Topics

- What is a Database Management System.
- Types of Databases (Relational vs. Non-Relational)
- Relational or SQL Database
- Non-Relational or NOSQL DB
- Microsoft Access DB

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DATABASE CONCEPTS

WEEK 1-4 LESSONS

Types of Databases

There are two types of DBMSs: relational and non-relational, also referred to as SQL and NoSQL respectively. let's take a closer look at how relational and non-relational database systems differ,

Feature	Relational db (SQL)	Non Relational(NOSQL)
Data Structure	Organize data into tables	Use different data models: document oriented
	Strict Schema	No fix schema
	Data resides in records/attributes	Unstructured data
Language	Structured Query Language (SQL)	Various query languages depends on data model
Security	Better Security ACID compliant	Weaker Security ACID is limited

What is a Database Management System

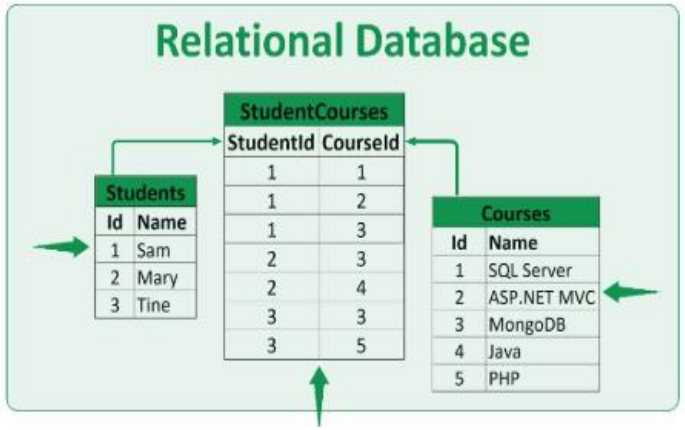
A **Database Management System (DBMS)** is a specialized software designed to store, retrieve, and manipulate data. It acts as a mediator between the database, applications, and user interfaces to manage and organize data effectively. The system provides a comprehensive suite of tools to govern databases, ensuring data security, consistency, and integrity.

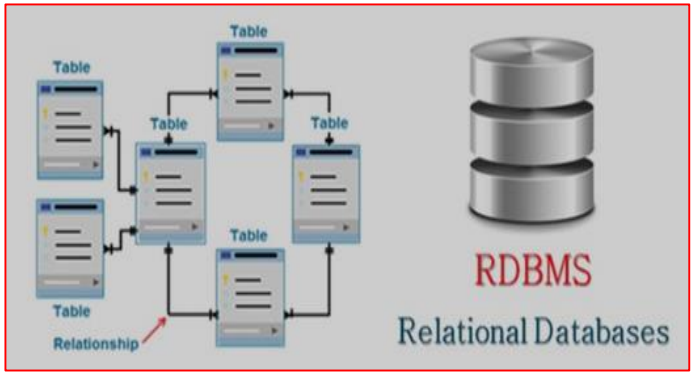
A DBMS supports various applications, from simple storage and retrieval tasks to complex data-driven systems, by implementing efficient data access and management practices. Additionally, the system can handle concurrent users, maintain transactional consistency, and provide robust backup and recovery options, making it an essential component in any data-centric environment.

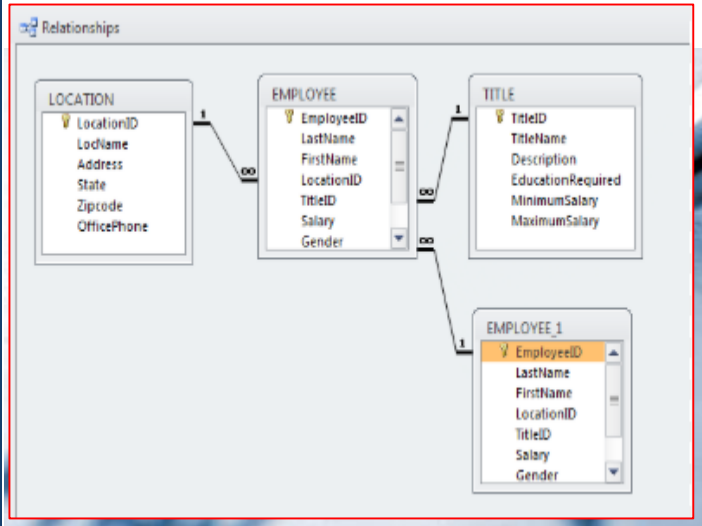
Remember databases are just a part of the whole data management strategy.

Types of Databases..cont

Feature	Relational db	Non
Scalability	Scale vertically – add more computing power to a single server	Scale horizontally – add more servers
	Horizontal scaling is challenging	Share data between servers
Performance	Performs well on intensive read/write operations on a small to medium data sets	High performance with distributed designs Provide simultaneous access to large number of users
Use Case	Complex software solution, Ecommerce	For start-ups, sprint based development, storing unstructured data







Relational or SQL Database

A relational database management system (RDBMS) is an information repository that organizes data into tables consisting of rows (records) and columns (attributes that contain the properties of these records). Each table represents a relation, and the rows (also called *tuples*) hold individual records within that relation. RDBMSs have a predefined schema with a strict structure and clear dependencies between different data points.

So tables in relational databases are connected to other tables through primary key or foreign key relationships.

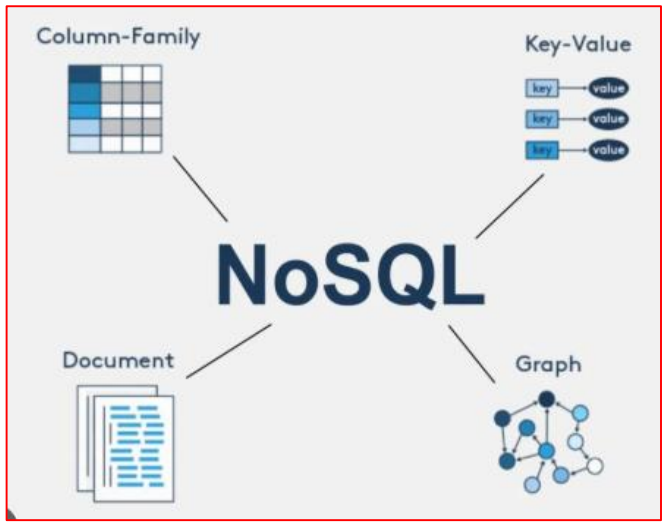
The second name of such systems is *SQL databases*. This is because Structured Query Language (SQL) is used to communicate with and manage these

Relational db ….cont

A primary key is a unique identifier for each record in a table, ensuring that no two records have the same value for that specific column or set of columns.

On the other hand, a foreign key is a column or a set of columns in one table that refers to the primary key in another table, establishing a link between them.

Despite these connections between tables, the term *relational* in relational database systems comes from the mathematical concept of relations. Dr. Edgar F. Codd proposed this idea as a new way to organize and manage data using principles from mathematics in his seminal paper "A Relational Model of Data for Large Shared Data Banks published in 1970.



Non-Relational or NOSQL Database

A non-tabular or non-relational database uses different data models for storing, managing, and accessing data. The most common data models are: **document-oriented, wide-column, key-value**

As these databases aren't limited to a table structure, they are called *NoSQL*. They allow for storing such as texts, photos, videos, PDF files, and a bunch of other formats.

Non-Relational or NOSQL Database…cont

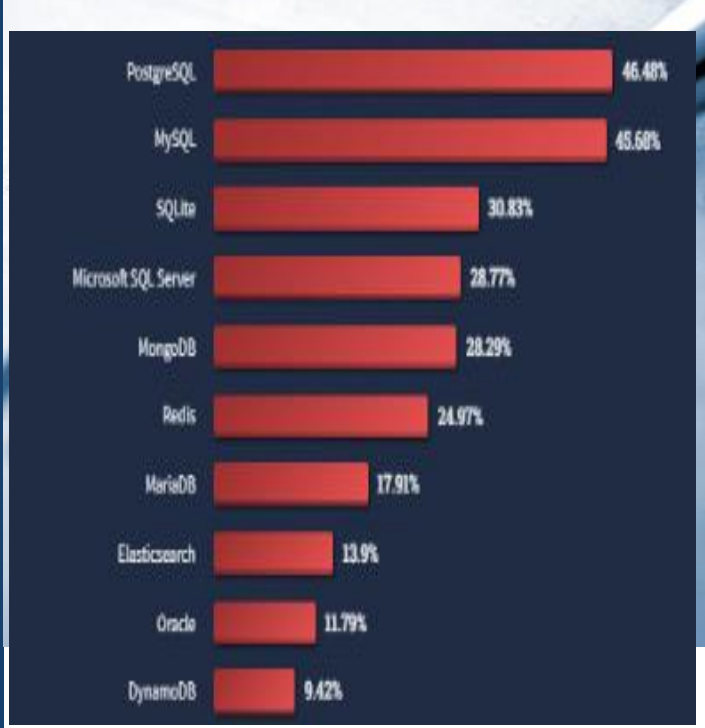
Since NoSQL databases allow for reserving various data types together and scaling across multiple servers, their never-decreasing popularity is understandable Also, NoSQL databases can be highly advantageous when it comes to . They don't require pre-deployment preparations, making quick, time-lag-free updates to the data structure easier.

Commonly used database systems

What are their main advantages and disadvantages, and how should businesses use them? Let's take a deeper look.

Below, we'll discuss the following list of SQL databases:

- MySQL
- MariaDB
- Oracle
- PostgreSQL
- MSSQL
- SQLite



Most popular database systems. Source: 2022 Developer Survey by StackOverflow

Commonly used database systems....1

and will complement it with such NoSQL databases as:

- MongoDB
- Redis
- Cassandra
- Elasticsearch
- Firebase
- Amazon DynamoDB

DATABASE MANAGEMENT SYSTEMS COMPARISON

	Database Type	Licensing	Scalability	Data Types Supported	Learning Curve
MySQL	SQL	GNU Generally Public License	Vertical, complex	Structured, semi-structured	Mild
MariaDB	SQL	GNU Generally Public License	Vertical	Structured, semi-structured	Mild
Oracle	Multi-model, SQL	Proprietary	Both (Vertical & Horizontal)	Structured, semi-structured, unstructured	Hard
PostgreSQL	Object-relational, SQL	Open-source	Vertical	Structured, semi-structured, unstructured	Hard
MSSQL	T-SQL	Proprietary	Vertical, complex	Structured, semi-structured, unstructured	Hard
SQLite	SQL	Public domain	Vertical	semi-structured, unstructured	Mild
MongoDB	NoSQL, document-oriented	SSPL	Horizontal	Structured, semi-structured, unstructured	Mild
Redis	NoSQL, key-value	Open-source, BSD 3-clause	Horizontal	Structured, semi-structured, unstructured	Mild
Cassandra	NoSQL, wide-column	Open-source	Horizontal	Structured, semi-structured, unstructured	Hard
Elasticsearch	NoSQL, document-oriented	Open-source	Horizontal	Structured, semi-structured, unstructured	Hard
Firebase	NoSQL, real-time database	Open-source	Horizontal	Structured, semi-structured, unstructured	Mild

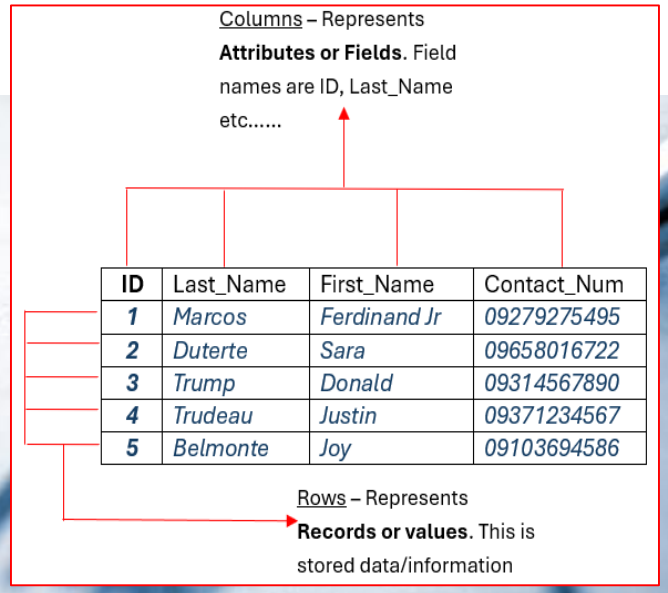
https://www.altexsoft.com/blog/comparing-database-management-systems-mysql-postgresql-mssql-server-mongodb-elasticsearch-and-others/

What is MS ACCESS

Microsoft Access is a well-known database management system produced by Microsoft and is part of the Microsoft 365 office suite. Microsoft Access combines Microsoft's relational Jet Database Engine with software development tools and a graphic user interface (GUI). It was first released in November 1992, so it's been around for a while. In the rapidly changing, fast-paced IT world, we can best describe a 30-year-old program as "venerable."

MS Access Limitations:

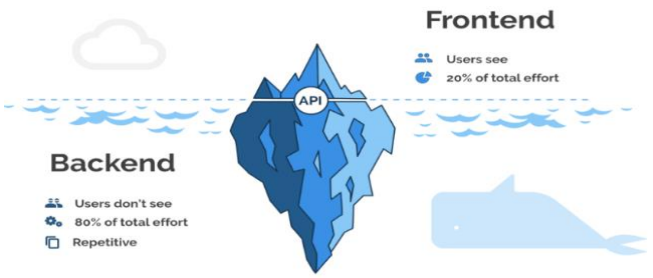
1. Microsoft Access database is more beneficial for small-to-medium businesses but not as much for large-sized organizations.
2. MS Access lacks the robustness of a DB found in MS SQL and Oracle DB.
3. There can be multiple tables in a database linked via a relationship
4. Although the technical limit is 255 concurrent users; the real-world limit actually ranges from only 10 to 80.
5. Microsoft Access requires considerably more learning and training when compared with other Microsoft programs.



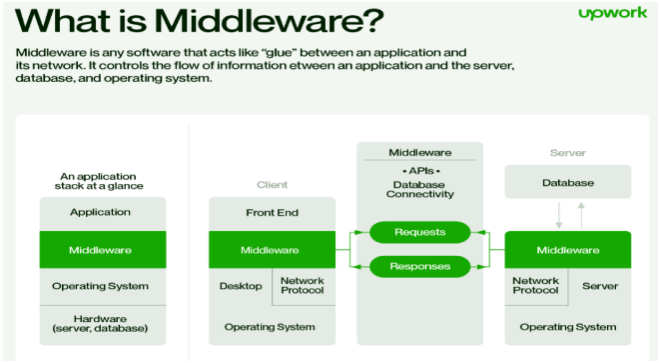
Primary purpose of a table in a RDBMS is mainly for data storage only. Nothing more nothing less

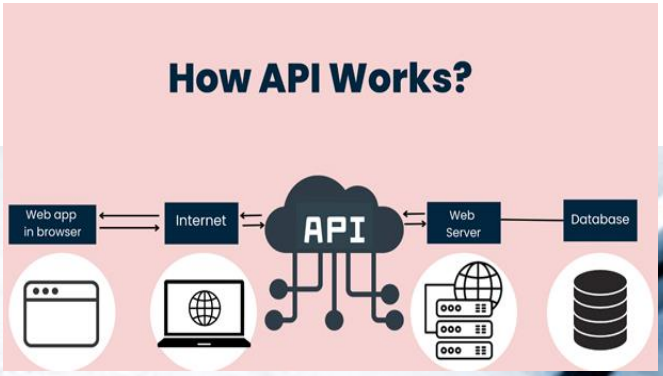
Relational Database Rules:

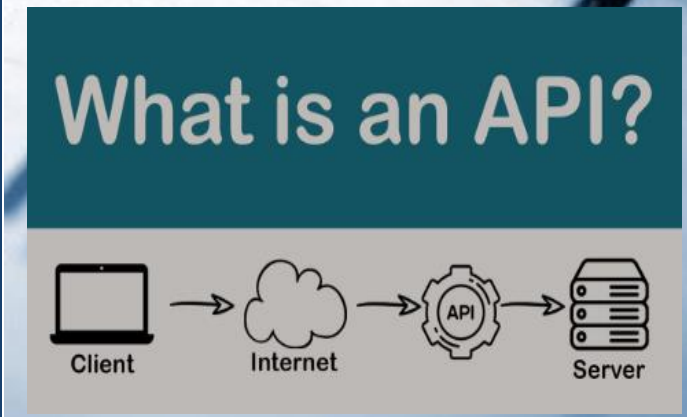
1. Database , tables, queries, reports and other db element names should not contain a space. Use underscore or don't separate words.
2. All data are stored in a table consisting of Columns and Rows. Therefore, it should be safe and secure.
3. There can be multiple tables in a database linked via a relationship
4. There should be a unique key for every table it is called a Primary key
5. It is a must that records or values should be formatted to the shortest data size possible.



Iceberg analogy (Credit: plopdo.com)







Relational Database Rules:

6. There can be multiple tables in a single database.

7. DB Relationships can be the following: One-to-One, One-to-Many, vice versa

8. As database developers, Database Design is given more emphasis followed in second by actual programming or coding/development.

9. Tables and queries are Back-end elements while Forms and Reports are Front-end elements and connection strings or API for integration.

Next Topics:

1. Relationships
2. ERD / RD
3. Normalization Rules
4. MS Access Prototype – Library System (Design to Prototype)
5. Student Management System – (Design to Prototype)

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Q & A

THANK YOU

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