



## Module 9 – Web App Architecture & To-Do App

In this module we connect everything together in a **simple web application**:

- Basic web application architecture
  - Frontend vs backend vs database
  - Building a minimal backend for a To-Do app
  - Building a minimal frontend for it
  - Extra mini-project for practice
-

# Big Picture – Web Application Architecture

Modern web apps are usually split into three main parts:

- **Frontend** – code running in the browser (HTML/CSS/JS)
- **Backend** – server code handling requests and business logic
- **Database** – persistent storage for data



The browser never talks to the database directly – it always goes through the backend.

---

## Roles of Frontend, Backend, Database

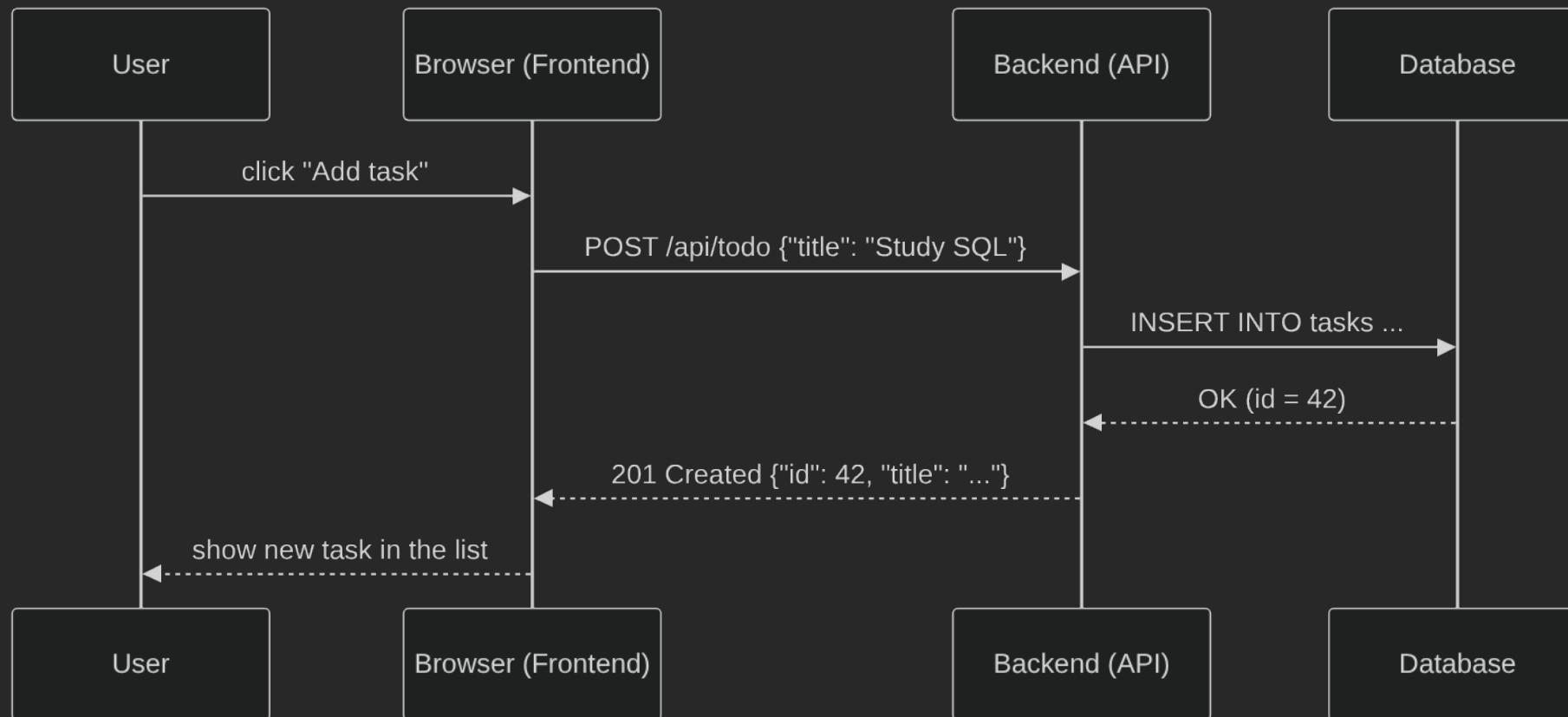
Layer	Main role	Technologies (examples)
Frontend	UI, layout, user interactions	HTML, CSS, JavaScript
Backend	Logic, validation, security, APIs	Python, Node, Java, Go, etc.
Database	Store and query structured data	SQLite, PostgreSQL, MySQL, etc.

Analogy:

- Frontend = restaurant dining area & menu
  - Backend = kitchen + waiters
  - Database = pantry where ingredients are stored
-

## Request / Response Flow

User action → network request → backend → database → response → UI update.



Key idea: **HTTP** is the language between frontend and backend.

# Designing a Simple To-Do Backend

We will build a tiny **JSON API** in Python for a To-Do app.

Features:

- List all tasks
- Create new task
- Mark task as completed

Simplest storage option:

- Start with an **in-memory list** (lost on restart but easy to understand)
  - Later you can swap it with SQLite (from Module 7)
-

## To-Do Backend – Minimal API (Flask)

todo\_backend.py

```
from flask import Flask, jsonify, request

app = Flask(__name__)

tasks = [] # in-memory list of dicts
next_id = 1

@app.get("/api/todo")
def list_tasks():
    return jsonify(tasks)

@app.post("/api/todo")
def create_task():
    global next_id
    data = request.get_json() or {}
    title = data.get("title", "").strip()
    if not title:
        return {"error": "title is required"}, 400
    task = {"id": next_id, "title": title, "completed": False}
    next_id += 1
    tasks.append(task)
    return task, 201

if __name__ == "__main__":
    app.run(debug=True)
```

snippet +exec is disabled, run with -x to enable

Run with:

```
pip install flask
python todo_backend.py
```

## Testing the Backend with curl

```
# list tasks
curl http://localhost:5000/api/todo

# create a new task
curl -X POST http://localhost:5000/api/todo \
-H "Content-Type: application/json" \
-d '{"title": "Finish Module 9 slides"}'
```

Check:

- HTTP method (GET, POST)
  - URL path (`/api/todo`)
  - Request body and headers
  - Response JSON and status code
-

## Optional: Persist To-Dos with SQLite

You can reuse **Module 7** knowledge to save tasks in `app.db`.

Sketch:

```
CREATE TABLE IF NOT EXISTS tasks (
    id INTEGER PRIMARY KEY AUTOINCREMENT,
    title TEXT NOT NULL,
    completed INTEGER NOT NULL DEFAULT 0
);
```

```
import sqlite3

def get_conn():
    return sqlite3.connect("app.db")
```

Then inside your Flask handlers, instead of using a global `tasks` list, execute `INSERT`, `SELECT`, and `UPDATE` queries.

---

## Building the Frontend – HTML Skeleton

index.html

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="UTF-8" />
    <title>Mini To-Do App</title>
    <style>
      body { font-family: system-ui, sans-serif; margin: 2rem; background: #1d2021; color: #ebdbb2; }
      h1 { color: #fabd2f; }
      input, button { padding: 0.4rem 0.6rem; margin-right: 0.4rem; }
      ul { list-style: none; padding: 0; }
      li { padding: 0.25rem 0; }
    </style>
  </head>
  <body>
    <h1>Mini To-Do App</h1>
    <input id="title" placeholder="New task..." />
    <button id="add-btn">Add</button>
    <ul id="list"></ul>

    <script src="app.js"></script>
  </body>
</html>
```

Serve this folder with:

```
python3 -m http.server 8000
```

## Frontend Logic – Fetching Tasks

app.js

```
const API_URL = "http://localhost:5000/api/todo";

async function loadTasks() {
  const res = await fetch(API_URL);
  const data = await res.json();

  const list = document.getElementById("list");
  list.innerHTML = "";
  for (const task of data) {
    const li = document.createElement("li");
    li.textContent = `${task.id}. ${task.title}`;
    list.appendChild(li);
  }
}

loadTasks();
```

Open <http://localhost:8000> in a browser to see the list (empty at first).

---

## Frontend Logic – Creating Tasks from UI

Extend `app.js`:

```
const input = document.getElementById("title");
const button = document.getElementById("add-btn");

button.addEventListener("click", async () => {
  const title = input.value.trim();
  if (!title) return;

  await fetch(API_URL, {
    method: "POST",
    headers: { "Content-Type": "application/json" },
    body: JSON.stringify({ title }),
  });

  input.value = "";
  await loadTasks();
});
```

Flow:

- User types a title and clicks **Add**
  - Browser sends **POST** request to backend
  - Backend adds task and returns JSON
  - Frontend reloads the list using `loadTasks()`
-

# Bringing It All Together

End-to-end:

1. Start backend:
  - `python todo_backend.py` → serves `http://localhost:5000/api/todo`
2. Start static frontend server in same folder as `index.html`:
  - `python3 -m http.server 8000`
3. Visit `http://localhost:8000` in browser:
  - Add tasks from UI
  - Confirm requests in **Network** tab of DevTools
4. Observe:
  - Frontend ↔ Backend via HTTP
  - Backend may use in-memory list or SQLite

You just built a tiny full-stack application.

---

# Mini Project – Student Manager

Build a mini student management tool that reuses the same architecture:

1. **Backend API:**
  - Endpoints: GET /api/students, POST /api/students, PATCH /api/students/<id>
  - Each student record includes id, name, email, course, and status (active/inactive)
2. **Database (recommended):**
  - SQLite table students with columns (id INTEGER PRIMARY KEY, name TEXT, email TEXT UNIQUE, course TEXT, status TEXT)
  - Seed 3 demo rows for quick testing
3. **Frontend:**
  - Table showing all students (name, course, status badge)
  - Form to add a new student (name, email, course)
  - Button to toggle status between Active / Inactive (calls PATCH)

Stretch ideas:

- Filter students by course or status
  - Add simple validation and inline error messages
  - Export the current list to JSON for download
-