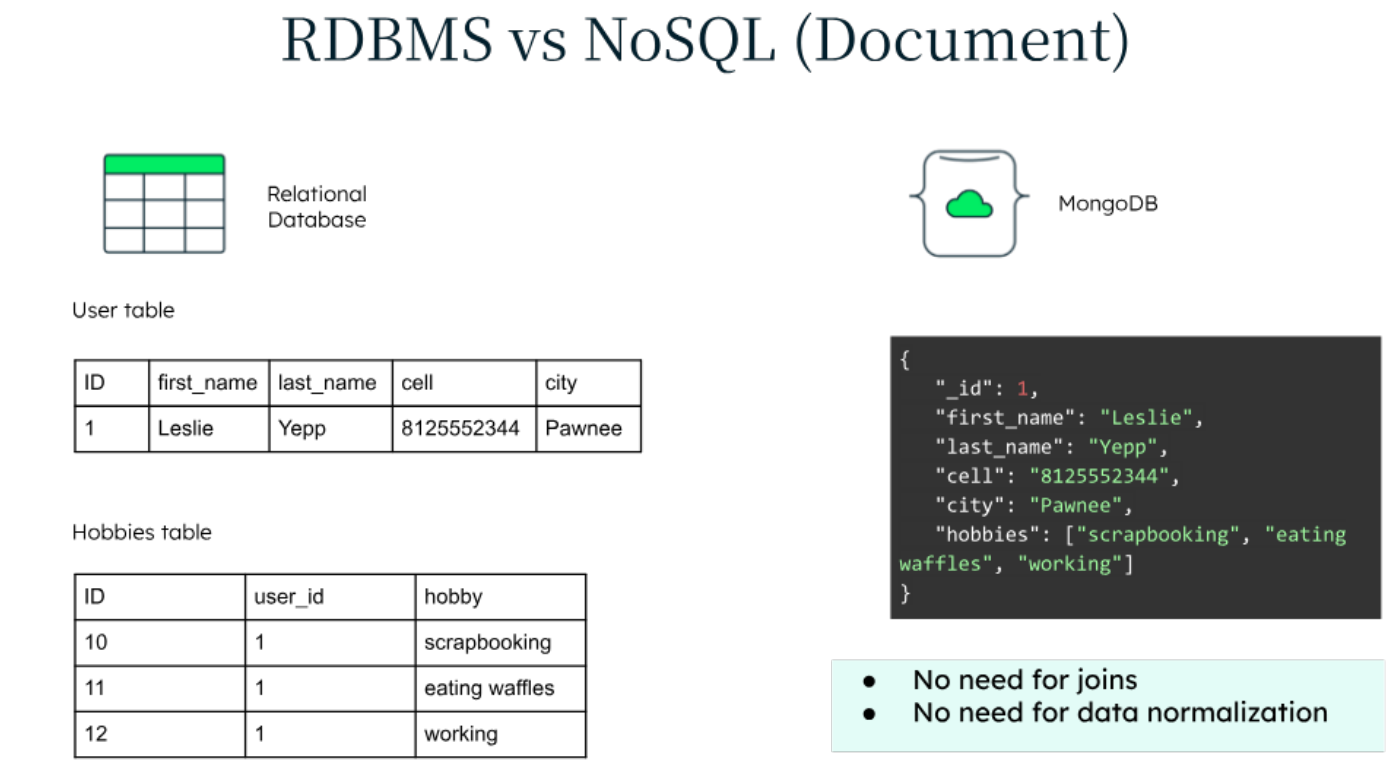
Week 3

Before we get into PostgreSQL, we need to understand why we use databases in the first place. Right now, if our apps use dictionaries to store our data. The problem is that the data disappears when the server restarts, creating a problem in the future. A database allows us to store our data permanently so it survives restarts, crashes, and can support concurrent users.

There are two categories of databases

	Relational (SQL)	Non-Relational (NoSQL)
Structure	Tables with rows and columns	Similar to JSON
Schema	Fixed, predefined	Flexible, schema-less
Relationships	Tables link with keys	Handled in the app's code
Query Language	SQL	Varies but usually none
Best for	Structured data that relates to each other	Unstructured or rapidly changing data
Examples	PostgreSQL, MySQL	MongoDB, Redis



What is a relational database?

A relational database organizes data into tables. Each table represents one thing (a resource, a user, an order, etc). Each row is one record and each column is an attribute of that record, with a defined data type.

id	first_name	last_name	email
1	Miguel	Merlin	mmerlin@stevens.edu
2	Nishit	Sharma	nsharma11@stevens.edu

Because these tables are relational, that means they can be linked to each other. An orders table can reference a user table, so every order knows which user placed it.

What is PostgreSQL?

PostgreSQL is an open source Relational Database Management System (RDBMS). The RDBMS is a software layer that sits on top of your data. It enforces rules, handles queries, and manages connections.

Tables and Schema

When you create a table in PostgreSQL, you define its schema, the column names and what type of data each column holds. You do this with `CREATE TABLE`

```
CREATE TABLE users (
    id    SERIAL PRIMARY KEY,
    name  VARCHAR(100) NOT NULL,
    email VARCHAR(255)
);
```

You have to define this schema otherwise, PostgreSQL will reject any data that doesn't fit the schema

Data Types

Every column has a data type that constrains what values it can store:

Type	What it stores	Example
INTEGER	Whole numbers	42

SERIAL	Auto-incrementing integers (use it for IDs)	1, 2, 3, ...
VARCHAR(n)	Text up to n characters	"Nishit Sharma"
TEXT	Unlimited length text	Long descriptions
BOOLEAN	True/False	true
DATE	Calendar date	2026-3-25
NUMERIC	Decimal numbers	19.99

Primary Keys and Foreign Keys

A primary key is a column that uniquely identifies every row in a table. No two rows can share the same primary key. `SERIAL PRIMARY KEY` makes PostgreSQL auto assign a new integer ID to each row you insert.

A foreign Key is a column in one table that references the primary key of another table. This creates the relationship between tables

```
CREATE TABLE orders (
    id          SERIAL PRIMARY KEY,
    user_id     INTEGER REFERENCES users(id),
    amount      NUMERIC,
    order_date  DATE
);
```

In this example, user_id is a foreign key, and it must match an existing id in the users table. If you try to insert an order with a user_id that doesn't exist, PostgreSQL will reject it automatically.

Basic SQL

SQL (Structured Query Language) is the language we will use. Every operation you will perform (creating tables, inserting data, and reading data) is written in SQL.

CREATE TABLE

Defines a new table and its schema:

```
CREATE TABLE resources (
    id            SERIAL PRIMARY KEY,
    name          VARCHAR(255) NOT NULL,
    category      VARCHAR(50),
    description   TEXT
);
```

`NOT NULL` means that the column is required, PostgreSQL won't let you insert a row without a value there.

INSERT (Create)

Adds a new row to a table:

```
INSERT INTO resources (name, category, description)
VALUES ('City Food Bank', 'Food', 'Free weekly groceries for families.');
```

SELECT (Read)

Retrieves rows from a table:

```
-- Get everything
SELECT * FROM resources;

-- Get specific columns
SELECT name, category FROM resources;

-- Filter with WHERE
SELECT * FROM resources WHERE category = 'Food';
```

UPDATE

Changes an existing row:

```
UPDATE resources
SET description = 'Updated description here.'
WHERE id = 1;
```

Make sure to include a `WHERE` clause on `UPDATE` otherwise you will update every row in the table

DELETE

Removes a row:

```
DELETE FROM resources WHERE id = 1;
```

Relationships between tables

The most common relationship in web apps is one-to-many. This means that one resource can have many referrals, one user can have many orders.

```
-- One user
CREATE TABLE users (
    id   SERIAL PRIMARY KEY,
    name VARCHAR(100)
);

-- Many orders belonging to one user
CREATE TABLE orders (
    id       SERIAL PRIMARY KEY,
    user_id  INTEGER REFERENCES users(id),
    amount   NUMERIC
);
```

To retrieve related data across two tables, you can use a `JOIN`

```
SELECT users.name, orders.amount
FROM orders
JOIN users ON orders.user_id = users.id;
```

This pulls the user's name from the `users` table and matches it to their orders using the foreign key relationship

Getting Started

Join the GitHub Classroom assignment with the following link:

https://classroom.github.com/a/yW_GReTh

Once you join, your repository will be created https://github.com/blueprint-learn/week3-techteam-sp26-{github-username}

Once you join, GitHub Classroom will automatically create your personal repository. You will receive an email confirming access.

After receiving access:

1. Clone your repository locally
2. Install dependencies
3. Run the starter FastAPI app

This repository contains the scaffolding you will extend during this week.

```
git clone https://github.com/blueprint-learn/week3-techteam-sp26-{github-username}.git
```

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