guide # html-css

Consuming a Web API from the Browser

TCSS 460 — Client/Server Programming

This is the canonical front-end-side reference for talking to a web API. The patterns here — `fetch`, async/await, error handling, headers, CORS, bearer tokens — show up unchanged in the React, Next.js, and NextAuth guides that follow. Read this guide once, deeply; the rest of the front-end half of the course will reference it constantly.

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1 Why This Guide Exists

The front-end half of TCSS 460 is fundamentally about consuming web APIs. First you'll consume your own back-end — the one you built in Sprints 1–3. Later, in the cross-group swap (Sprints 5+), you'll consume a partner team's API. Every week from here forward, your front-end code's main job is asking a server for data and rendering what comes back.

Every framework you'll use sits on top of the same browser primitive: `fetch`. React's `useEffect` calls `fetch`. Next.js Server Components call `fetch`. NextAuth uses `fetch` internally to talk to OAuth2 token endpoints. Learning `fetch` cleanly here means the rest is just sugar.

You already know HTTP from the back-end side. You've sent requests with Postman. You've written Express route handlers that respond with JSON. What you have **not** done is make a web page send an HTTP request from inside the browser. That's what this guide teaches.

> **Prerequisite**
>
> This guide assumes you've worked through HTML, CSS & the DOM. You don't need to be fluent — you need to know what a `<button>`, an event handler, and `document.querySelector` are.

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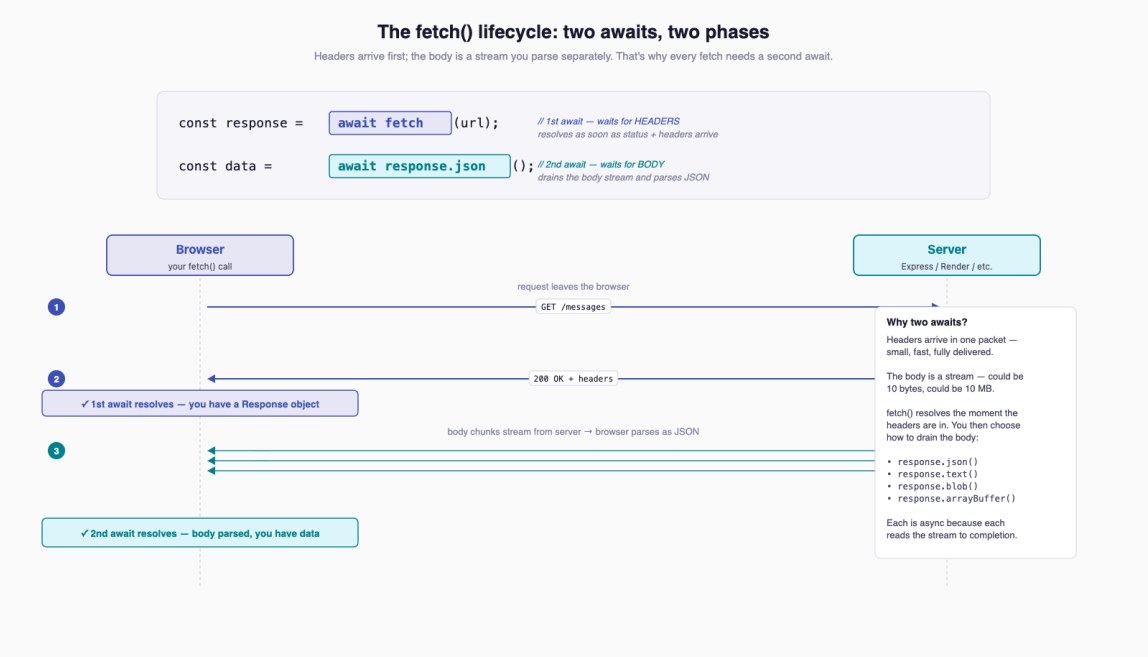
2 The Problem — Browser Talking to Server

The HTML/CSS/DOM guide ended with a fully static page: open `index.html`, see content, click a button, change some text. That's the full extent of what HTML and CSS alone can do.

A real application needs more. It needs to load *current* data — not whatever was hard-coded into the HTML when you wrote the file. It needs to send user input back to a server so it can be saved, validated, or shared with other users.

The browser already knows how to do this. Every time you visit a URL, the browser sends an HTTP request and parses the response. What we want is to do the same thing **from inside JavaScript** — programmatically, after the page has loaded, in response to user actions.

That's what `fetch` does.



The request/response model is exactly what you saw in Week 1. The new piece is the JavaScript code on the left that drives the request.

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3 The `fetch` API

`fetch` is a function built into every modern browser. You call it with a URL; it returns a `Promise<Response>`.

```
const response = await fetch("https://your-app.onrender.com/messages");
const data = await response.json();
console.log(data);
```

Three things to notice:

1. **`fetch` is a single function call** — no setup, no library, no constructor. The platform gives it to you for free.
2. **Two `await`s.** The first waits for the *headers* to arrive. The second waits for the *body* to arrive and parses it as JSON. The body is treated as a stream that you consume separately, which is why parsing is its own asynchronous step.
3. **`fetch` is asynchronous.** Network calls take time. The browser refuses to block on them, so the result is wrapped in a `Promise`.

3.1 A Word on Other HTTP Libraries

You may have seen older tutorials that use `XMLHttpRequest` (XHR), or `axios`, or `jQuery.ajax`. Here's the short version:

- **`XMLHttpRequest`** — the legacy primitive `fetch` replaced. Don't use it for new code.
- **`axios`** — a popular npm package that wraps `fetch` with automatic JSON parsing and error-on-non-2xx. It's fine, but adds a dependency for things `fetch` already does.
- **`jQuery.ajax`** — historical. The HTML/CSS/DOM guide covers why jQuery exists.

This course uses `fetch` exclusively. Next.js extends `fetch` with its own caching and revalidation features; NextAuth uses `fetch` internally; React has no opinion but the React community defaults to `fetch`. Learning `fetch` is the highest-leverage choice.

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4 async / await in the Browser

You've seen `async` / `await` on the back-end side — Express route handlers that `await` a Prisma query. The browser side is identical.

```
async function loadMessages(): Promise<void> {
  const response = await fetch("https://your-app.onrender.com/messages");
  const data = await response.json();
  console.log(data);
}

loadMessages();
```

Any function that uses `await` must be declared `async`. The `async` keyword has one effect: the function now returns a `Promise` instead of its raw return value. That's it.

4.1 Top-Level await — Modules vs Script Tags

Inside an ES module (a `.ts` or `.js` file loaded with `<script type="module">`), you can `await` at the top level:

```
// app.ts loaded as <script type="module" src="app.js"></script>
const response = await fetch("/messages");
const data = await response.json();
console.log(data);
```

Inside a classic script tag (no `type="module"`), top-level `await` is a syntax error. You'll need to wrap the code in an `async` function and call it:

```
async function main(): Promise<void> {
  const response = await fetch("/messages");
  const data = await response.json();
  console.log(data);
}

main();
```

For the rest of this guide, assume modules. When you scaffold a Vite project for React (next guide), you'll be in module-land automatically.

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5 Sending Each HTTP Method

`fetch` defaults to `GET`. For anything else, pass a second argument — an options object — with `method`, `headers`, and `body` as needed.

5.1 GET — The Default

```
const response = await fetch("https://your-app.onrender.com/messages");
const messages = await response.json();
```

No options object, no `method`, no body. Just a URL.

5.2 POST with a JSON Body

```
interface NewMessage {
  text: string;
  priority: number;
```

```
}

const payload: NewMessage = { text: "Hello, world", priority: 1 };

const response = await fetch("https://your-app.onrender.com/messages", {
  method: "POST",
  headers: { "Content-Type": "application/json" },
  body: JSON.stringify(payload),
});

const created = await response.json();
```

Three things must line up:

- `method: "POST"` — the verb.
- `headers: { "Content-Type": "application/json" }` — tells the server "the body is JSON, please parse it as such." Without this, Express's `express.json()` middleware will not run, and `request.body` on the server will be empty.
- `body: JSON.stringify(payload)` — the body must be a *string*, not an object. `JSON.stringify` does the conversion.

5.3 PUT, PATCH, DELETE

Same shape, different verb:

```
// PUT — full replacement
await fetch(`https://your-app.onrender.com/messages/${id}`, {
  method: "PUT",
  headers: { "Content-Type": "application/json" },
  body: JSON.stringify({ text: "Updated", priority: 2 }),
});

// PATCH — partial update
await fetch(`https://your-app.onrender.com/messages/${id}`, {
  method: "PATCH",
  headers: { "Content-Type": "application/json" },
  body: JSON.stringify({ priority: 3 }),
});

// DELETE — usually no body
await fetch(`https://your-app.onrender.com/messages/${id}`, {
  method: "DELETE",
});
```

The semantics are exactly what you implemented on the back-end side. Nothing about `fetch` is special-cased per verb.

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6 Headers — Content-Type and Authorization

Headers are key/value pairs the browser sends with the request. The two you'll care about:

6.1 Content-Type

`Content-Type` describes the body. For a JSON body, always send:

```
headers: { "Content-Type": "application/json" }
```

For a `GET` or `DELETE` with no body, you can omit it. Some servers ignore unexpected `Content-Type` headers; some reject them. The safe default: include it on requests that have a body, omit it on those that don't.

6.2 Authorization

Once the user has signed in (Week 5 onward), every request to a protected endpoint must carry a bearer token:

```
const token: string = "eyJhbGciOiJSUzI1NiIs..."; // from auth-squared

const response = await fetch("https://your-app.onrender.com/messages", {
  headers: {
    "Authorization": `Bearer ${token}`,
  },
});
```

The exact string format is `Bearer` (literally — with the space) followed by the JWT. The `Authorization` header is what `requireAuth` middleware on the back-end reads to identify the user.

For now, treat the token as something you have. Section 12 covers where it comes from and how to store it; the Authentication with NextAuth guide formalizes the whole flow.

6.3 Reading Response Headers

The response object has a `headers` property with a `get` method:

```
const response = await fetch(url);
const contentType: string | null = response.headers.get("content-type");
const total: string | null = response.headers.get("x-total-count");
```

Header names are case-insensitive. `response.headers.get("Content-Type")` and `response.headers.get("content-type")` return the same value.

---

7 Working with JSON

Almost every API in this course speaks JSON. A few specifics matter:

7.1 response.json() Is Async

```
// CORRECT
const data = await response.json();

// WRONG — `data` is a Promise, not your data
const data = response.json();
```

Forgetting the second `await` is one of the most common new-fetch mistakes. The symptom: you `console.log(data)` and see `Promise { <pending> }` instead of the object you expected.

7.2 When the Response Isn't JSON

Sometimes a server responds with HTML (an error page from a misconfigured proxy), an empty body (HTTP 204 No Content), or plain text. Calling `.json()` on a non-JSON body throws a `SyntaxError`.

For empty bodies:

```
if (response.status === 204) {
  return; // nothing to parse
}
const data = await response.json();
```

For unknown content types, check the header first:

```
const contentType = response.headers.get("content-type") ?? "";
if (contentType.includes("application/json")) {
  return await response.json();
}
return await response.text();
```

7.3 Typing the Response

`response.json()` returns `Promise<any>`. TypeScript can't know the shape — that's a runtime contract between you and the server. Type the data manually:

```
interface Message {
  id: number;
  text: string;
  priority: number;
  createdAt: string;
}

const response = await fetch("/messages");
const messages = (await response.json()) as Message[];
```

This is one of the few places `as` is appropriate. You're asserting "I know the back-end returns this shape." If the back-end lies, you'll find out at runtime — usually with a `Cannot read property 'x' of undefined` somewhere downstream.

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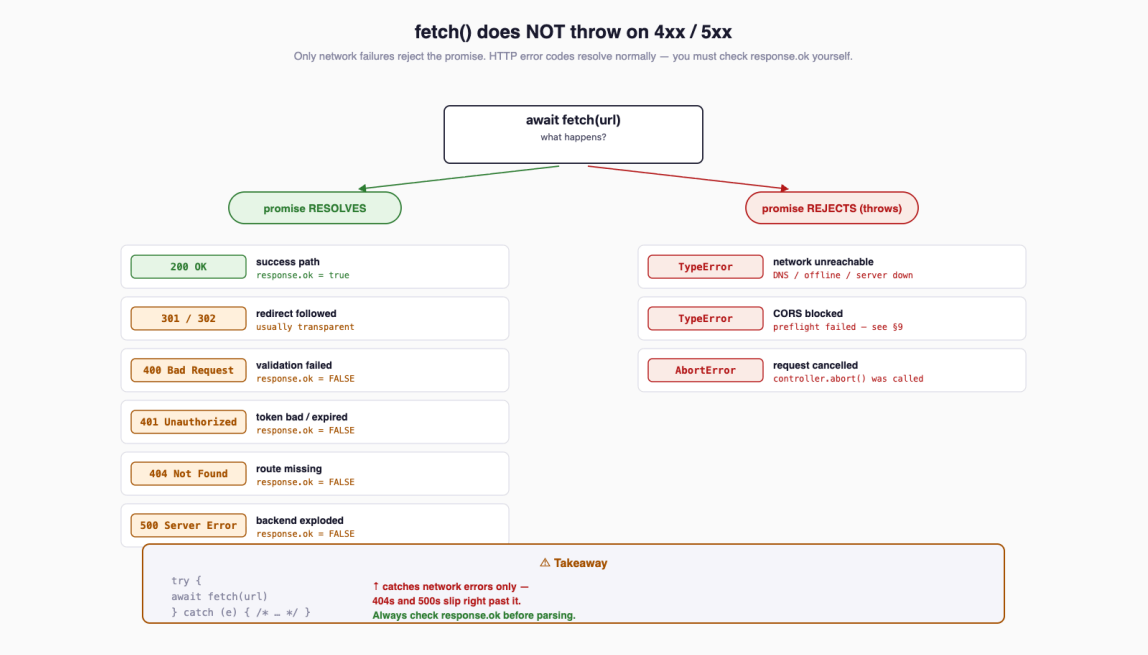
8 Error Handling — The fetch Gotcha

This section is the single most important one in the guide. Internalize it now and you'll save yourself hours of debugging.



⚠ fetch Does NOT Throw on HTTP Error Codes

A 404, 500, or 401 response **does not** reject the `fetch` promise. The `await` succeeds. The only way to know the request failed is to check `response.ok`.

The `try/catch` block you'd reach for from other languages catches **network failures** (DNS error, server unreachable, request aborted) — not HTTP errors. This is the most common new-fetch mistake.

Here's the correct pattern:

```
const response = await fetch("/messages");

if (!response.ok) {
  throw new Error(`Request failed: ${response.status}
${response.statusText}`);
}

const data = await response.json();
```

`response.ok` is `true` only for status codes in the 200–299 range. Anything else — 301, 404, 500, 502 — is `false`.

8.1 What Each Failure Mode Looks Like

Scenario	`await fetch(...)`	`response.ok`	What to do
200 OK	resolves	`true`	parse body, render
404 Not Found	resolves	`false`	show "not found" message
500 Server Error	resolves	`false`	show "something went wrong"
401 Unauthorized	resolves	`false`	redirect to sign-in
Network error (DNS, offline, server down)	**throws**	n/a	show "offline" message
Request aborted (`AbortController`)	**throws** `AbortError`	n/a	usually ignore — user navigated away

8.2 A Reusable apiFetch Helper

Wrapping the boilerplate in a helper function is the canonical move. Copy this into your projects:

```
export async function apiFetch<T>(
  url: string,
  options: RequestInit = {},
): Promise<T> {
  const response = await fetch(url, {
    ...options,
    headers: {
      "Content-Type": "application/json",
      ...options.headers,
    },
  });

  if (!response.ok) {
    const body = await response.text();
    throw new Error(`${response.status} ${response.statusText}: ${body}`);
  }

  if (response.status === 204) {
    return undefined as T;
  }

  return (await response.json()) as T;
}
```

Use it like this:

```
interface Message {
  id: number;
  text: string;
}

// GET
const messages = await apiFetch<Message[]>("/messages");

// POST
const created = await apiFetch<Message>("/messages", {
  method: "POST",
  body: JSON.stringify({ text: "Hello" }),
});

// DELETE
await apiFetch<void>(`/messages/${id}`, { method: "DELETE" });
```

Generic type parameter `T` lets the caller declare what shape they expect. The helper handles the `response.ok` check, the `JSON.stringify`, the `Content-Type` header, and the empty-body case. From this point forward in the course, prefer `apiFetch` over raw `fetch` for any non-trivial code.

Try It Yourself

1. Create `api.ts` and paste the `apiFetch` function.
2. In `app.ts`, import it and call `apiFetch<Message[]>("/messages")` against your Sprint 2/3 backend's URL.
3. Stop your back-end server and reload the page — observe the network error in the console.
4. Restart the server but request a path that doesn't exist (`/notreal`) — observe the 404 thrown as a regular `Error`.

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9 CORS — What It Is, Why It Will Bite You

The browser's **same-origin policy** is a baseline security rule: JavaScript running on `https://example.com` is not allowed to read responses from `https://other.com` *unless* `other.com` explicitly opts in. The opt-in mechanism is **CORS — Cross-Origin Resource Sharing**.

An "origin" is the triple `(scheme, host, port)`. `http://localhost:3000` and `http://localhost:5173` are different origins. So are `https://my-app.vercel.app` and `https://your-app.onrender.com`. The first time you serve your front-end on one URL and your back-end on another, you will see a CORS error.

9.1 What the Error Looks Like

In the browser's DevTools Console, a CORS failure looks like this:

```
Access to fetch at 'https://your-app.onrender.com/messages'
from origin 'https://my-frontend.vercel.app' has been blocked
by CORS policy: No 'Access-Control-Allow-Origin' header is
present on the requested resource.
```

The Network tab shows the request as failed (red). The fetch promise rejects with a generic `TypeError: Failed to fetch` — there's no useful information in the error itself. The Console message is the only signal.

9.2 Whose Problem Is It? The Server's.

CORS is a server-side concern. The browser is just enforcing what the server tells it. To fix the error, you (or whoever owns the back-end) must add the `Access-Control-Allow-Origin`

header to responses.

In Express, the `cors` middleware does this for you:

```
import cors from "cors";

const app = express();

// Dev — allow everyone (NOT for production)
app.use(cors());

// Prod — allow specific origins only
app.use(cors({
  origin: ["https://my-frontend.vercel.app", "http://localhost:5173"],
  credentials: true,
}));
```

You already added `app.use(cors())` to your back-end in the Routing & Middleware guide. The deployment problem is usually that production needs an *explicit* allowlist — `cors()` with no arguments allows everything, which is fine for dev but a bad practice (and sometimes a security finding) in prod.

> **On the Back-End Side**
>
> The Express `cors()` middleware setup is covered in the Routing & Middleware guide. When you deploy your front-end, you'll need to add the production origin to the back-end's allowlist and redeploy the back-end.

9.3 Preflight — Why You Sometimes See Two Requests

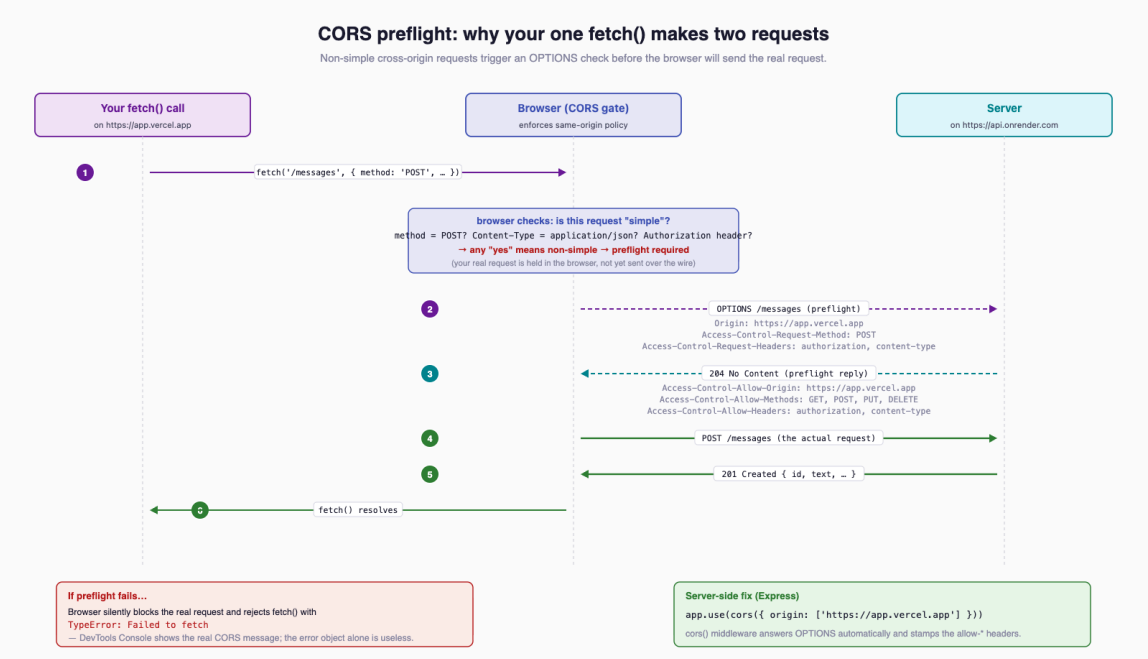
For "non-simple" requests, the browser sends an `OPTIONS` request first to ask the server "is this allowed?" before sending the real request. This is called a **preflight**.

A request is "non-simple" (and triggers preflight) when *any* of these are true:

- The method is `PUT`, `PATCH`, or `DELETE` (anything other than `GET`, `HEAD`, or `POST`)
- The `Content-Type` is `application/json` (anything other than `text/plain`, `application/x-www-form-urlencoded`, or `multipart/form-data`)
- A custom header like `Authorization` is present

In practice, **almost every request you'll write in this course triggers preflight** — they're all JSON, and most carry an `Authorization` header.

The flow looks like this:



If you see two requests in DevTools (one `OPTIONS`, one `POST`) for what feels like a single fetch call, that's preflight working. The `cors` middleware handles the `OPTIONS` automatically.

9.4 Why Dev Often "Just Works"

In development, students often don't see CORS errors because:

1. They serve front-end and back-end from the **same origin** (e.g., both on `localhost`, or via a Vite proxy that hides the cross-origin call).
2. They have `app.use(cors())` with no allowlist, so every origin is allowed.

Then they deploy. The front-end is on `https://my-app.vercel.app`. The back-end is on `https://your-app.onrender.com`. Suddenly: CORS error. Section 5 of the deployment guide walks through fixing this.

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10 Inspecting Requests in DevTools

The browser's DevTools Network tab is the most important debugging tool for front-end-to-back-end work. Open it now and keep it open whenever you're writing fetch code.

Open DevTools with `F12` (or right-click → "Inspect"). Click the **Network** tab.

10.1 What You See

Every HTTP request the page makes shows up as a row. Useful columns:

Column	What it tells you
Name	The path (and host on hover)
Status	The HTTP status code — your first signal
Type	`fetch`, `xhr`, `document`, `script`, `stylesheet`, etc.
Initiator	Which line of code started the request — clickable
Time	How long the request took
Size	Payload size

Click any row to open a detail panel with tabs:

- **Headers** — request headers, response headers, the `Authorization` value, the `Content-Type`
- **Payload** — the request body (your `JSON.stringify`'d POST)
- **Response** — the response body, JSON-formatted
- **Preview** — the response body in a tree view, often easier to read
- **Initiator** — the JavaScript call stack that triggered the request

10.2 Filtering

The page makes lots of requests beyond your `fetch` calls — every image, stylesheet, and font shows up here. Filter to just your API calls:

- Click the **Fetch/XHR** filter button at the top of the Network tab.
- Or type into the filter box: `method:POST`, `status-code:401`, `domain:your-app.onrender.com`.

10.3 Copy as cURL — The Best Debugging Trick

Right-click a request → **Copy** → **Copy as cURL**. You now have a complete shell command that reproduces the exact request the browser sent — headers, body, everything.

Paste it into your terminal. Does it work outside the browser? If yes, the back-end is fine and the bug is in your front-end. If no, the back-end has a problem and you can iterate on the cURL command independently of your front-end code.

This is the single most useful trick in the front-end debugging toolkit.

10.4 The Console Tab

The Console tab shows `console.log` output and any errors thrown from your code. CORS errors and uncaught exceptions show up here. Get used to checking it.

```
const response = await fetch("/messages");
console.log("status:", response.status);
console.log("ok:", response.ok);
const data = await response.json();
console.log("data:", data);
```

When in doubt, log everything. Remove the logs before committing.

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11 Loading and Error States

A real UI has at least three states for any data it shows: **loading**, **data**, **error**. The naive code shape leads to a flash of "no data" before "loading" appears, which looks broken.

11.1 The Wrong Shape

```
let data: Message[] | null = null;
let error: string | null = null;

async function load(): Promise<void> {
  try {
    data = await apiFetch<Message[]>("/messages");
  } catch (err) {
    error = (err as Error).message;
  }
  render();
}

function render(): void {
  // Bug: when data is null and error is null, what do we show?
  if (error) {
```

```
    document.body.textContent = `Error: ${error}`;
    return;
  }
  if (data) {
    document.body.textContent = JSON.stringify(data);
    return;
  }
  // Falls through — nothing rendered, blank screen
}
```

Three independent variables and an order-dependent render: it's easy to get a blank screen during the first render, before the fetch resolves.

11.2 The Right Shape — A Single State Object

```
type Status = "loading" | "success" | "error";

interface State<T> {
  status: Status;
  data: T | null;
  error: string | null;
}

let state: State<Message[]> = { status: "loading", data: null, error: null };

async function load(): Promise<void> {
  state = { status: "loading", data: null, error: null };
  render();

  try {
    const data = await apiFetch<Message[]>("/messages");
    state = { status: "success", data, error: null };
  } catch (err) {
    state = { status: "error", data: null, error: (err as Error).message };
  }
  render();
}

function render(): void {
  if (state.status === "loading") {
    document.body.textContent = "Loading...";
  } else if (state.status === "error") {
    document.body.textContent = `Error: ${state.error}`;
  } else {
    document.body.textContent = JSON.stringify(state.data);
  }
}
```

One variable. Three exhaustive states. The render function can never fall through to "nothing." This is the same shape React's data-fetching libraries (TanStack Query, SWR) use, and the same shape the React Fundamentals guide adapts to `useState`.

11.3 Cancelling In-Flight Requests with AbortController

When a user navigates away or triggers a new search before the previous one finishes, you want to cancel the stale request. `AbortController` does this:

```
const controller = new AbortController();

try {
  const response = await fetch("/messages", { signal: controller.signal });
  const data = await response.json();
} catch (err) {
  if ((err as Error).name === "AbortError") {
    return; // user cancelled, ignore
  }
  throw err;
}

// Somewhere else — e.g., user navigates away
controller.abort();
```

When `controller.abort()` is called, the in-flight `fetch` rejects with a `DOMException` named `AbortError`. The React guide uses this pattern in `useEffect` cleanup functions to prevent setting state on unmounted components.

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12 Auth — Bearer Tokens

Once a user signs in via auth-squared (Week 5), they receive a JWT. Every subsequent request to a protected endpoint must carry that token in the `Authorization: Bearer <token>` header.

12.1 Where the Token Comes From

For now, in this guide, we treat the token as a string you have. In real life it comes from one of:

- **The Token Playground** (used in Check-Off 5 for manual testing)
- **A login form that POSTs to auth-squared's token endpoint** (rare in this course — we use redirect-based OAuth)
- **NextAuth's session** (Week 7 — the production path)

The deeper picture is in the Week 5 auth concepts reading. The mechanics of getting a token into NextAuth's session are covered in the Authentication with NextAuth guide.

12.2 Where to Store the Token

Three options:

Storage	Survives reload?	Survives tab close?	Risk
In-memory variable	No	No	Lowest — token never written to disk or persisted
`localStorage`	Yes	Yes	XSS — any script on the page can read it
HttpOnly cookie	Yes	Yes	Lowest — JavaScript cannot read it; CSRF concerns instead

The course default for the React/Next.js portion is **HttpOnly cookies**, managed automatically by NextAuth. You won't write `localStorage.setItem("token", ...)` directly in production code — that's the path that gets hacked. The auth-concepts reading covers the trade-offs in depth.

12.3 Attaching the Token to Every Request

If you have the token as a string, attach it explicitly:

```
const token = await getToken(); // implementation depends on storage choice

const response = await apiFetch<Message[]>("/messages", {
  headers: {
    "Authorization": `Bearer ${token}`,
  },
});
```

Or extend the `apiFetch` helper to attach it automatically:

```
export async function authedFetch<T>(
  url: string,
  options: RequestInit = {},
): Promise<T> {
  const token = await getToken();
  return apiFetch<T>(url, {
    ...options,
    headers: {
      ...options.headers,
      "Authorization": `Bearer ${token}`,
```

```
    },
  });
}
```

12.4 Handling 401 Unauthorized

A 401 means "your token is missing, expired, or invalid." The user has to sign in again (or refresh the token, which NextAuth handles in Week 7). For now, the simplest reaction:

```
try {
  const data = await authedFetch<Message[]>("/messages");
} catch (err) {
  const message = (err as Error).message;
  if (message.startsWith("401")) {
    window.location.href = "/login";
    return;
  }
  throw err;
}
```

In Week 7, NextAuth replaces this manual handling with built-in session-expiry logic.

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13 Try It Yourself — Talking to Your Sprint 2/3 Backend

Build a single-page CRUD UI against your own deployed back-end. No frameworks, no build step — `index.html` and `app.ts` only.

Setup

1. Create a folder `crud-demo/`.
2. Create `index.html` and `app.ts` inside it.
3. Compile `app.ts` to `app.js` with `tsc app.ts` (or skip TS and use `app.js` directly while learning).
4. Serve with `npx serve` so you're on `http://localhost:3000` and not `file://` (CORS won't work from `file://`).

`index.html`

```
<!doctype html>
<html lang="en">
  <head>
```

```
    <meta charset="utf-8" />
    <title>CRUD Demo</title>
  </head>
  <body>
    <h1>Messages</h1>

    <form id="new-message-form">
      <input id="text" type="text" placeholder="Message" required />
      <button type="submit">Add</button>
    </form>

    <ul id="messages"></ul>

    <p id="status"></p>

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

app.ts

```
const API_BASE = "https://your-app.onrender.com"; // replace with your URL

interface Message {
  id: number;
  text: string;
}

async function apiFetch<T>(
  url: string,
  options: RequestInit = {},
): Promise<T> {
  const response = await fetch(url, {
    ...options,
    headers: { "Content-Type": "application/json", ...options.headers },
  });
  if (!response.ok) {
    throw new Error(`${response.status} ${response.statusText}`);
  }
  if (response.status === 204) return undefined as T;
  return (await response.json()) as T;
}

const list = document.querySelector<HTMLUListElement>("#messages")!;
const form = document.querySelector<HTMLFormElement>("#new-message-form")!;
const input = document.querySelector<HTMLInputElement>("#text")!;
const status = document.querySelector<HTMLParagraphElement>("#status")!;

async function refresh(): Promise<void> {
  status.textContent = "Loading...";
  try {
    const messages = await apiFetch<Message[]>(`${API_BASE}/messages`);
    list.innerHTML = "";
    for (const m of messages) {
      const li = document.createElement("li");
      li.textContent = m.text;
```

```
      const del = document.createElement("button");
      del.textContent = "Delete";
      del.addEventListener("click", async () => {
        await apiFetch<void>(`${API_BASE}/messages/${m.id}`, {
          method: "DELETE",
        });
        await refresh();
      });

      li.appendChild(del);
      list.appendChild(li);
    }
    status.textContent = "";
  } catch (err) {
    status.textContent = `Error: ${(err as Error).message}`;
  }
}

form.addEventListener("submit", async (e) => {
  e.preventDefault();
  await apiFetch<Message>(`${API_BASE}/messages`, {
    method: "POST",
    body: JSON.stringify({ text: input.value }),
  });
  input.value = "";
  await refresh();
});

refresh();
```

Adapt the endpoint paths (`/messages` , `/items` , `/notes` , whatever your back-end uses) to match your own routes. The shape of the code stays the same.

Bonus: add a hard-coded bearer token at the top and hit a protected route:

```
const TOKEN = "eyJhbGciOiJSUzI1NiIs..."; // from the Token Playground

await apiFetch<Message[]>(`${API_BASE}/protected/messages`, {
  headers: { "Authorization": `Bearer ${TOKEN}` },
});
```

This is exactly what NextAuth does for you in Week 7 — the only difference is who manages the token's lifecycle.

---

14 Common Mistakes

A focused list of the bugs students hit most often. If your fetch isn't working, this list catches ~80% of cases.

14.1 Forgetting `await` on `response.json()`

```
// WRONG
const data = response.json();
console.log(data); // Promise { <pending> }

// RIGHT
const data = await response.json();
```

14.2 Not Checking `response.ok`

The response promise resolves on 404 and 500. Without an `ok` check, your code happily parses the error JSON as if it were the success shape, then renders `undefined` everywhere. See Section 8.

14.3 Sending an Object Instead of a String

```
// WRONG — fetch can't serialize an object as the body
fetch(url, { method: "POST", body: payload });

// RIGHT
fetch(url, { method: "POST", body: JSON.stringify(payload) });
```

14.4 Forgetting `Content-Type: application/json`

If the header is missing, Express's `express.json()` middleware does not parse the body. `request.body` is empty, your validation fails, and you get a confusing 400. Always send the header on JSON POSTs/PUTs.

14.5 CORS Works in Dev, Breaks in Prod

Dev often colocates origins or uses `cors()` with no allowlist. Prod has separate origins on Vercel and Render. Add the prod front-end origin to the back-end's CORS allowlist *and redeploy the back-end*. See Section 9.

14.6 Serving `index.html` via `file://`

Opening `index.html` directly in the browser uses the `file://` protocol. CORS is stricter on `file://`, `localStorage` may behave oddly, and modules don't load. Always serve via a real dev server: `npx serve`, Vite, or Next.js's `npm run dev`.

14.7 Using `==` Instead of `===`

```
if (response.status == 200) { ... }   // works, but...
if (response.status === 200) { ... }  // always use this
```

`==` does type coercion with surprising rules. `===` is strict equality. The TypeScript-Fundamentals guide series covers this; in fetch code, defaulting to `===` avoids one whole category of bug.

---

15 Looking Ahead

Everything in this guide is reused — usually with a thin framework wrapper — by every subsequent front-end guide:

- **React Fundamentals** — `fetch` moves inside `useEffect`, the loading/data/error state object becomes three `useState` calls (or a reducer). The patterns are identical; the React-specific overlay is *when* the fetch runs and how cleanup works on unmount.
- **Next.js** — Server Components let you `await fetch(url)` directly in the component body. Because the request runs on the server, **CORS does not apply** for server-side fetches. Client Components still use the `useEffect` + `fetch` pattern from React Fundamentals.
- **Auth with NextAuth** — the bearer token attached manually here gets pulled from `useSession()` (client) or `await auth()` (server) and attached automatically. The `apiFetch` helper grows an auth-aware sibling.

The Week 5 auth concepts reading covers the deeper question of *where* the token lives and *why* HttpOnly cookies beat `localStorage` for production. This guide deliberately stays mechanical — once you know how `fetch` and the `Authorization` header work, the auth concepts reading and the NextAuth guide are about applying that knowledge under real threat models.

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16 Summary

Concept	Key Point
`fetch(url)`	The browser primitive. Returns `Promise<Response>`.

Concept	Key Point
Two `await`s	One for the headers (`fetch`), one for the body (`response.json()`).
`method`, `headers`, `body`	The three options you'll set. `body` must be a string — use `JSON.stringify`.
`Content-Type: application/json`	Required on JSON POSTs/PUTs/PATCHes. Missing it breaks `express.json()`.
`Authorization: Bearer <token>`	The header that carries the JWT to protected back-end routes.
`response.ok`	`true` only for 2xx. **`fetch` does not throw on 4xx/5xx.** Always check.
`response.json()` is async	Forgetting the second `await` gives you a `Promise`, not data.
CORS	Same-origin policy blocks cross-origin reads unless the server opts in via `Access-Control-Allow-Origin`. Server's problem to fix.
Preflight `OPTIONS`	JSON requests, `PUT` / `DELETE` / `PATCH`, and custom headers all trigger an extra `OPTIONS` request. Handled by `cors()` middleware.
`apiFetch<T>` helper	The reusable wrapper — `Content-Type` header, `response.ok` check, generic typing. Use it everywhere.
`AbortController`	Cancels in-flight `fetch` calls. Used in React `useEffect` cleanup.
Loading/data/error state	Use one state object, not three independent variables.
DevTools Network tab	Open it. Always. "Copy as cURL" is the best debugging trick on the platform.

17 References

Official Documentation:

- MDN — Using the Fetch API — the canonical `fetch` reference
- MDN — Response.ok — the property that decides success
- MDN — Cross-Origin Resource Sharing (CORS) — the full CORS specification, in tutorial form
- MDN — Preflight request — what triggers `OPTIONS` and what the server must answer
- MDN — AbortController — cancelling in-flight requests
- Express `cors` middleware — the npm package and its options
- OWASP — Cross-Origin Resource Sharing Cheat Sheet — security-focused CORS guidance

Course Cross-References:

- HTML, CSS & the DOM — the previous guide; assumed knowledge
- Routing & Middleware (Express `cors()`) — the back-end side of CORS
- React Fundamentals — these patterns adapted to React
- Next.js — server-side fetches, no CORS
- Auth with NextAuth — bearer tokens via session
- Week 5 — Auth Concepts — token storage trade-offs

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18 Further Reading

External Resources

- Jake Archibald — That's so fetch! — older but still excellent on the design rationale of `fetch`
- web.dev — Introduction to fetch() — Google's tutorial-style intro
- Chrome DevTools — Network features reference — every column, every filter, every panel
- HTTP Status Code Reference — when in doubt, look up what 422 actually means
- Auth.js (NextAuth) docs — the production-grade place for tokens, sessions, and OAuth flows

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