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Year/Course/Section: 3-BSCS-B

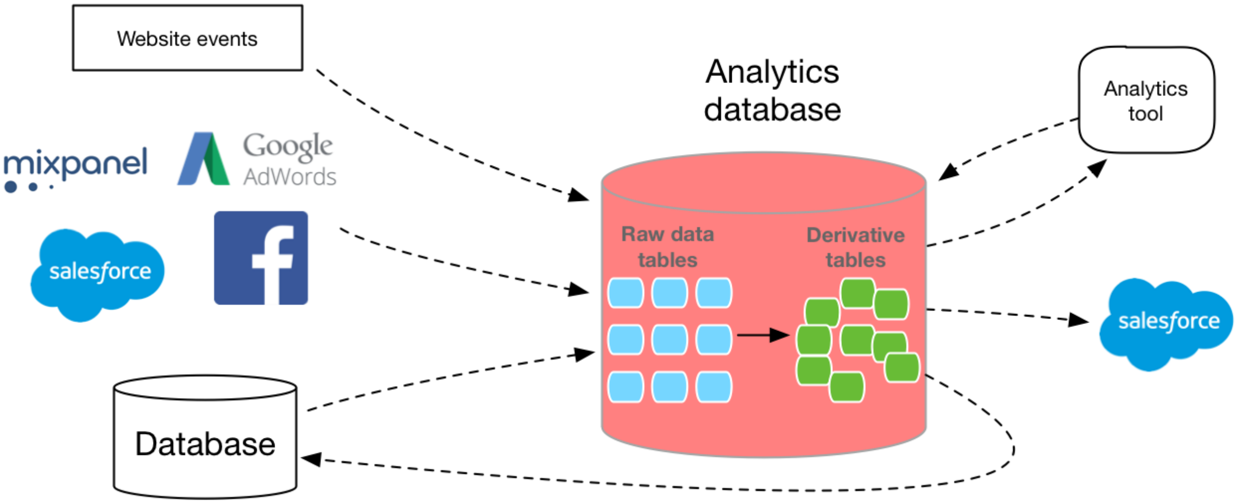
Data Base Management

1. **Relational Data Base-** A relational database is a type of database that stores and provides access to data points that are related to one another. Relational databases are based on the relational model, an intuitive, straightforward way of representing data in tables. In a relational database, each row in the table is a record with a unique ID called the key. The columns of the table hold attributes of the data, and each record usually has a value for each attribute, making it easy to establish the relationships among data points.

Relational Model Concepts

1. **Attribute:** Each column in a Table. Attributes are the properties which define a relation. e.g., Student_Rollno, NAME,etc.
2. **Tables –** In the Relational model the, relations are saved in the table format. It is stored along with its entities. A table has two properties rows and columns. Rows represent records and columns represent attributes.
3. **Tuple –** It is nothing but a single row of a table, which contains a single record.
4. **Relation Schema:** A relation schema represents the name of the relation with its attributes.
5. **Degree:** The total number of attributes which in the relation is called the degree of the relation.
6. **Cardinality:** Total number of rows present in the Table.
7. **Column:** The column represents the set of values for a specific attribute.
8. **Relation instance –** Relation instance is a finite set of tuples in the RDBMS system. Relation instances never have duplicate tuples.
9. **Relation key –** Every row has one, two or multiple attributes, which is called relation key.
10. **Attribute domain –** Every attribute has some pre-defined value and scope which is known as attribute domain

2. **Analytical Database (OLAP)**- An analytical database stores and manages big data, including business, market and customer data for business intelligence (BI) analysis. Analytical databases are specially optimized for faster queries and scalability. An analytical database is also known as OLAP (OnLine Analytical Processing). It is used for fast processing of massive amounts of data with few or no filters.



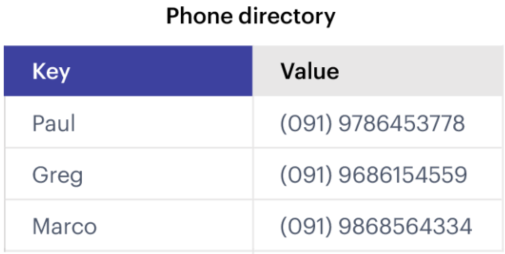
Example of Analytical Database:

- Market data — Historical price and volume data for financial markets for testing trading strategies.
- Transactional data — Historical transactions that can include purchasing patterns for improved marketing.
- Sensor data — Historical data from sensors that monitor situations like the weather.
- Natural language data — Study of social media posts for research purposes.
- Process data — Study of processes to better understand logistics and find bottlenecks.
- Machine data — Software and hardware-generated data from products to improve efficiency.

3. **Key-value Database**- A key-value database (sometimes called a key-value store) uses a simple key-value method to store data. These databases contain a simple string (the key) that is always unique and an arbitrary large data field (the value). They are easy to design and implement.

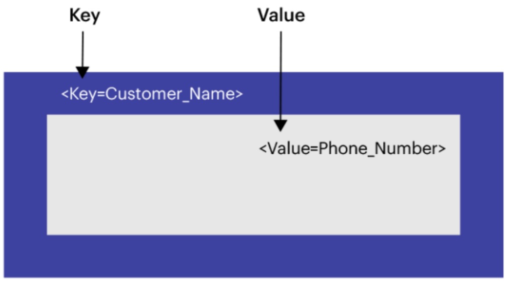
An Example of Key-value database

As the name suggests, this type of NoSQL database implements a hash table to store unique keys along with the pointers to the corresponding data values. The values can be of scalar data types such as integers or complex structures such as JSON, lists, BLOB, and so on. A value can be stored as an integer, a string, JSON, or an array—with a key used to reference that value. It typically offers excellent performance and can be optimized to fit an organization's needs. Key-value stores have no query language but they do provide a way to add and remove key-value pairs. Values cannot be queried or searched upon. Only the key can be queried.

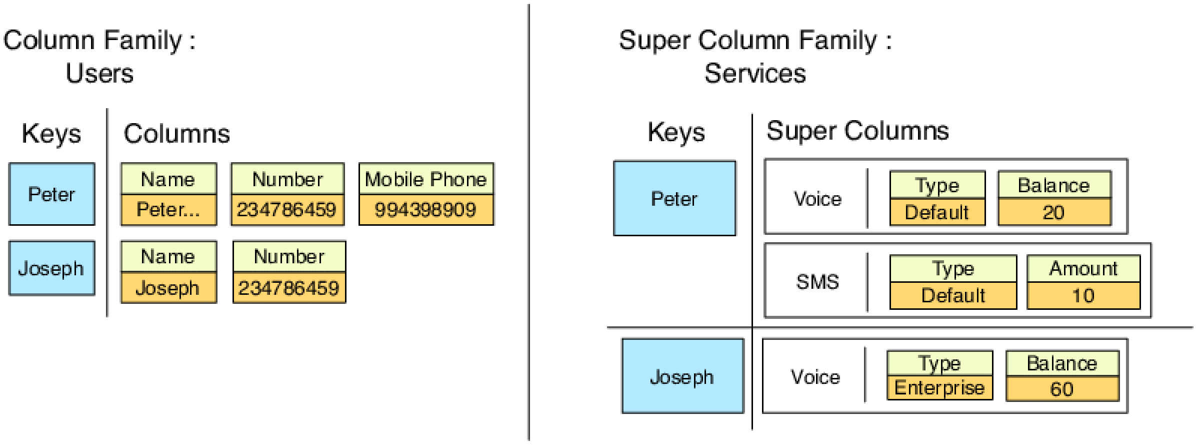


Phone directory

Key	Value
Paul	(091) 9786453778
Greg	(091) 9686154559
Marco	(091) 9868564334



4. **Column Family**- A column family is a database object that contains columns of related data. It is a tuple that consists of a key–value pair, where the key is mapped to a value that is a set of columns. In analogy with relational databases, a column family is as a "table", each key-value pair being a "row".



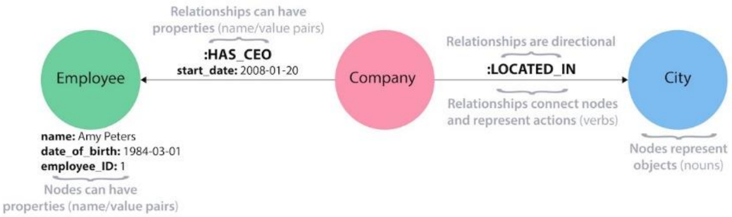
5. **Graph Database-** is a database designed to treat the relationships between data as equally important to the data itself. It is intended to hold data without constricting it to a pre-defined model. Instead, the data is stored like we first draw it out - showing how each individual entity connects with or is related to others.

The Property Graph Model

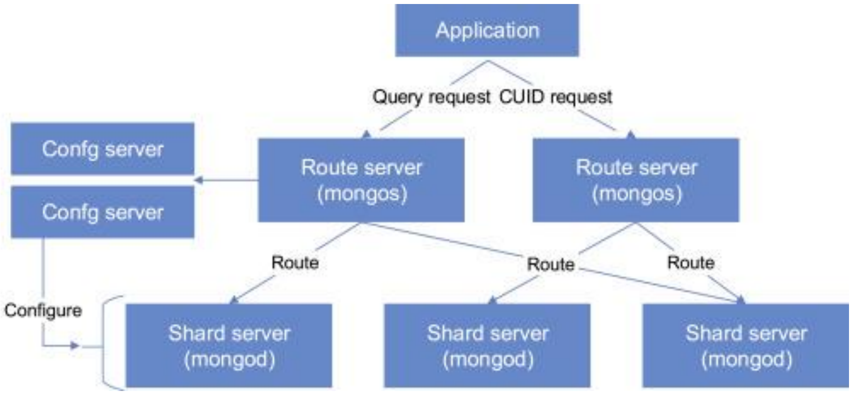
As with most technologies, there are few different approaches to what makes up the key components of a graph database. One such approach is the property graph model, where data is organized as nodes, relationships, and properties (data stored on the nodes or relationships).
We will cover this model in more detail in the **Data Modeling section** of these guides, but for now, we will briefly define the components that make up the property graph model.
Nodes are the entities in the graph. They can hold any number of attributes (key-value pairs) called *properties*. Nodes can be tagged with *labels*, representing their different roles in your

domain. Node labels may also serve to attach metadata (such as index or constraint information) to certain nodes.

Relationships provide directed, named, semantically-relevant connections between two node entities (e.g. Employee *WORKS_FOR* Company). A relationship always has a direction, a type, a start node, and an end node. Like nodes, relationships can also have properties. In most cases, relationships have quantitative properties, such as weights, costs, distances, ratings, time intervals, or strengths. Due to the efficient way relationships are stored, two nodes can share any number or type of relationships without sacrificing performance. Although they are stored in a specific direction, relationships can always be navigated efficiently in either direction.


Relationships can have properties (name/value pairs)
:HAS_CEO
start_date: 2008-01-20
Employee
Company
Relationships are directional
:LOCATED_IN
City
Relationships connect nodes and represent actions (verbs)
name: Amy Peters
date_of_birth: 1984-03-01
employee_ID: 1
Nodes can have properties (name/value pairs)
Nodes represent objects (nouns)

6. **Document Database-** A document database is a type of nonrelational database that is designed to store and query data as JSON-like documents. Document databases make it easier for developers to store and query data in a database by using the same document-model format they use in their application code. The flexible, semi-structured, and hierarchical nature of documents and document databases allows them to evolve with applications' needs. The document model works well with use cases such as catalogs, user profiles, and content management systems where each document is unique and evolves over time. Document databases enable flexible indexing, powerful ad hoc queries, and analytics over collections of documents.


Application
Query request
CUID request
Confg server
Confg server
Route server (mongos)
Route server (mongos)
Route
Route
Route
Configure
Shard server (mongod)
Shard server (mongod)
Shard server (mongod)