First Unit

2-Tire Architecture

3-Tire Architecture

| PRESENTATION TIER | BUSINESS LOGICS TIER | DATA MANAGEMENT TIER |

Middleware

client
Mozilla Firefox,
Internet Explorer,
etc.

Internet

Web server
+
Application server

Apache + Zend engine

Database server

MySQL

client
Android devices
(smartphones, tablets, etc.
diverse platforms)
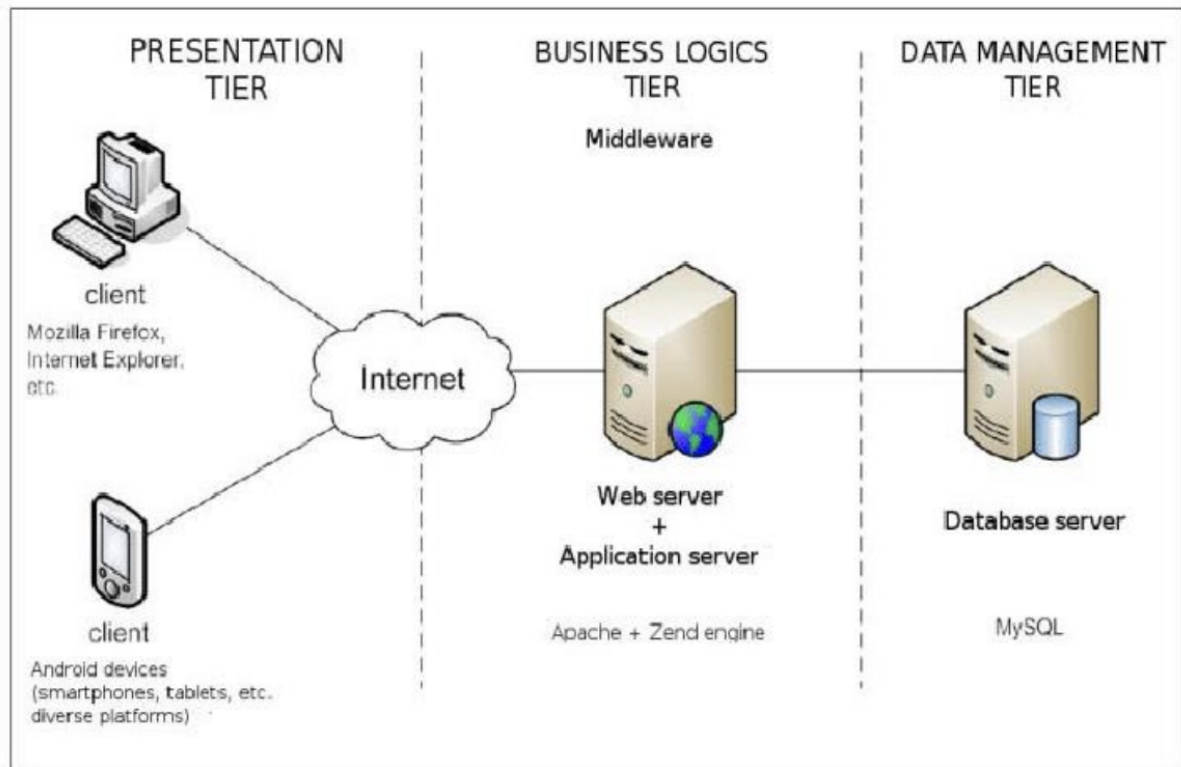
What is NoSQL?

- Full form: Not only Sql / non- SQL.

- It is non relational Database Management system.

- Does not requires fix-schema.

- It is used to store Big data and real-time web-apps.

- Big advantage is to store humongous data.

- Founder:- Carl Strozz.

- In traditional RDBMS tech. it uses SQL syntax to store and retrieve the data for further insights.

- NoSQL tech. can store structured, semi-structured, unstructured and polymorphic data.

Difference between SQL and NoSQL?

Advantages of NoSQL:

1. **Dynamic Schemas:** NoSQL databases allow for the addition and removal of fields without the need to make changes to the underlying database schema.

2. **Scalability:** NoSQL databases are designed to handle large amounts of data and are easily scalable to accommodate growing data requirements.

3. **Performance:** NoSQL databases are optimized for high performance, with the ability to handle large amounts of read and write operations in real-time.

4. **Flexibility:** NoSQL databases can handle a wide range of data types and structures, including unstructured and semi-structured data, making them well-suited for modern applications.

5. **Distributed Architecture:** Many NoSQL databases use a distributed architecture, allowing them to store and process data across multiple servers, improving scalability and reliability.
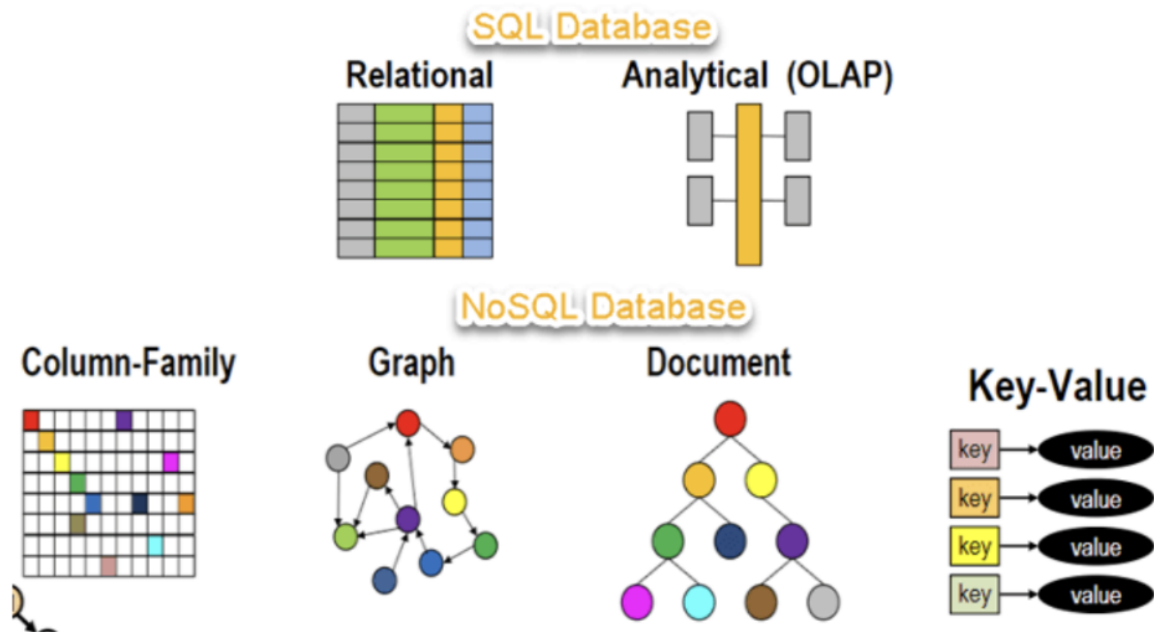
Types of NoSql Databases:

1. **Document Based Database:** Document Databases use key-value pairs to store and retrieve data from the documents. A document is stored in the form of XML and JSON. A typical
example of the document database is shown below:
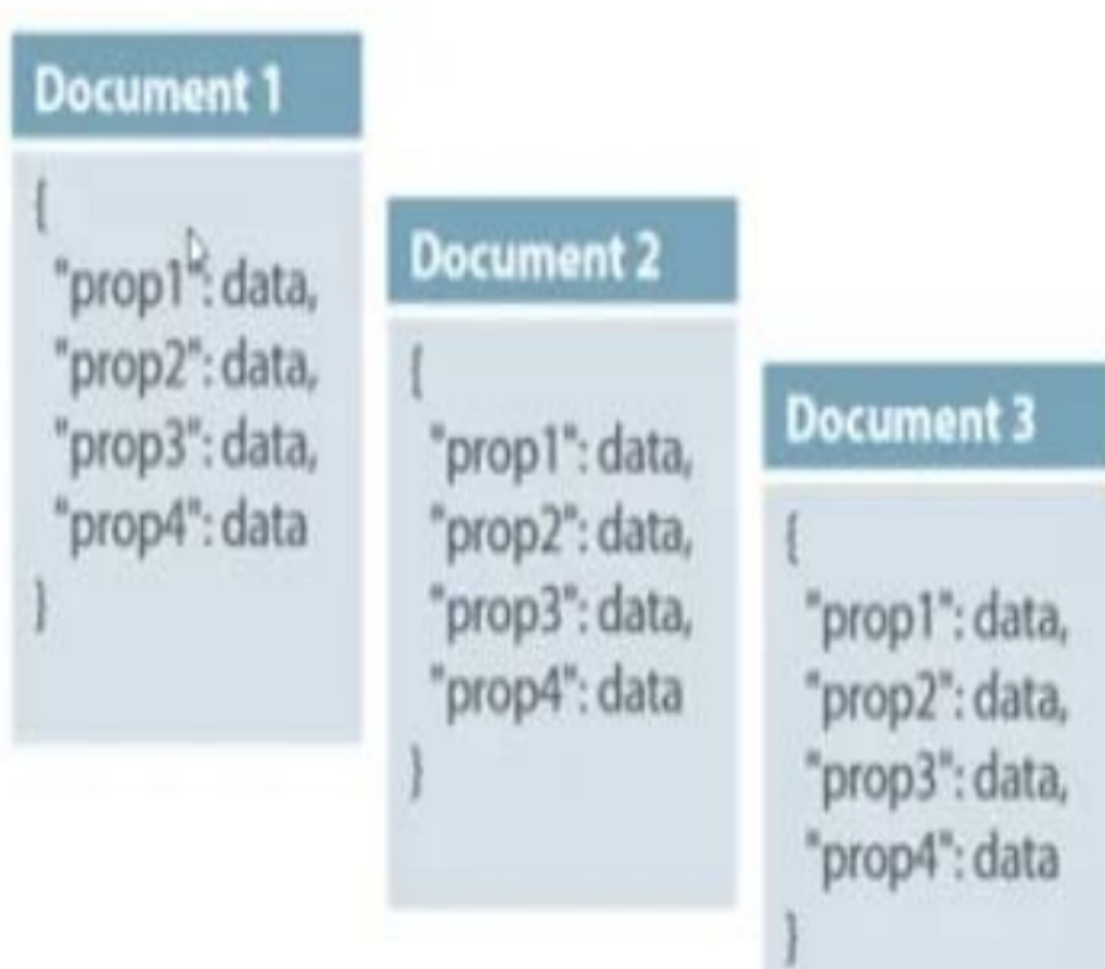
- The Documents can be nested andindexed for faster querying.

- Examples of Document databases are – MongoDB, OrientDB, Apache CouchDB,
IBM Cloudant, CrateDB, BaseX, and many more.

2. **Key-Value Stores:** Key-value Stores are the simplest type of NoSQL Database. It uses keys and values to store the data. The attribute name is stored in 'key', whereas the values
corresponding to that key will be held in 'value'.

- The key only be string and value can be of any datatype such as: JSON, XML, Blob, etc.

- Applications: user preferences, user profiles, shopping carts, etc.

- Ex. DynamoDB, Riak.

- Twitter, Pinterest uses this technology.
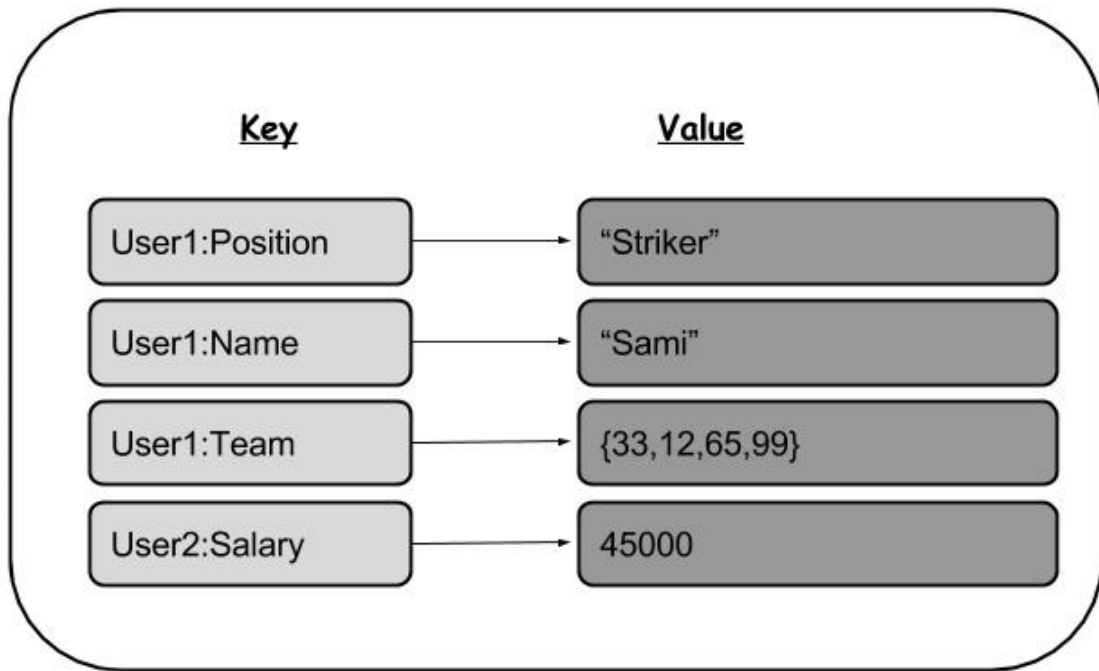
3. **Column-Oriented Database:** Column-oriented databases store the data in a set of columns known as column families. That means that whenever a user wants to run queries for a smaller number of columns, they can read those columns directly without consuming
memories corresponding to all data. The working of the Column-oriented database is based on the concept of the BigTable paper by Google. Below schematics shows how values are stored on Column-oriented databases:

Ex. Cassendra, HBase, HyperTable etc.

4. **Graph Database:**

- Graph databases form and store the relationship of the data. Each element/data is
  stored in a node, and that node is linked to another data/element. A typical
  example for Graph database use cases is Facebook. It holds the relationship
  between each user and their further connections.

- Graph databases help search the connections between data elements and link one
  part to various parts directly or indirectly.

- The Graph database can be used in social media, fraud detection, and knowledge
  graphs.

- Examples of Graph Databases are – Neo4J, Infinite Graph, OrientDB, FlockDB, etc.
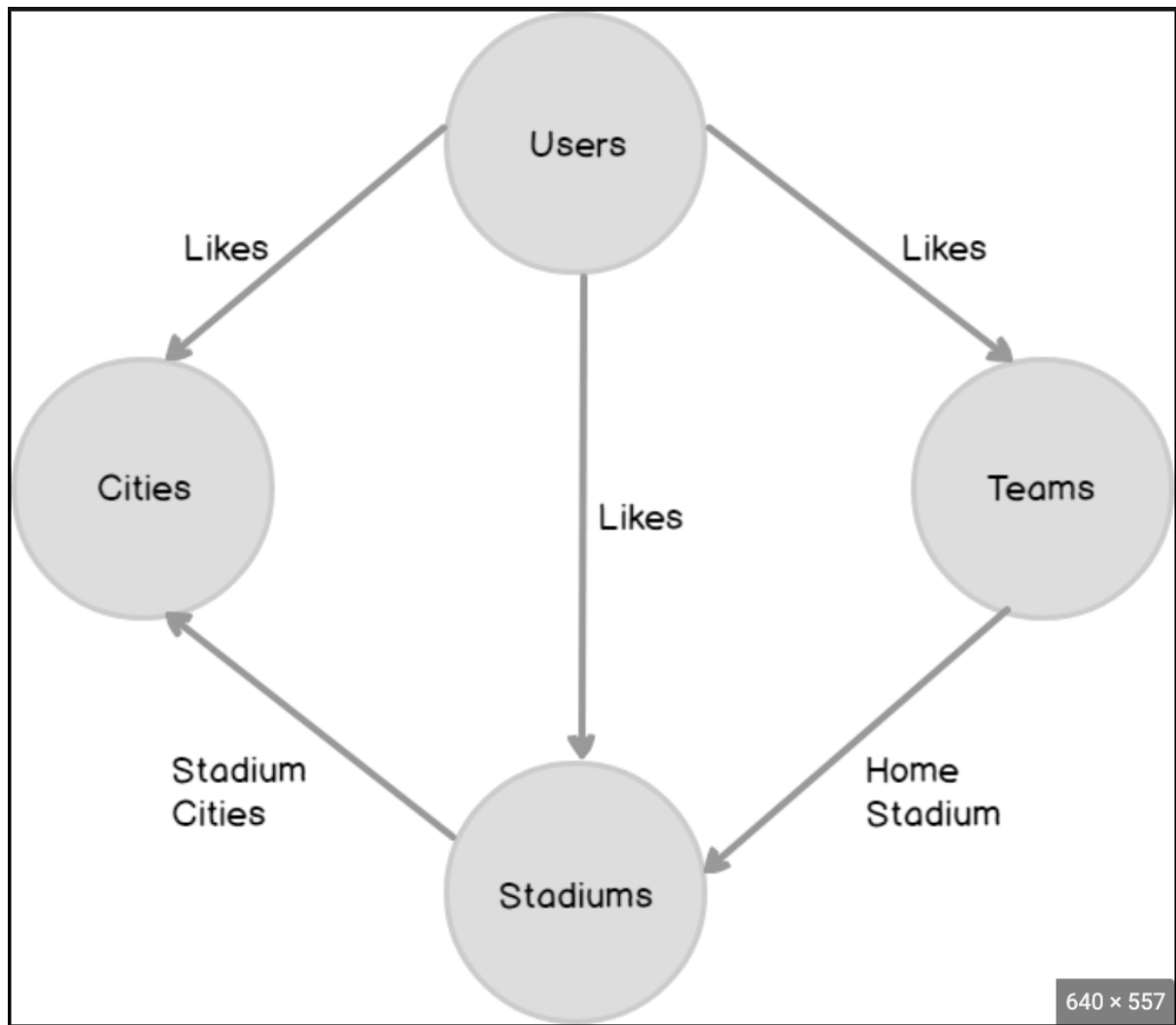
Advantages and Disadvantages of NoSQL:

Advantages:

• Can be used as Primary or Analytic Data Source
• Big Data Capability
• No Single Point of Failure
• Easy Replication
• No Need for Separate Caching Layer
• It provides fast performance and horizontal scalability.
• Can handle structured, semi-structured, and unstructured data with equal effect
• Object-oriented programming which is easy to use and flexible
• NoSQL databases don't need a dedicated high-performance server
• Support Key Developer Languages and Platforms
• Simple to implement than using RDBMS
• It can serve as the primary data source for online applications.

• Handles big data which manages data velocity, variety, volume, and complexity

• Excels at distributed database and multi-data center operations

• Eliminates the need for a specific caching layer to store data

• Offers a flexible schema design which can easily be altered without downtime or service disruption.

Disadvantages:

• No standardisation rules

• Limited query capabilities

• RDBMS databases and tools are comparatively mature

• It does not offer any traditional database capabilities, like consistency when multiple transactions are performed simultaneously.

• When the volume of data increases it is difficult to maintain unique values as keys become difficult.

• Doesn't work as well with relational data

• The learning curve is stiff for new developers

• Open source options so not so popular for enterprises.

Difference between NoSQL and SQL:

	SQL	NoSQL
1)	Databases are categorized as Relational Database Management System (RDBMS).	NoSQL databases are categorized as Non-relational or distributed database system.
2)	SQL databases have fixed or static or predefined schema.	NoSQL databases have dynamic schema.
3)	SQL databases display data in form of tables so it is known as table-based database.	NoSQL databases display data as collection of key-value pair, documents, graph databases or wide-column stores.
4)	SQL databases are vertically scalable.	NoSQL databases are horizontally scalable.

5)	SQL databases use a powerful language "Structured Query Language" to define and manipulate the data.	In NoSQL databases, collection of documents are used to query the data. It is also called unstructured query language. It varies from database to database.
6)	SQL databases are best suited for complex queries.	NoSQL databases are not so good for complex queries because these are not as powerful as SQL queries.
7)	SQL databases are not best suited for hierarchical data storage.	NoSQL databases are best suited for hierarchical data storage.
8)	MySQL, Oracle, Sqlite, PostgreSQL and MS-SQL etc. are the example of SQL database.	MongoDB, BigTable, Redis, RavenDB, Cassandra, Hbase, Neo4j, CouchDB etc. are the example of nosql database

Properties which SQL and NoSQL Follows:

SQL:

• Atomicity: All transactions must succeed or fail completely and cannot be left partially complete, even in the case of system failure.
• Consistency: The database must follow rules that validate and prevent corruption at every step.
• Isolation: Concurrent transactions cannot affect each other.
• Durability: Transactions are final, and even system failure cannot "rollback" a complete transaction.

NoSQL:

• Availability: Every request receives either the most recent result or an error. MongoDB is an example of a strongly consistent system, whereas others such as Cassandra offer eventual consistency.
• Availability: Every request has a non-error result.
• Partition tolerance: Any delays or losses between nodes do not interrupt the system operation.