

Networking Fundamentals

A computer network, or a network, or simply a net, is a group of autonomous devices connected to one another that can exchange data using shared technologies.

Two computers are considered connected when they are able to exchange information.

The Internet is the best-known example of a computer network: it is a vast global network that connects billions of hosts around the world.

A host is any device connected to a network.



Databases

In the previous chapter, we saw that a network allows multiple devices to communicate and exchange information. However, many network services do more than simply transmit data from one device to another: they also need to store, organize, and retrieve data when required.

For example, a social network must store profiles, posts, and messages; an e-commerce website must manage products, users, orders, and payments; a school platform must store information about students, teachers, grades, absences, and communications.

Databases are used to perform these functions.

A database is a collection of information, or data, organized in a structured way and generally stored electronically within a computer system.

Databases are essential to the Internet because they make it possible to store, organize, and quickly retrieve huge amounts of data reliably, including user profiles, posts, products, payments, messages, bookings, logs, and permissions.

A database is managed by software called a **DBMS**, which stands for Database Management System. A **DBMS** makes it possible to insert, modify, delete, search, and organize data.



Most databases are relational **databases**.

Data in relational databases is generally organized into rows and columns within a series of **tables**.

A table consists of fields, which are the columns, and records, which are the rows.

- A record is a row in a table and represents a single stored item, such as a student.
- A field is a column in a table and represents a characteristic of that item, such as first name, last name, or class.

When a new item is added to the table, a new record is created.

For example, adding a new student means creating a new row in the “Students” table.

Example

Below is a table containing student data, where:

- Each field is an attribute of the record.
- Each record represents one student.

STUDENT TABLE		
Name	Surname	Class
Mario	Rossi	3
Giuseppe	Bianchi	3
Luca	Verdi	2
Mario	Russo	2
Paolo	Rossi	1

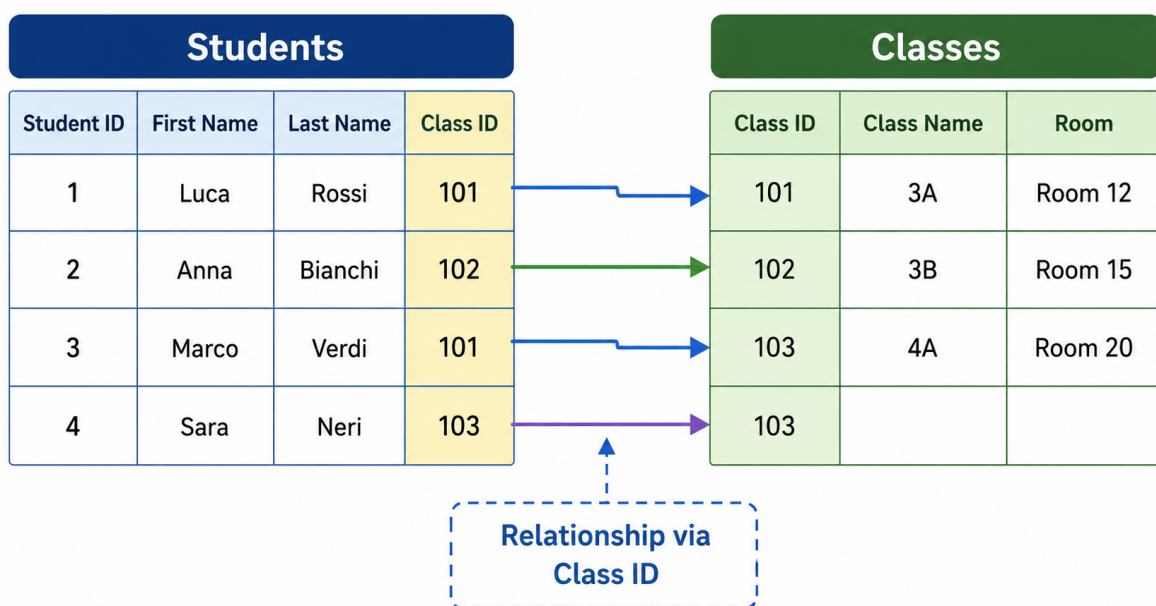
A query is a request sent to a database. It can be used to search for data, insert new data, modify existing data, or delete it. For example, a query can ask the database to display all the students in class 3A.

Example

A query could, for example, retrieve all student records whose class field has the value 3A.

The main feature of relational databases is that tables can be linked to one another through common fields, such as an identification code or ID.

For example, a “Students” table can be linked to a “Classes” table through the class ID. This makes it possible to organize large amounts of data, avoid unnecessary repetition, and easily retrieve information through queries.



Many relational databases use SQL, which stands for Structured Query Language, a language used to create, modify, and query tables.

Example

Imagine having an application for managing a library, where you need to keep track of books, authors, and members. In this case, a database could be used to organize and store all the relevant information.

Database structure:

“Books” table

Fields: ID, Title, Author, Year of publication, Genre, ISBN, Available quantity.

"Authors" table

Fields: ID, First name, Last name, Date of birth, Nationality.

"Members" table

Fields: ID, First name, Last name, Email, Phone number, Registration date.

"Loans" table

Fields: ID, Book ID, Member ID, Loan date, Expected return date.

Example of use

Suppose that a new member, Marco, registers at the library and wants to borrow the book The Lord of the Rings by J.R.R. Tolkien. This is how the application would use the database:

- The application checks whether The Lord of the Rings is available by checking the available quantity in the "Books" table.
- After confirming that the book is available, the application creates a new record in the "Loans" table containing Marco's information, the book, and the loan date.
- The book's available quantity is updated by subtracting one, since one copy has been borrowed.
- When Marco returns the book, the application updates the record in the "Loans" table with the actual return date.
- If the library receives new books to catalogue, they are added to the "Books" table, while the corresponding authors are added to the "Authors" table.
- If a member forgets to return a book by the expected return date, the application can send a notification reminding them to return it.
- The application can generate reports using the information stored in the database, such as a list of books currently on loan, the most popular books based on the number of loans, and a list of the authors represented in the library.

In this example, the database plays a fundamental role in organizing and managing information about the library's books, authors, and members. It simplifies the process of borrowing and returning books and provides tools for analysing data related to the library's activities.