

# System Design — SQL vs NoSQL



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## References

- <https://www.guru99.com/nosql-tutorial.html>
- [NoSQL Patterns](#)
- <https://www.acodersjourney.com/10-questions-to-ask-yourself-before-choosing-a-nosql-database/>

## 1. Common types of NoSQL

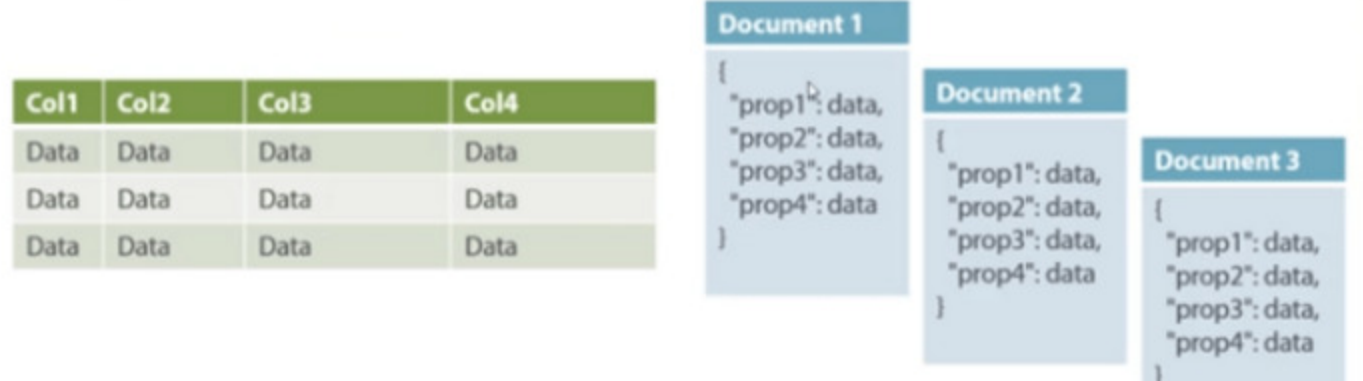
### 1.1. Key-value stores

- Array of key-value pairs. The “key” is an attribute name.
- The value can be a JSON, BLOB(Binary Large Objects), string, etc.
- Used as a collection, dictionaries, associative arrays, etc. Key value stores help the developer to store schema-less data. They work best for shopping cart contents.
- e.g. Redis, Vodemort, Dynamo, Riak.

Key	Value
Name	Joe Bloggs
Age	42
Occupation	Stunt Double
Height	175cm
Weight	77kg

### 1.2 Document databases

- Data is stored in documents. It stores and retrieves data as a key-value pair but the value part is stored as a document. The document is stored in JSON or XML formats. The value is understood by the DB and can be queried.
- Each document can have an entirely different structure.
- The document type is mostly used for CMS systems, **blogging** platforms, **real-time analytics & e-commerce** applications. It should not use for complex transactions that require multiple operations or queries against varying aggregate structures.
- Amazon SimpleDB, CouchDB, MongoDB, Riak, Lotus Notes



Relational Vs. Document

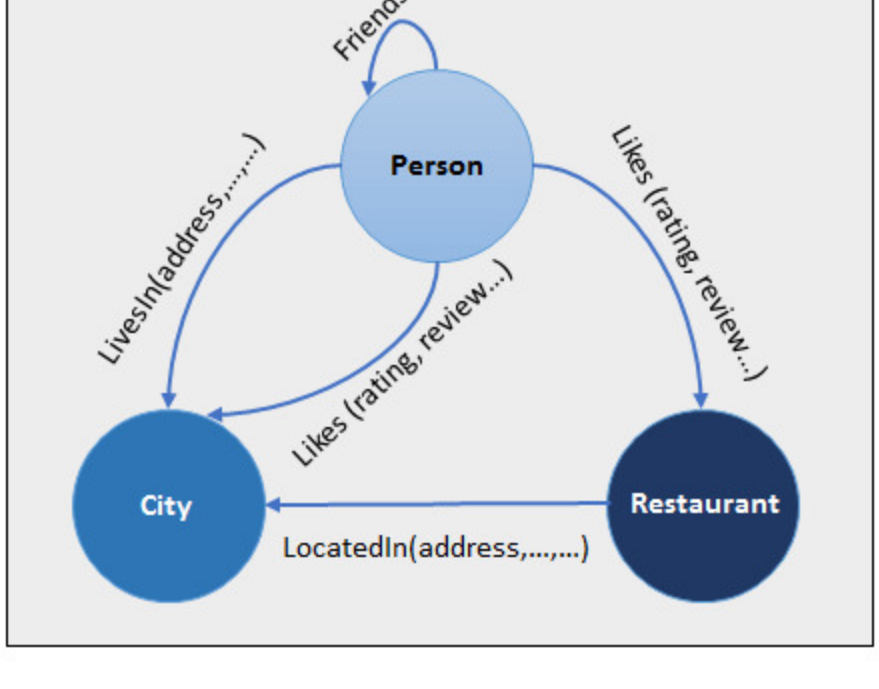
### 1.3 Wide-column / columnar databases / column-based

- Column-oriented databases work on columns and are based on BigTable paper by Google. Every column is treated separately. The values of single column databases are stored contiguously. Each row can have a different number of columns.
- They deliver high performance on aggregation queries like SUM, COUNT, AVG, MIN etc. as the data is readily available in a column.
- Widely used to manage data warehouses, business intelligence, CRM, Library card catalogs.
- HBase, Cassandra, HBase, Hypertable.

ColumnFamily			
Row Key	Column Name		
	Key	Key	Key
	Value	Value	Value
	Column Name		
	Key	Key	Key
	Value	Value	Value

### 1.4 Graph database

- Data is stored in graph structures
  1. Nodes: entities
  2. Properties: information about the entities
  3. Lines: connections between the entities
- Compared to a relational database where tables are loosely connected, a Graph database is a multi-relational in nature. Traversing relationship is fast as they are already captured into the DB, and there is no need to calculate them.
- Graph base databases are mostly used for **social networks**, **logistics**, **spatial data**.
- Neo4J, InfiniteGraph



## 2. Differences between SQL and NoSQL

### 2.1 Storage

- SQL: store data in tables.
- NoSQL: have different data storage models.

### 2.2 Schema

- SQL
  1. Each record conforms to a fixed schema.
  2. Schema can be altered, but it requires modifying the whole database.
- NoSQL:
  1. Schemas are dynamic.

### 2.3 Querying

- SQL
  1. Use SQL (structured query language) for defining and manipulating the data.
- NoSQL
  1. Queries are focused on a collection of documents.
  2. UnQL (unstructured query language).
  3. Different databases have different syntax.

### 2.4 Scalability

- SQL
  1. Vertically scalable (by increasing the horsepower: memory, CPU, etc) and expensive.
  2. Horizontally scalable (across multiple servers); but it can be challenging and time-consuming.
- NoSQL
  1. Horizontally scalable (by adding more servers) and cheap.

### 2.5 ACID

- Atomicity, consistency, isolation, durability
- SQL
  1. ACID compliant
  2. Data reliability
  3. Guarantee of transactions
- NoSQL
  1. Most sacrifice ACID compliance for performance and scalability.

## 3. Which one to use?

### 3.1 SQL

- Ensure **ACID** compliance.
  1. Reduce anomalies.
  2. Protect database integrity.
- Data is structured and unchanging.

### 3.2 NoSQL

- Data has little or no structure.
- Make the most of cloud computing and storage.
  1. Cloud-based storage requires data to be easily spread across multiple servers to scale up.
- Rapid development.
  1. Frequent updates to the data structure.

In a lot of cases, you might need SQL and NoSQL technologies to co-exist side by side in the same system. For example, if you're building a photo sharing application like Instagram, your photos might reside in a NoSQL database whereas your login/ ACLs information might reside in a SQL database.

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System Design Interview    NoSQL



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