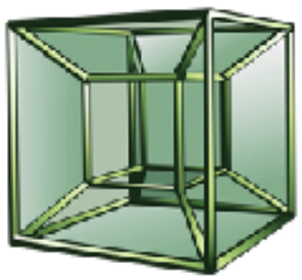
Content management system
E-commerce system
Web analytics
Realtime analytics
Blogging platform

Document tools

Column family

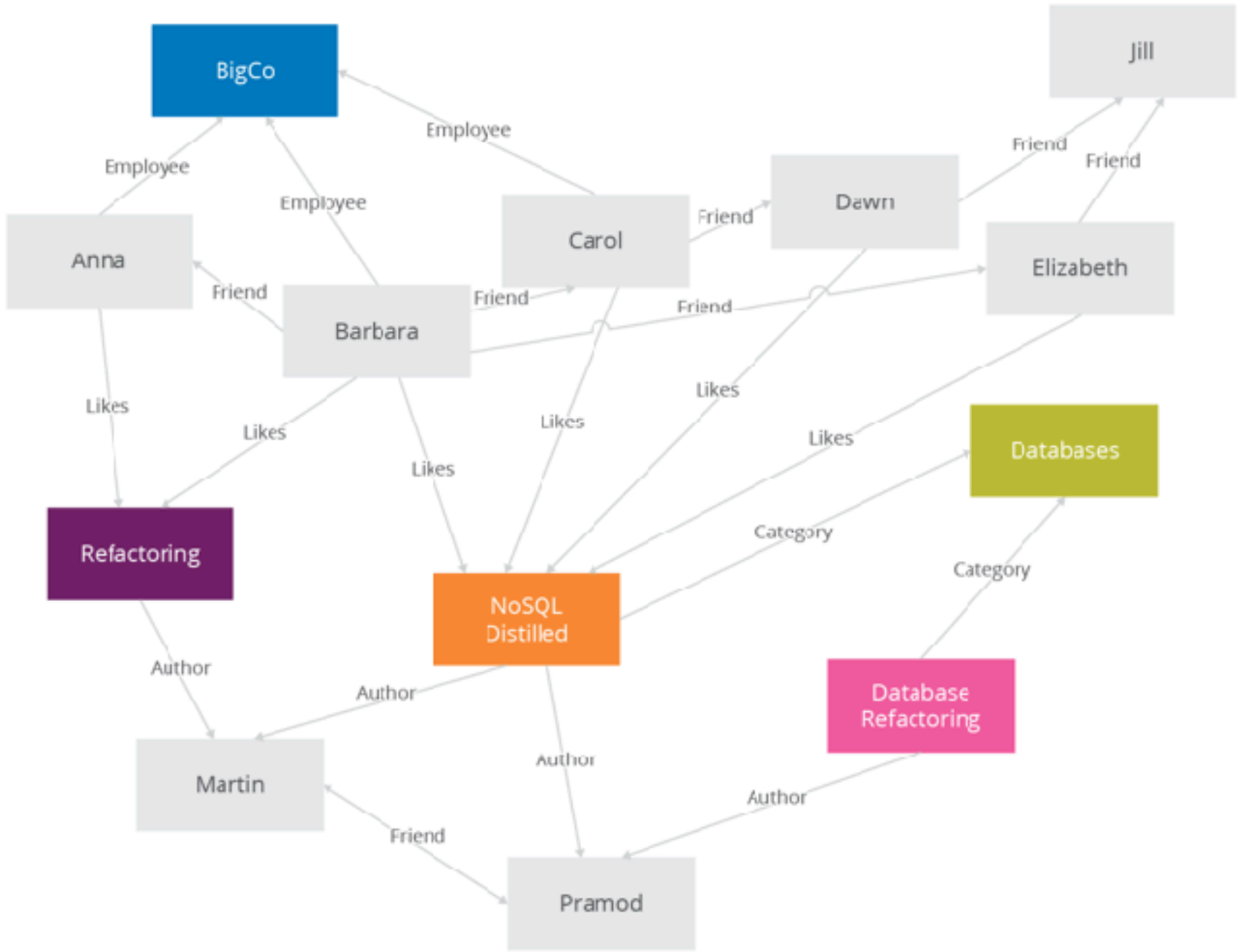


Column family tools

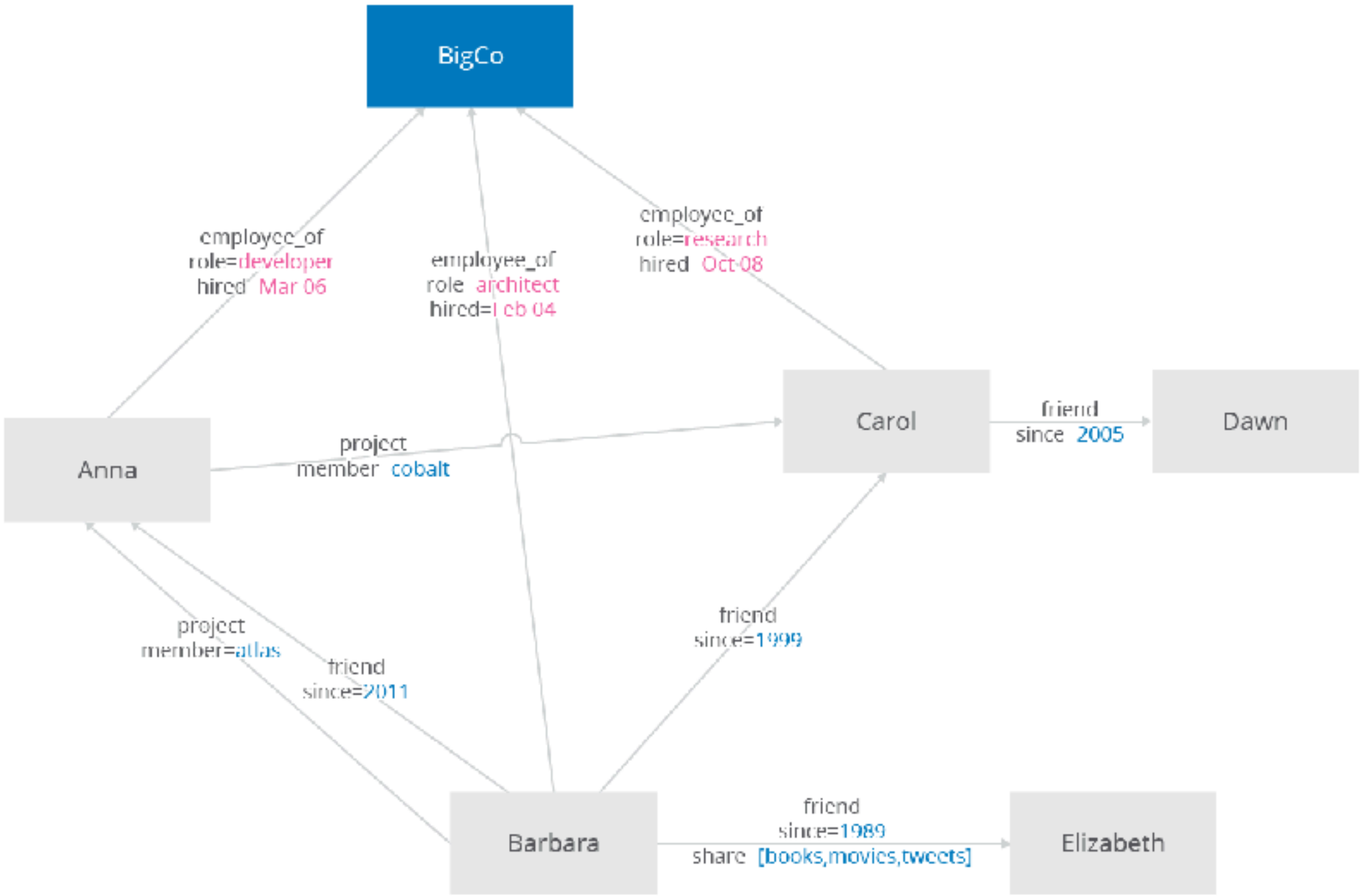


HYPERTABLE INC

Graph



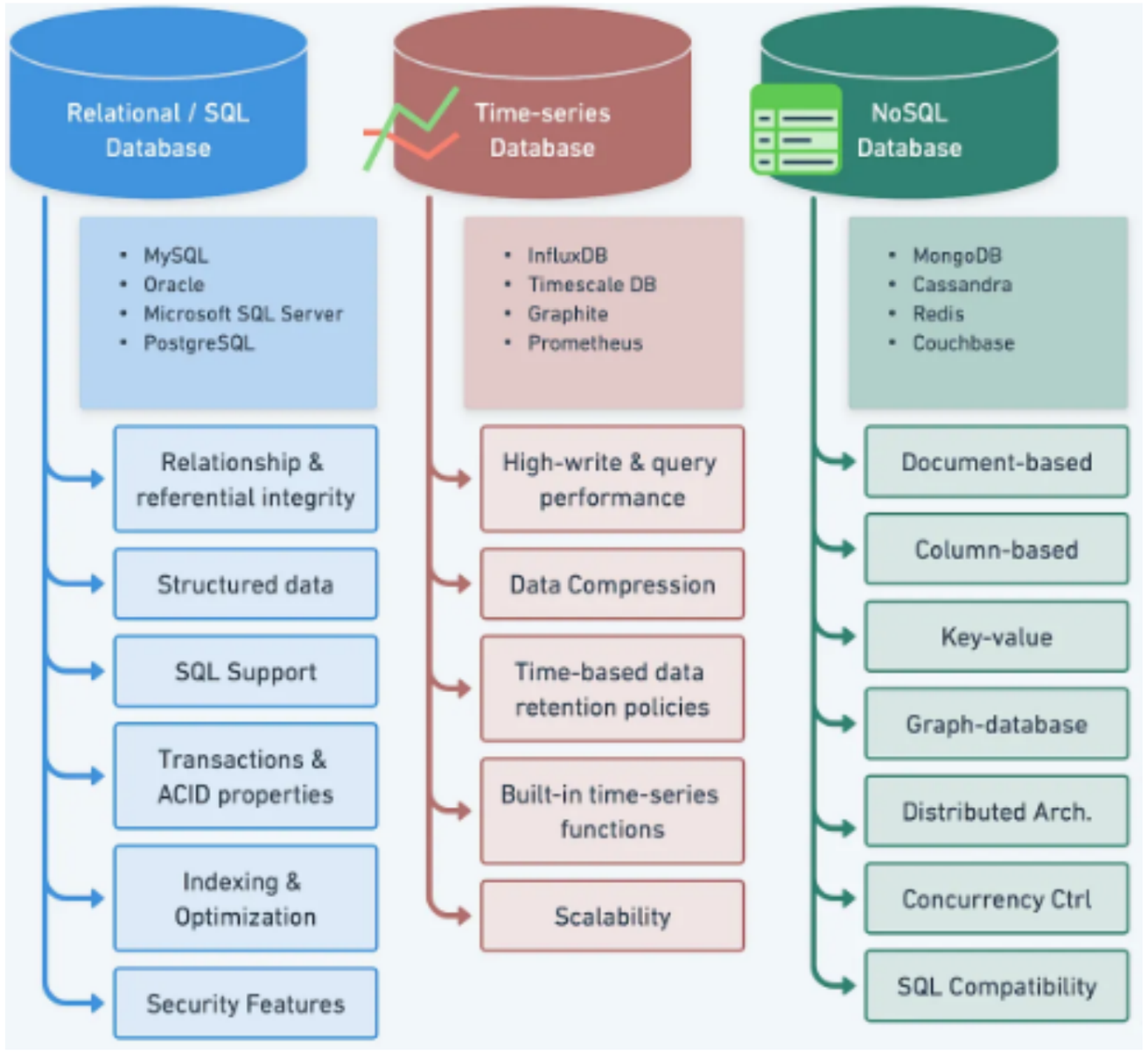
Graph



Graph tools

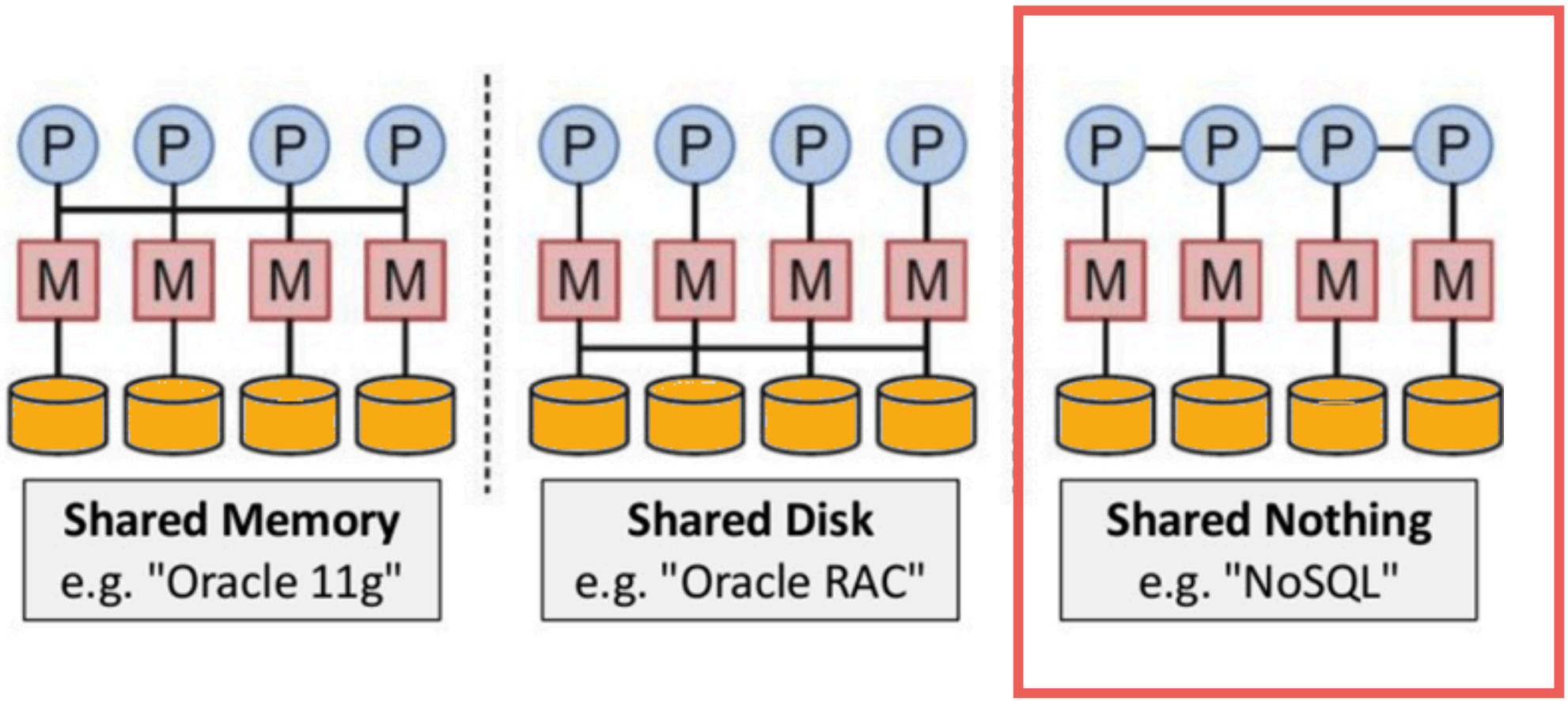
Types of Database

Types of Databases



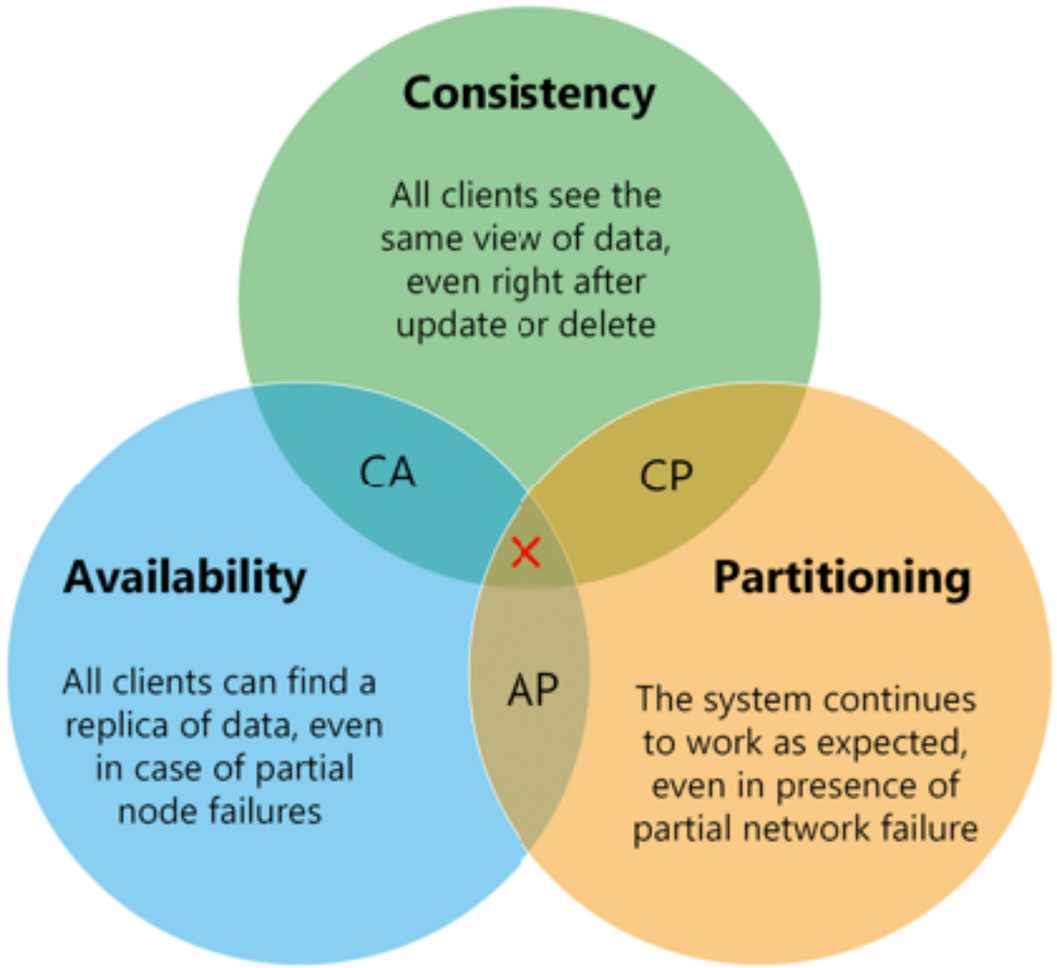
Distributed System

Shared nothing



CAP theorem

Design for distributed system

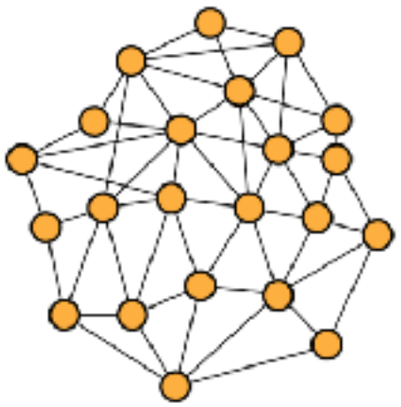


https://en.wikipedia.org/wiki/CAP_theorem

CAP theorem

C : Consistency

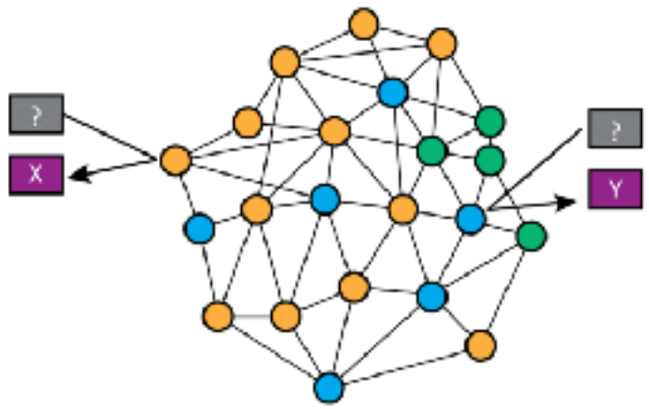
At any given time, all nodes in the network have exactly the same (most recent) value.



= Value: X @ 2018-05-03T08:52:40

A : Availability

Every request to the network receives a response, though without any guarantee that returned data is the most recent.



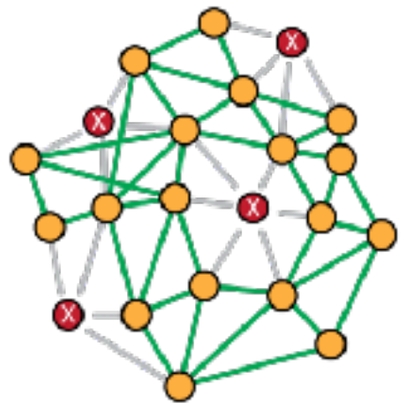
= Value: X @ 2018-05-03T08:52:40

= Value: Z @ 2018-05-03T08:32:58

= Value: Y @ 2018-05-03T07:12:12

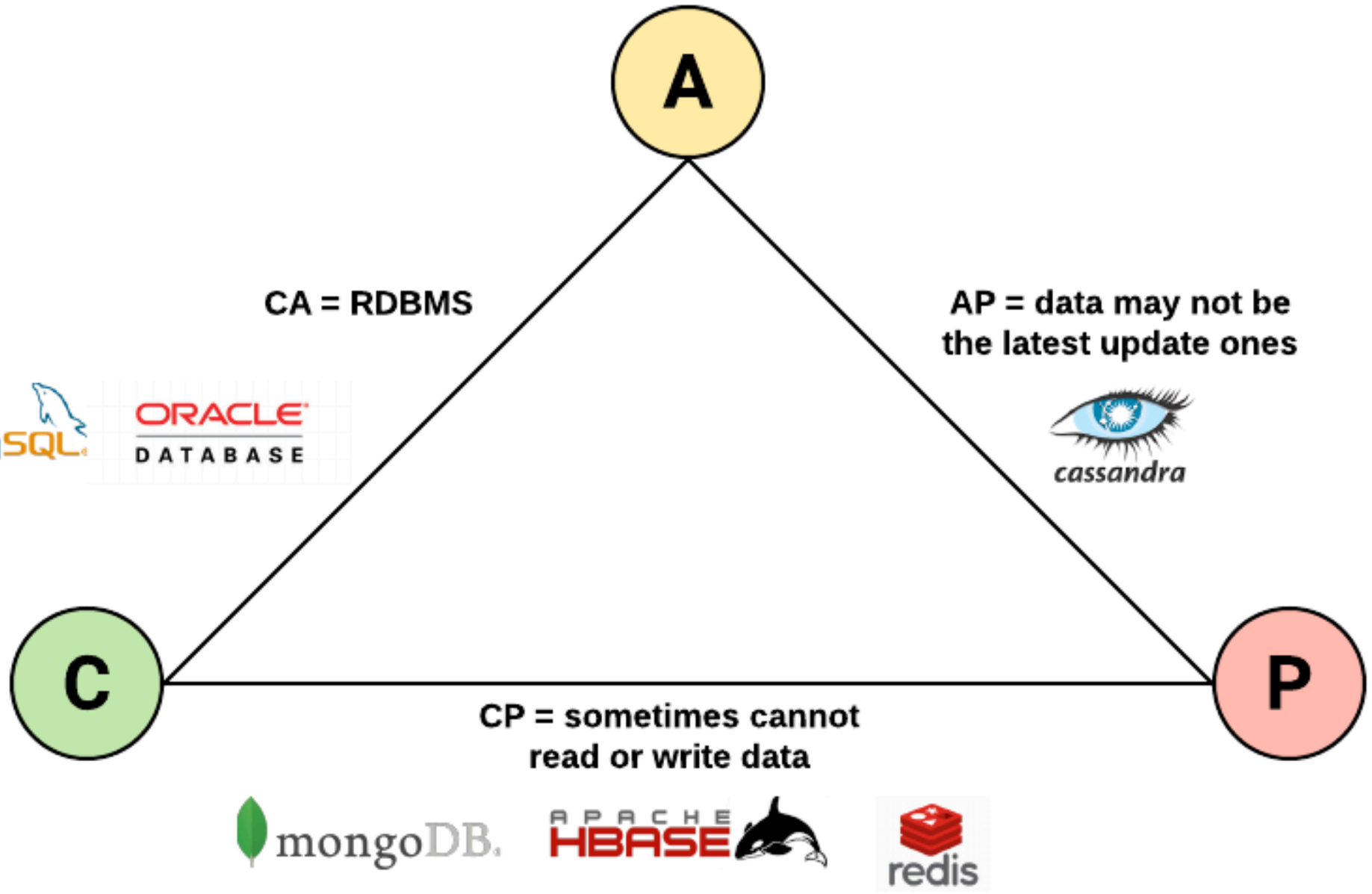
P : Partition tolerance

The network continues to operate, even if an arbitrary number of nodes are failing.

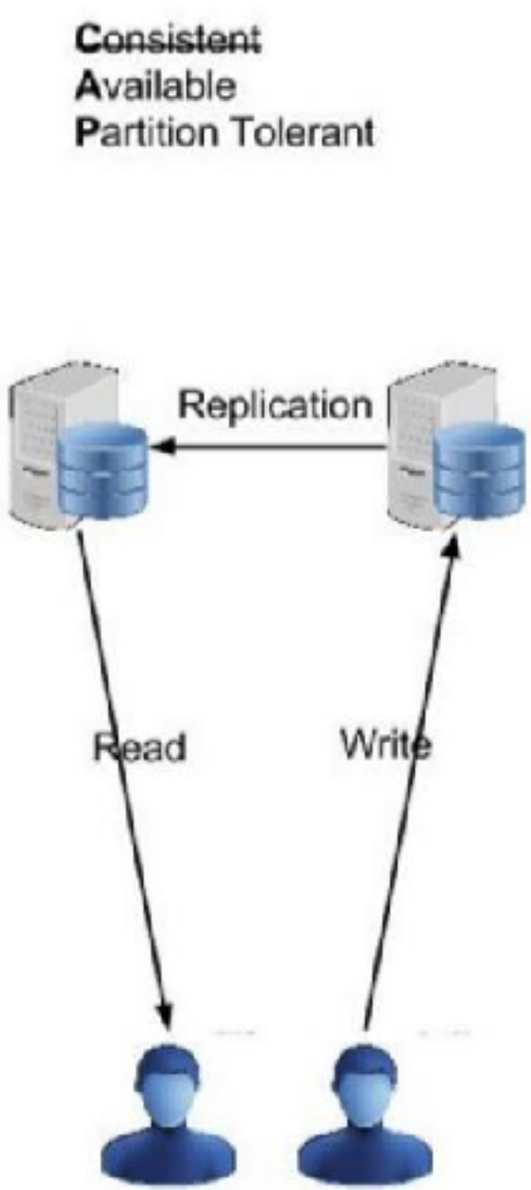


https://cryptographics.info/cryptographics/blockchain/cap-theorem/

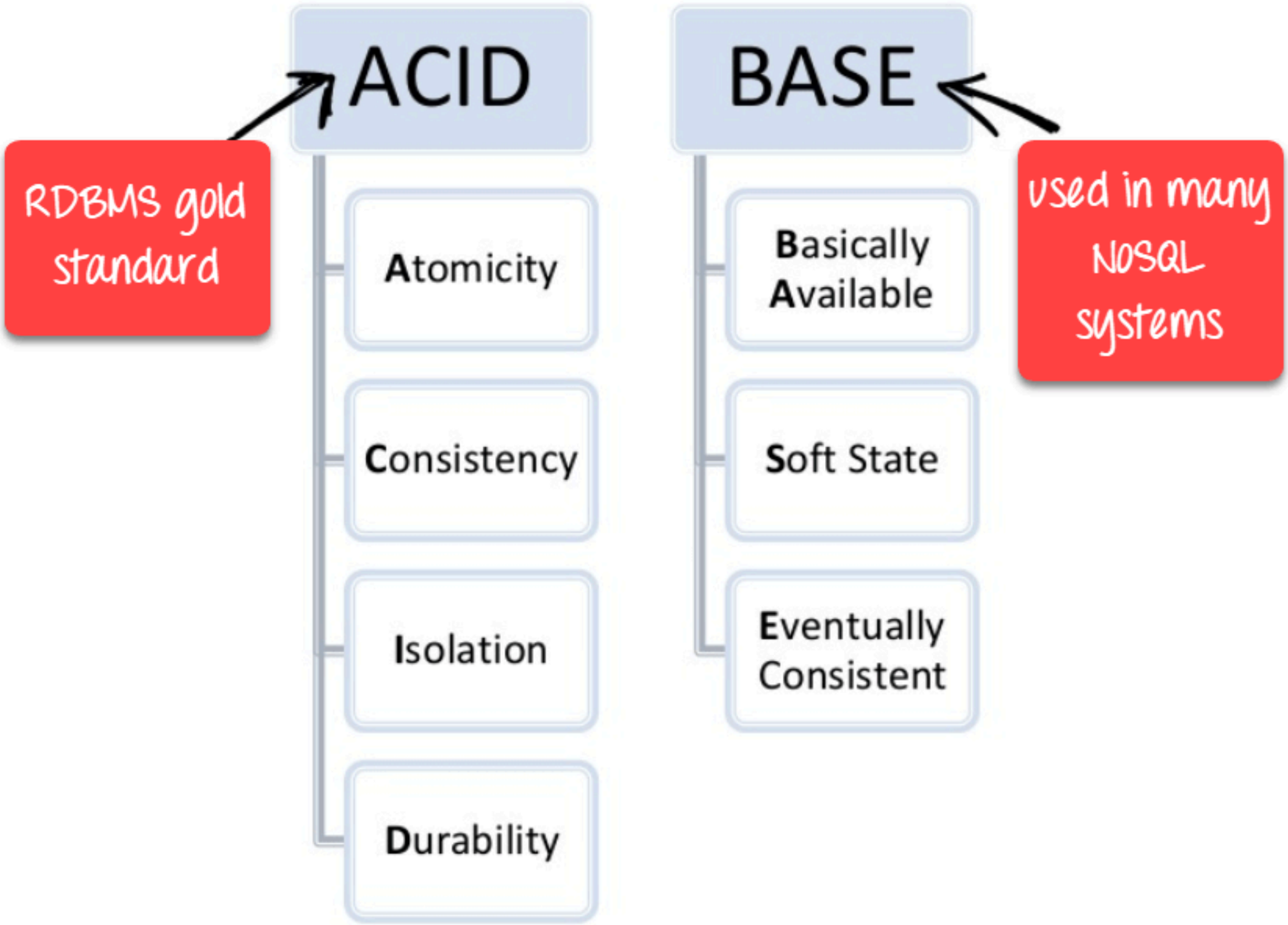
CAP theorem



CAP theorem



ACID vs BASE



B.A.S.E

Basically **A**vailable
Soft state
Eventually consistency

"Provide flexibility approach"

Basically Available

Always work

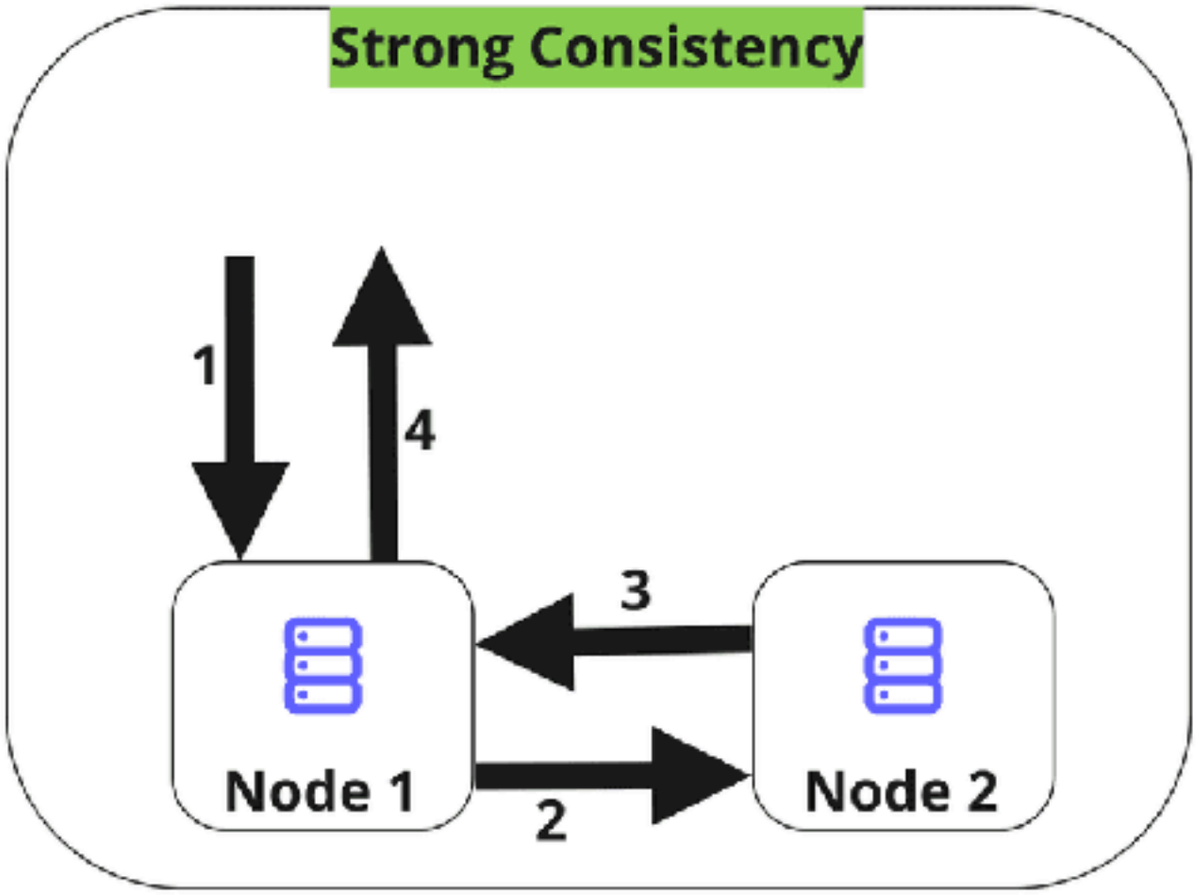
24x7

Soft state

Stores don’t have to be write-consistent

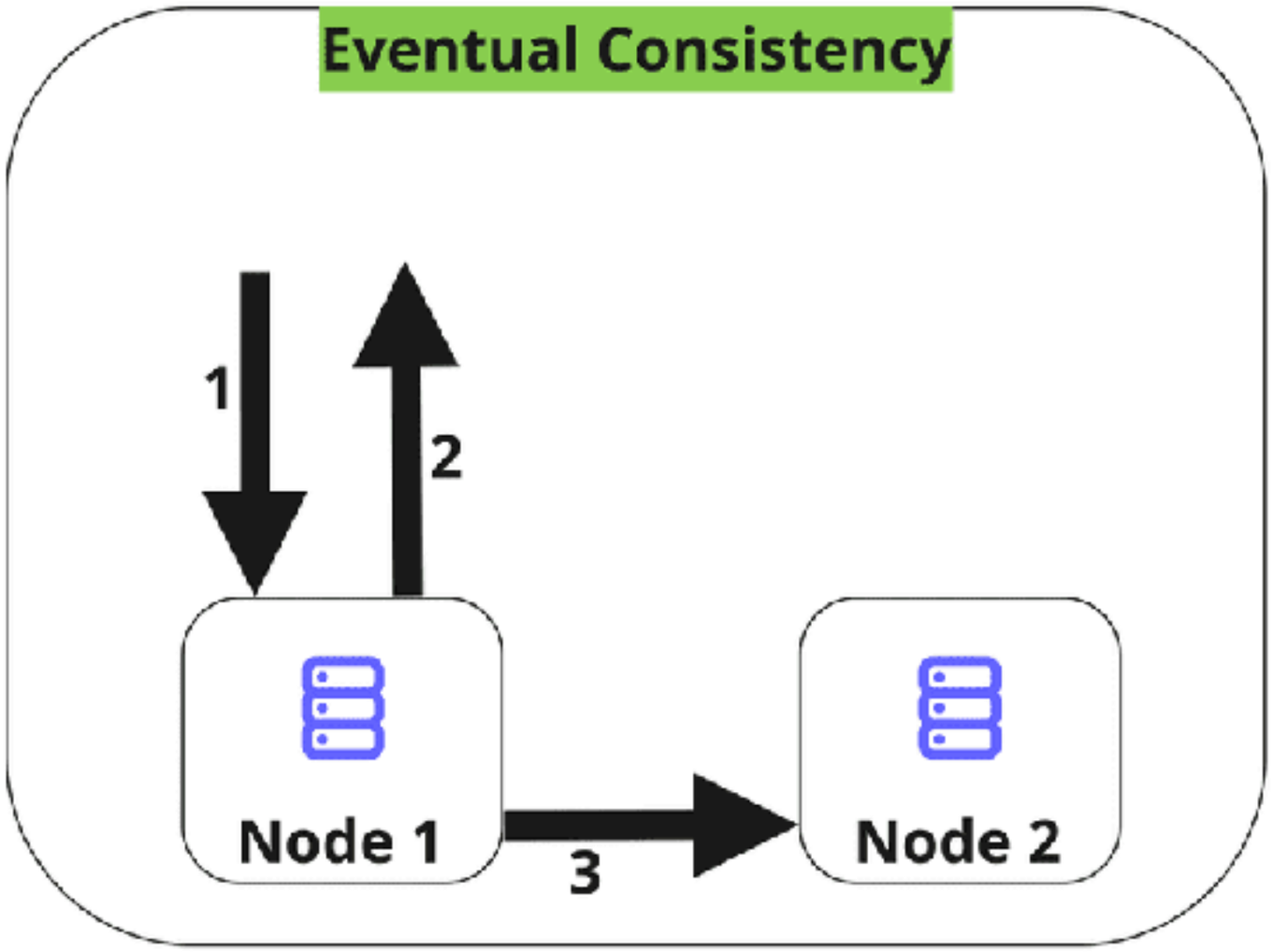
“Eventual Consistency”

Strong Consistency



1. Write request from client.
2. Write request propagated through cluster.
3. Internal acknowledgement.
4. Acknowledgement to the client.

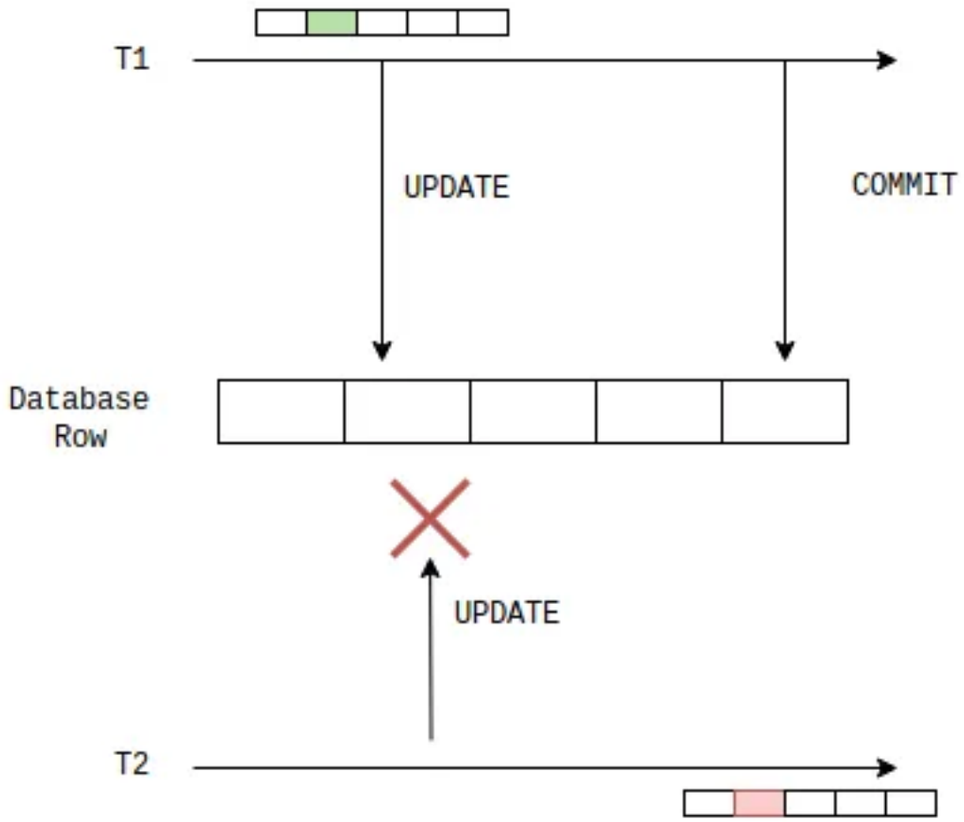
Eventual Consistency



1. Write request from client.
2. Acknowledgement to the client.
3. Eventual write propagation.

Isolation level

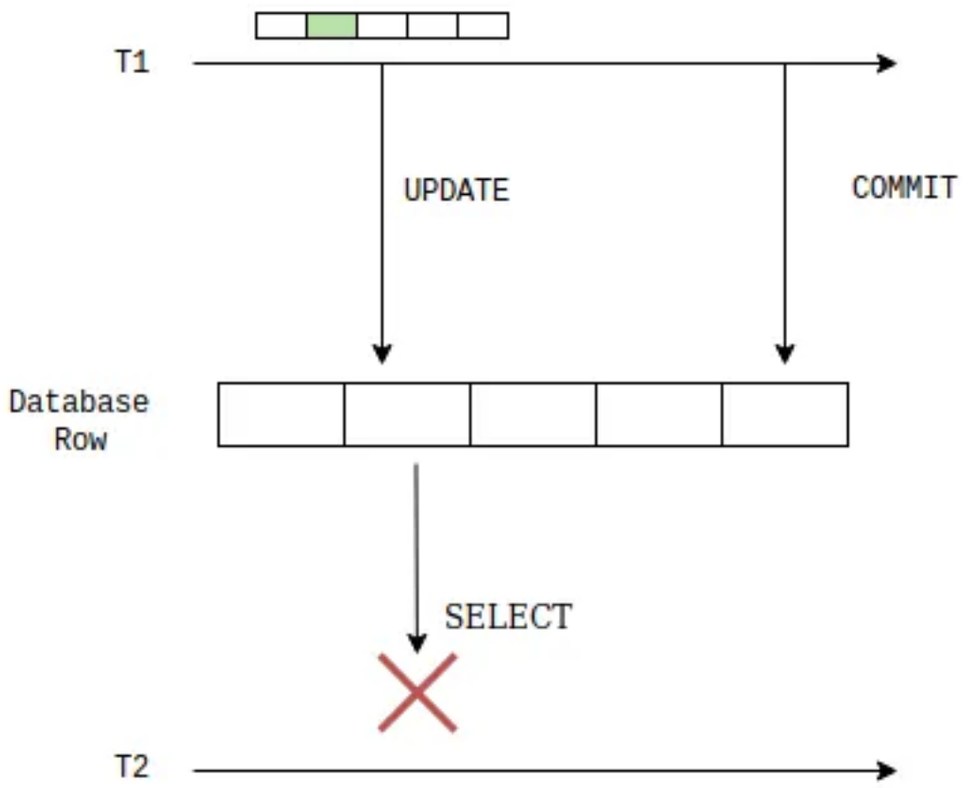
Read uncommitted



Can’t update

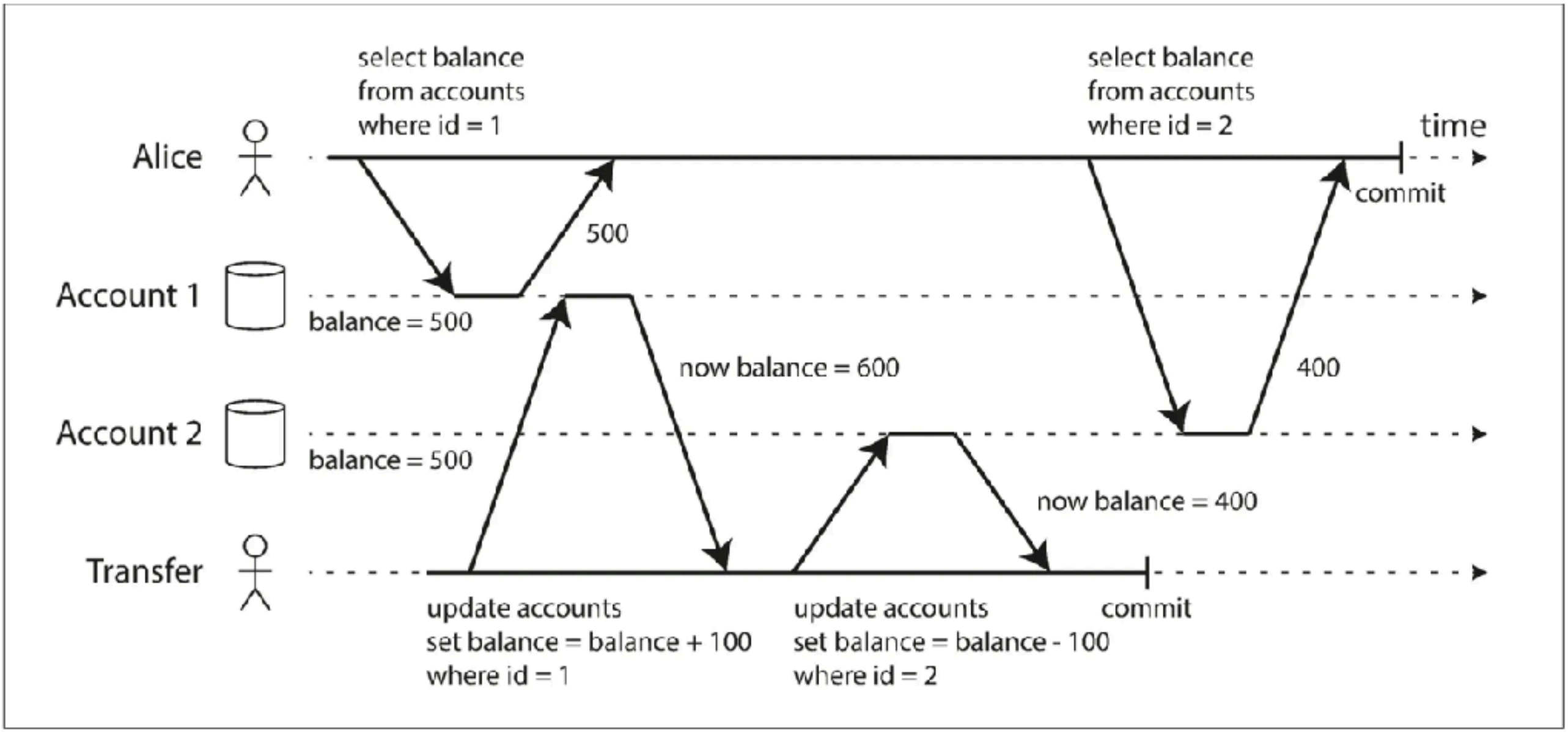
Isolation level

Read committed



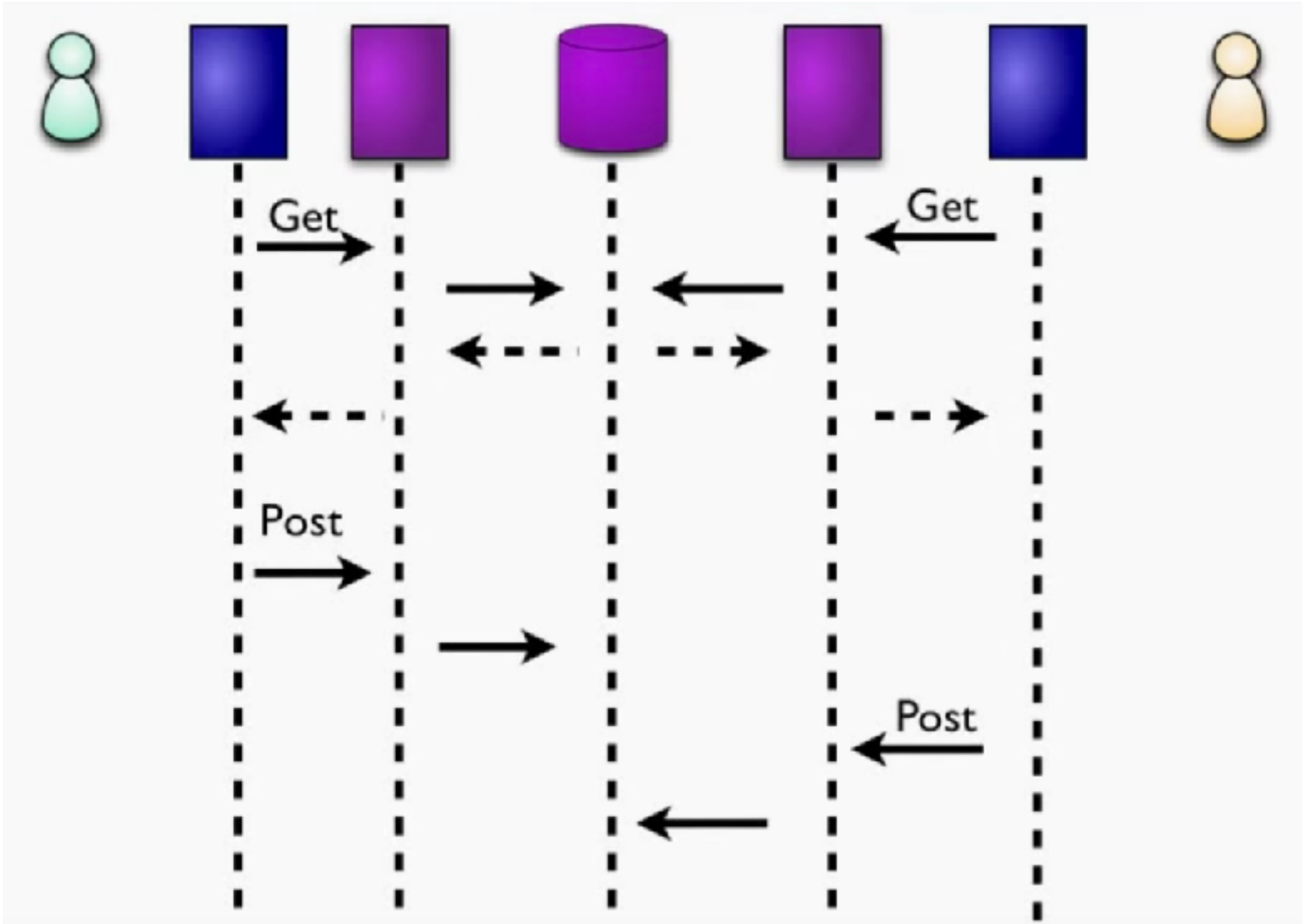
Can’t read/update

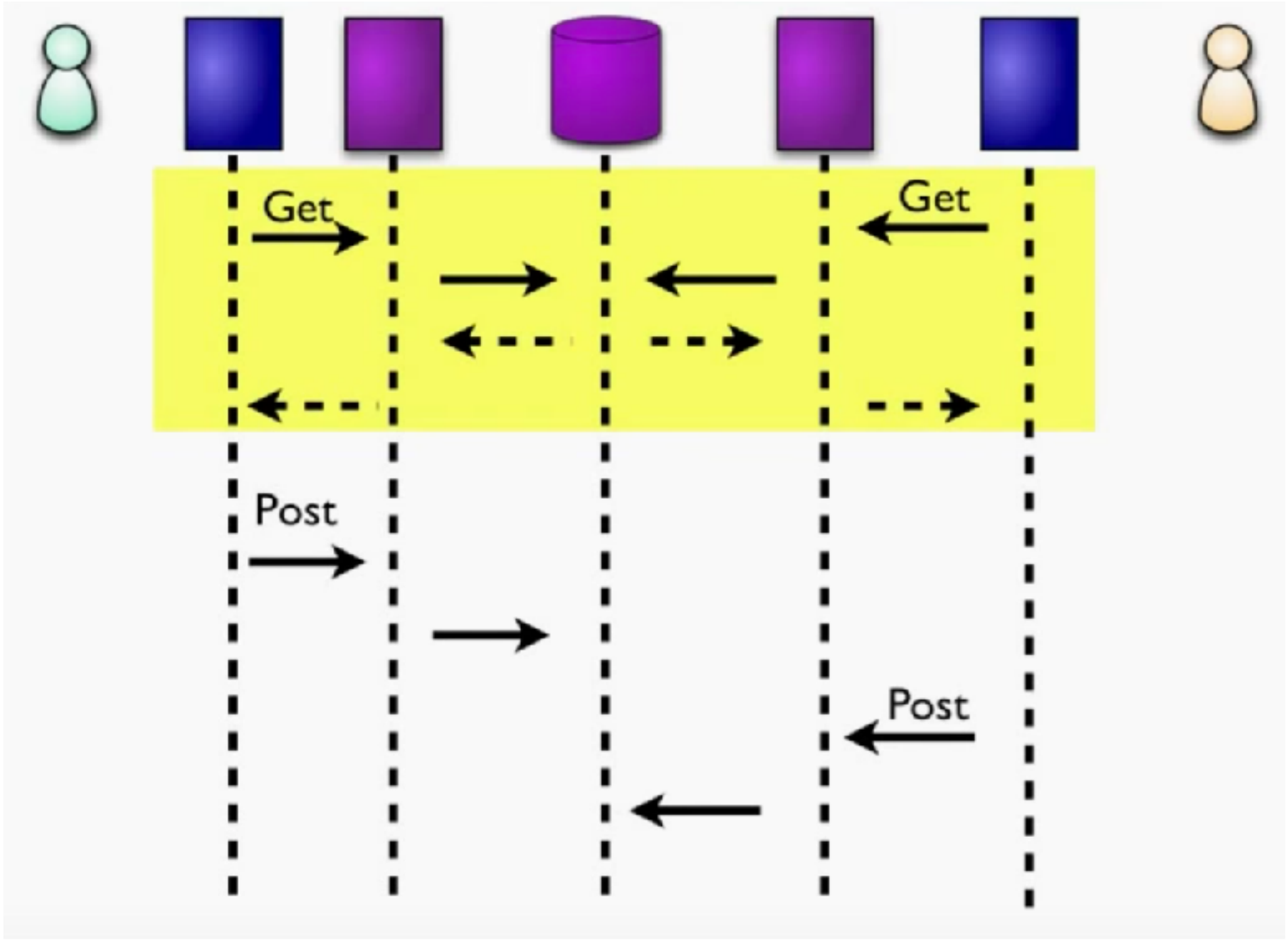
Isolation level



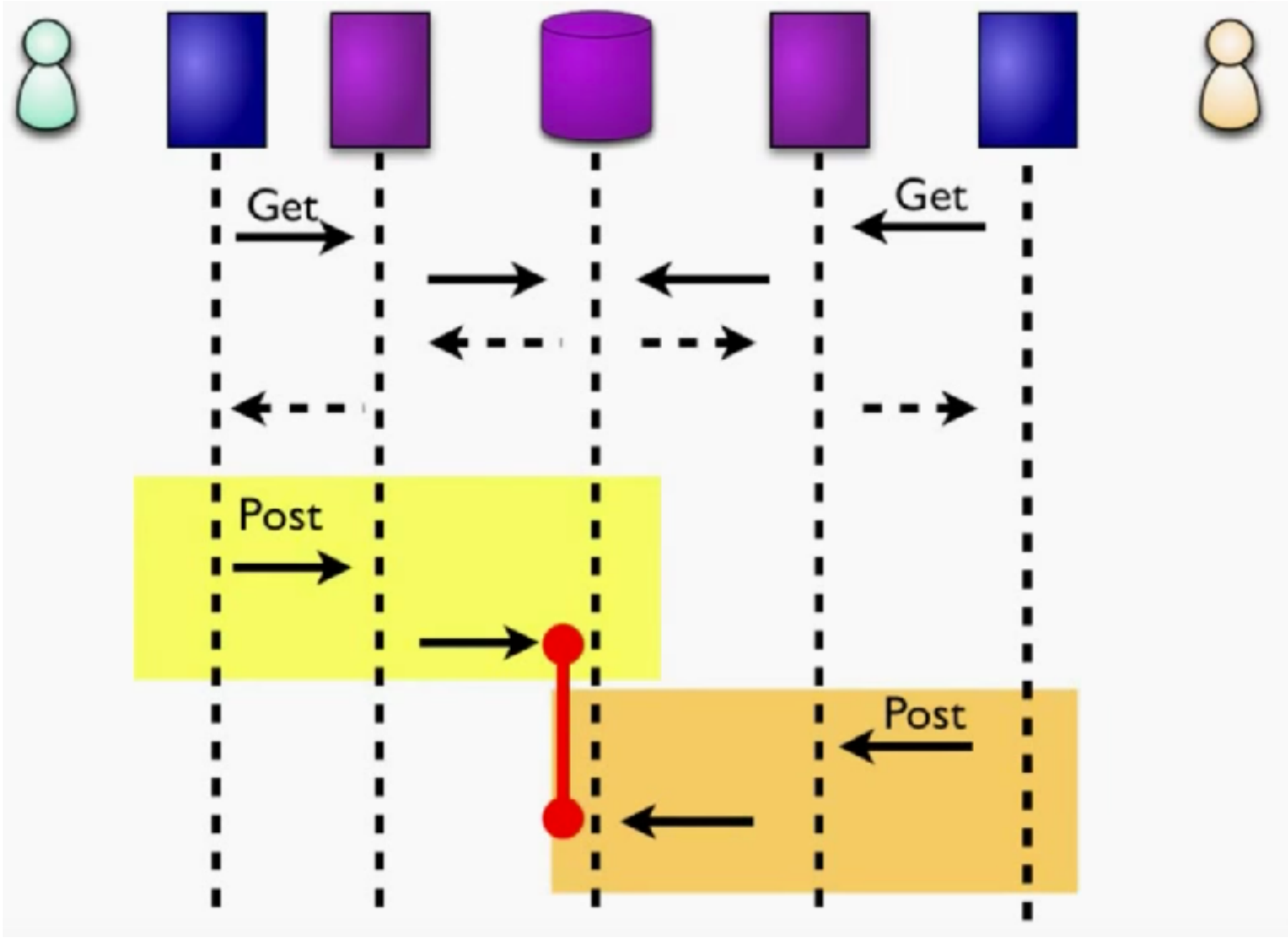
https://medium.com/@pulkitent/system-design-database-transactions-isolation-levels-concurrency-control-contd-part-2-78db036f6971

Consistency !!

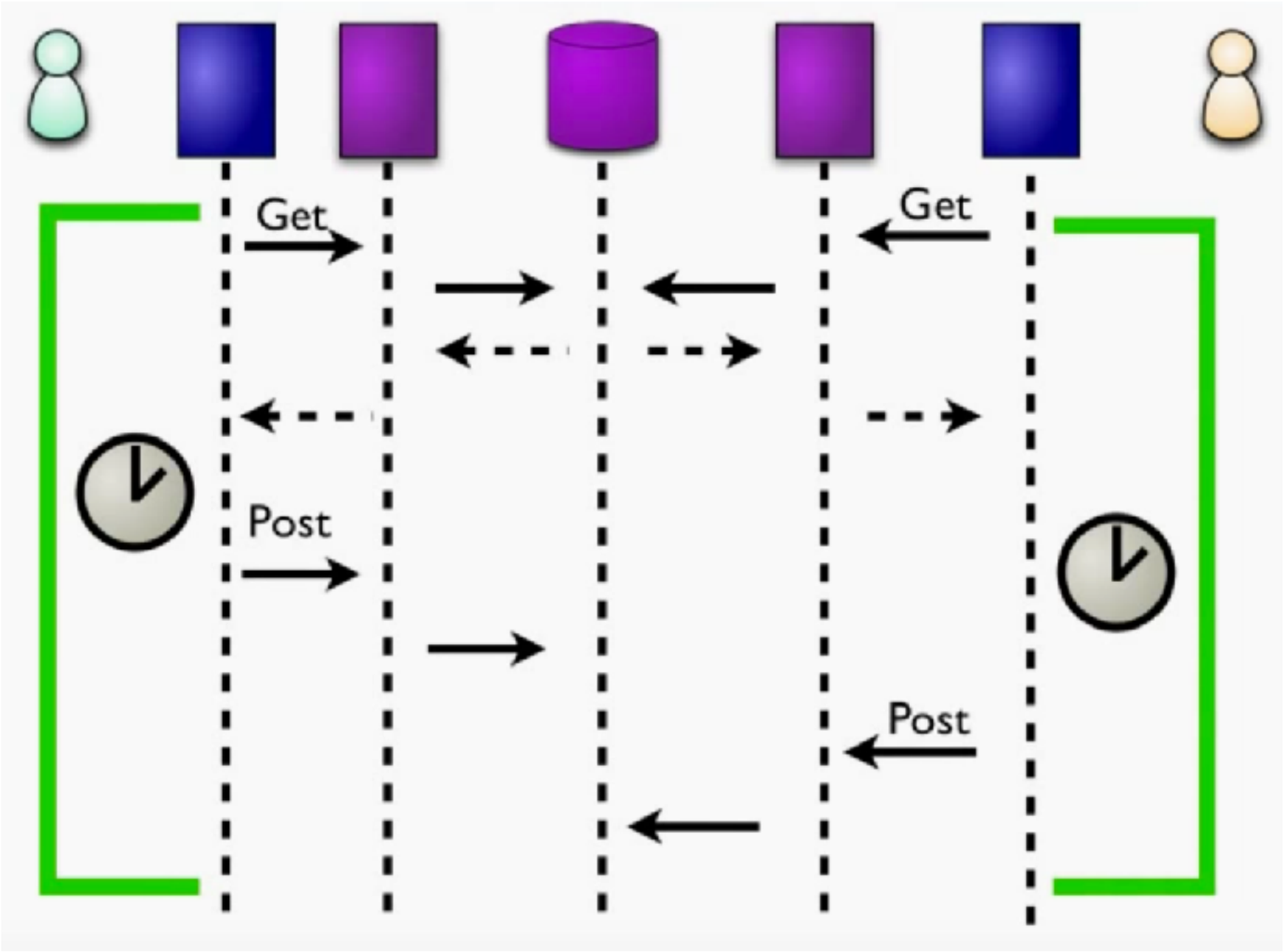




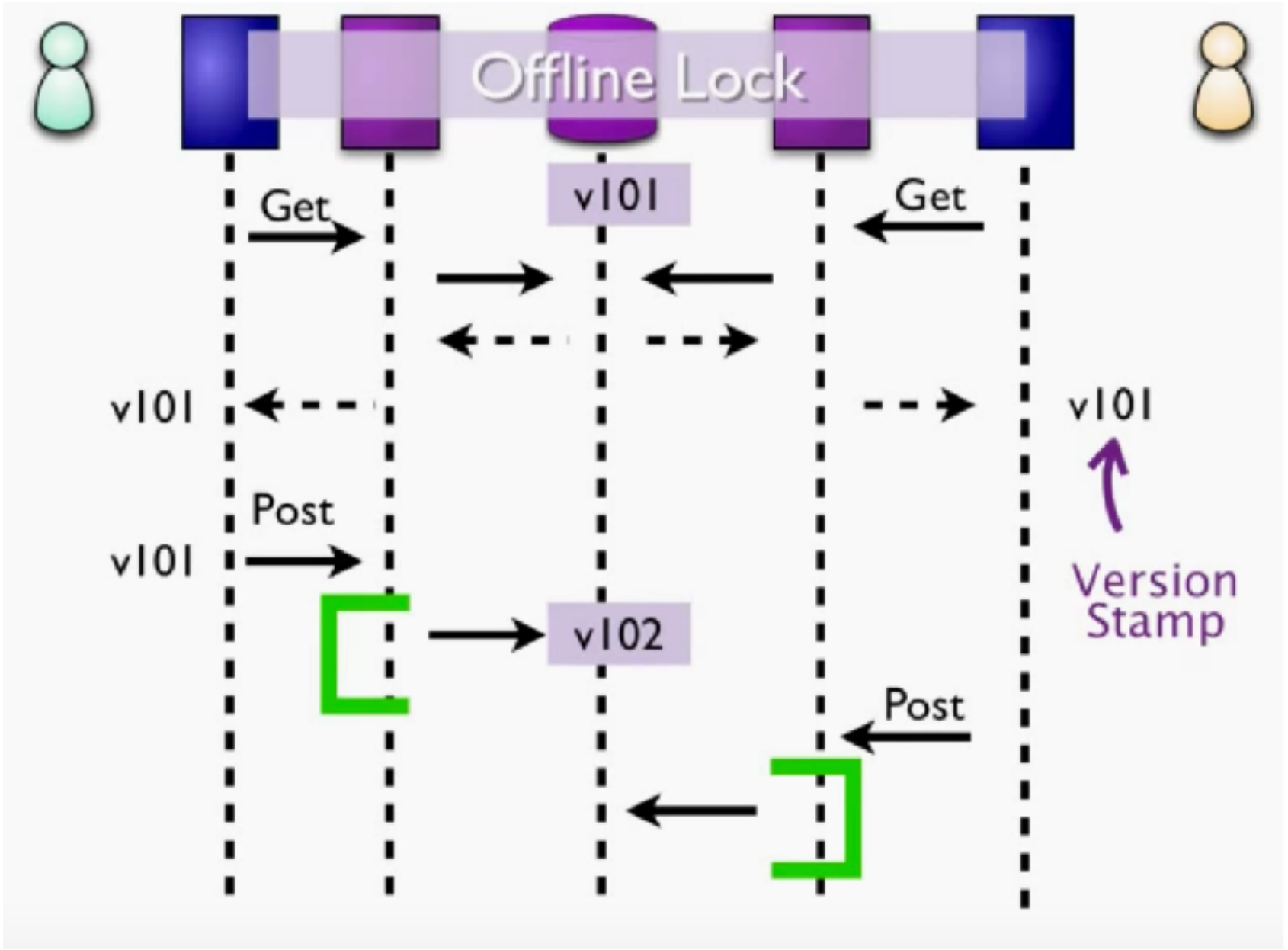
Problem ?



Transaction ?



Optimistic locking



ACID vs BASE

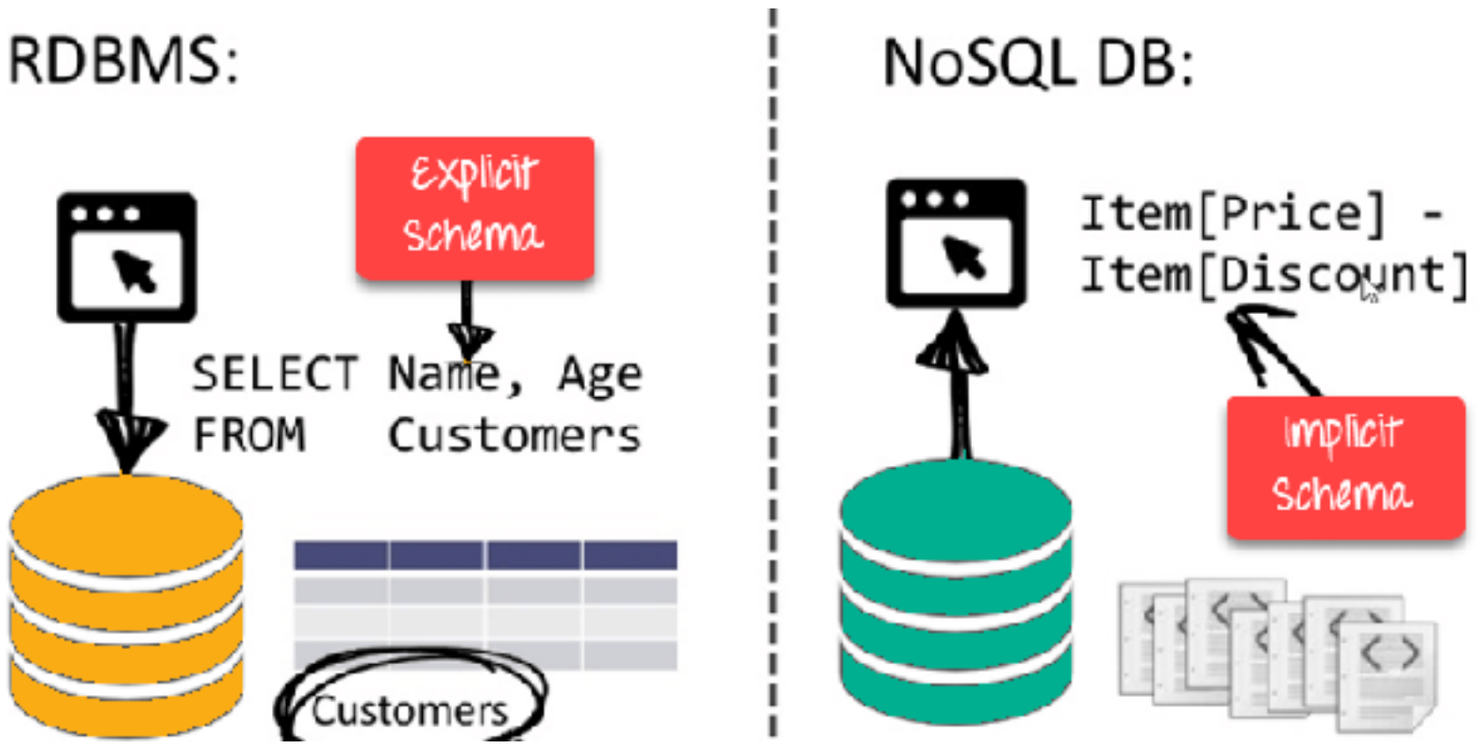
ACID	BASE
Provide vertical scaling	Provide horizontal scaling
Strong consistency	Weak/Eventual consistency
Isolation	Last write win, availability first
Transaction	Application managed
Available and Consistent	Available and Partition
Expensive join and relationship	Free from join and relationship

https://systemdesignbasic.wordpress.com/2020/06/20/15-acid-vs-base-database-transactions/

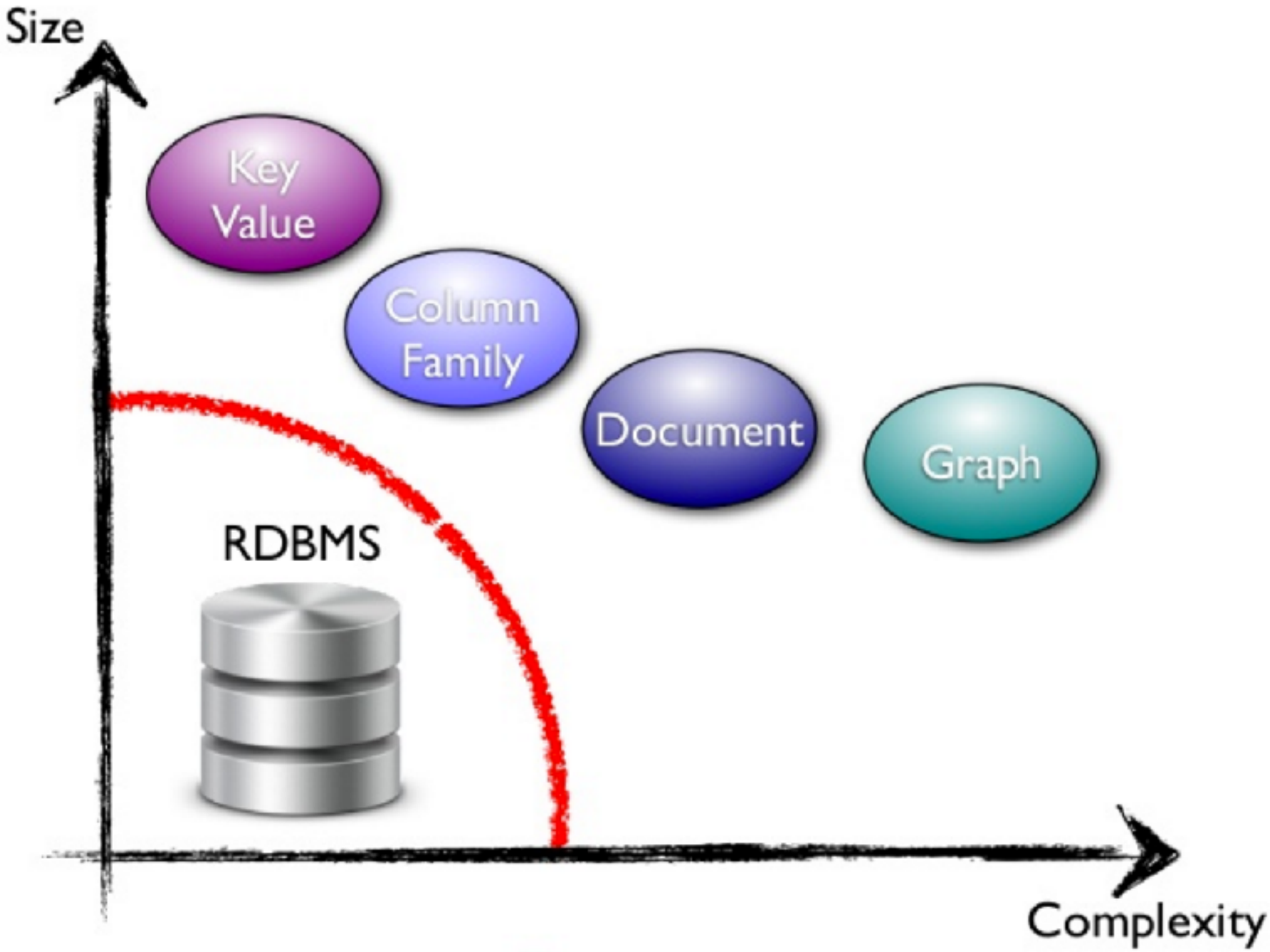
Schema-less
Dynamic schema
No schema

Schema-less / Dynamic schema

Offer multiple structures of data in same domain
Allow zero downtime deployment



Database selection ?



Database selection ?

Scalability
Performance
Data consistency
Data model
Security
Cost
Community and ecosystem

Design workshop

Working with MongoDB

Document database model

https://www.mongodb.com/developer/products/mongodb/mongodb-schema-design-best-practices/

Normalization process

Users

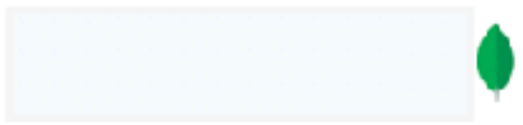
ID	first_name	surname	cell	city	location_x	location_y
1	Paul	Miller	447557505611	London	45.123	47.232

Professions

ID	user_id	profession
10	1	banking
11	1	finance
12	1	trader

Cars

ID	user_id	model	year
20	1	Bentley	1973
21	1	Rolls Royce	1965



MongoDB Schema Design

No formal process
No algorithms
No rules

Design Consideration

Store the data
Provide good query performance
Require reasonable amount of hardware

Think about how to use data before stored !!

Relationships in MongoDB

One-to-One

One-to-Few

One-to-Many

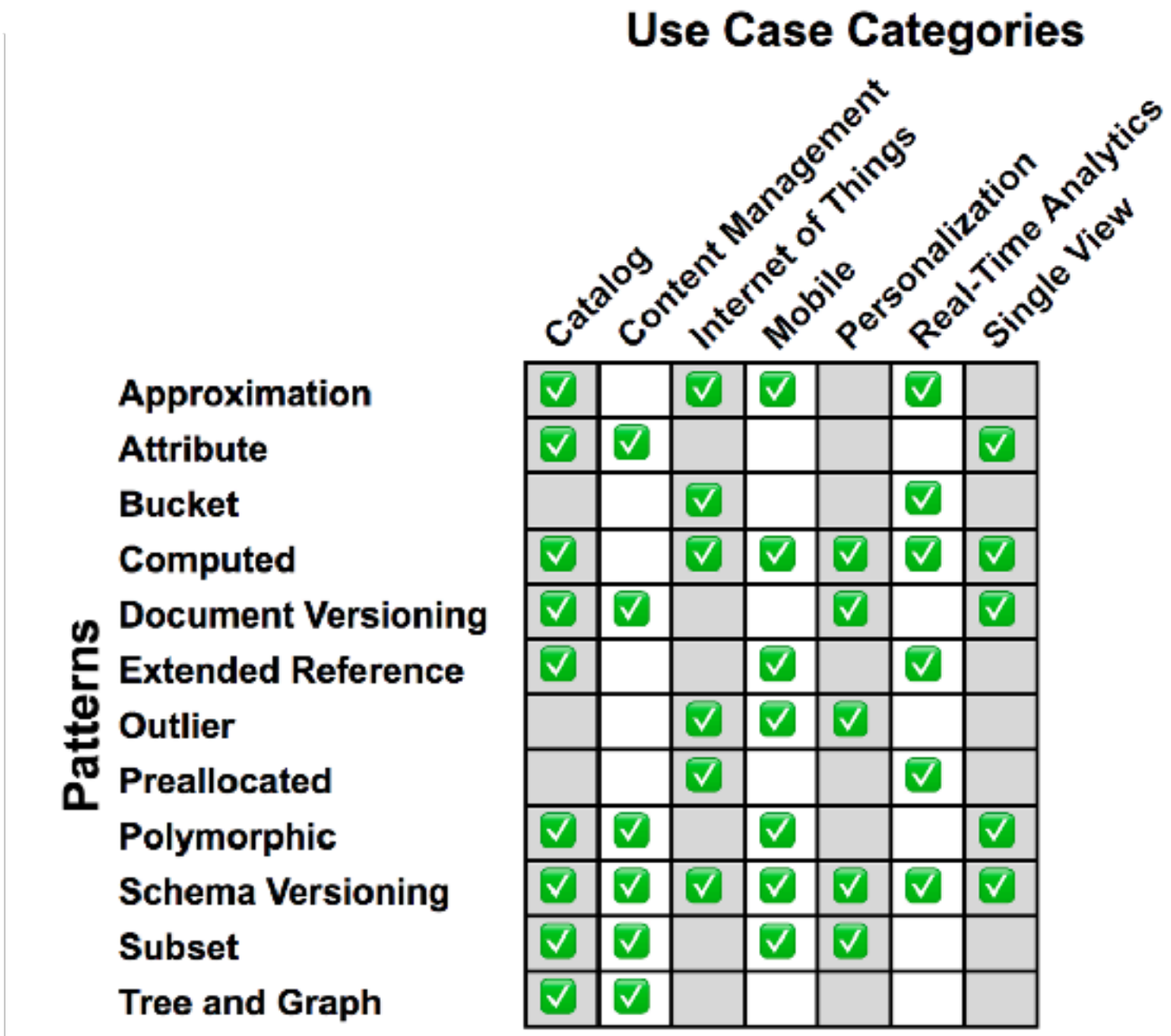
One-to-Squillions

Many-to-Many

Basic of Design schema

Use embedding data
Avoid joins and lookups
Arrays should not grow without bound
Must design data model from usage (app access)

More Design patterns



https://www.mongodb.com/blog/post/building-with-patterns-a-summary

Q/A