RELATIONAL DATABASES



USE CASES

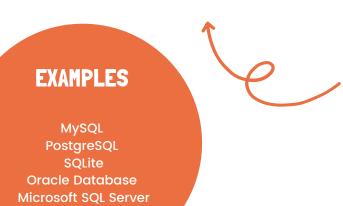
When to Use a Relational Database:

- Consistent Data Structure: Optimal for projects where data structure, size, and access frequency are predictable. (MongoDB, n.d., para. 44)
- Advantages of Normalization: Reduces data duplication and anomalies, which can help avoid future vertical scaling. (MongoDB, n.d., para. 45)
- Crucial Relationships: Best suited for scenarios where the relationships between entities are significant. (MongoDB, n.d., para. 46)
- Extensive Support: Offers a wide range of tools and integration capabilities due to the long history of relational database management systems. (MongoDB, n.d., para. 48)

DEFINITION

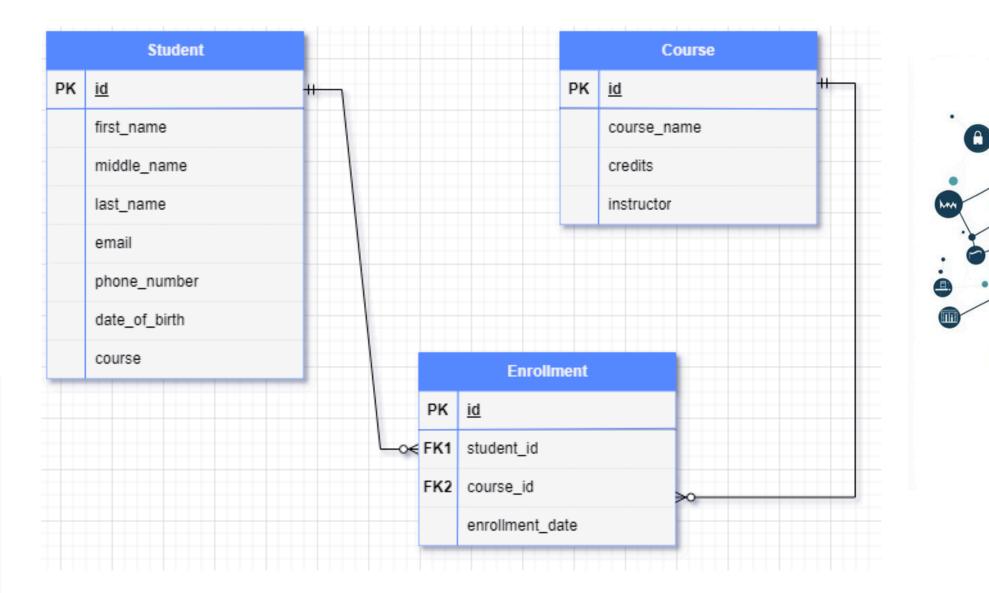
A relational database is a type of database that organizes and allows access to data that is interconnected. It is based on the relational model, which is a simple and logical method of representing data in tables. (Oracle, n.d., para. 1)

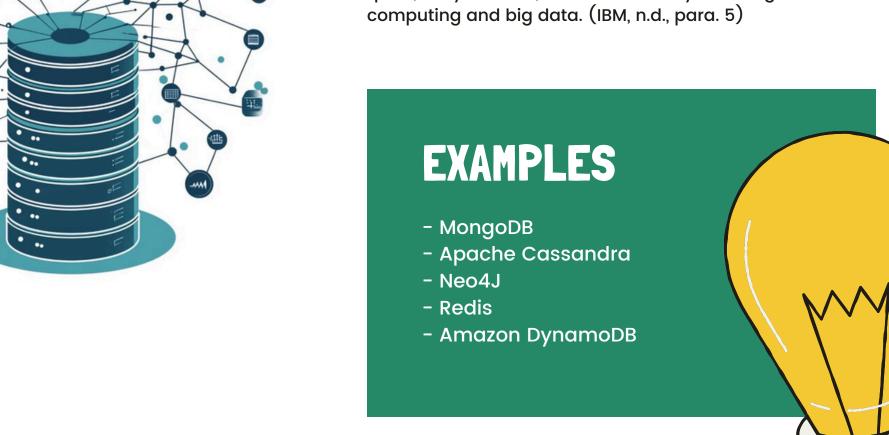
In this structure, each row represents a record with a unique identifier known as the key. Columns contain the attributes of the data. Usually, each record holds a value for every attribute, making it easy to define relationships between different data points. (Oracle, n.d., para. 1)





SCHEMA EXAMPLE





ADVANTAGES AND DISADVANTAGES

PERFORMANCE CONSIDERATIONS

Performance consideration of Relational Databases

Note. Adapted from MongoDB, n.d., Inc. © 2024.

FEATURES	RELATIONAL DATABASES	
Availability	High	
Horizontal Scaling	Low	
Vertical Scaling	High	
Data Storage	Medium to large data	
Performance	Low To Medium	
Reliability	High (Acid)	
Complexity	Medium (Joins)	
Flexibility	Low (Strict-Schema)	
Suitability	Suitable For OLTP	

Advantages

- Data Consistency: Structured data management ensures accuracy and consistency. (Couchbase Product Marketing, 2023, para. 36)
- Flexibility: Supports complex queries and analysis of large datasets for various applications. (Couchbase Product Marketing, 2023, para. 36)
- Security: Provides features like user authentication and access controls to safeguard sensitive information. (Couchbase Product Marketing, 2023, para. 36)
- Strong Data Integrity: Enforces rules and constraints on data entry, maintaining consistency over time. (Couchbase Product Marketing, 2023, para. 36)

Disadvantages

- Complexity: Setup and management can be intricate, often requiring specialized knowledge. (Couchbase Product Marketing, 2023, para. 37)
- Cost: Higher setup and maintenance costs, especially for large-scale systems. (Couchbase Product Marketing, 2023, para. 37)
- Limited Scalability: While scalable, may struggle with extremely large or rapidly changing datasets. (Couchbase Product Marketing, 2023, para. 37)
- Performance: Can be slower compared to other database types for high transaction volumes or complex queries. (Couchbase Product Marketing, 2023, para. 37)

NON-RELATIONAL DATABASES

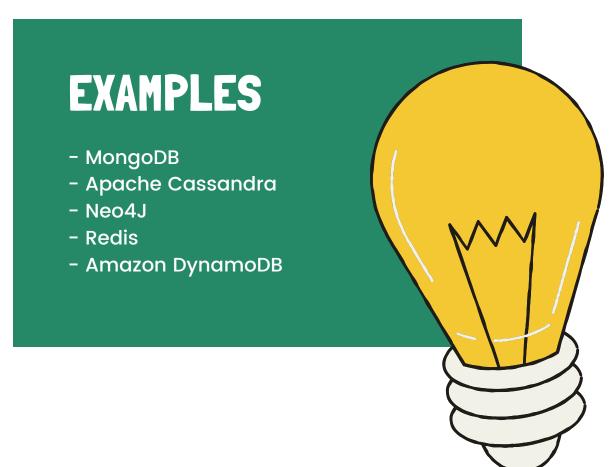


DEFINITION

NoSQL, short for "not only SQL," is a type of database that lets you store and access data in a flexible way, not just in tables like traditional databases. Instead, it often uses formats like JSON documents, which allows it to grow quickly and handle large amounts of unstructured data without needing a fixed layout. (IBM, n.d., para. 1)

NoSQL databases are spread out over multiple servers, which helps keep data available and reliable. If one part goes down, the rest can still work. (IBM, n.d., para. 4)

Today, as companies deal with lots of data fast, NoSQL databases are becoming popular for web applications because they are quick, easy to scale, and user-friendly in the age of cloud



SCHEMA EXAMPLE

Example Schema for a Social Media Post (Document based database like MongoDB)

```
" id": "ObjectId('5c0d8149a8591e7b9a44f37d')",
 "user_id": "ObjectId('d73f44a9b7e1958a9418d0c5')",
  "username": "john_doe"
  "caption": "I had a great day at the college today!",
      "type": "image/jpeg",
     "url": "http://path/myimage.jpg"
"metadata":
 "tags": ["college", "learning", "growth"],
  "location": {
    "latitude": 43.4501,
    "longitude": 80.4869
"timestamp": "2024-09-17T10:00:00Z",
  "ObjectId('a45g63m4g4q1958a9418d0j8')",
  "ObjectId('k90f44a9b7q1458m9113d0k0')"
 comments": [
   "user_id": "ObjectId('p66g63m4g1r5958a9418d0j8')",
    "comment": "Good for you!",
    "timestamp": "2024-09-17T11:00:00Z"
"shared_by": [
 "ObjectId('o98p63m4g4q1958a9418d0a4')",
 "ObjectId('q23p44a9b7q1458m9113d0p2')"
```

ADVANTAGES AND DISADVANTAGES

Advantages

- Flexibility: NoSQL handles unstructured or changing data, ideal for modern apps and big data. (Couchbase Product Marketing, 2023, para. 55)
- Scalability: It can manage large data and lots of traffic easily. (Couchbase Product Marketing, 2023, para. 56)
- Performance: NoSQL works well with big data and complex tasks. (Couchbase Product Marketing, 2023,
- Distributed: Data is spread across servers for better speed and scaling. (Couchbase Product Marketing, 2023, para. 58)
- Agile: You can easily add or remove data without changing the whole system. (Couchbase Product Marketing, 2023, para. 59)

Disadvantages

- Limited queries: NoSQL isn't as good for complex searches. (Couchbase Product Marketing, 2023, para.
- No standard language: There's no single query language like SQL, which can make it harder to develop. (Couchbase Product Marketing, 2023, para.
- Fewer tools: It has less support and tools compared to traditional databases. (Couchbase Product Marketing, 2023, para. 64)
- Security: It might not have strong security features like access control or encryption. (Couchbase Product Marketing, 2023, para. 65)

USE CASES

When to Use a Non-Relational Database:

- High Performance: NoSQL databases like Cassandra can read data quickly by using more servers and copying data across them. (Coursera Staff, 2024, para.
- High Availability: NoSQL databases keep copies of data on multiple servers, so even if one server fails, your data stays safe, and the application keeps working. (Coursera Staff, 2024, para. 51)
- Handling Large Data Volumes: NoSQL databases are built to handle huge amounts of unstructured or semistructured data, making them perfect for big data projects.
- Flexible Data Models: NoSQL is a good option when your data might change over time or doesn't fit into a fixed structure.

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PERFORMANCE CONSIDERATIONS

Performance consideration of Non-Relational Databases

FEATURES	DOCUMENT DATABASE	COLUMN STORE DATABASE	KEY-VALUE STORE DATABASE	GRAPH DATABASE
Performance	High	High	High	Moderate
Availability	High	High	High	High
Flexibility	High	Moderate	High	High
Scalability	High	High	High	Moderate
Complexity	Low	Low	Moderate	High

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