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# Programming and frameworks for ML

## Introduction to NoSQL Databases

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# About Me

---


## Big Data Consultant at Santander / Big Data Lecturer

- More than 20 years of experience in different environments, technologies, customers, countries ...
- Passionate about data and technology
- Enthusiastic about Big Data world and NoSQL



Daniel Villanueva Jiménez

Cartagena99

 Santander Tecnología

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# Objectives

- Tour of different database models
- Comparison of a relational database with NoSql databases
  - Key/Value
  - Documents
  - Column oriented
  - Graphs



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# Agenda

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- **Material**
- Use case
- Relational Databases
- NoSQL
- Riak
- MongoDB
- Apache Cassandra
- Neo4j



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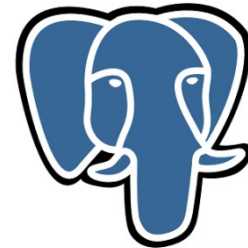
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# Material - Virtual Machine



<http://localhost:8001/>



PostgreSQL

12.2



<http://localhost:3100/>



**Cassandra**

3.11



<http://localhost:7474/>



<http://localhost:8098/>



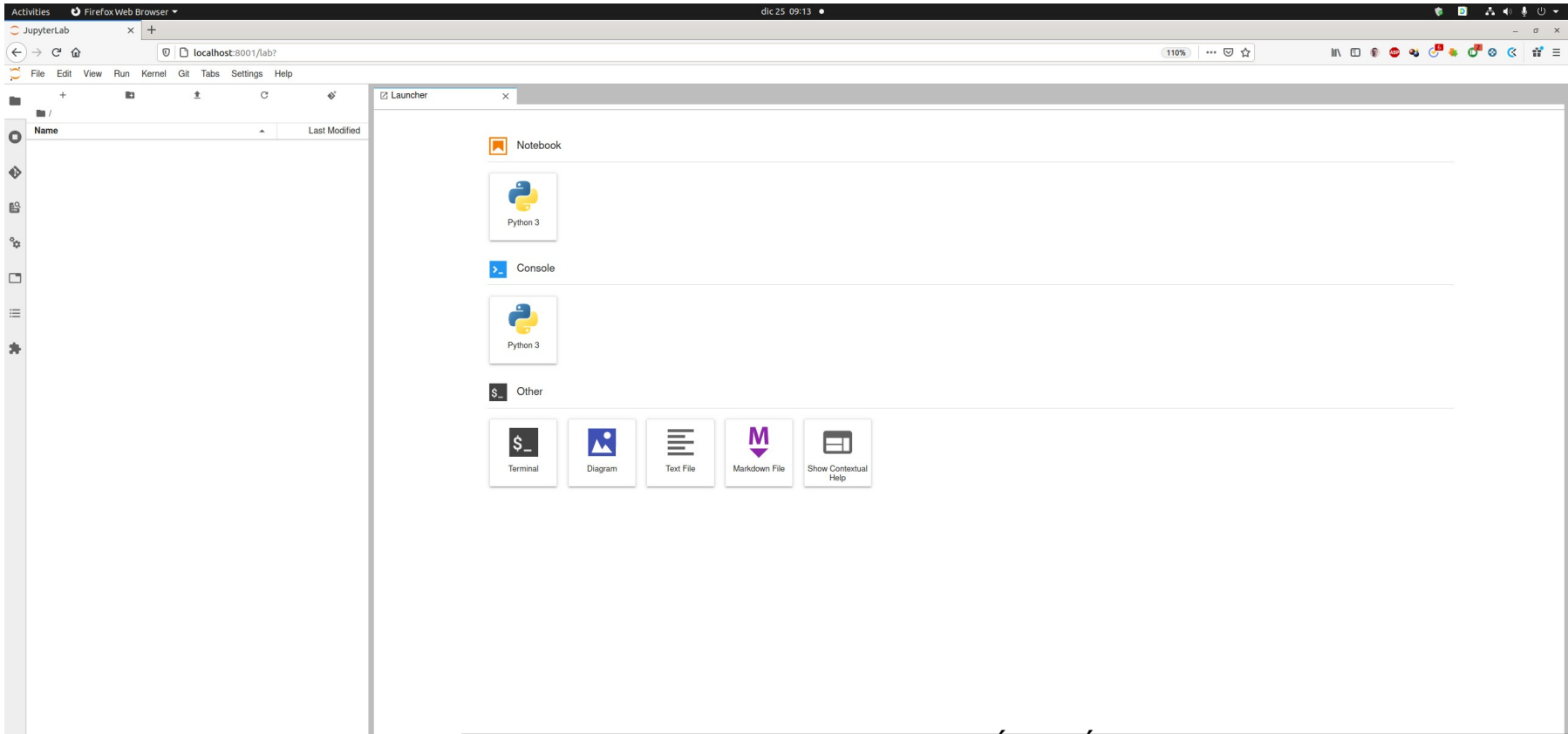
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# Material - Virtual Machine



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# What are databases?

The logo for Cartagena99 features the text 'Cartagena99' in a stylized, teal-colored font. The '99' is significantly larger and more prominent than the rest of the text. The logo is set against a light blue and orange gradient background that resembles a stylized wave or a banner.

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# What are databases?

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"A database is a **storehouse** that allows us to store **large amounts of information** in an **organized** manner so that we can easily **find** and **use it.**"

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# Case Study - Twitter

The image shows a screenshot of the Twitter profile for IMMUNE Technology Institute. The profile includes a header with the name and 1,463 tweets, a profile picture, and a bio: "Immune is the first coding institute for outstanding professionals." It also shows location (Madrid, España), website (immune.institute), and join date (October 2017). Below the bio are two tweets. The first is a pinned tweet from October 16 asking if users have questions about programs. The second is a tweet from 20 hours ago mentioning a recent event at IMMUNE Campus. To the right, there are sections for "You might like" (featuring Hack&Beers and Joaquim Bretcha) and "What's happening" (featuring trending topics like Iglesias and Esther Palomera).

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# Case Study – Tarjetas Black

## Gastos de los exdirectivos de Caja Madrid, uno a uno, con las 'tarjetas negras' (tabla)

CUARTOPODER | Publicado: 11/10/2014 07:59 - Actualizado: 16/5/2017 11:14



El juez de la Audiencia Nacional, Fernando Andréu, facilitó ayer a las partes el detalle de los pagos realizados con las llamadas 'tarjetas negras' por 86 exdirectivos de Caja Madrid: 15,5 millones de euros en total.

El informe de los gastos -86 tablas de Excel con miles de datos- ha sido realizado por Bankia y remitido a la fiscalía del caso ante la posibilidad de que quienes utilizaron las tarjetas pudieran haber cometido hechos delictivos.

**cuartopoder** ha desglosado la información de los gastos realizados por los exdirectivos de la entidad, uno por uno, para facilitar la consulta de los datos en esta tabla.

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ORACLE®

SYBASE® MySQL®

Microsoft®  
SQL Server® PostgreSQL

TERADATA®

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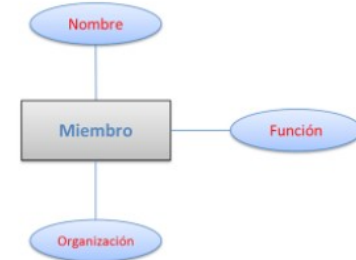
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# Elements of a relational database

- Tables
- Fields (or Columns)



```

CREATE TABLE miembros (
  id_miembro      int not null PRIMARY KEY,
  nombre          varchar(200),
  funcion         varchar(40),
  organizacion    varchar(200),
  CONSTRAINT pk_miembros UNIQUE(id_miembro)
);
  
```

miembros
id_miembro
nombre
funcion
organizacion

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# Elements of a relational database

- Records (or Rows)

id_miembro	nombre	funcion	organizacion
1	Alberto Recarte García Andrade	concejal	Partido Popular
2	Alejandro Couceiro Ojeda	concejal	CEIM
83	Ángel Eugenio Gómez del Pulgar Perales	concejal	PSOE
3	Angel Rizaldos González	concejal	Izquierda Unida
4	Antonio Cámara Eguinoa	concejal	Partido Popular
5	Antonio Rey de Viñas Sánchez-Majestad	concejal	CC OO
6	Antonio Romero Lázaro	concejal	PSOE
7	Arturo Luis Fernández Álvarez	concejal	CEIM
8	Beltrán Gutiérrez Moliner	concejal	Partido Popular

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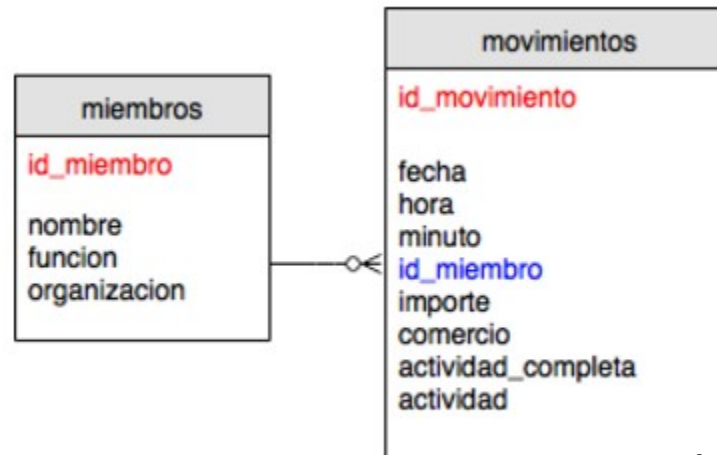
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# Elements of a relational database

- Relationships between tables
- Primary Keys
- Foreign Keys



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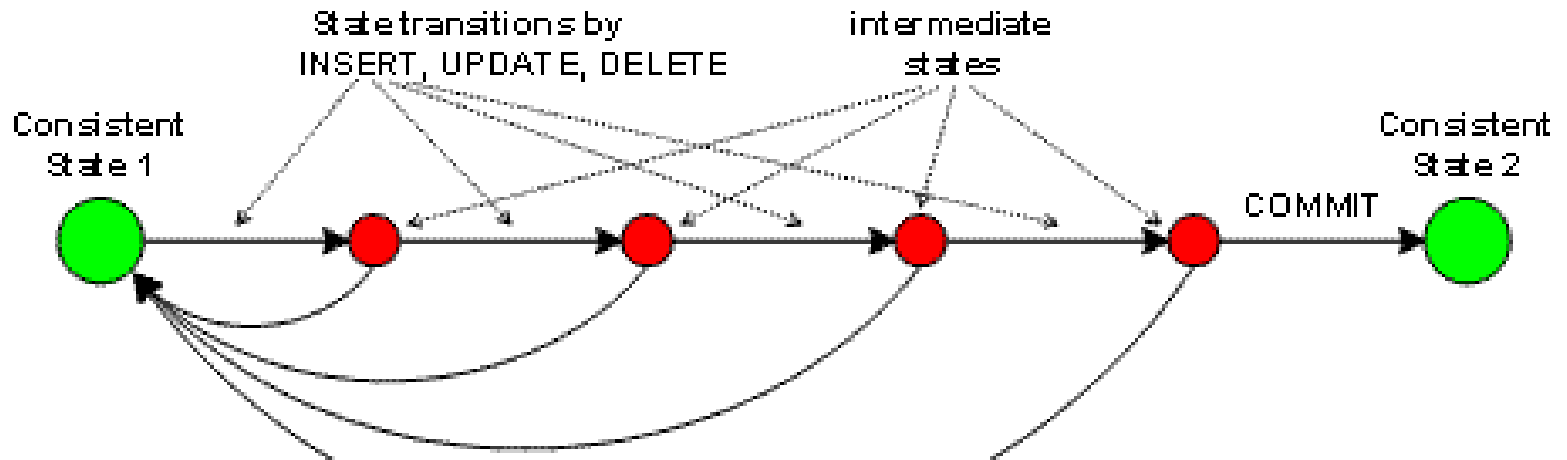
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# Elements of a relational database

- Views
- Transactions



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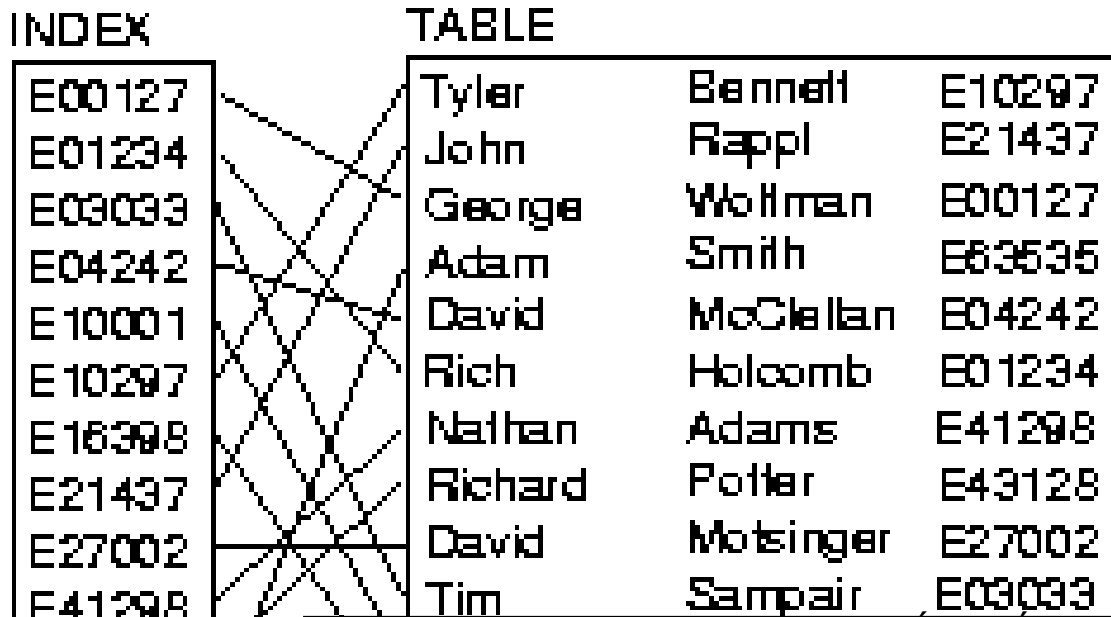
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# Elements of a relational database

- Indexes



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# Elements of a relational database

- SQL Language

```
CREATE TABLE users (
  user_id      bigint not null PRIMARY KEY,
  screen_name  varchar(50) not null,
  name         varchar(50) null,
  created_at   timestamp with time zone null,
  description  varchar(200) null,
  retweet_count int null,
  favorite_count int null,
  friends_count int null,
  followers_count int null,
  statuses_count int null,
  geo_enabled  boolean null,
  time_zone    varchar(50) null,
  profile_image_url varchar(300) null
);
```

```
select user_id, count(*) as count
from tweet_usermention
group by 1
having count(*) > 0
order by 2 desc
```

```
CREATE INDEX id_user_screename
ON users (screen_name)
```

```
SELECT * FROM tweets
```

```
DELETE FROM users
```

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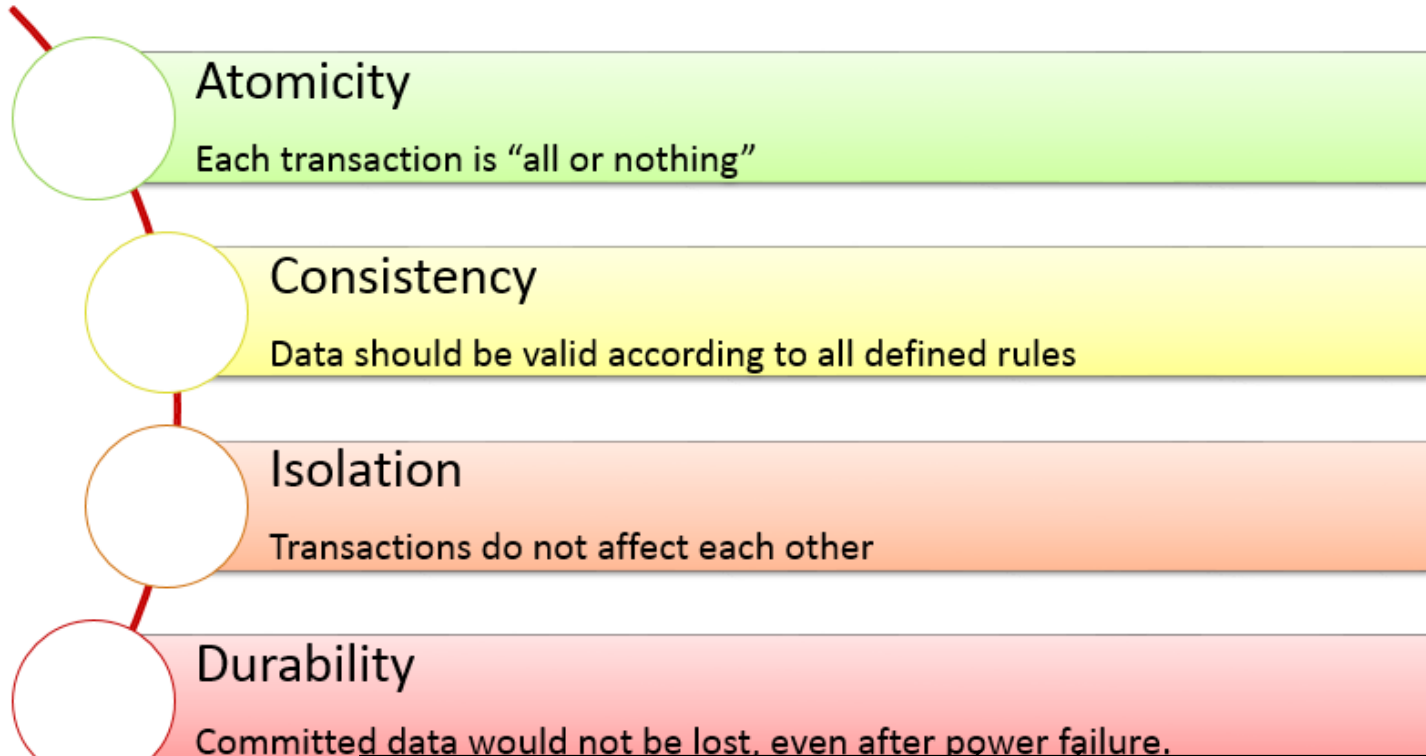
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# ACID properties associated to a Relational database

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# PostgreSQL - HandsOn

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# Problems?

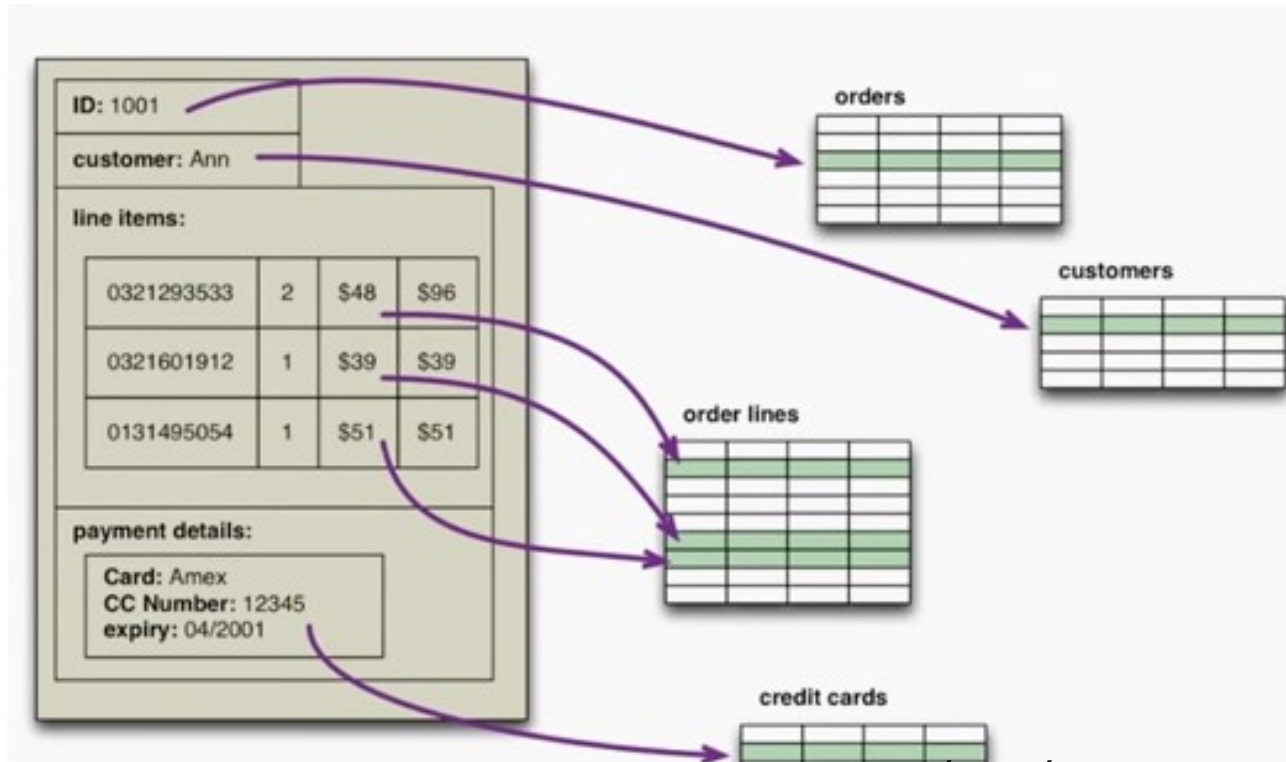
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# Impedance Mismatch



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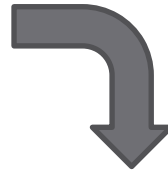
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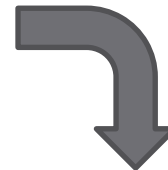
# Rigid schemes

---

```
CREATE TABLE Customers (  
  Customer_Id Int,  
  Name Varchar(100),  
  ...  
)
```



```
BULK INSERT Customers  
FROM 'CustFile.txt'  
WITH FIELDTERMINATOR = ';' ;
```



```
SELECT Customer_Id, Name  
FROM Customers
```

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# Rigid schemes

---

- You cannot load the information until you create the structure in the database
- You cannot create the structure until you understand the schema to be stored in the table
- What happens if the data changes?

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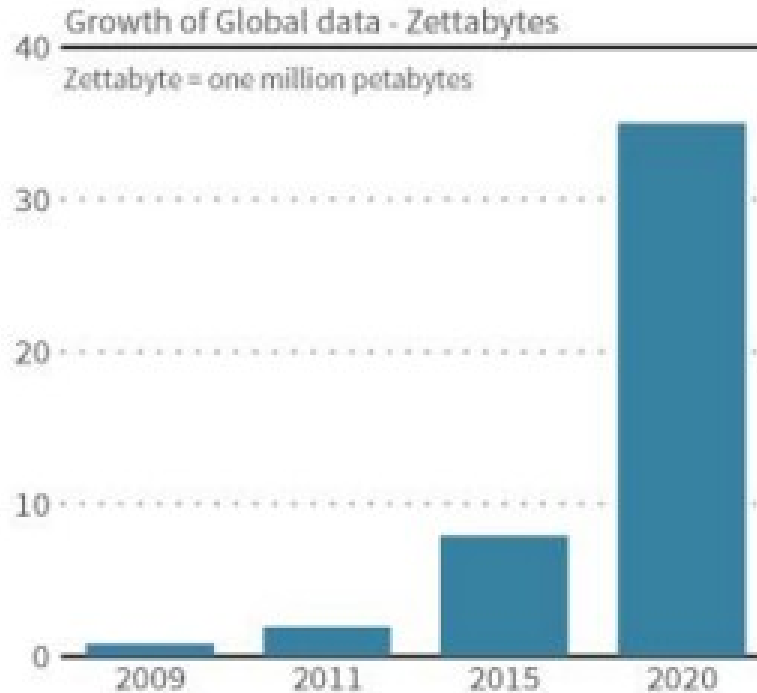
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# Volume



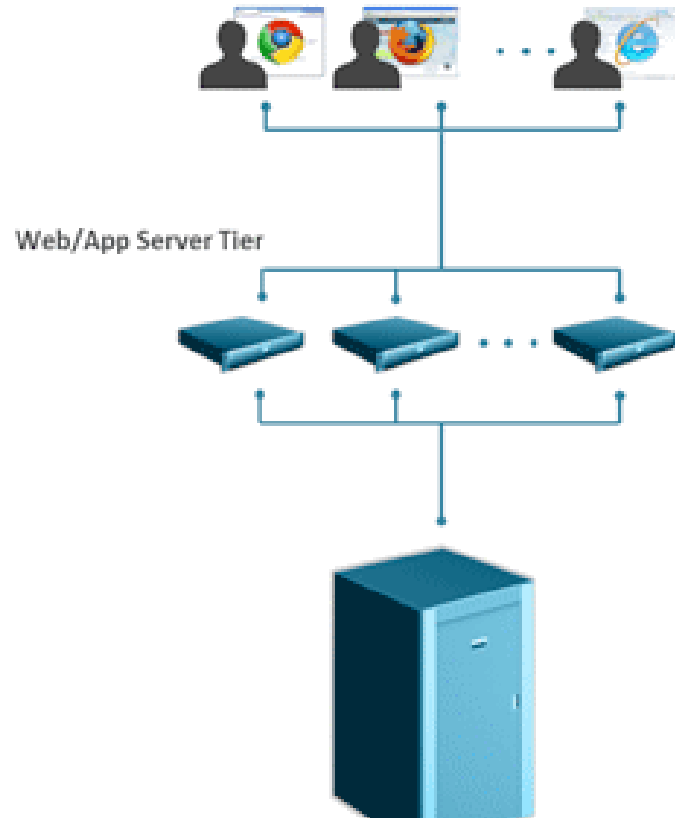
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# Scalability



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# Scalability

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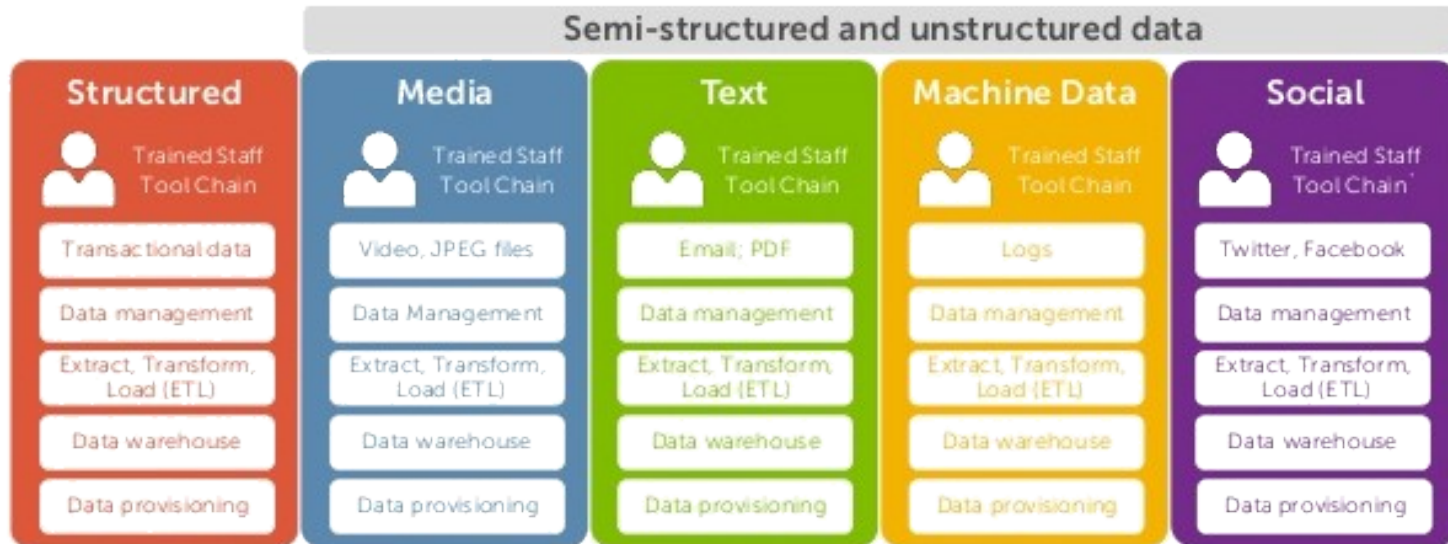
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# Variety of information



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# Structured Data

model	mpg	cyl	disp	hp	drat
Mazda RX4	21	6	160	110	3.9
Mazda RX4 Wag	21	6	160	110	3.9
Datsun 710	22.8	4	108	93	3.85
Hornet 4 Drive	21.4	6	258	110	3.08
Hornet Sportabout	18.7	8	360	175	3.15
Valiant	18.1	6	225	105	2.76
Duster 360	14.3	8	360	245	3.21
Merc 240D	24.4	4	146.7	62	3.69
Merc 230	22.8	4	140.8	95	3.92
Merc 280	19.2	6	167.6	123	3.92
Merc 280C	17.8	6	167.6	123	3.92
Merc 450SE	16.4	8	275.8	180	3.07
Merc 450SL	17.3	8	275.8	180	3.07



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# Semi-Structured Data

model	mpg	cyl	disp	hp	drat
Mazda RX4	21	6	160	110	3.9

Mazd

Datsu[

```

Hornet {"model":"Mazda RX4","mpg":21,"cyl":6,"disp":160,"hp":110,"drat":3.9},
Hornet {"model":"Mazda RX4 Wag","mpg":21,"cyl":6,"disp":160,"hp":110,"drat":3.9},
Valiant {"model":"Datsun 710","mpg":22.8,"cyl":4,"disp":108,"hp":93,"drat":3.85},
Duster {"model":"Hornet 4 Drive","mpg":21.4,"cyl":6,"disp":258,"hp":110,"drat":3.08},
Merc {"model":"Hornet Sportabout","mpg":18.7,"cyl":8,"disp":360,"hp":175,"drat":3.15},
Merc {"model":"Valiant","mpg":18.1,"cyl":6,"disp":225,"hp":105,"drat":2.76},
Merc {"model":"Duster 360","mpg":14.3,"cyl":8,"disp":360,"hp":245,"drat":3.21},
Merc {"model":"Merc 240D","mpg":24.4,"cyl":4,"disp":146.7,"hp":62,"drat":3.69},
Merc {"model":"Merc 230","mpg":22.8,"cyl":4,"disp":140.8,"hp":95,"drat":3.92},
Merc {"model":"Merc 280","mpg":19.2,"cyl":6,"disp":167.6,"hp":123,"drat":3.92},
Merc {"model":"Merc 280C","mpg":17.8,"cyl":6,"disp":167.6,"hp":123,"drat":3.92},
Merc {"model":"Merc 450SE","mpg":16.4,"cyl":8,"disp":275.8,"hp":180,"drat":3.07},
Merc {"model":"Merc 450SL","mpg":17.3,"cyl":8,"disp":275.8,"hp":180,"drat":3.07},

```

]

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# Velocity



**Ellen DeGeneres** ✓  
@TheEllenShow

Follow

If only Bradley's arm was longer. Best photo ever. #oscars

4:06 AM - 3 Mar 2014

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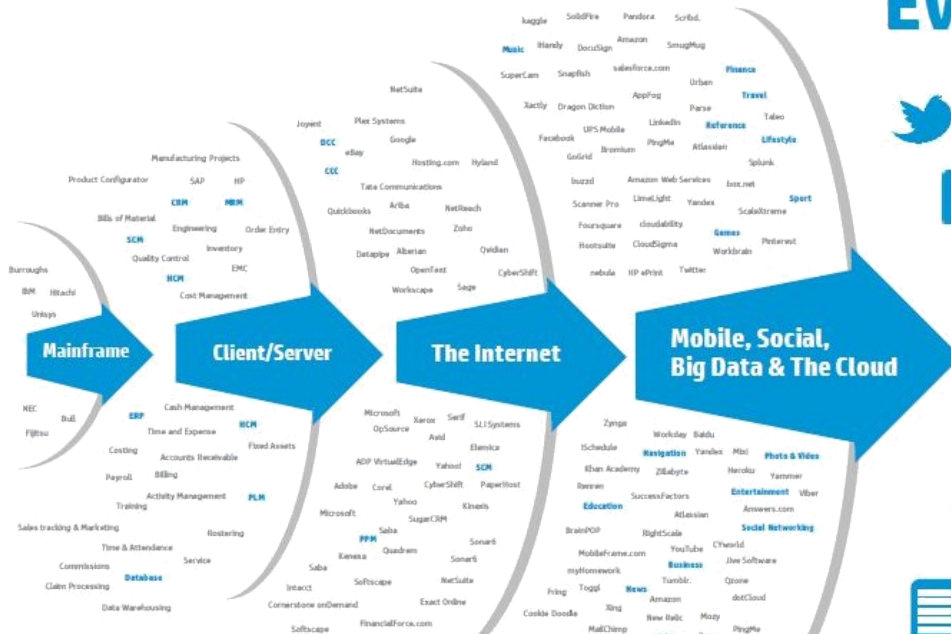
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# Velocity



## Every 60 seconds



98,000+ tweets



695,000 status updates



11 million instant messages



698,445 Google searches



168 million+ emails sent



1,820TB of data created



217 new mobile web users

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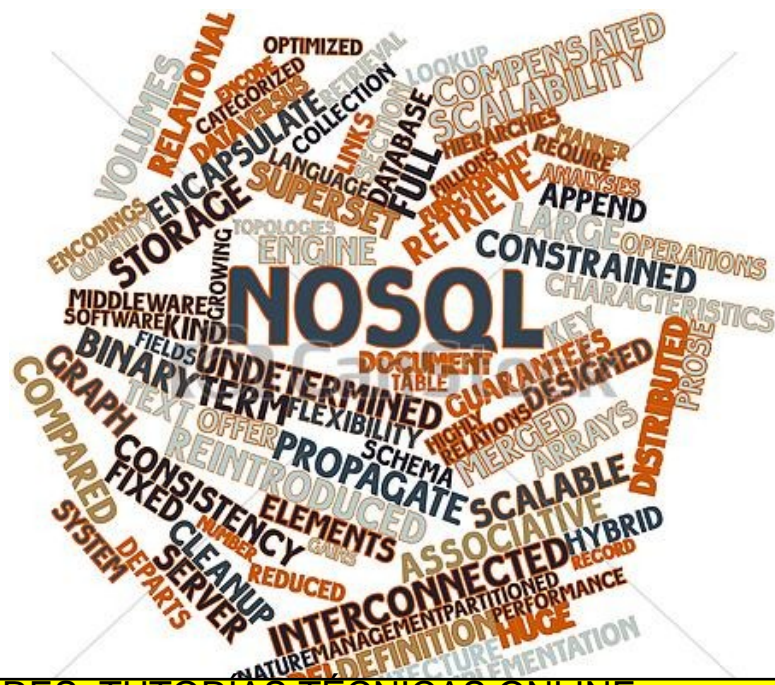
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# NoSQL

**NoSQL** is a broad class of **database management systems** that differs from the classic model of the relational database management system

- They usually **scale** well horizontally
- Do not use **SQL** as the main query language
- Stored data does not require **fixed structures** such as tables
- Normally do not support **JOIN** operations
- Not fully guaranteed by **ACID**

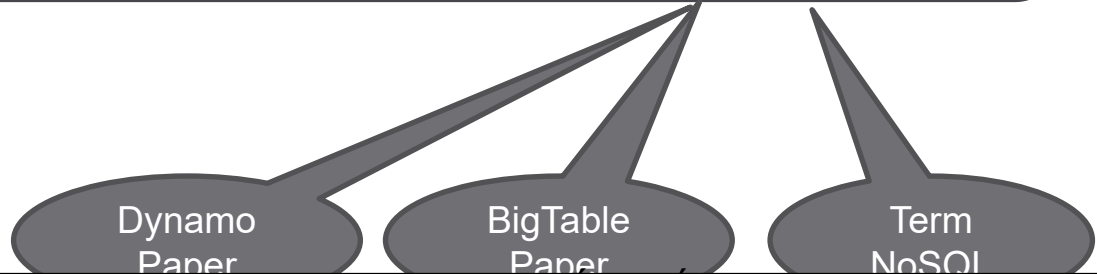
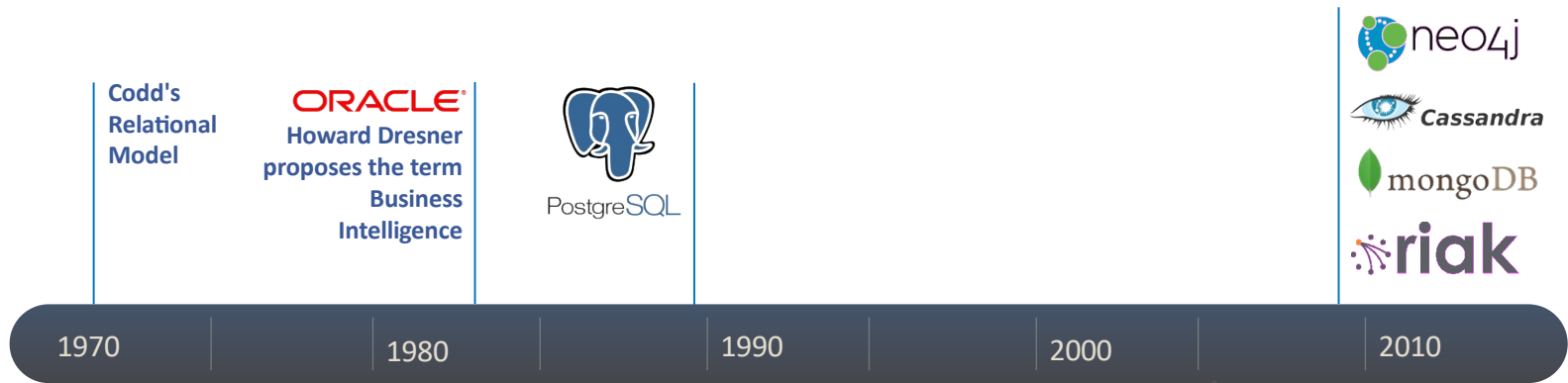
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# A little bit of history



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# Types of NoSQL databases

Key / Value	Columnar	Documents	Graphs																																												
<table border="1"> <thead> <tr> <th>Key</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>New York</td> </tr> <tr> <td>2</td> <td>Boston</td> </tr> <tr> <td>3</td> <td>Mexico</td> </tr> <tr> <td>4</td> <td>Kansas</td> </tr> <tr> <td>5</td> <td>Detroit</td> </tr> <tr> <td>6</td> <td>California</td> </tr> </tbody> </table>	Key	Value	1	New York	2	Boston	3	Mexico	4	Kansas	5	Detroit	6	California	<table border="1"> <tbody> <tr> <td>101</td> <td>email</td> <td>name</td> <td>tel</td> <td></td> </tr> <tr> <td></td> <td>ab@c.to</td> <td>otto</td> <td>12345</td> <td></td> </tr> <tr> <td>103</td> <td>email</td> <td>name</td> <td>tel</td> <td>tel2</td> </tr> <tr> <td></td> <td>karl@a.b</td> <td>karl</td> <td>6789</td> <td>12233</td> </tr> <tr> <td>104</td> <td>name</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>linda</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	101	email	name	tel			ab@c.to	otto	12345		103	email	name	tel	tel2		karl@a.b	karl	6789	12233	104	name					linda				<pre> {   "firstName": "John",   "lastName": "Smith",   "isActive": true,   "age": 25,   "address": {     "streetAddress": "21 2nd Street",     "city": "New York",     "state": "NY",     "postalCode": "10021-3100"   },   "phoneNumbers": [     {       "type": "home",       "number": "212 555-1234"     },     {       "type": "office",       "number": "646 555-4567"     }   ],   "children": [],   "spouse": null } </pre>	
Key	Value																																														
1	New York																																														
2	Boston																																														
3	Mexico																																														
4	Kansas																																														
5	Detroit																																														
6	California																																														
101	email	name	tel																																												
	ab@c.to	otto	12345																																												
103	email	name	tel	tel2																																											
	karl@a.b	karl	6789	12233																																											
104	name																																														
	linda																																														



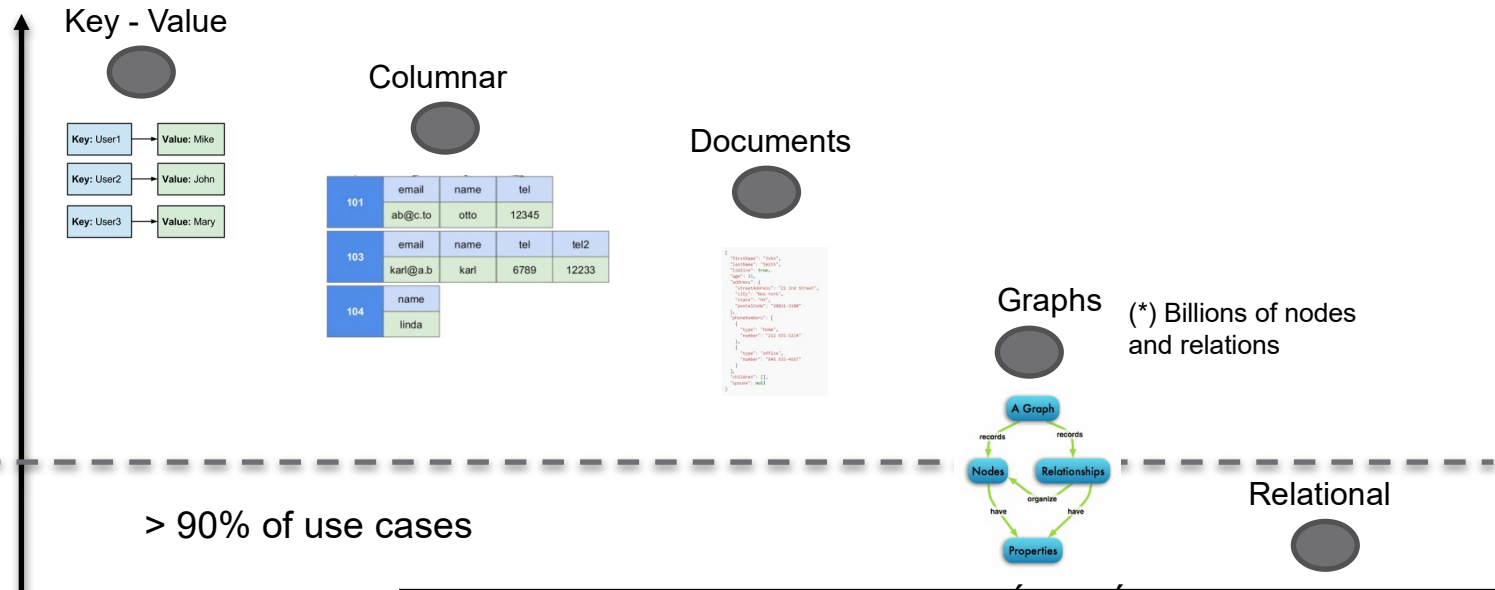
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# Size vs. Functionality

## Scalability



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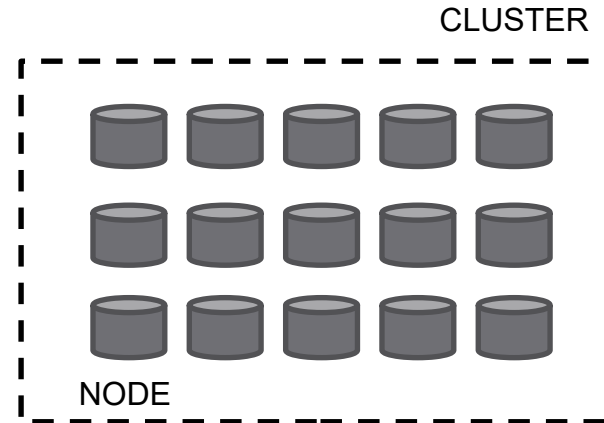
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# Vertical and horizontal scaling



VERTICAL SCALING



HORIZONTAL SCALING

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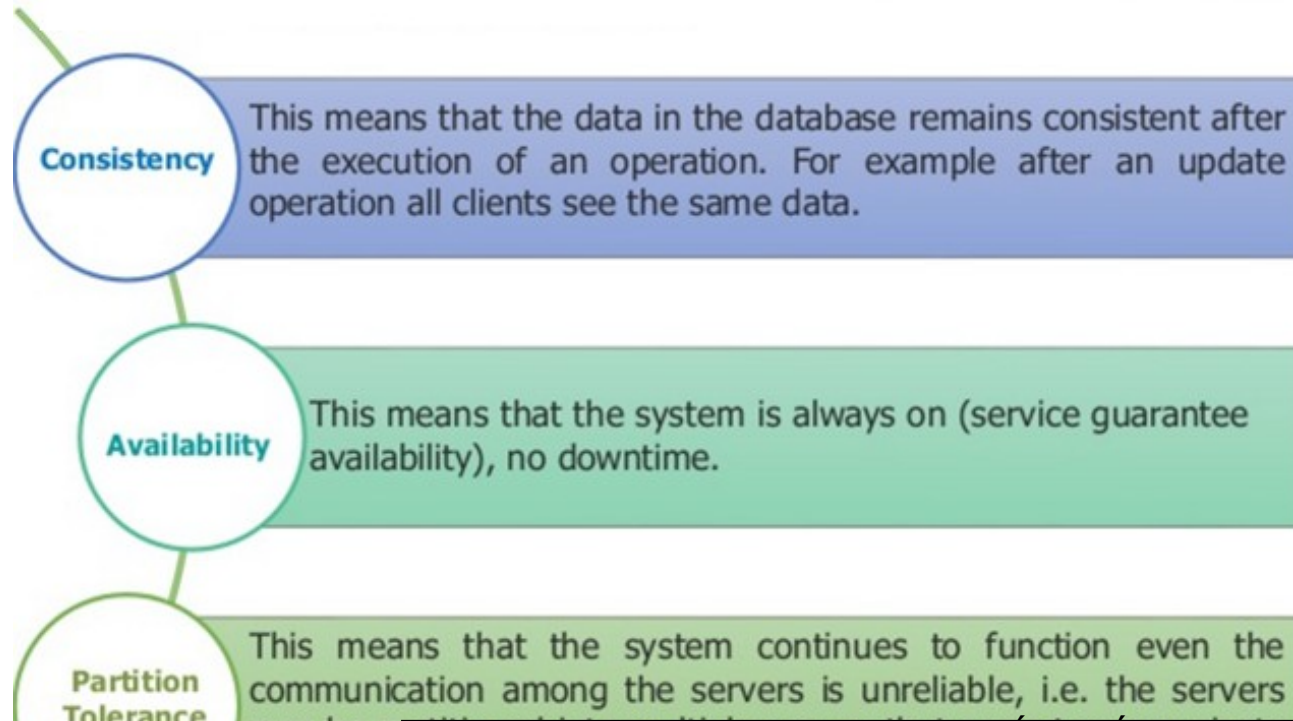
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# CAP Theorem

- Requirements for distributed databases



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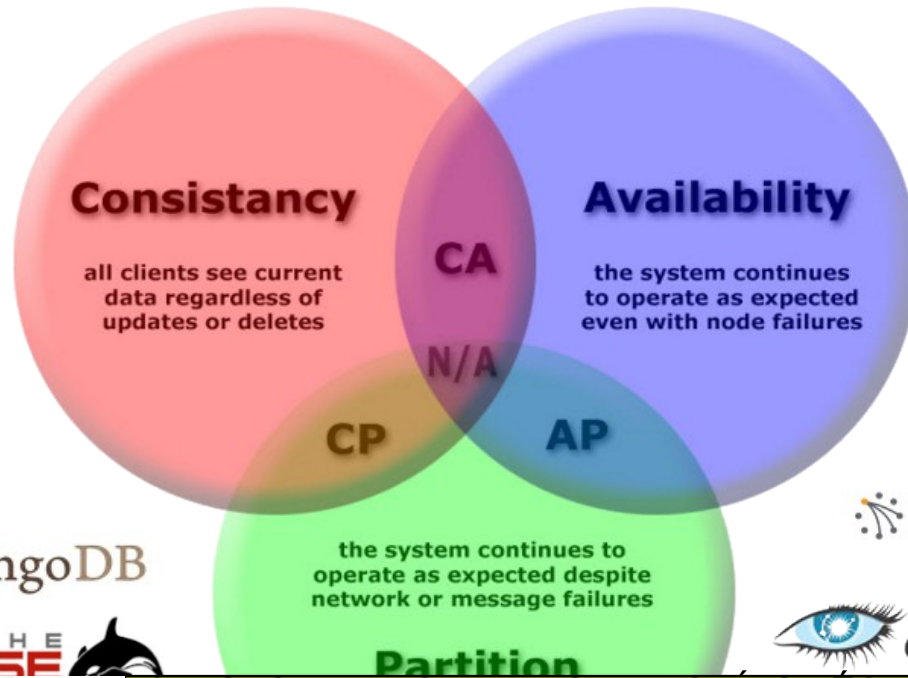
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# CAP Theorem



PostgreSQL



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# Agenda

---

- Material
- Use case
- Relational Databases
- NoSQL
- Riak
- Apache Cassandra
- MongoDB
- Neo4j

Key	Value
1	New York
2	Boston
3	Mexico
4	Kansas
5	Detroit
6	California

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# Riak

- Developed by Basho Technologies in Erlang
- Inspired by Amazon Dynamo
- Horizontal Distribution - Fault Tolerant
- Prioritizes availability - Tunable consistency
- No master node - No single point of failure
- Querys - Provides a REST API over HTTP
- Drivers in multiple languages - Java, Python, Ruby, etc.
- Storage options - Memory, disk or both.

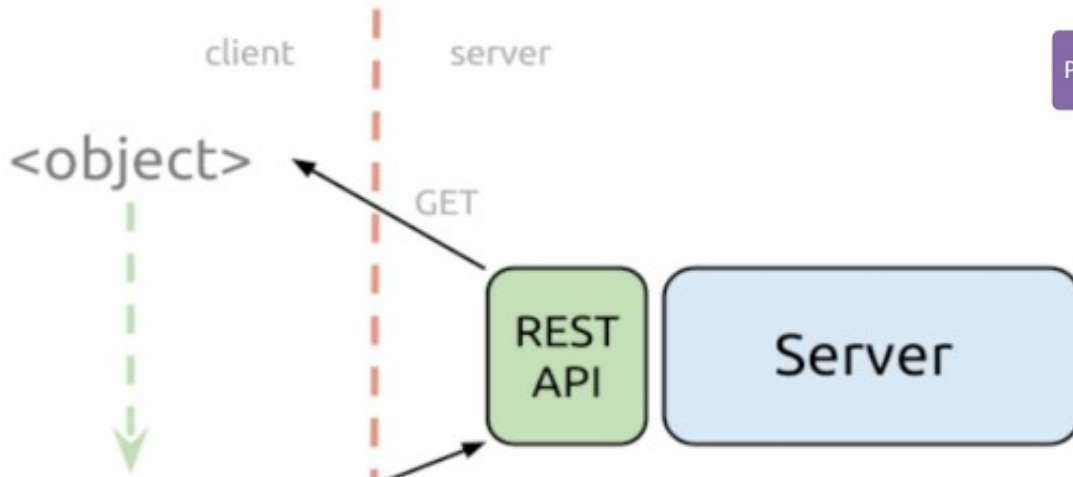
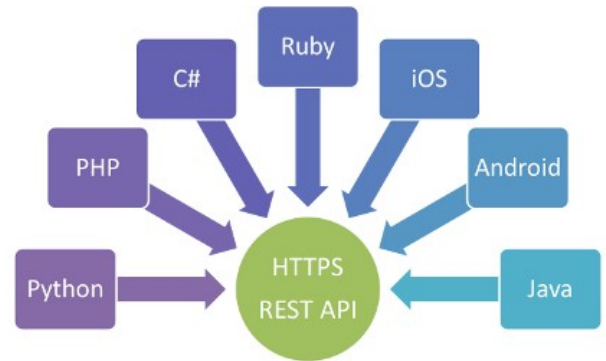


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# API REST



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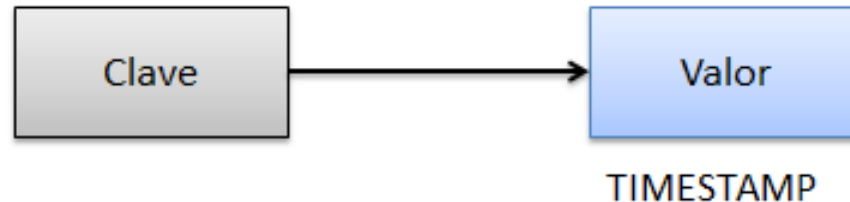
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# Key and Value

---

- It's the most basic structure



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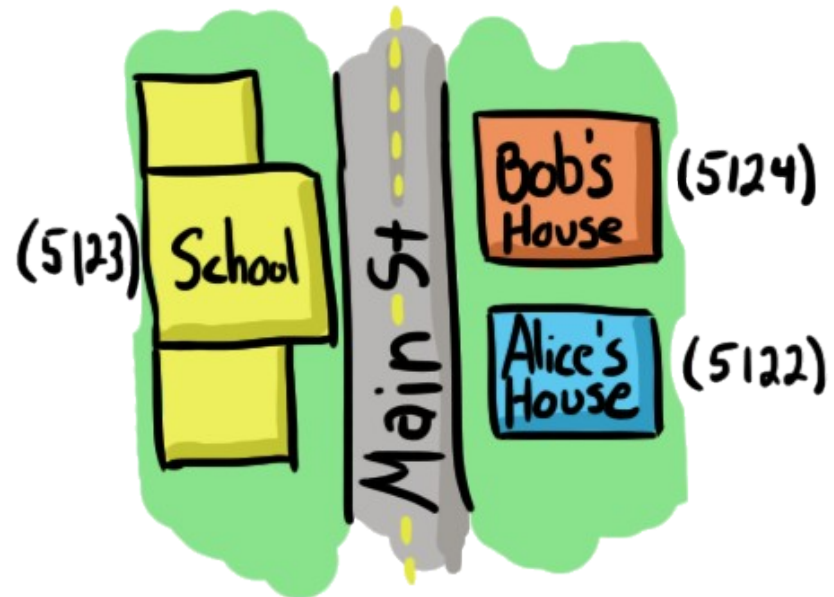
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# Key and Value

- For example:
  - Key: Address
  - Value: Tenant

```
hashtable = {}  
hashtable["5124"] = "Bob"  
  
print hashtable["5124"]
```

Bob



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# Buckets

- They allow to separate the same key according to a context
- Example: Streets

```
Street23rd = {}  
Street6thAve = {}  
  
Street23rd["5124"] = "Bob"  
Street6thAve["5124"] = "Sara"
```



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# Data distribution in Riak

---

- Riak is kept available by distributing the data between different nodes
- There are 2 styles of layout ...

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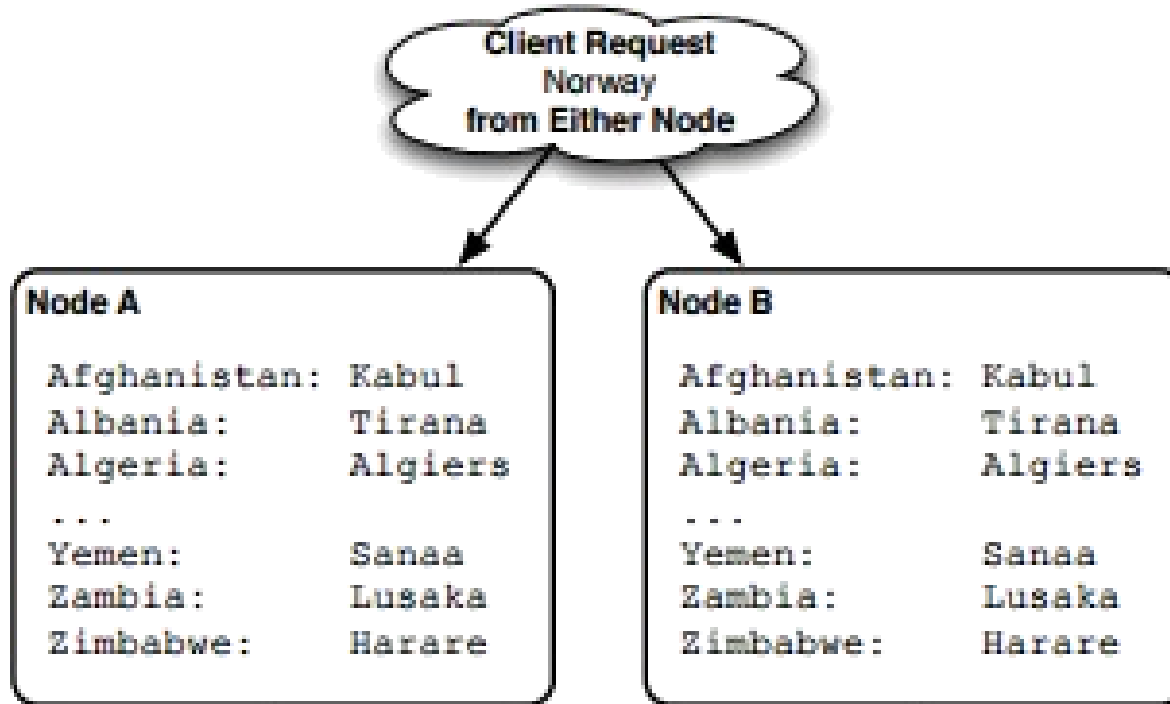
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# Data distribution in Riak

- Replication



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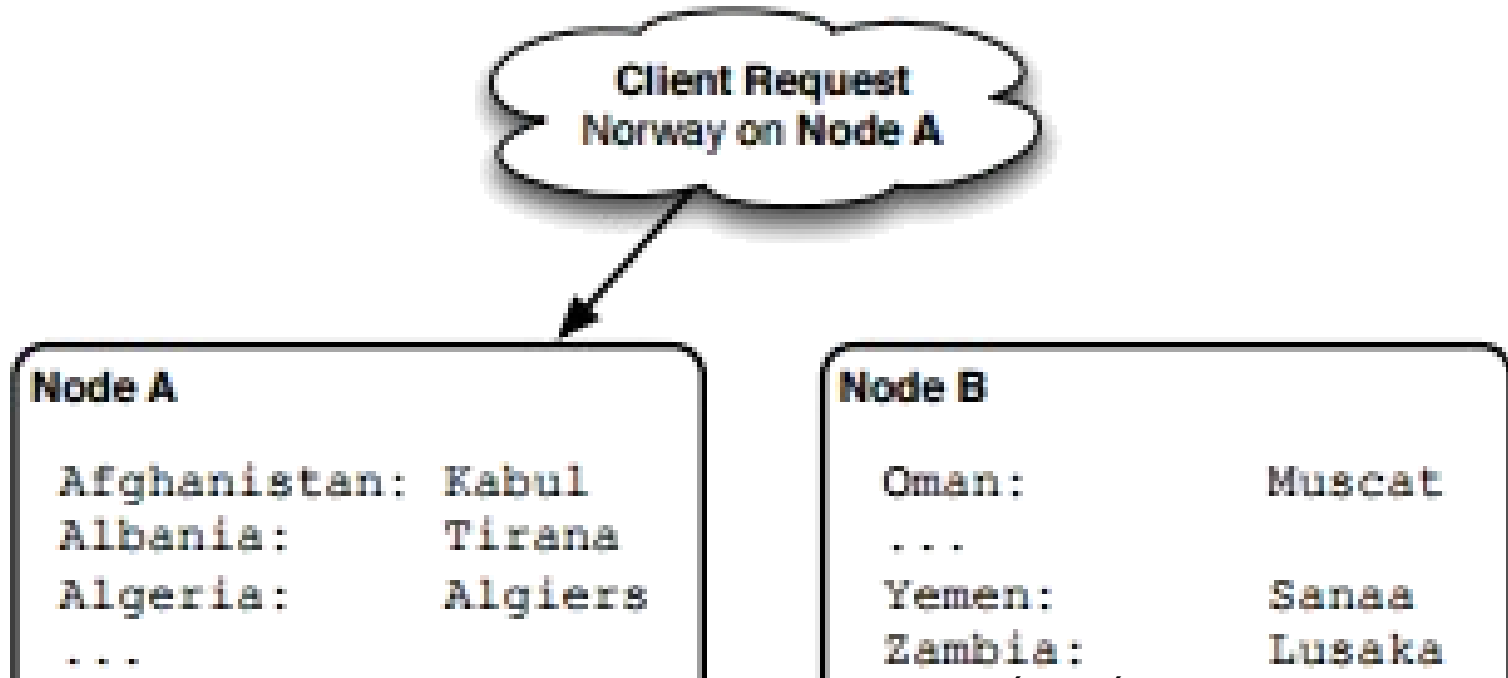
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# Data distribution in Riak

- Partitioned



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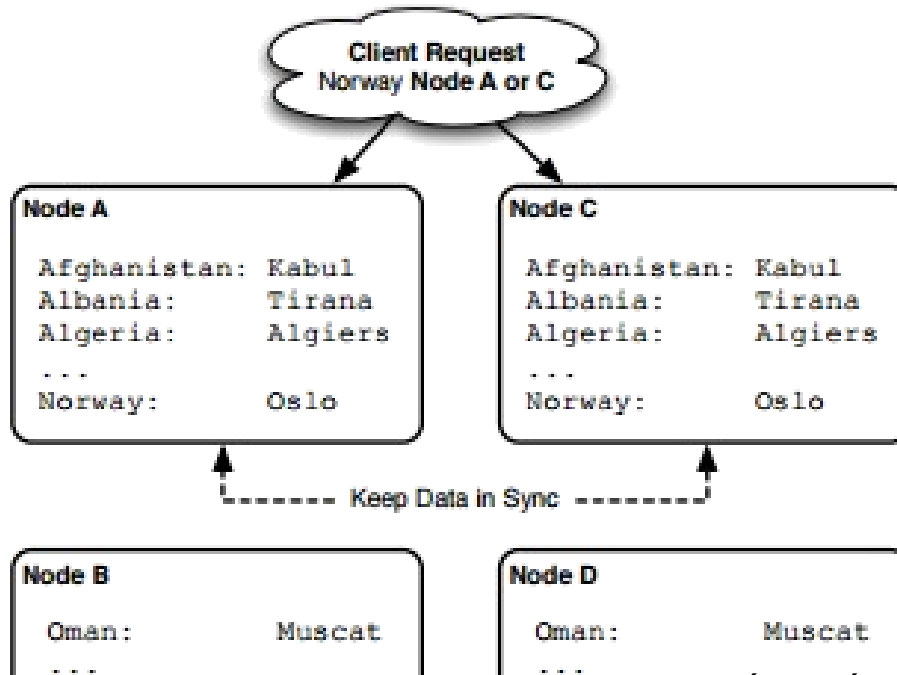
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# Data distribution in Riak

- Riak uses Replication + Partitioning



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# Hash function

---

```
print("Hash for 'favorite' is ", hash('favorite'))  
print("Hash for 'favorite' is ", hash('favorite'))  
print("Hash for 'FAVORITE' is ", hash('FAVORITE'))
```

```
Hash for 'favorite' is -1293964328614459245  
Hash for 'favorite' is -1293964328614459245  
Hash for 'FAVORITE' is -7294038943333753459
```

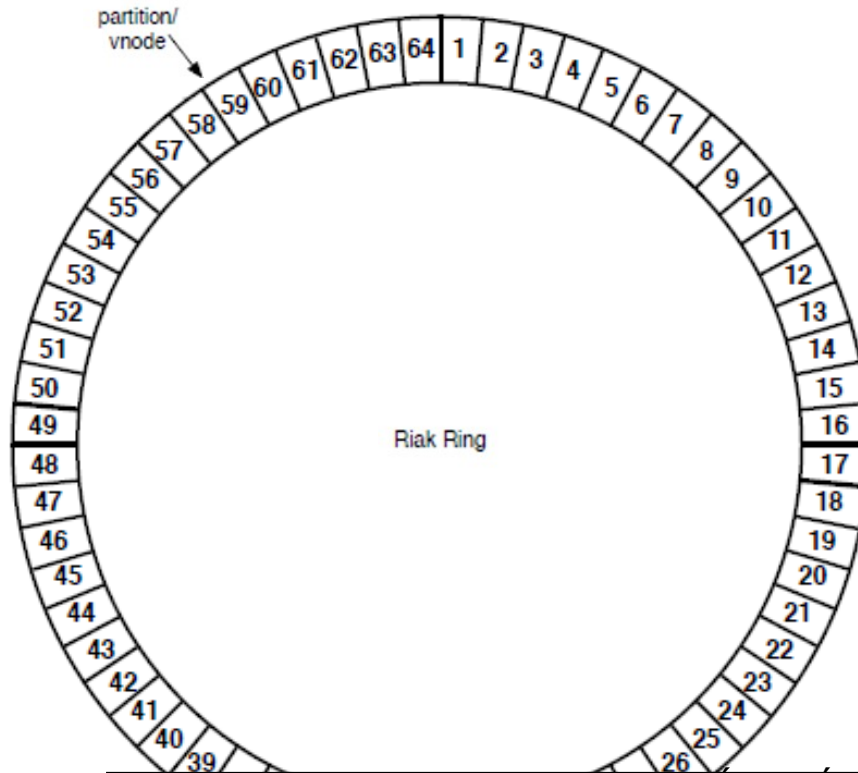
The logo for Cartagena99 features the text "Cartagena99" in a stylized, teal-colored font. The "99" is significantly larger and more prominent than the rest of the text. The logo is set against a background of overlapping light blue and orange shapes that resemble a stylized map or abstract graphic.

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# The Riak Ring – The Cluster



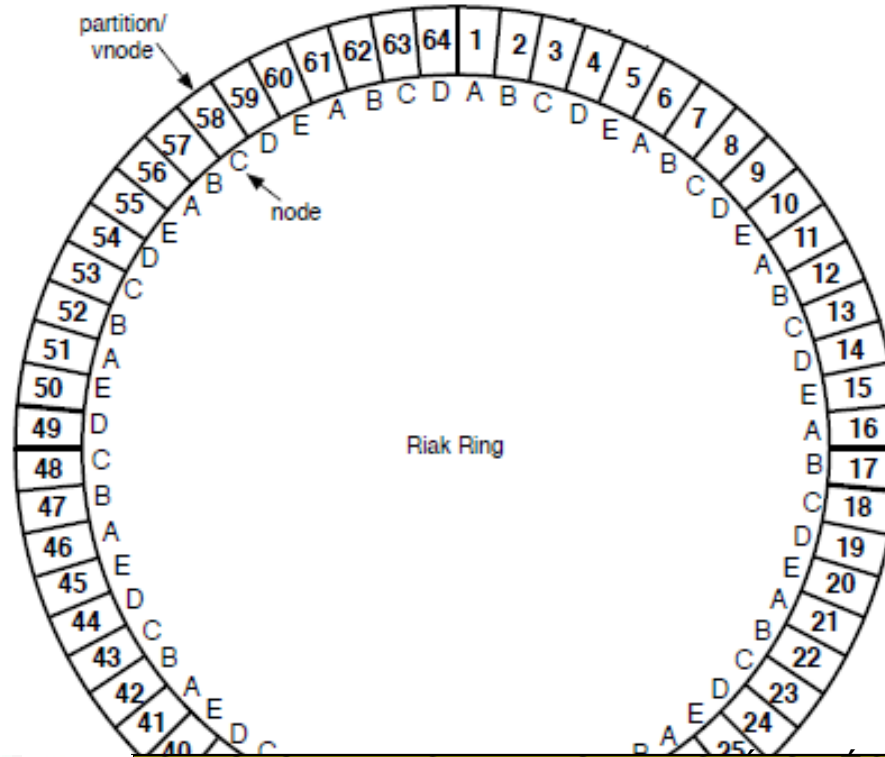
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# The Riak Ring – The Cluster



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# Hash function

---

```
print("Hash for 'favorite' is ", hash('favorite'))  
print("Vnode for 'favorite' is ", abs(hash('favorite') & 64) + 1)
```

```
Hash for 'favorite' is -1293964328614459245  
Vnode for 'favorite' is 25
```

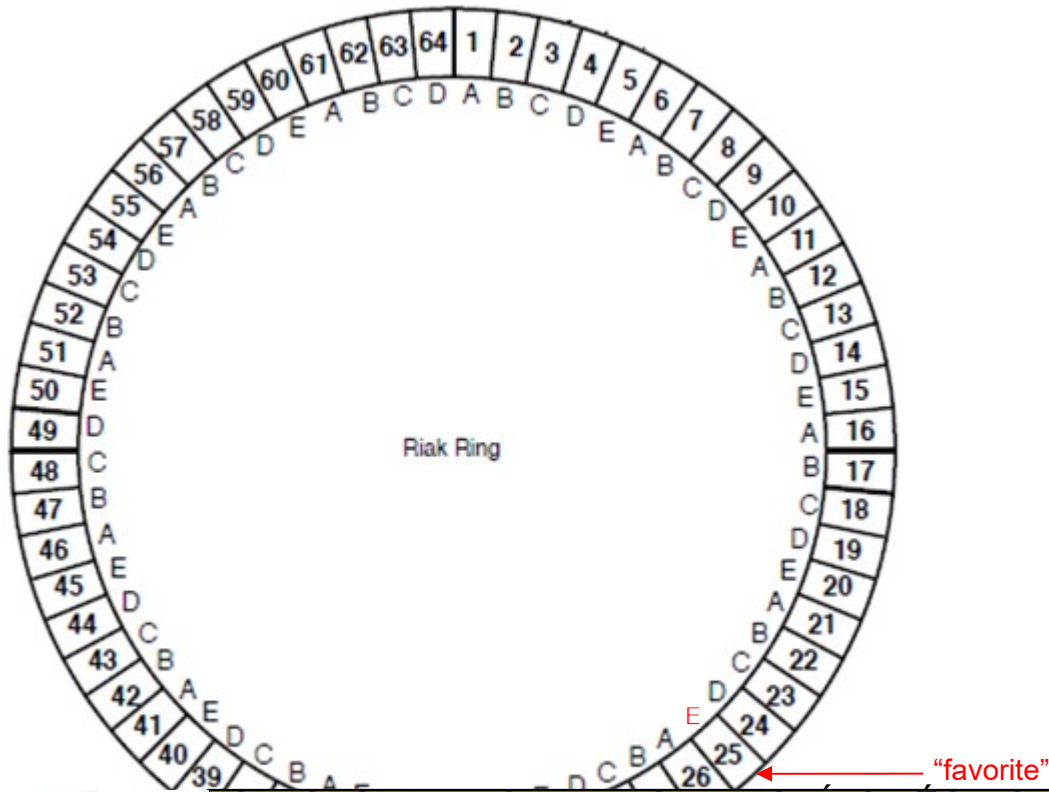
The logo for Cartagena99 features the text "Cartagena99" in a stylized, teal-colored font. The "99" is significantly larger and more prominent than the "Cartagena" part. The text is set against a background of light blue and orange geometric shapes, including a large, light blue triangle pointing upwards and an orange shape below it.

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# The Riak Ring – Replication



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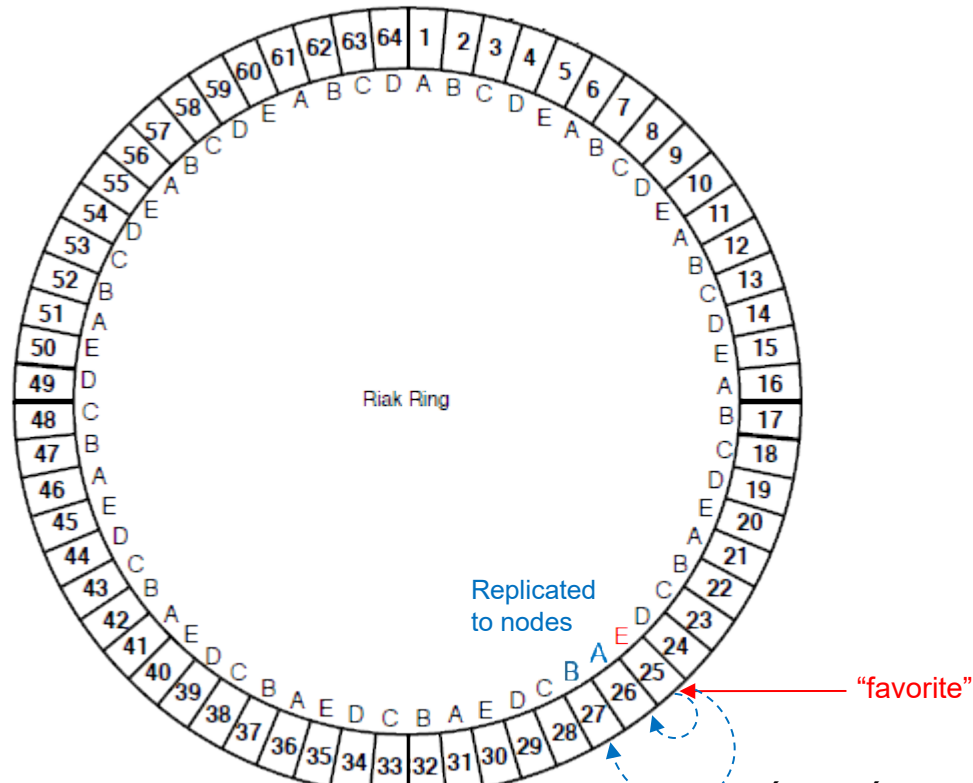
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# The Riak Ring – Replication



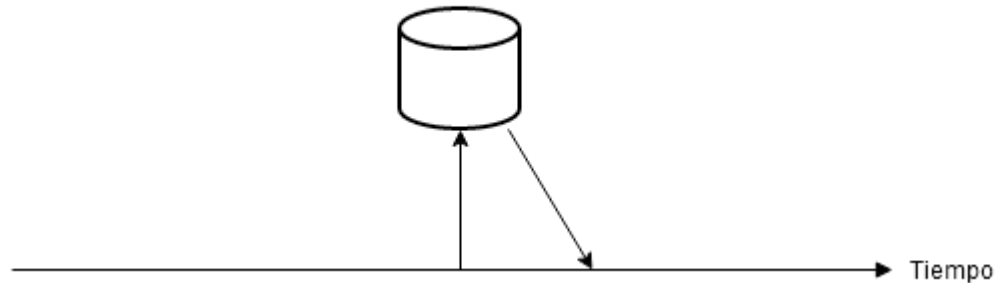
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# Consistence vs Disponibilidad



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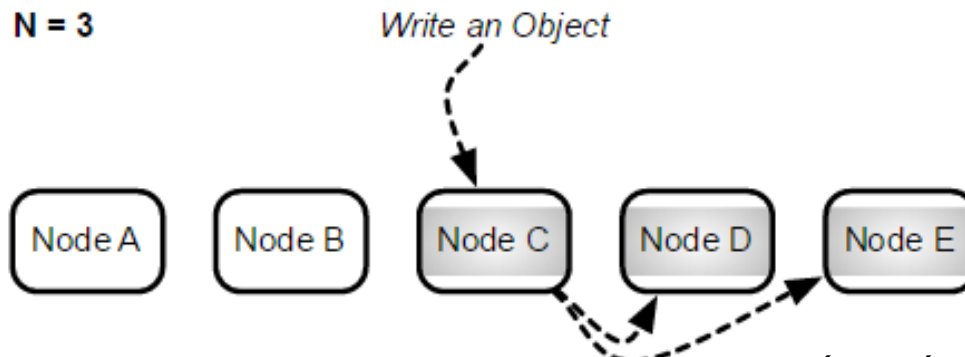
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# N/R/W

- N - Number of nodes in which the information is replicated



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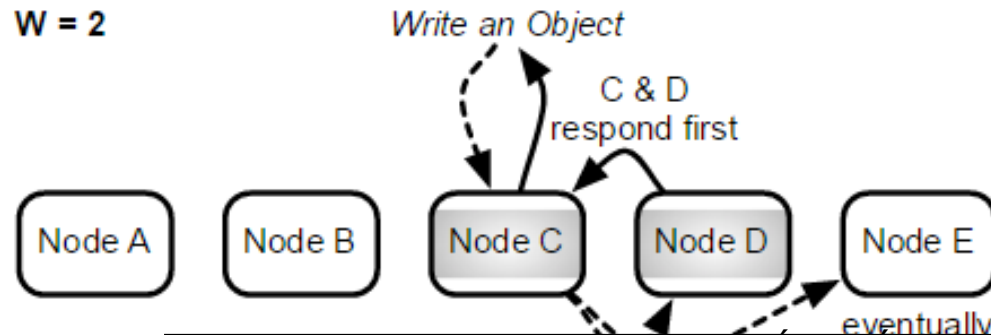
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# N/R/W

- W - Number of nodes to be written to before the operation is considered successful



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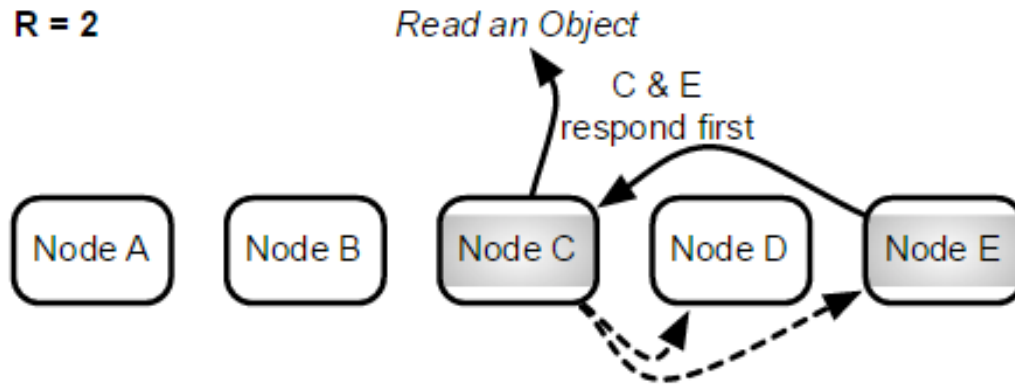
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# N/R/W

- R - Number of nodes to be read from before returning the value



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# Riak Data Types

## RIAK DISTRIBUTED DATA TYPES

HOME | PRODUCTS | RIAK KV | RIAK DISTRIBUTED DATA TYPES

### Simplify development of distributed applications

Riak KV is a distributed system architected to never lose a write, so conflicts between replicas are inevitable. Riak Distributed Data Types reduce the complexity of building distributed applications by providing built-in conflict resolution in the Riak Data Types themselves.

While Riak KV is built as a data-agnostic key/value store, Riak Data Types enable you to use Riak KV as a data-aware system and perform transactions on CRDT-inspired data types. The following Riak Distributed Data Types are implemented in Riak KV:

-  Flags
-  Registers
-  Counters
-  Sets
-  Maps

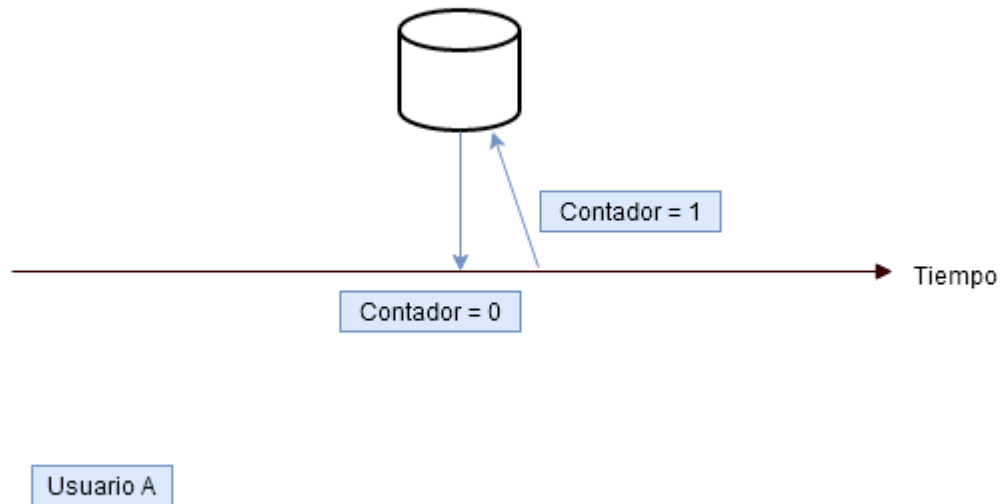
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# Handling conflicts can be complex



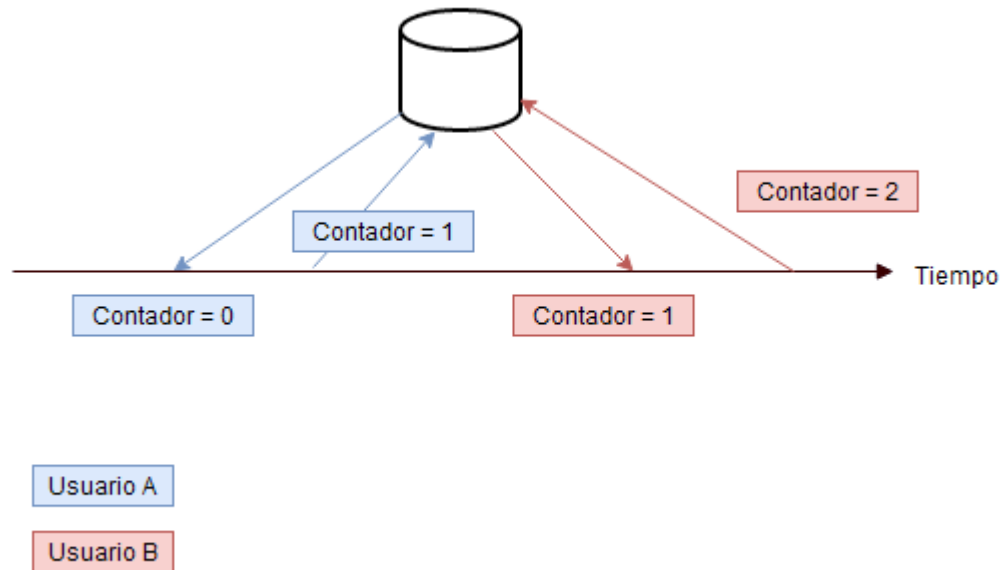
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# Handling conflicts can be complex



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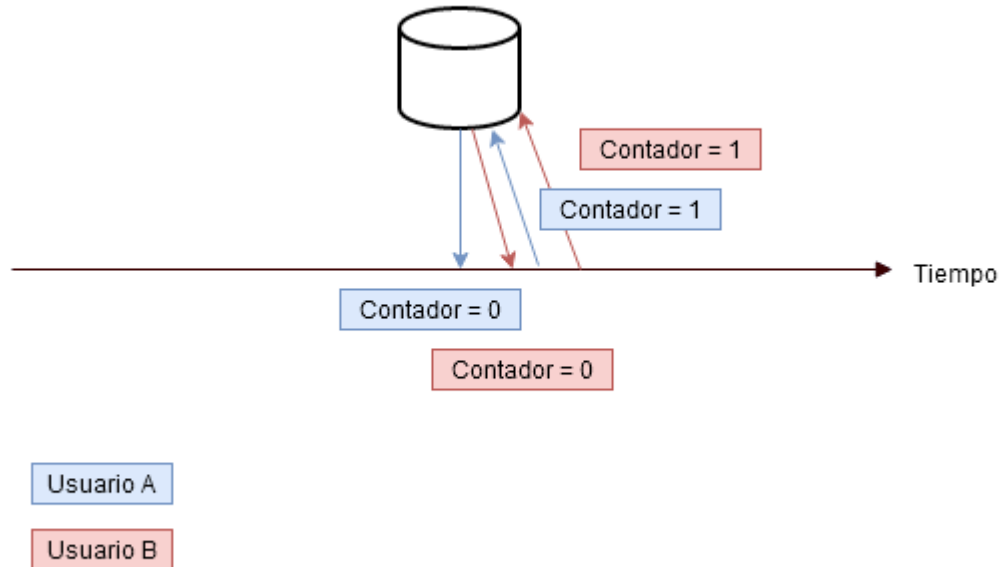
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# Handling conflicts can be complex



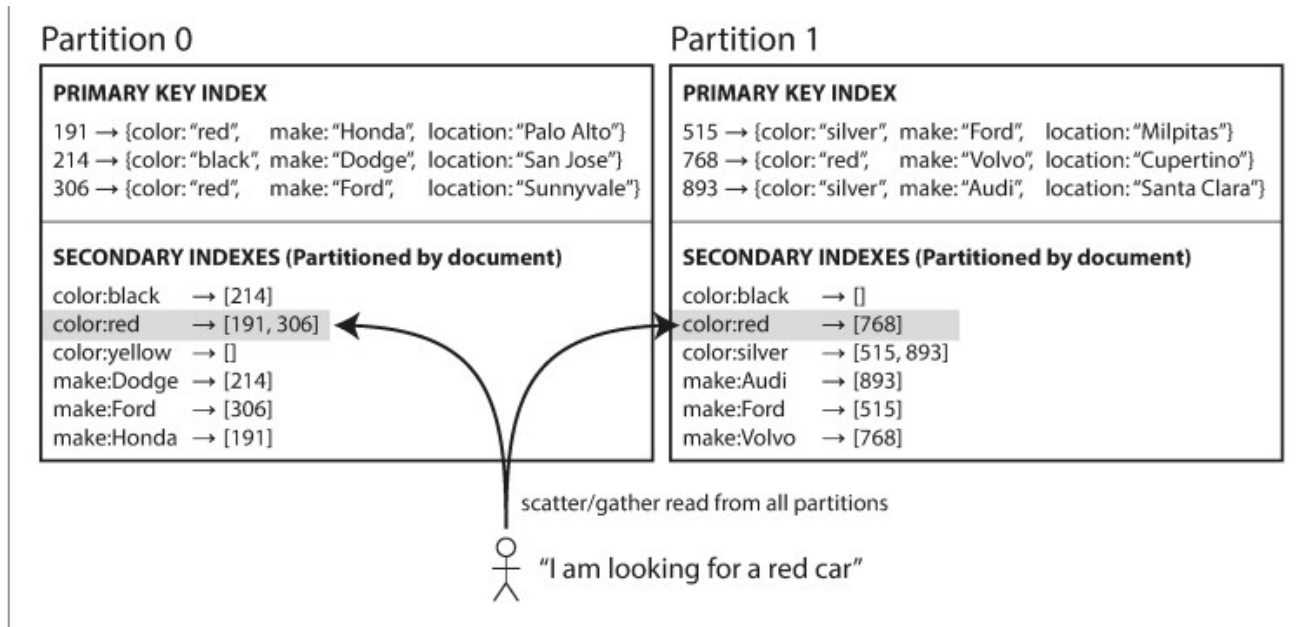
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# Riak Secondary Index



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# CRUD operations in Riak

---

- Inserting / Changing a key

```
curl -i -XPUT "http://localhost:8098/riak/food/favorite" \  
-H "Content-Type:text/plain" \  
-d "pizza"
```

```
HTTP/1.1 204 No Content  
Vary: Accept-Encoding  
Server: MochiWeb/1.1 WebMachine/1.10.8 (that head fake, tho)  
Date: Fri, 13 Nov 2015 07:16:34 GMT  
Content-Type: text/plain  
Content-Length: 0
```

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# CRUD operations in Riak

---

- Reading a key

```
curl -i -XGET "http://localhost:8098/riak/food/favorite"
```

```
HTTP/1.1 200 OK
X-Riak-Vclock: a85hYGBgzGDKBVI8ypz/fkY4RxxgYPx9KYMpkTGP1SGIa9d5viwA
Vary: Accept-Encoding
Server: MochiWeb/1.1 WebMachine/1.10.8 (that head fake, tho)
Link: </riak/food>; rel="up"
Last-Modified: Fri, 13 Nov 2015 07:16:34 GMT
ETag: "5eBXvxQJPMoirlTo6QeXV5"
Date: Fri, 13 Nov 2015 07:16:35 GMT
Content-Type: text/plain
Content-Length: 5
```

pizza

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# CRUD operations in Riak

---

- Deleting a key

```
: curl -i -XDELETE "http://localhost:8098/riak/food/favorite"
```

```
HTTP/1.1 204 No Content  
Vary: Accept-Encoding  
Server: MochiWeb/1.1 WebMachine/1.10.8 (that head fake, tho)  
Date: Fri, 13 Nov 2015 07:16:42 GMT  
Content-Type: text/plain  
Content-Length: 0
```

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# Riak - HandsOn

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# Use Cases

---

- Simple applications requiring high performance in read/write operations
- Applications that need the database to be always available
- Serving ads to web / mobile applications
- User preferences
- Session Storage



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# Agenda

- Material
- Use case
- Relational Databases
- NoSQL
- Riak
- **Apache Cassandra**
- MongoDB
- Neo4j

101	email	name	tel	
	ab@c.to	otto	12345	
103	email	name	tel	tel2
	karl@a.b	karl	6789	12233
104	name			
	linda			

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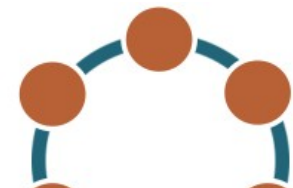
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# Apache Cassandra



- Developed in java by Facebook and donated to the Apache Foundation in 2008
- It is based on a key/value model by storing several columns per key.
- Inspired by Amazon's Dynamo (Same as Riak) and Google's BigTable (Column families)
- There's no central controller. No single point of failure
- Querys: CQL Language - Similar to SQL
- Compatible with Hadoop and Spark
- Supports multiple data centers



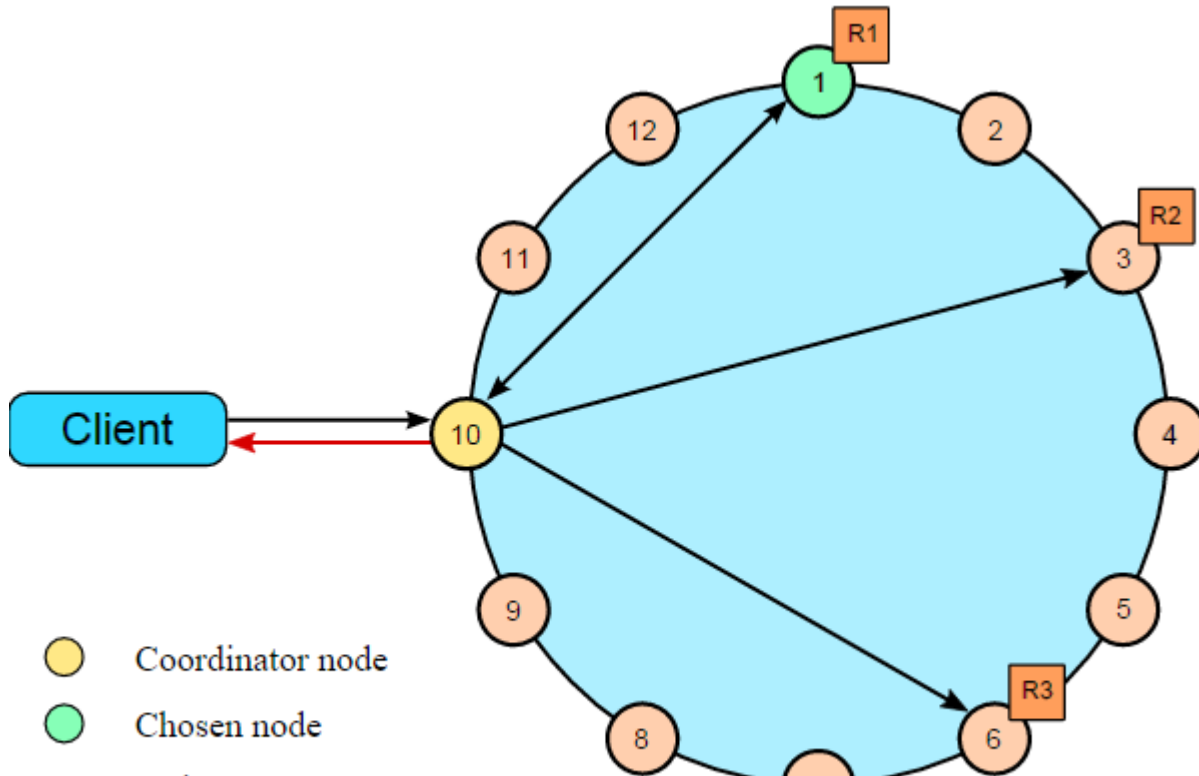
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# Architecture - Writing (W = 3)



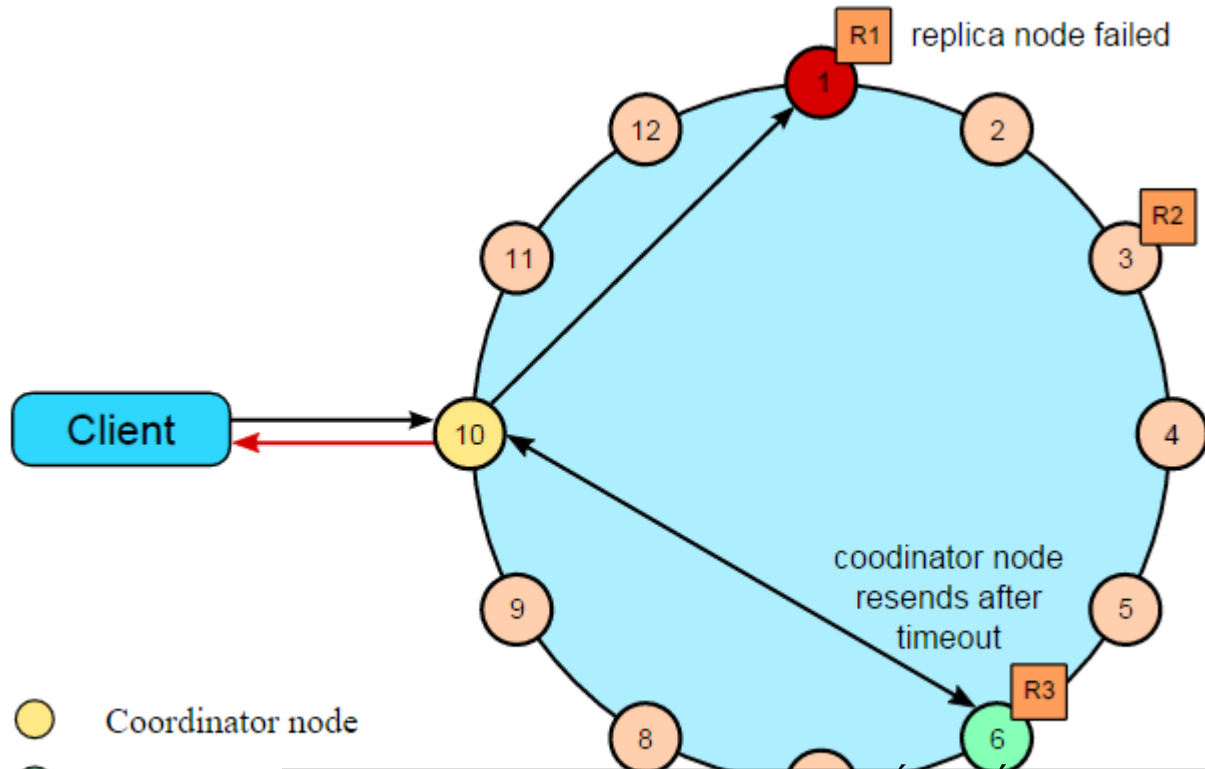
- Coordinator node
- Chosen node

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# Architecture - Reading



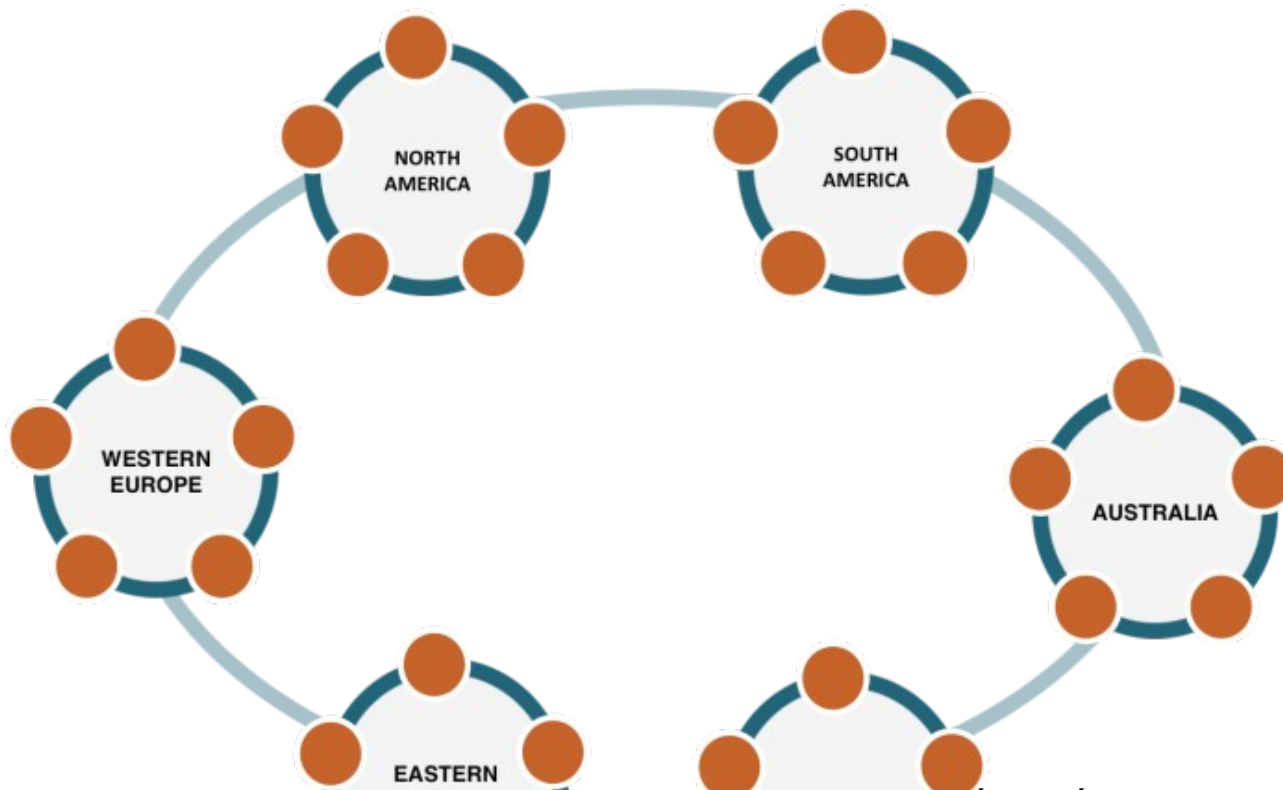
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# Cassandra Cluster Multiple DataCenters



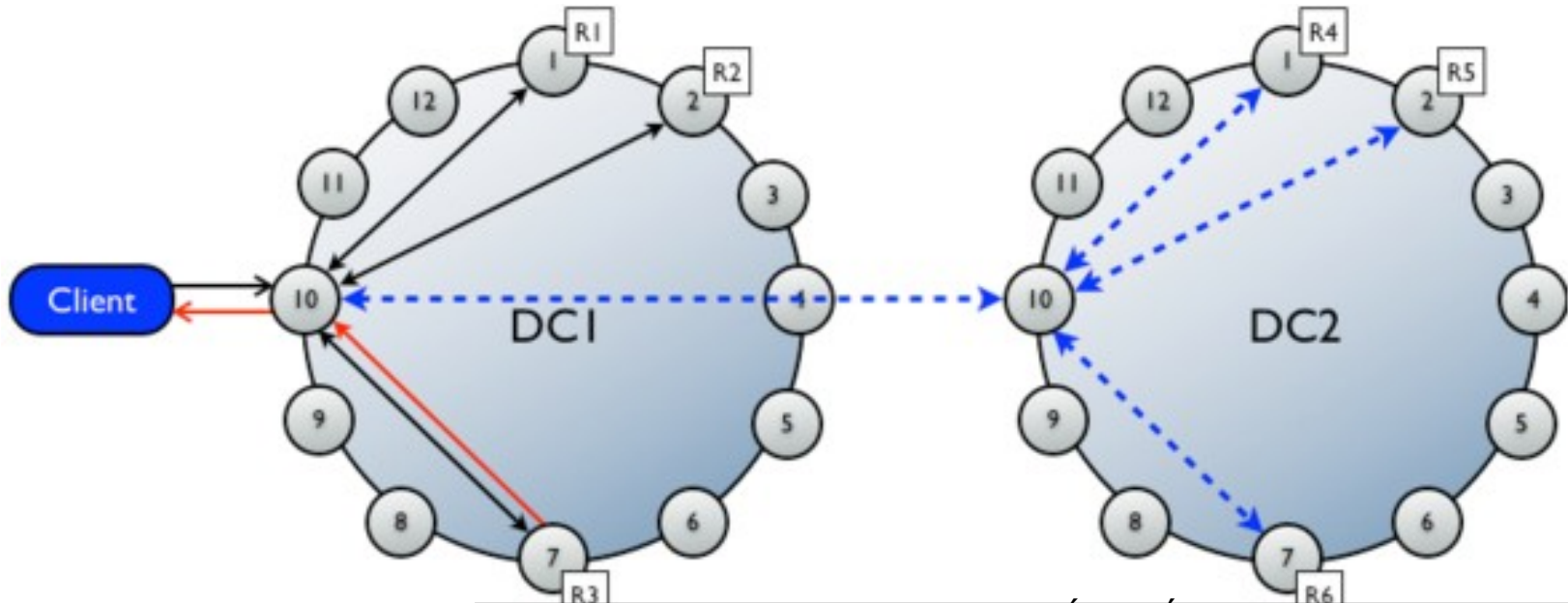
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# Cassandra Cluster Multiple DataCenters



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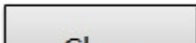
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# BigTable

- Data is stored in tables (Column Families)
- Tables are stored in separate databases (Keyspaces)
- Every table must have a primary key (Partition Key)
- Additionally a table can have composite keys

Partition KEY



Composite Key	Columna 2	Columna 3	Composite Key	Columna 2	Columna 3	Columna 1	Columna 2	Columna 3
---------------	-----------	-----------	---------------	-----------	-----------	-----------	-----------	-----------

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# Remembering the Key - Value model

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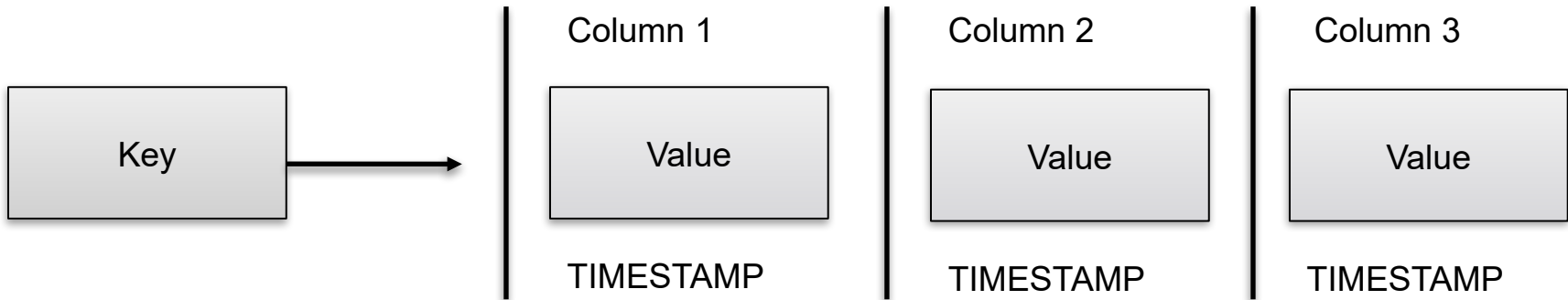
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# BigTable



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# BigTable

Family of Columns = TABLE

Partition KEY



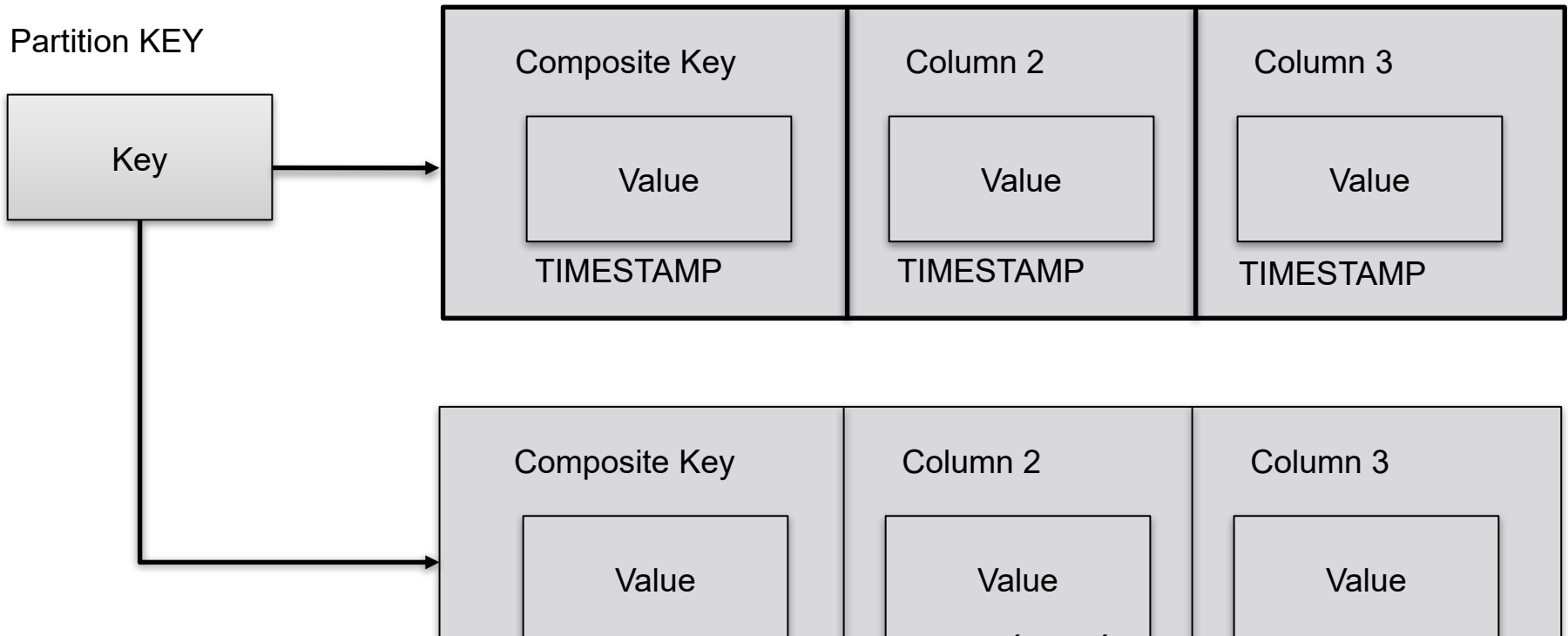
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# BigTable



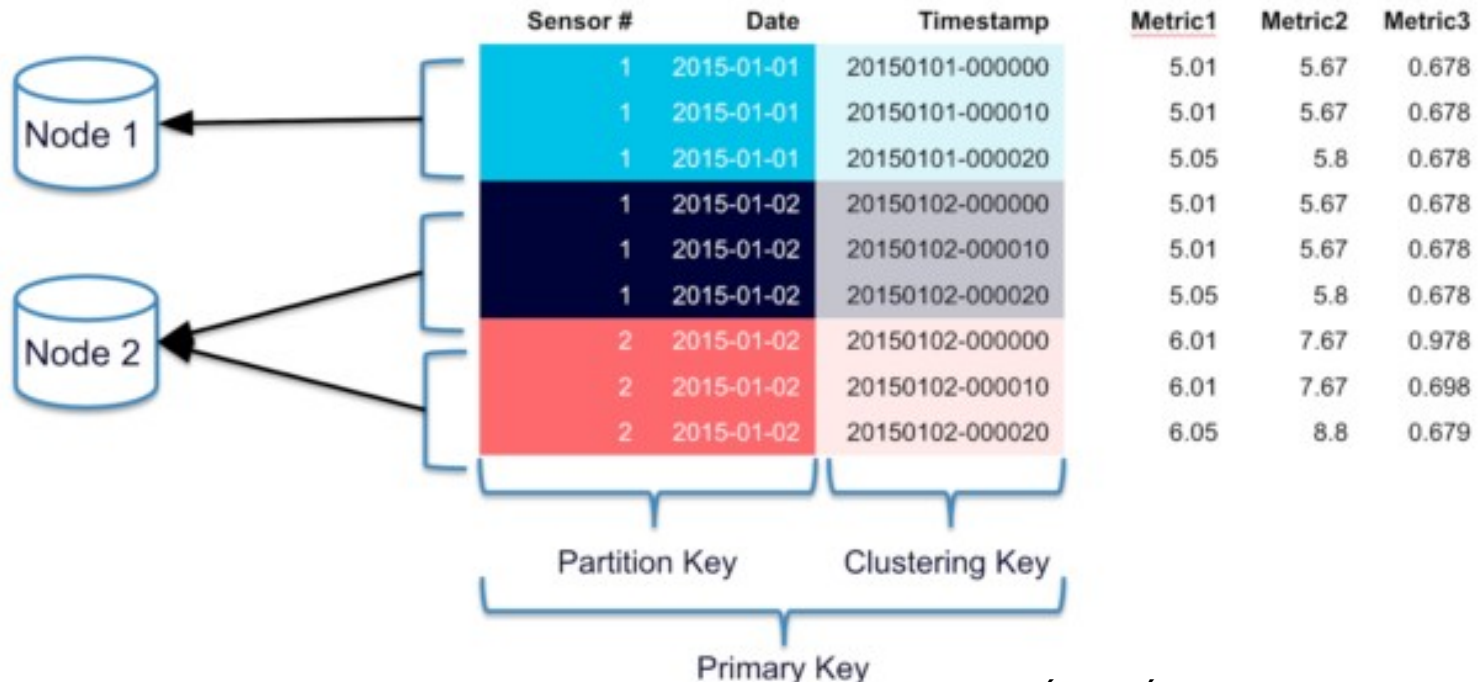
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# Partition Key vs Composite Key



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# Cassandra Query Language CQL

- It looks like SQL but is much more limited
  - No JOINS
  - No GROUP BY
  - No ORDER BY

```
CREATE KEYSPACE demo
WITH replication = {'class':'SimpleStrategy', 'replication_factor': 1};
```

```
CREATE TABLE users (
  firstname text,
  lastname text,
  age int,
  email text,
  city text,
  PRIMARY KEY (lastname)
);
```

```
SELECT *
FROM users
WHERE lastname= 'Doe'
LIMIT 1;
```

```
UPDATE users
  SET city= 'San Jose'
WHERE lastname= 'Doe';
```

```
DELETE from users WHERE lastname = 'Doe';
```

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# Cassandra - HandsOn

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# Use Cases

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- Applications requiring very high real-time writing capabilities
- Business Intelligence systems that require a very fast database reading
- Decentralized applications that need to store large amounts of information
- Smart cities. Sensors and monitoring
- Content Delivery Network (CDN) - Highly distributed static content servers

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# Agenda

---

- Material
- Use case
- Relational Databases
- NoSQL
- Riak
- Apache Cassandra
- MongoDB
- Neo4j

```
{
  "firstName": "John",
  "lastName": "Smith",
  "isAlive": true,
  "age": 25,
  "address": {
    "streetAddress": "21 2nd Street",
    "city": "New York",
    "state": "NY",
    "postalCode": "10021-3100"
  },
  "phoneNumbers": [
    {
      "type": "home",
      "number": "212 555-1234"
    },
    {
      "type": "office",
      "number": "646 555-4567"
    }
  ],
  "children": [],
  "spouse": null
}
```

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# MongoDB

- It is a document-oriented database (Key Collections / value)
- It is very flexible in structuring the data
- Querys: Javascript with its own API based on high capabilities for information querying
- It has geospatial characteristics
- Prioritizes consistency over availability
- Master / Slave type replication
- Scale horizontally thanks to Sharding
- There is a connector for BI tools

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# Nomenclature

RDBMS	MongoDB
Database	Database
Table	Collection
Tuple/Row	Document
Column/Attribute/Variable	Field
Table Join	Embedded Documents
Database Server and Client	
Primary Key	Primary Key (Default key _id provided by mongodb itself)
Mysqld/Oracle	mongod

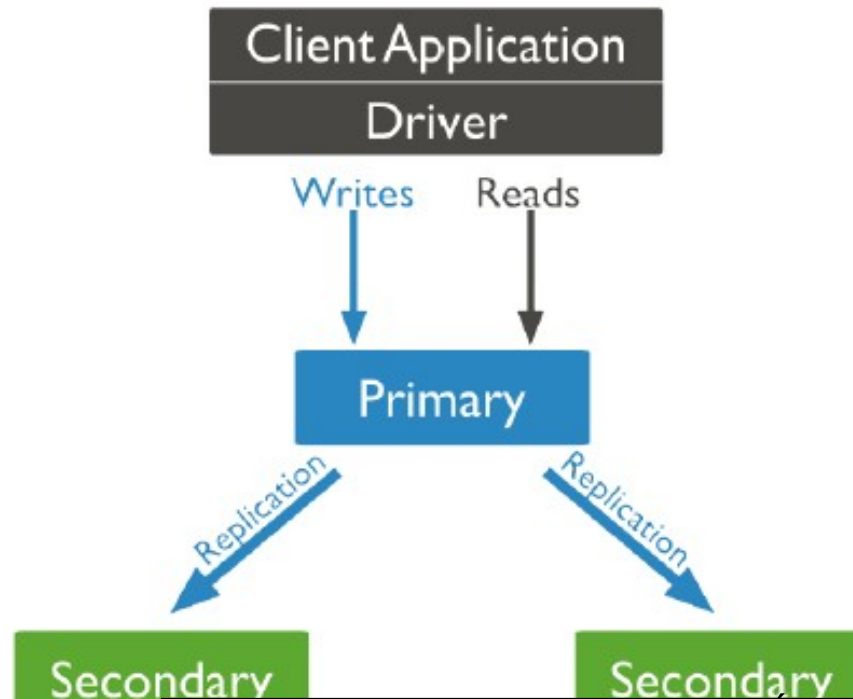
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# Replication - Scale the readings



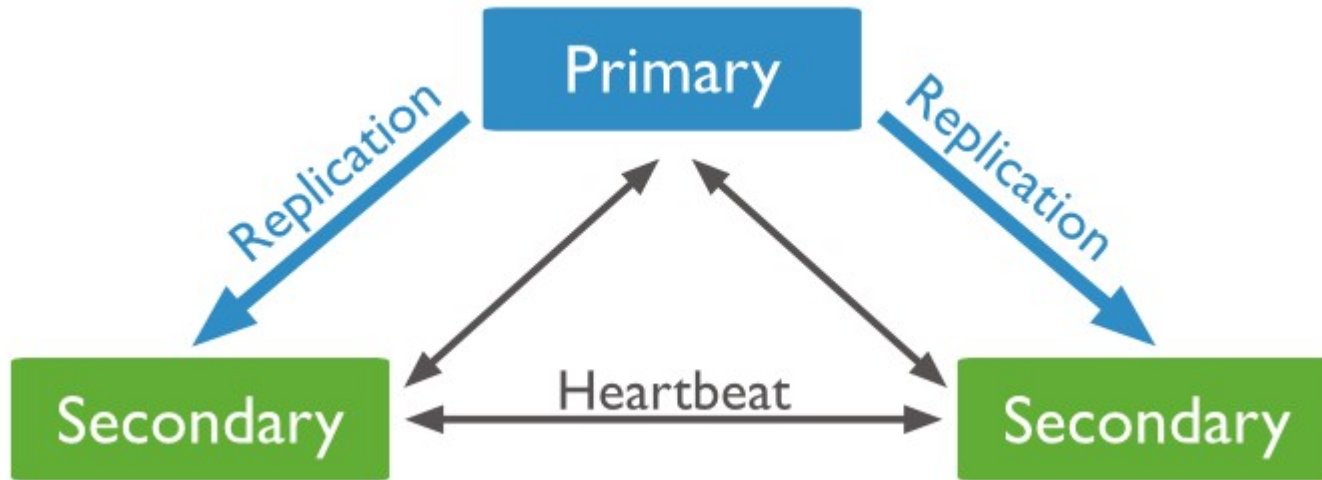
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# Replication



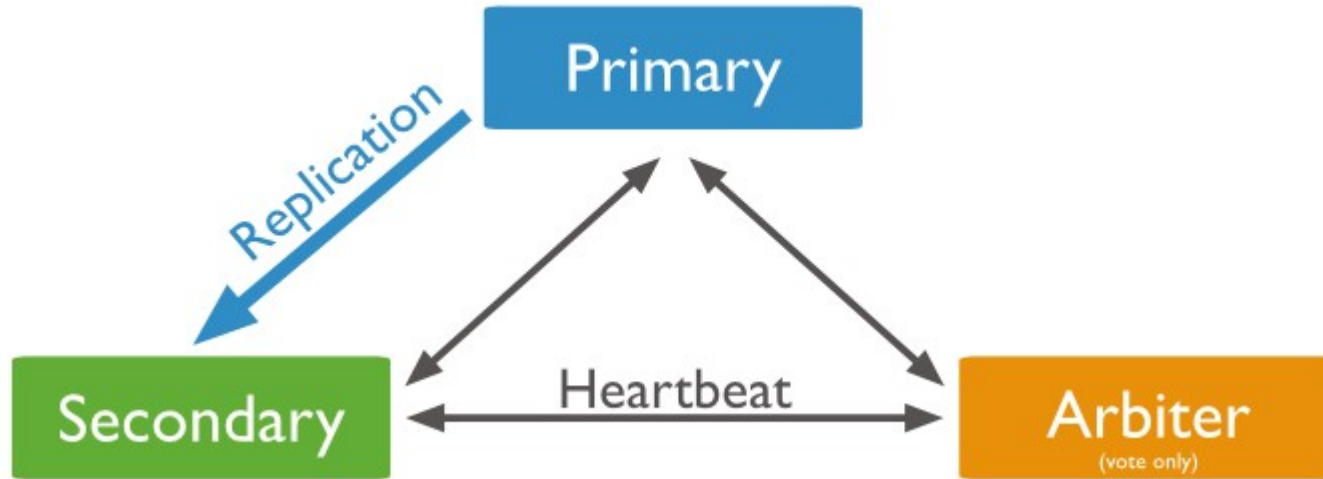
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# Replication



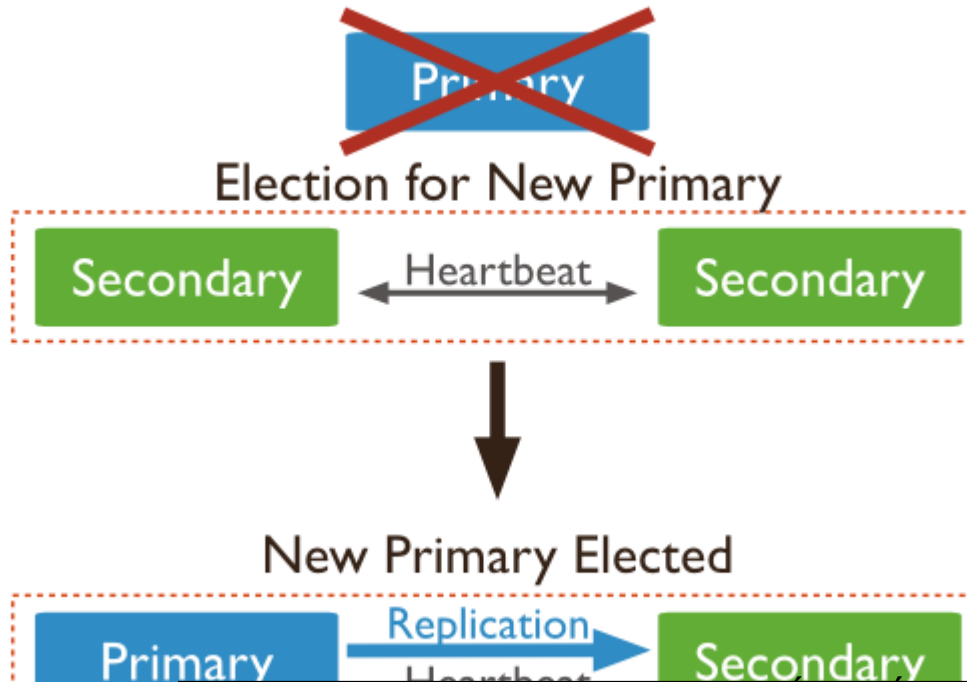
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# Replication



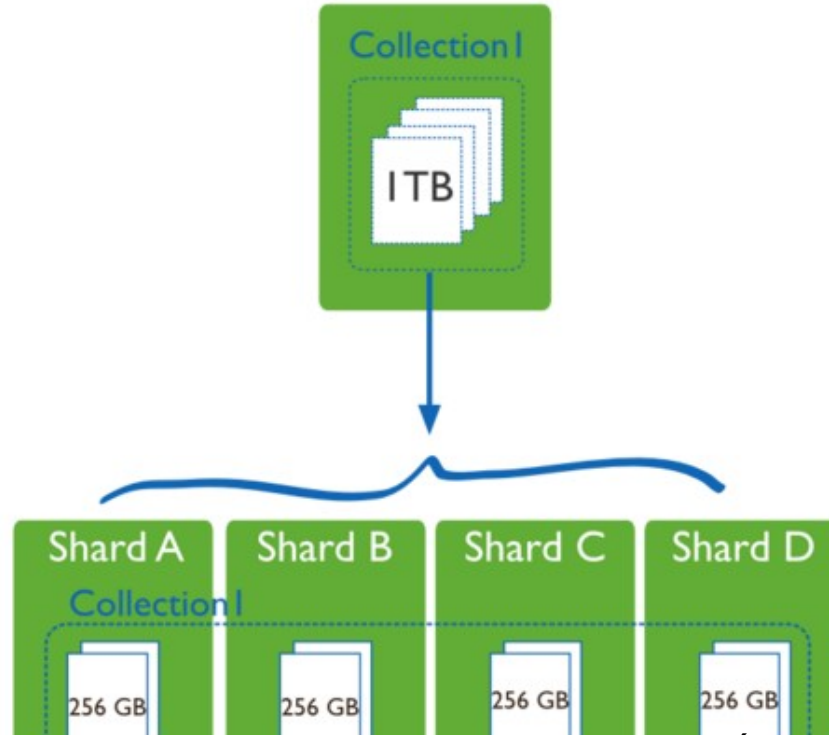
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# Sharding- Scale the scriptures



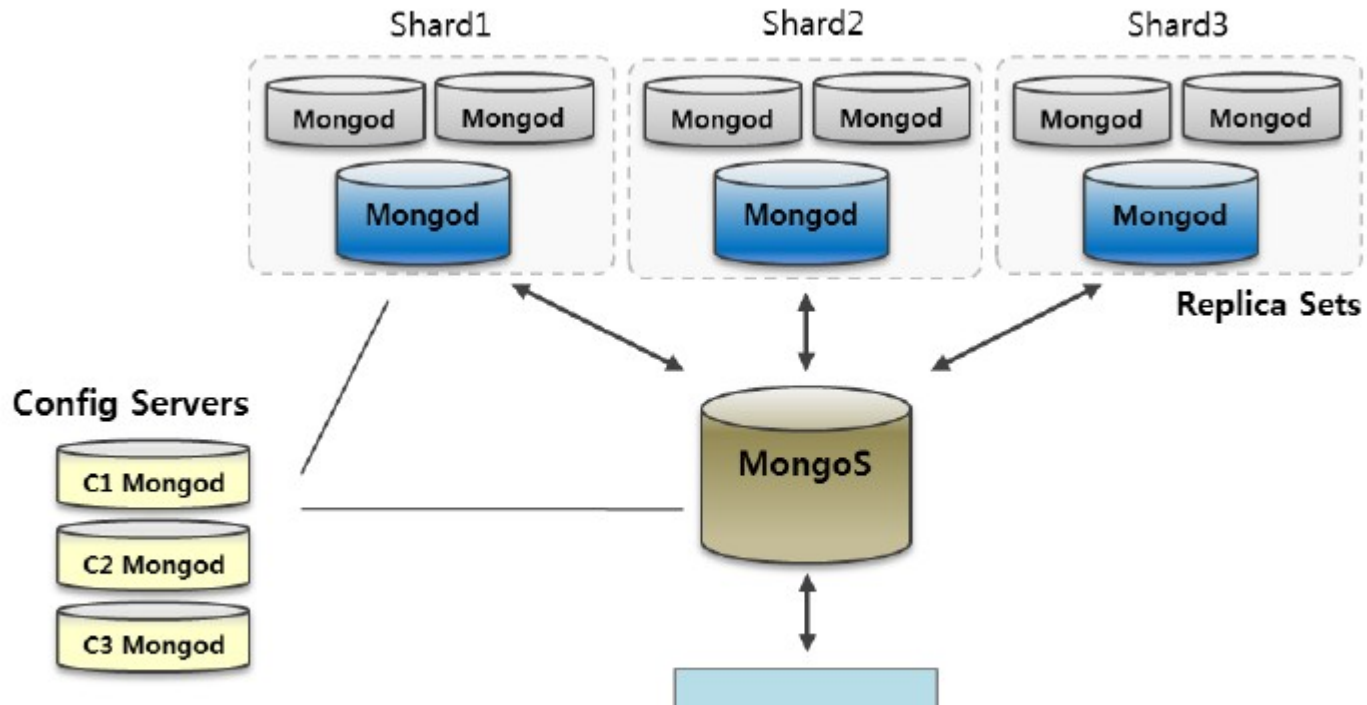
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# Complete map



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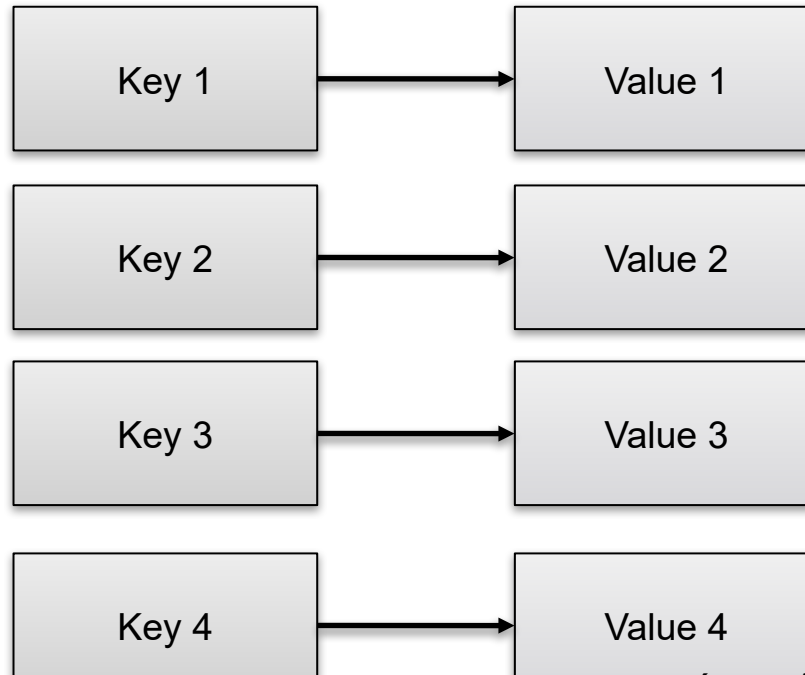
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# Document

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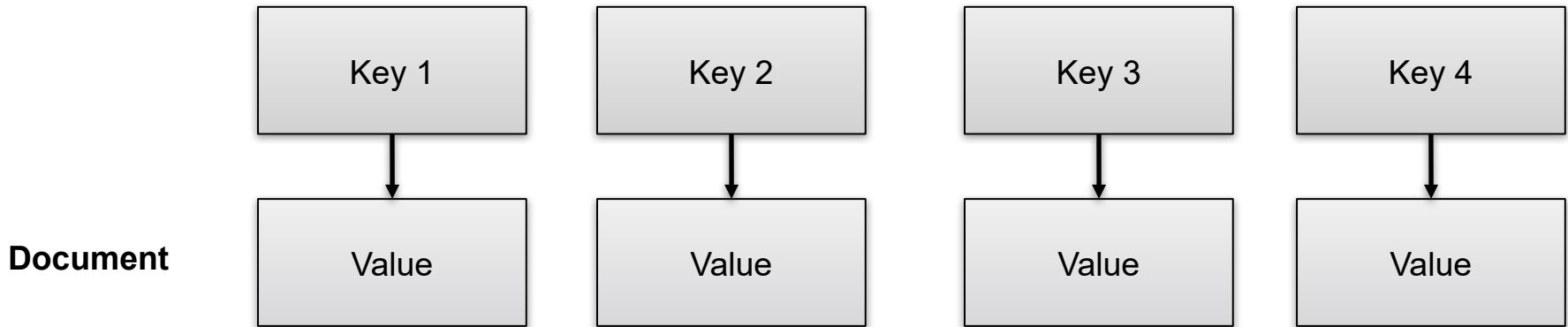
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# Document

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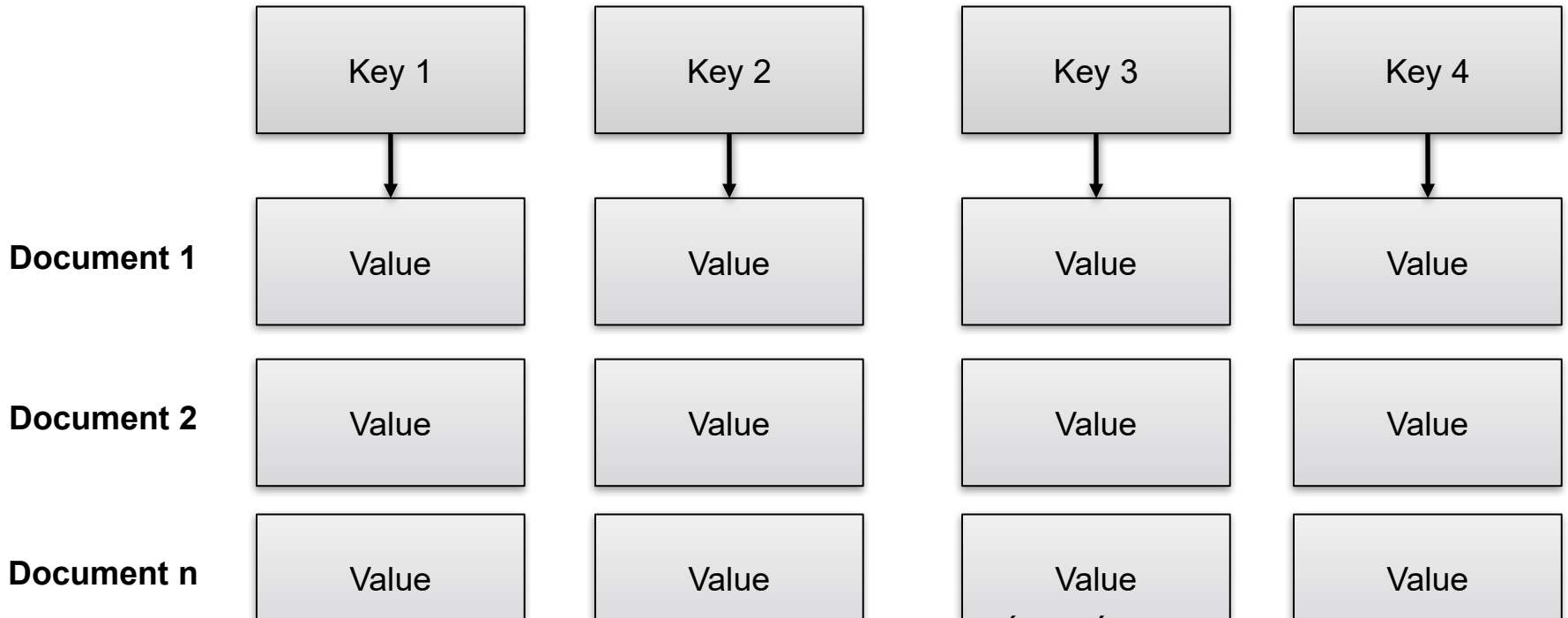
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# Collection



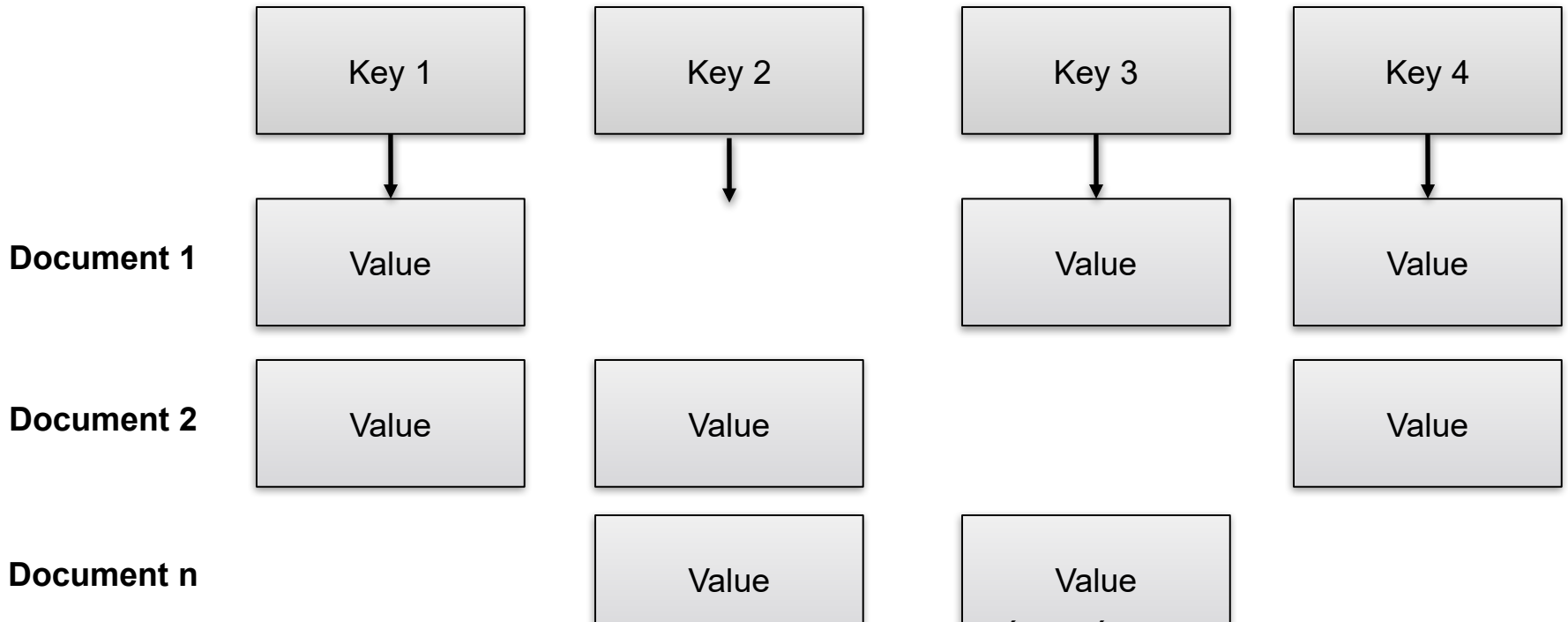
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# Collection



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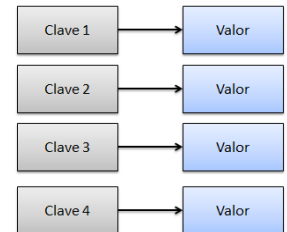
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# Documents

- The documents correspond to native data types in most programming languages.
- The ability to include other documents and arrays within the documents reduces the need for joins.
- Dynamic schemes allow support for any data structure in a collection

```
{
  name: "sue",
  age: 26,
  status: "A",
  groups: [ "news", "sports" ]
```

← field: value  
← field: value  
← field: value  
← field: value



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# Document



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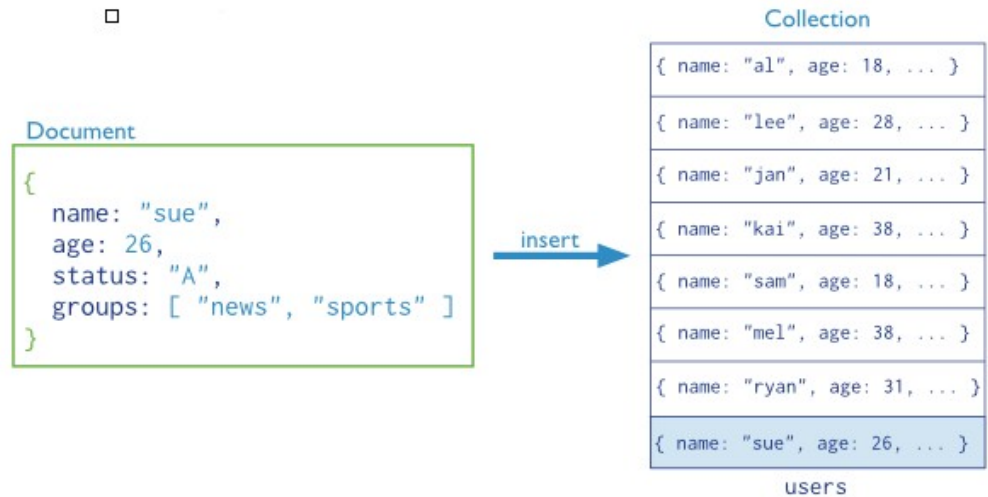
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# CRUD operations

- Data insertion



```
Collection
↓
db.users.insert(
  Document
  ↓
  {
    name: "sue",
    age: 26,
    status: "A",
    groups: [ "news", "sports" ]
  }
)
```

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# CRUD operations

- Querys

```
SELECT _id, name, address
FROM users
WHERE age > 18
LIMIT 5
```

← projection  
← table  
← select criteria  
← cursor modifier

```
db.users.find(
  { age: { $gt: 18 } },
  { name: 1, address: 1 }
).limit(5)
```

← collection  
← query criteria  
← projection  
← cursor modifier

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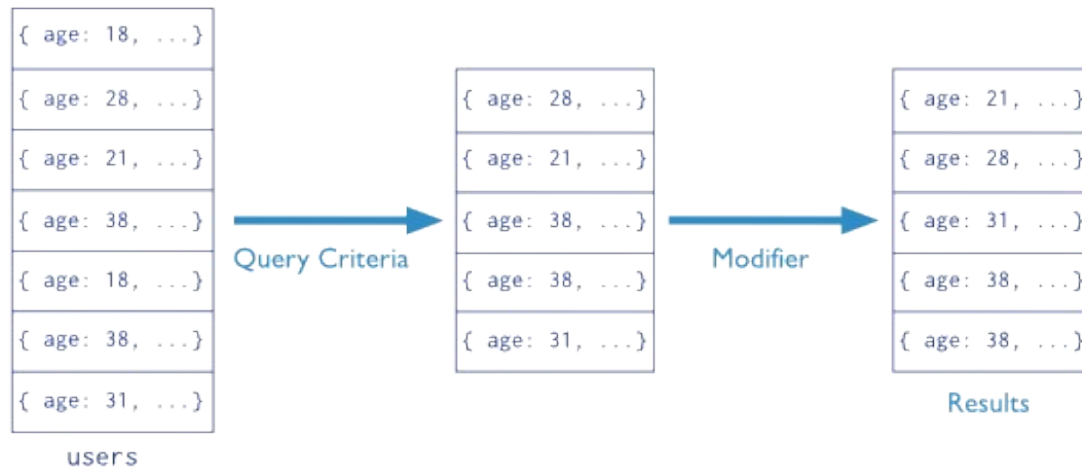
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# CRUD operations

- Ordered queries

Collection                      Query Criteria                      Modifier  
`db.users.find( { age: { $gt: 18 } } ).sort( {age: 1 } )`



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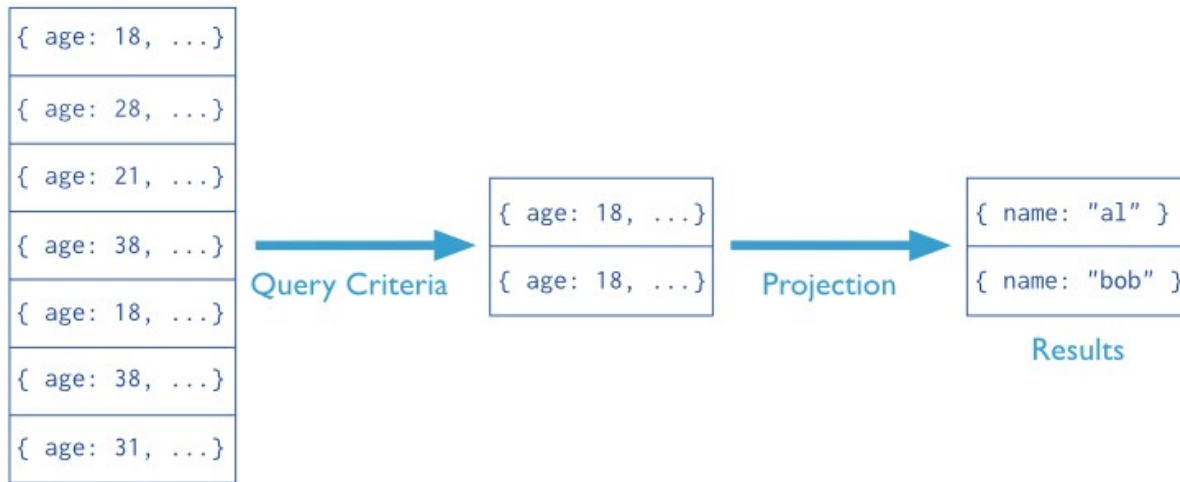
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# CRUD operations

- Queries with projection

Collection                      Query Criteria                      Projection  
`db.users.find( { age: 18 }, { name: 1, _id: 0 } )`



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# CRUD operations

- Update

```
UPDATE users           ← table
SET   status = 'A'    ← update action
WHERE age > 18        ← update criteria
```

```
db.users.update(      ← collection
  { age: { $gt: 18 } }, ← update criteria
  { $set: { status: "A" } }, ← update action
  { multi: true }     ← update option
)
```

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# CRUD operations

---

- Deletion

```
DELETE FROM users ← table  
WHERE status = 'D' ← delete criteria
```

```
db.users.remove( ← collection  
  { status: "D" } ← remove criteria  
)
```

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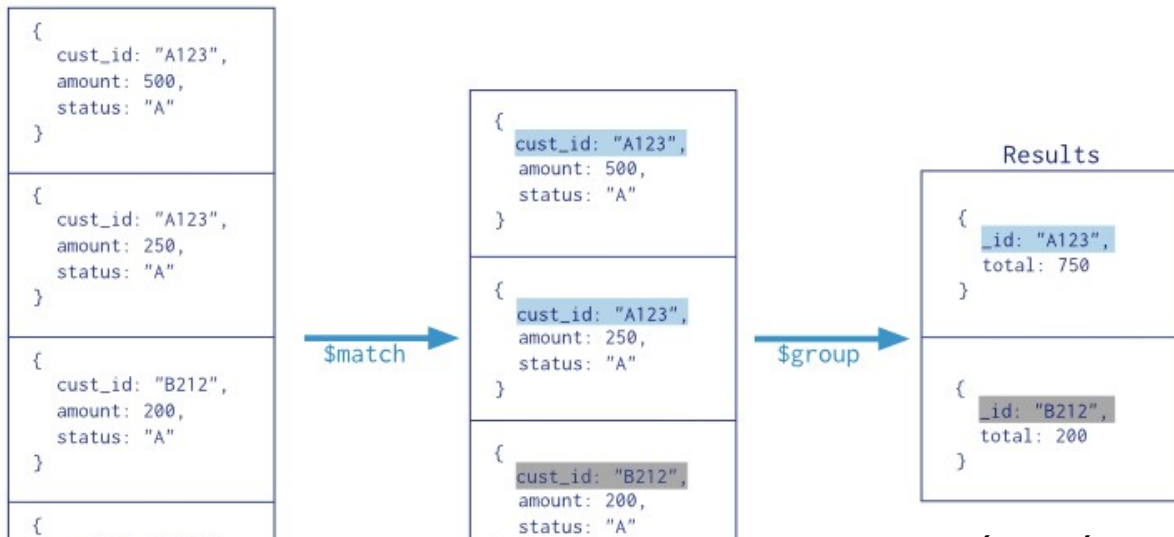
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# CRUD operations

- Aggregation - Equivalent to GROUP BY

```

Collection
  ↓
db.orders.aggregate( [
  $match stage → { $match: { status: "A" } },
  $group stage → { $group: { _id: "$cust_id", total: { $sum: "$amount" } } }
] )
  
```



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# Converting from SQL to MongoDB

## Convertidor de consulta SQL a MongoDB

Herramienta gratuita para convertir consultas SQL utilizadas en MySQL, Oracle, Postgresql o servidor SQL al formato de consulta MongoDB – NoSQL. Herramienta práctica para las personas que están acostumbradas a las consultas de bases de datos estructuradas y que son nuevos en el aprendizaje de MongoDB. También se proporcionan opciones para examinar y cargar la consulta SQL de entrada y descargar la consulta MongoDB de salida.

Entrada  No se ha seleccionado ningún archivo.

```
select *
from tabla
```

Salida

```
db.tabla.find({
});
```

Convertir

Borrar

Descargar

Copiar

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# Converting from SQL to MongoDB

The screenshot shows the MongoDB documentation website. The main navigation bar includes 'SERVER', 'DRIVERS', 'CLOUD', 'TOOLS', 'TUTORIALS', and 'Download MongoDB'. A search bar is located on the right. The left sidebar shows the 'MONGODB MANUAL' for version 3.4, with 'SQL to MongoDB Mapping Chart' highlighted. The main content area displays the title 'SQL to MongoDB Mapping Chart' and a list of links: 'Terminology and Concepts', 'Executables', 'Examples', and 'Additional Resources'. Below the list, there is a paragraph of text and a section titled 'Terminology and Concepts'.

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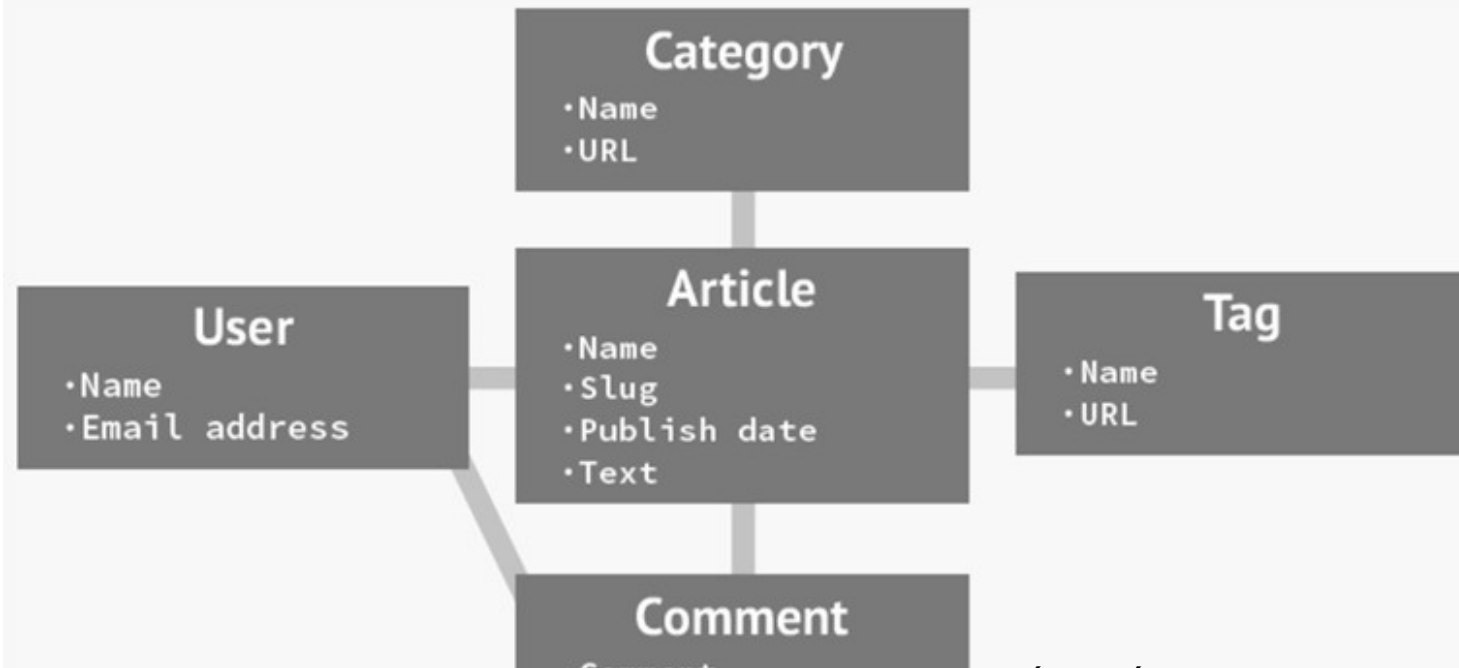
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# Schematic design

## Normalized Data



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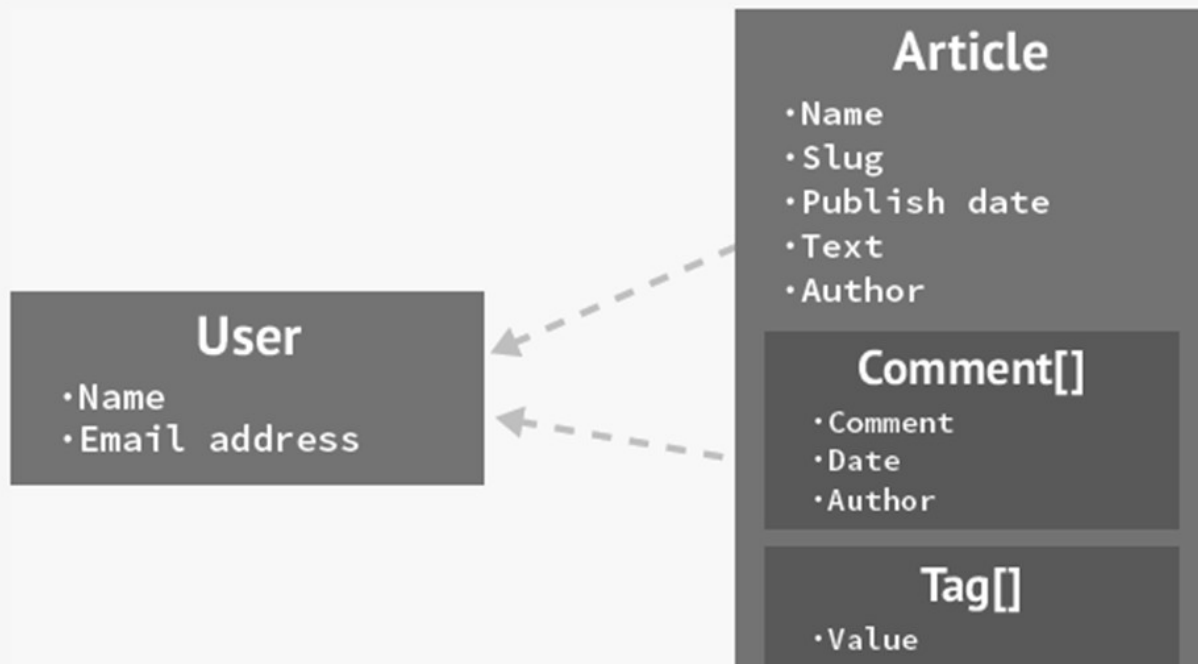
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# Scheme design

## De-Normalized (embedded) Data



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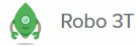
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# MongoDB Client



Download

Blog

Account

## Simplicity Meets Power

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A free 30-day trial of the full access edition of Studio 3T is included with your double-pack download of Robo 3T.

Try it out and see **how much more you can do.**

Download your Double Pack

### Studio 3T: the professional IDE for MongoDB

- Preferred by over 100,000 professional developers and DBAs because it saves time.
- Build queries fast, generate instant code, import/export in multiple formats, and much more
- Available for Windows, macOS, and Linux.
- Now with two **NEW tools**:
  - Data Masking

### Robo 3T: the hobbyist GUI

Robo 3T 1.4 brings support for MongoDB 4.2, and a mongo shell upgrade from 4.0 to 4.2, with the ability to manually specify visible databases.

Download Robo 3T Only

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# MongoDB - HandsOn

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# Use Cases

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- Any application that needs to use semi-structured data
- Applications with high volume of information
- Document and Content Management Systems
- Rapid development / Agile methodologies
- Machine-generated data (logs, sensors, etc.)
- It is not appropriate when there is more than one data center



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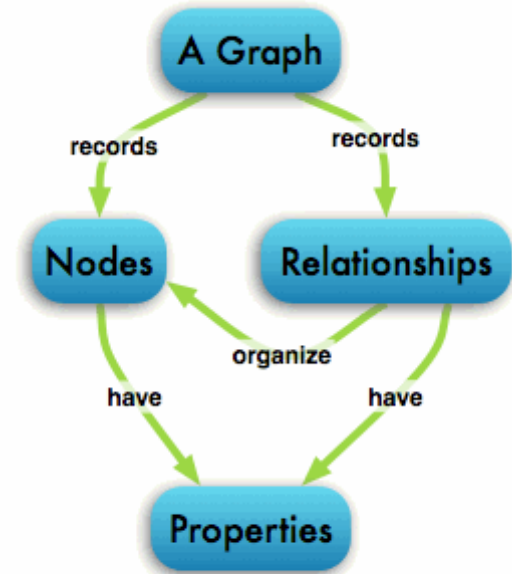
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# Agenda

- Material
- Use case
- Relational Databases
- NoSQL
- Riak
- Apache Cassandra
- MongoDB
- **Neo4j**



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neo4j

# Neo4j

- It is a network oriented database (stores information as nodes and relationships)
- Implemented in java in 2010
- Querys: Proprietary language called Cypher that allows you to explore connections between information
- REST Interface
- It is not necessary to declare a scheme
- Prioritizes consistency and availability
- ACID

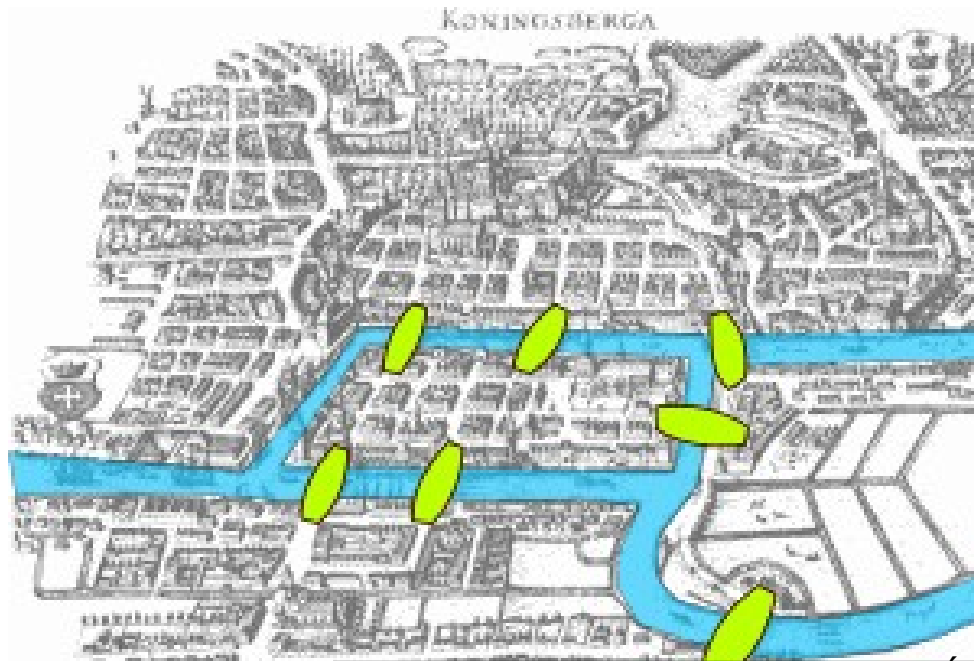


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# Graphite Theory - Königsberg Bridges



Leonhard Euler  
1707-1783

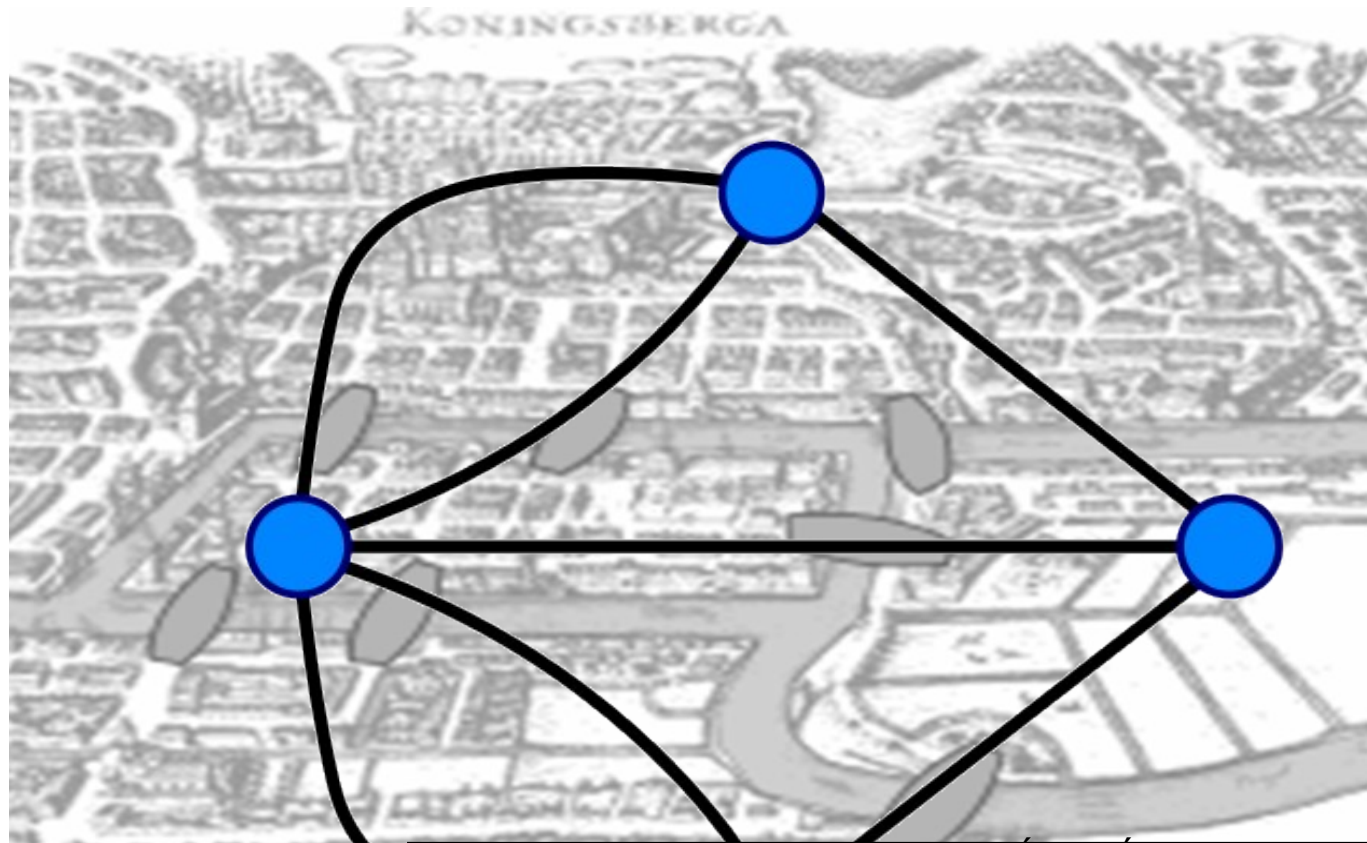
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# Graphite Theory - Königsberg Bridges



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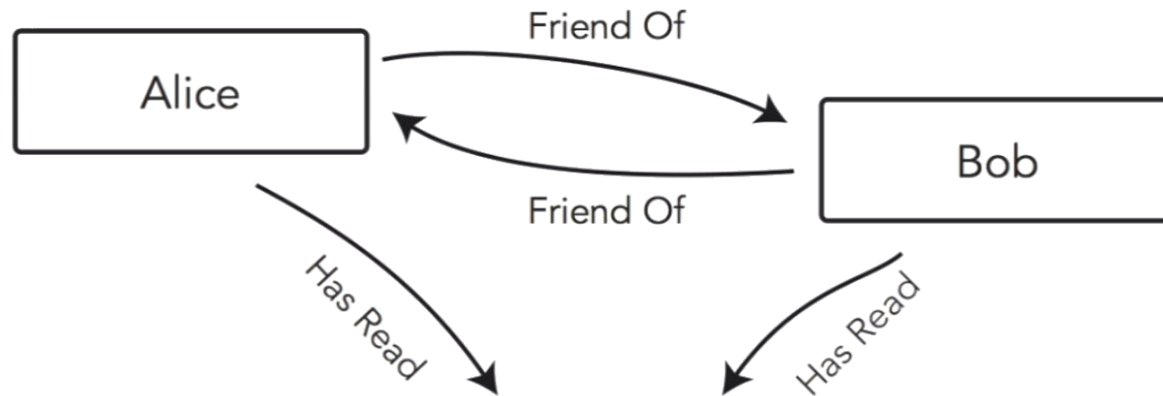
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# Nodes and Relations

- A network is built the way people really think
- The nodes or vertices represent entities
- The edges represent relationships



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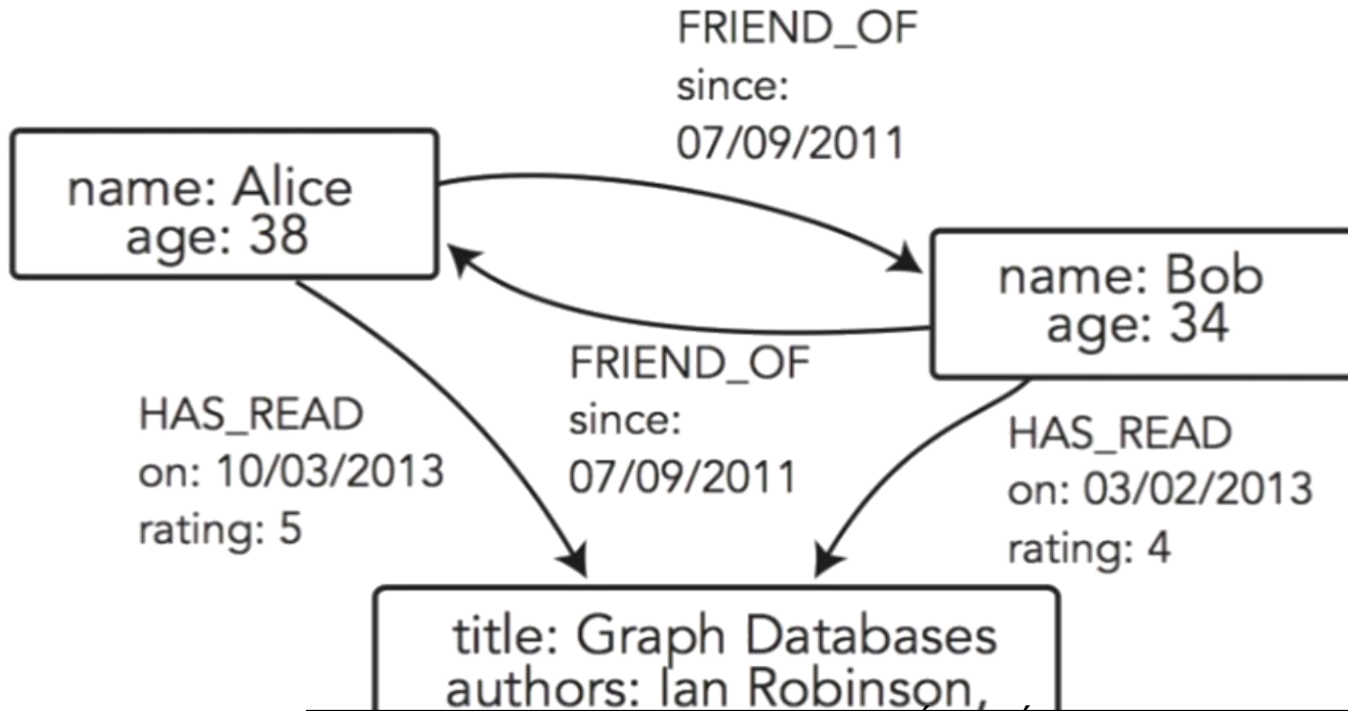
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# Properties



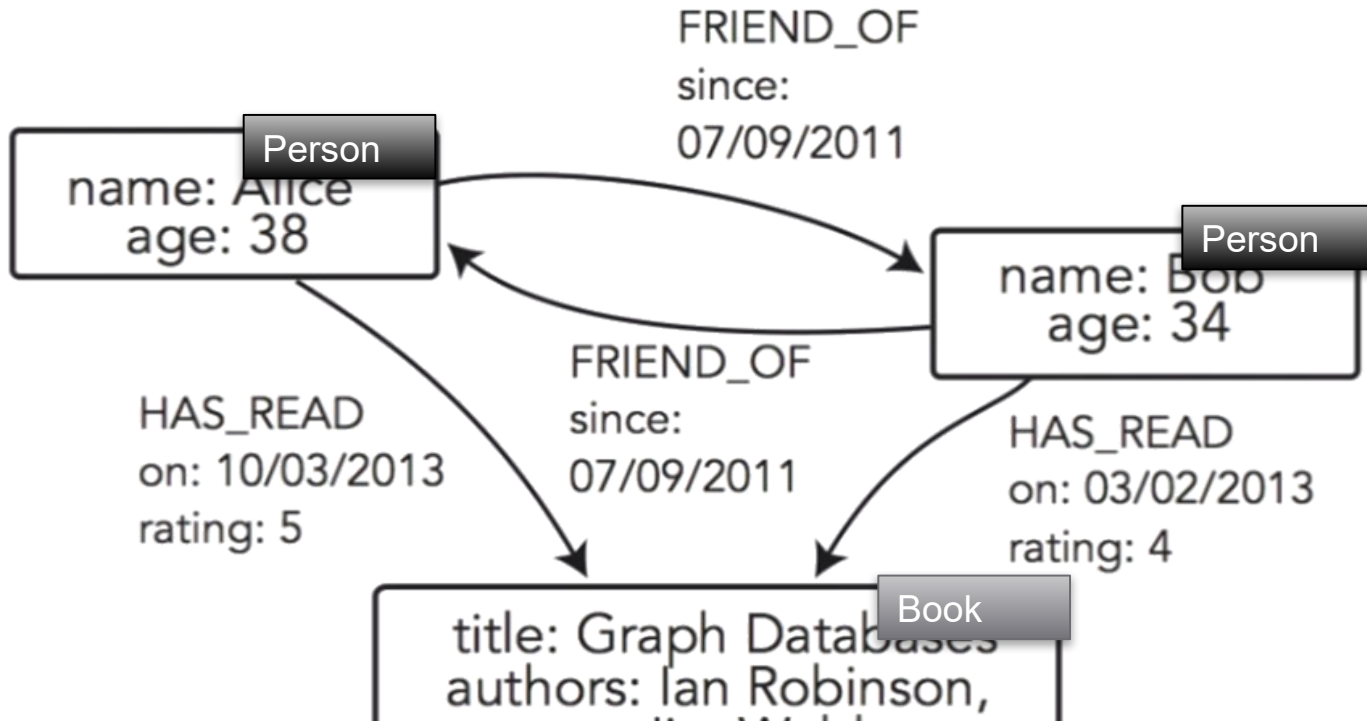
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# Tags



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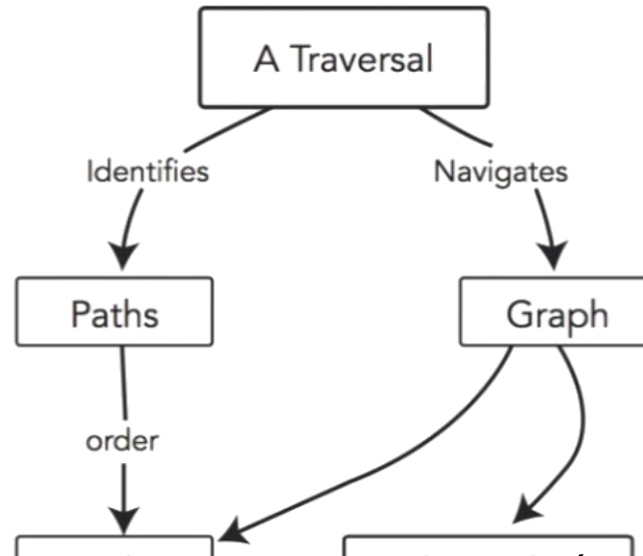
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# Searching for information

- Locate a node and explore other nodes through their relationships



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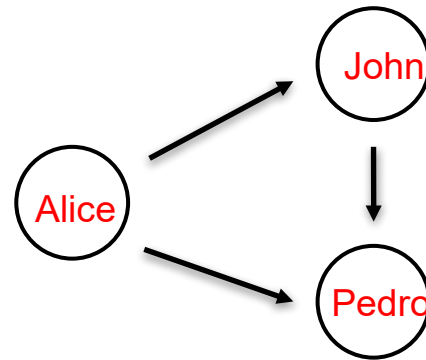
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# Searching for information

- Locate a node and explore other nodes through their relationships
- or we can identify patterns



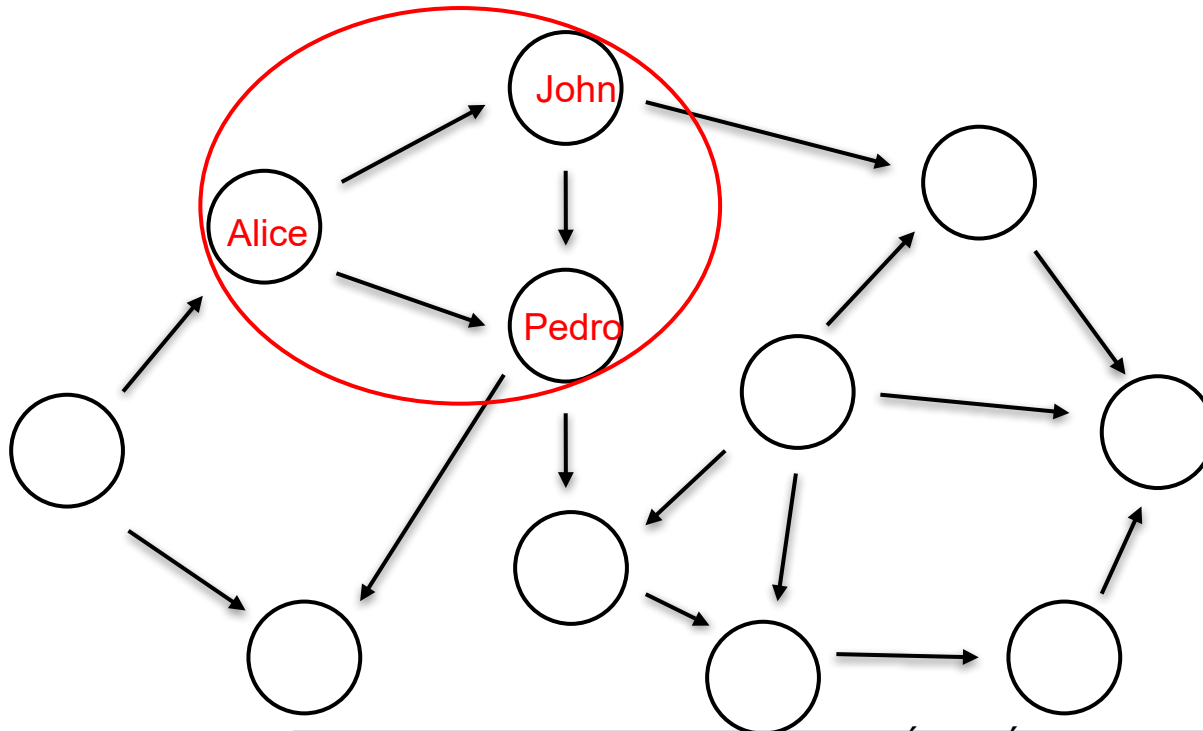
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# Patterns



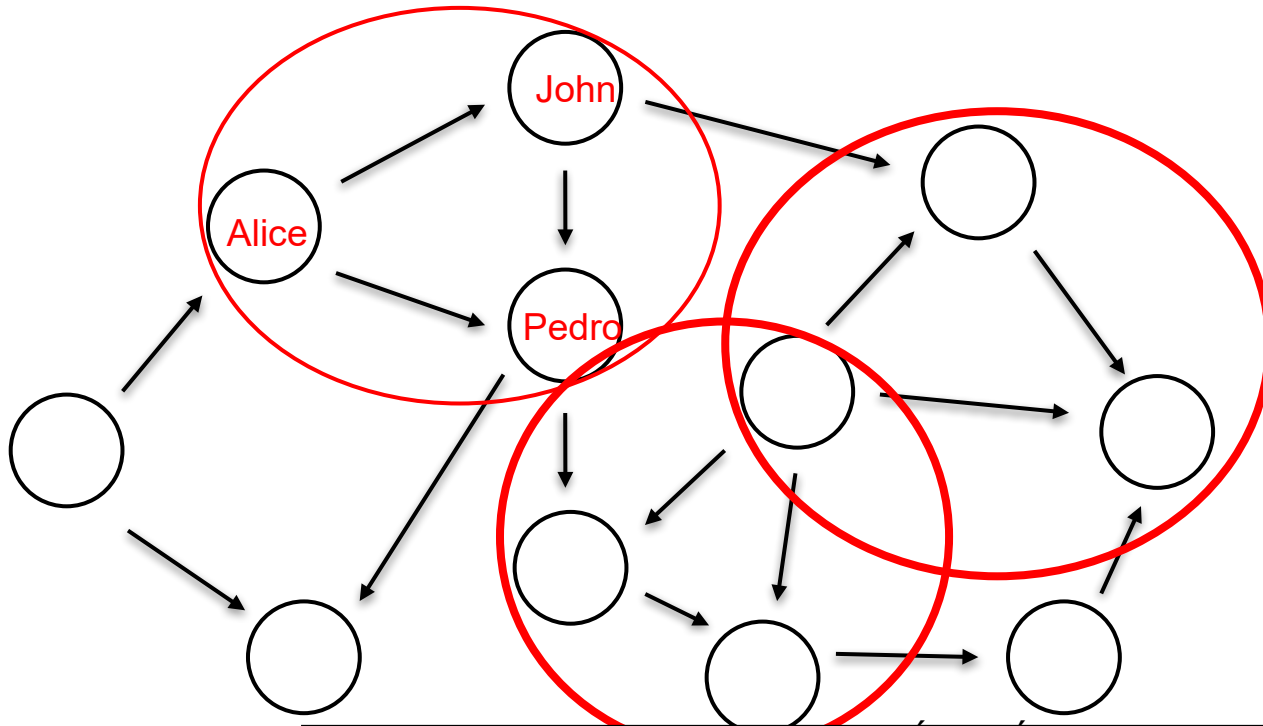
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# Patterns



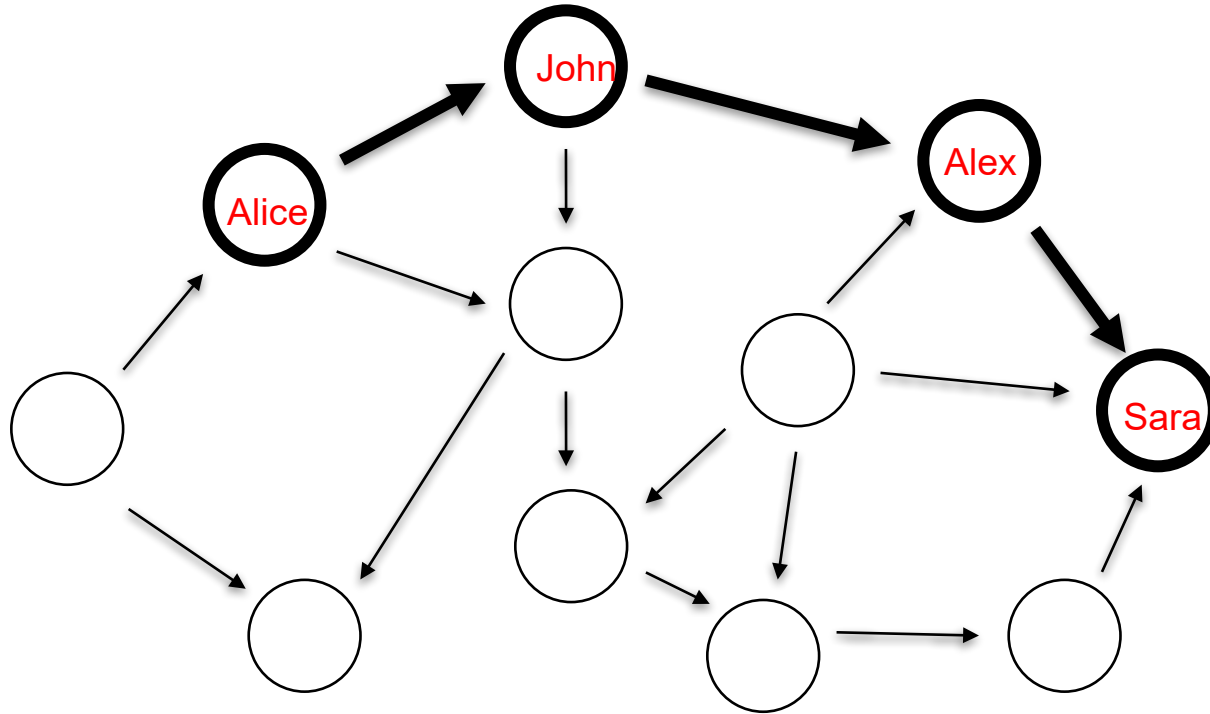
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# Algorithms - The shortest path



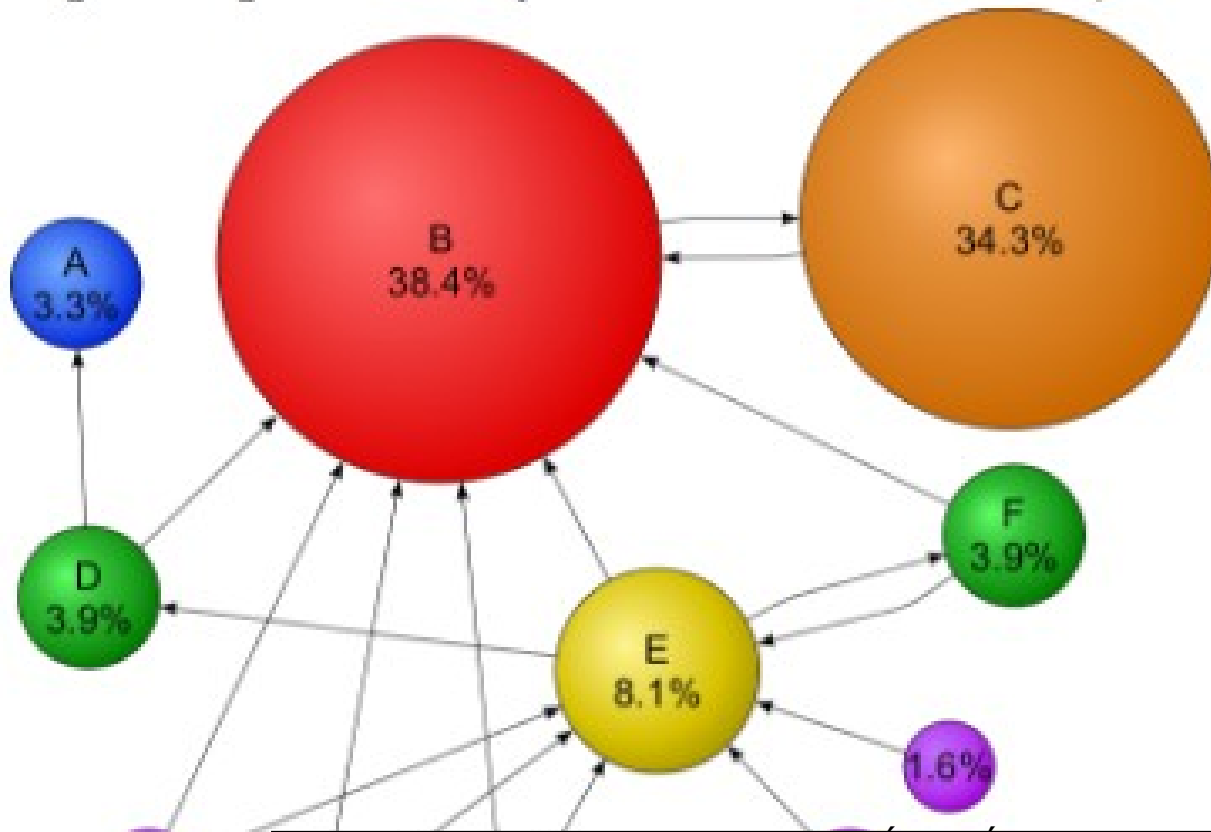
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# Algorithms - PageRank



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# Cypher

- Language with a philosophy similar to SQL
- Allows you to create nodes and/or relationships, maintain them or delete them
- Finding patterns
- Execute algorithms implemented in the DB

```
CREATE (ann:Person { name: 'Ann' })
RETURN ann
```

```
MATCH p=shortestPath(
  (a:Person { name: 'Ann' })-[:KNOWS]-(b:Person { name: 'Dan'})
)
RETURN p
```

```
MATCH (a:Person { name: 'Ann' }),
      (b:Person { name: 'Dan' })
CREATE (a)-[:KNOWS]->(b)
```

```
MATCH (Alex:Person {name:"Alex"})
DELETE Alex
```



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# Neo4j

S

:play start

neo4j  
2.3.0 - COMMUNITY

**Learn about Neo4j**  
A graph epiphany awaits you.

- What is a graph database?
- How can I query a graph?
- What do people do with Neo4j?

[Start Learning](#)

**Jump into code**  
Use Cypher, the graph query language.

- Code walk-throughs
- RDBMS to Graph
- Query templates

[Write Code](#)

**Monitor the system**  
Key system health and status metrics.

- Disk utilization
- Cache activity
- Cluster health and status

[Monitor](#)

Podcast Interview With Chris Daly by Rik Van Bruggen | Free Listening on SoundCloud

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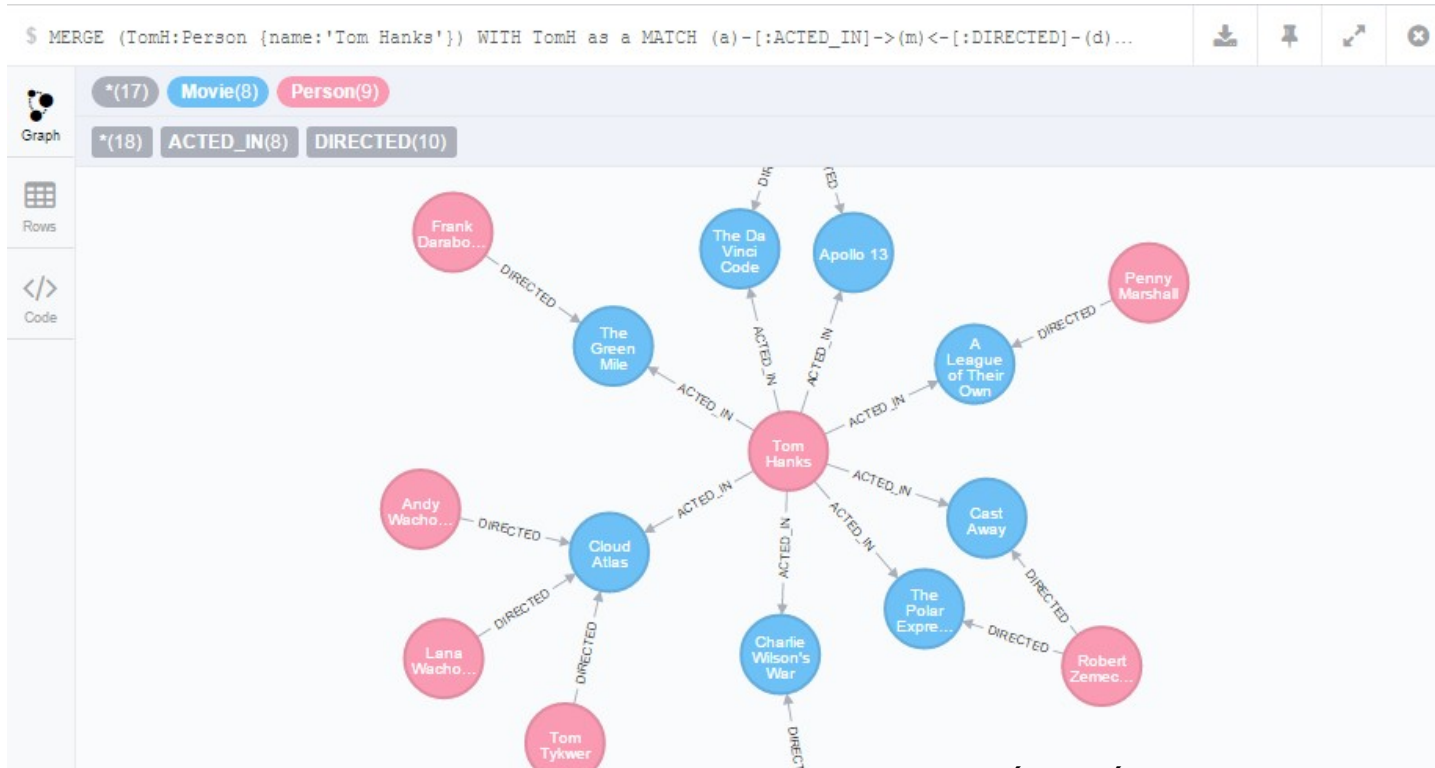
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# Neo4j - Visualization



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# Neo4j - HandsOn

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# Use Cases

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- Optimal for applications that need to look for relationships in information
- Social networking
- Fraud detection by identifying patterns
- Real-time recommendations
- Data center management - devices, users, etc.
- Master Data Systems Management
- Identity and access management



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# Panama's papers



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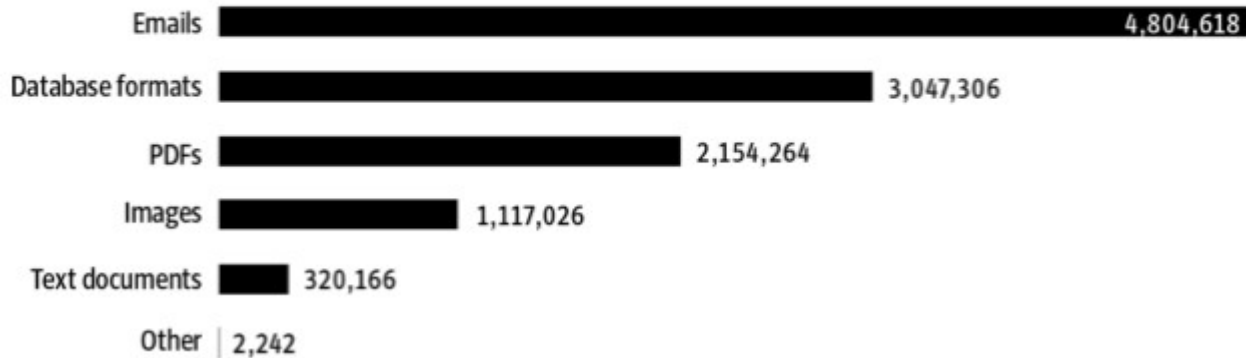
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# Panama's papers

## The structure of the leak

The 11,5 millionen contain the following file types



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# Panama's papers

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## The Steps Involved in the Document Analysis

1. Acquire documents
2. Classify documents
  - a. Scan / OCR
  - b. Extract document metadata
3. Whiteboard domain
  - a. Determine entities and their relationships
  - b. Determine potential entity and relationship properties
  - c. Determine sources for those entities and their properties
4. Work out analyzers, rules, parsers and named entity recognition for documents
5. Parse and store document metadata and document and entity relationships
  - a. Parse by author, named entities, dates, sources and classification
6. Infer entity relationships

The logo for Cartagena99 features the text 'Cartagena99' in a stylized, dark green font. The '99' is significantly larger and more prominent than the rest of the text. The logo is set against a background of overlapping light blue and orange shapes.

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# Panama's papers

## Prev: President of Ukraine



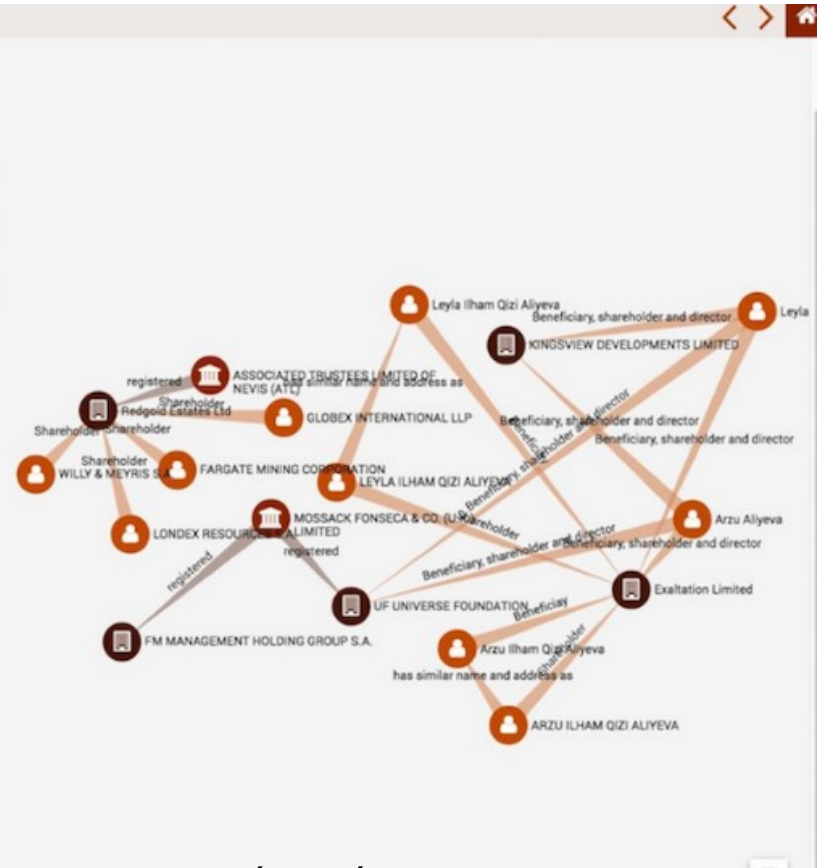
The family of Azerbaijan President Ilham Aliyev leads a charmed, glamorous life, thanks in part to financial interests in almost every sector of the economy. His wife, Mehriban, comes from the privileged and powerful Pashayev family that owns banks, insurance and construction companies, a television station and a line of cosmetics. She has led the Heydar Aliyev Foundation, Azerbaijan's pre-eminent charity behind the construction of schools, hospitals and the country's major sports complex. Their eldest daughter, Leyla, editor of Baku magazine, and her sister, Arzu, have financial stakes in a firm that won rights to mine for gold in the western village of Chovdar and Azerfon, the country's largest mobile phone business. Arzu is also a significant shareholder in SW Holding, which controls nearly every operation related to Azerbaijan Airlines ("Azal"), from meals to airport taxis. Both sisters and brother Heydar own property in Dubai valued at roughly \$75 million in 2010; Heydar is the legal owner of nine luxury mansions in Dubai purchased for some \$44 million. The president's sister, Sevil Aliyeva, a longtime London resident, founded Space TV, a news and entertainment channel in Azerbaijan.

Inside the Mossack Fonseca data > Sprawling offshore complex held interests in gold mining, real estate and a business conglomerate [Read more...](#)

Offshore glossary

Response

The Aliyev family did not respond to repeated requests for comment.



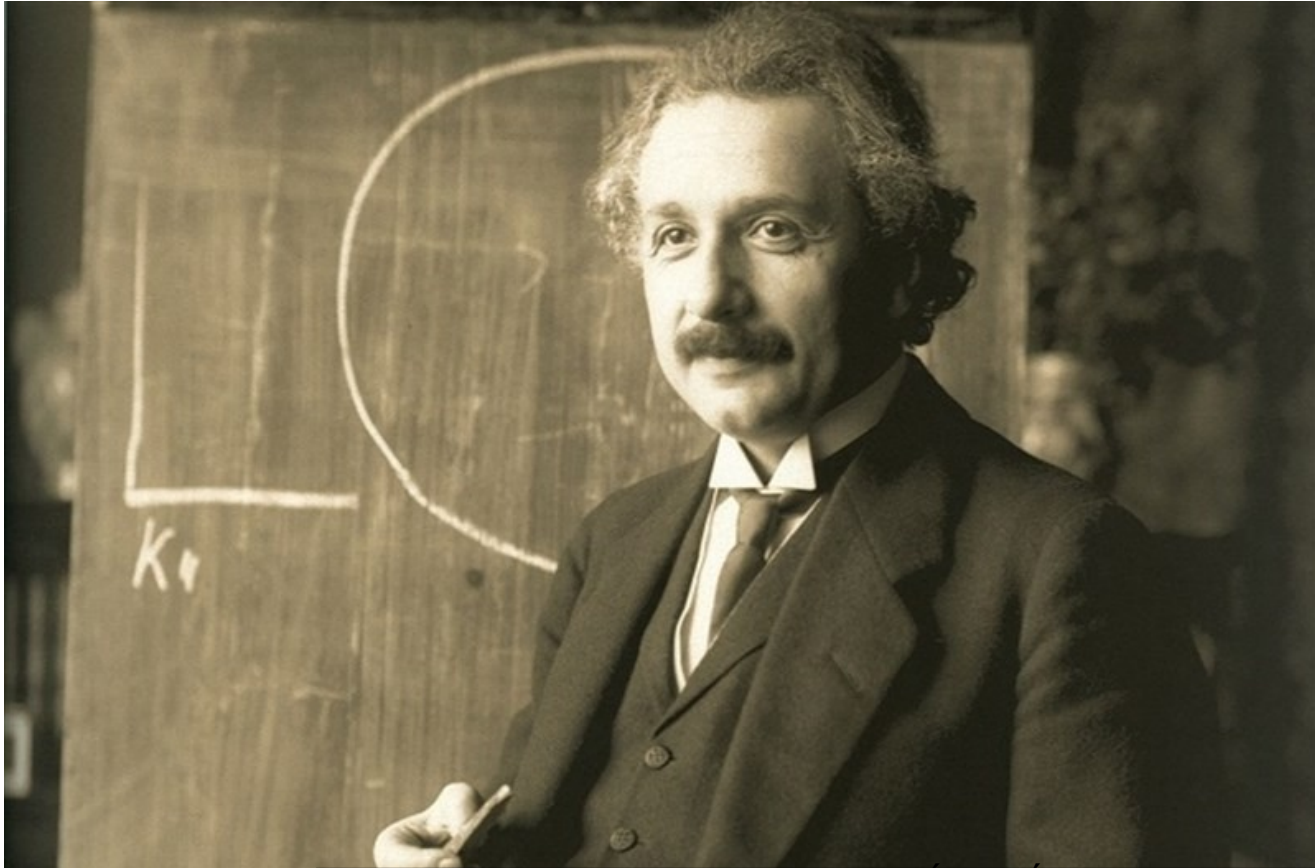
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# Einstein's Riddle



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# Einstein's Riddle

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- This seemingly simple Einstein's riddle is based on a number of considerations and one question.
- These are about a group of five people of different nationalities, with five different pets, consuming a certain brand of tobacco, drinking a certain drink and living in a different house entirely in each case.

## Who owns the fish?

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# Einstein's Riddle

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- The Englishman lives in the red house.
- The Swede has a dog.
- The Dane drinks tea.
- The Norwegian lives in the first house.
- The German smokes Prince.
- The green house is immediately to the left of the white one.
- The owner of the green house drinks coffee.

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# Einstein's Riddle

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- The person who smokes Pall Mall breeds birds.
- The owner of the yellow house smokes Durnhill.
- The man who lives in the house downtown drinks milk.
- The man who smokes Blends lives next door to the man who has a cat.
- The man who has a horse lives next to the man who smokes Dunhill.
- The man who smokes Bluemaster drinks beer.
- The man who smokes Blends is a neighbor of the man who drinks water.

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# THANKS FOR YOUR ATTENTION

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@dvillaj

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