Class 23: Asynchronous Client-Side HTTP Requests

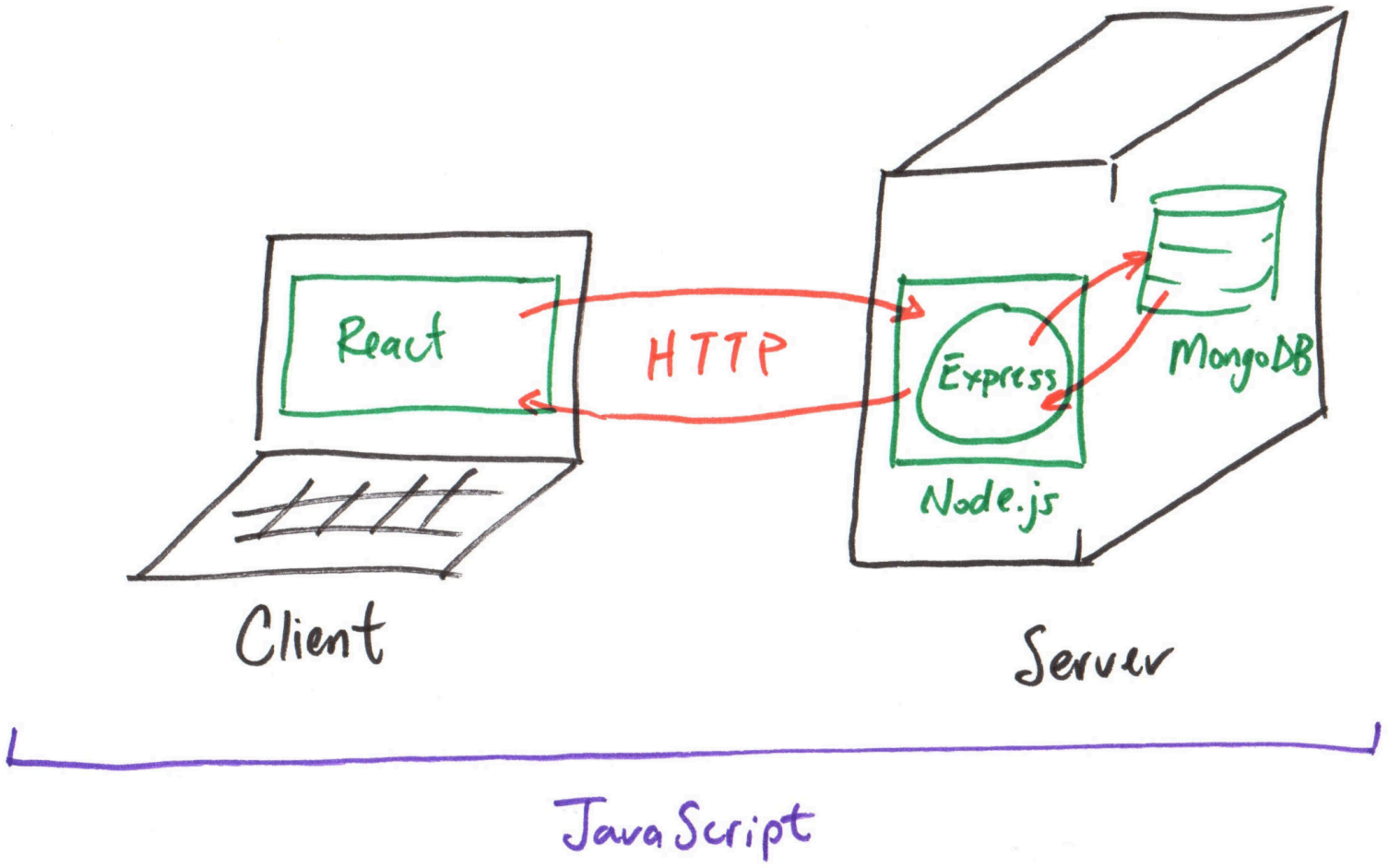
- Review: REST API Security Best Practices
- Client-Side HTTP Requests
- Asynchronous Request UX Design Patterns

Review

REST API Security Best Practices

- Keep all Node.js packages up to date (especially Express.js and MongoDB).
- Serve your API over HTTPS (not HTTP) using a TLS certificate.
- Never trust user input. Always validate and sanitize input on the server side.
- Employ HTTP security-related response headers.
- Reduce server software identifying information in HTTP response headers.
- Require authentication for privileged operations or private resources.
- Rate limit API requests to prevent abuse and denial-of-service attacks.

Review: MERN Stack



Client-Side HTTP Requests

Asynchronous Client-Side HTTP Requests

The old way:

```
getXMLHttpRequest("/api/endpoint", (error, data) => {
  if (error) {
    console.error("Error:", error);
  } else {
    console.log(data);
  }
});
```

Asynchronous Client-Side HTTP Requests

The new way:

```
fetch("/api/endpoint")
  .then((response) => response.json())
  .then((data) => {
    console.log(data);
  })
  .catch((error) => {
    console.error("Error:", error);
  });
```

The **axios** way:

```
axios.get("/api/endpoint")
  .then((response) => {
    console.log(response.data);
  })
  .catch((error) => {
    console.error("Error:", error);
  });
```

(Automatically parses JSON response data.)

Axios

A promise-based HTTP client for the browser and Node.js.

Compared to the built-in `fetch` API, Axios provides:

- Automatic JSON data transformation.
- Intercepting requests and responses.
- Request cancellation.

Activity: Getting Started with Axios

As a class, let's try making some requests with Axios.

1. Install Axios.
2. Create a test script: `client/test-http.mjs`
3. Define the base URL.
4. Make a GET request:

```
const response = await axios.get("/api/produce")
console.log(response.data)
```

Gotcha: React HTTP Requests Cannot `await`

React does not permit `await` at the top level of a component.
Instead, you must use a **promise fulfillment callback:** `.then()`

No (`await`)

```
const response =
  await axios.get("/api/produce")

console.log(response.data)
```

Yes (`.then()`)

```
axios.get("/api/produce")
  .then((response) => {
    console.log(response.data);
  })
```

Promise Fulfillment Callbacks

A promise is an object that represents the eventual completion (or failure) of an asynchronous operation (and its resulting value).

`get()` returns a **promise**

```
axios.get("/api/produce")
  .then((response) => {
    console.log(response.data);
  })
```

`.then()` is a method that takes a callback function to handle the resolved value of the promise.

Activity: Async HTTP with Promises

Update your `test-http.mjs` script to use promise fulfillment callbacks instead of `await`.

```
axios.get("/api/produce")
  .then((response) => {
    console.log(response.data);
  })
```

Error Handling with Axios

```
axios.get("/api/produce")
  .then((response) => {
    console.log(response.data);
  })
  .catch((error) => {
    console.error("Error:", error);
  })
  .finally(() => {
    console.log("Request completed.");
  })
```

- `.then()` handles successful responses.
- `.catch()` handles errors.
- `.finally()` executes code after the request completes, regardless of success **or** failure.

Query Parameters with Axios

The `config` object can include a `params` property to specify query parameters.

```
{
  params: {
    category: "fruit"
  }
}
```

```
axios.get("/api/produce", {
  params: {
    category: "fruit"
  }
})
  .then((response) => {
  })
  .catch((error) => {
  })
  .finally(() => {
  })
```

Activity: Query Parameters with Axios

Update your `test-http.mjs` script to include query parameters in your request.

```
axios.get("/api/produce", {
  params: {
    category: "fruit"
  }
})
```

HTTP Requests in React

Gotcha: Rendering Asynchronous Data in React

When making HTTP requests in a React component, you cannot directly use `await` or `.then()` in the component body.

No! (`await`)

```
export default function App() {
  const response =
    await axios.get("/api/produce");

  ...
}
```

No! (`.then()`)

```
export default function App() {
  axios.get("/api/produce")
    .then((response) => {
      console.log(response.data);
    });

  ...
}
```

Side Effect Hook

A **side effect** is any operation that interacts with the outside world (e.g., making an HTTP request, manipulating the DOM, setting up a timer).

```
import { useEffect } from "react"

export default function App() {
  useEffect(() => {
    // Side effect code (e.g., HTTP request) goes here
  }, [])

  ...
}
```

Activity: HTTP Requests in React

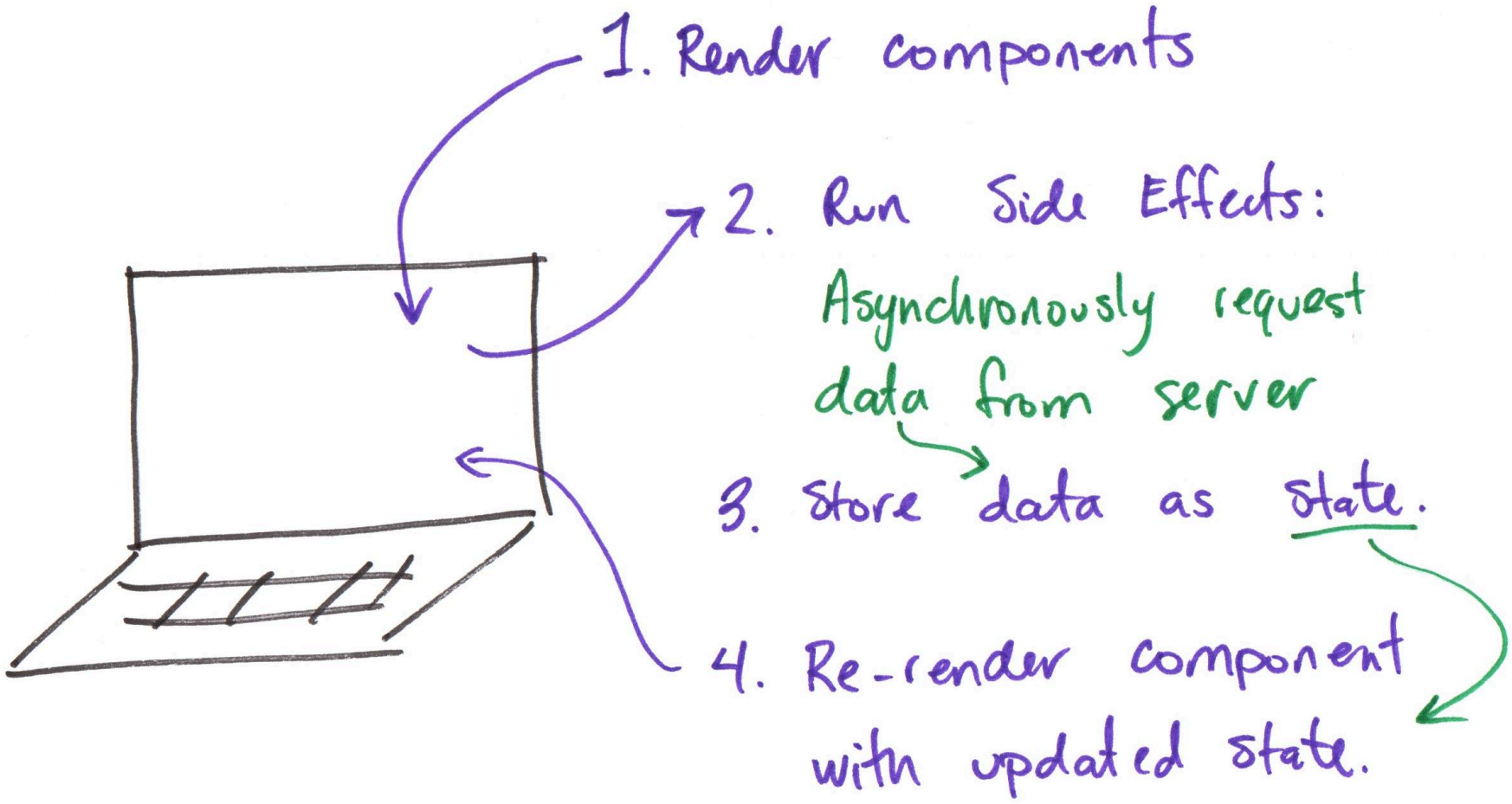
Working with your peers (2-4), update the `App` component to asynchronously fetch the `produce` collection data **on your handout**.

```
import { useEffect } from "react"

export default function App() {
  useEffect(() => {
    // Side effect code (e.g., HTTP request) goes here
  }, [])

  ...
}
```

Big Picture: Rendering Asynchronous Data in React



Gotcha: Event Handlers Don't Use Side Effects

Event handlers (e.g., `onClick`) run outside of React's rendering process. Therefore, you can use `.then()` directly in an event handler.

```
<button onClick={() => {
  axios.get("/api/produce")
    .then((response) => {
      console.log(response.data);
    });
}}>
  Fetch Produce
</button>
```

Asynchronous Request UX Design

Asynchronous Request UX Design

Design considerations:

- What is the user experience when the **data is loading**?
  (i.e. pending)
- What is the user experience when the **data fails to load**?
  (i.e. rejected)
- What is the user experience when the **data successfully loads**?
  (i.e. fulfilled)

Activity: Asynchronous Design Patterns

Working with your peers (2-4), design the user experience for the three states of an asynchronous HTTP request in React **at the board**:

- What is the user experience when the **data is loading**? (i.e. pending)
- What is the user experience when the **data fails to load**? (i.e. rejected)
- What is the user experience when the **data successfully loads**? (i.e. fulfilled)

Discussion: Asynchronous Design Patterns

1. When data is **pending**, show a loading indicator.
    - indeterminate loading indicator
    - skeleton
2. When data is **rejected**, show an error message with a retry option.
3. When data is **fulfilled**, show the data in the UI.

Summary

Summary

- Asynchronous HTTP requests can be made using the `fetch` API or the `axios` library.
- In React, do not use `await` or `.then()` directly in the component body.
- The `useEffect` hook is used to perform side effects (e.g., HTTP requests) in React components.
- `useEffect` is not used for event handlers; you can use `.then()` directly in an event handler.
- Design the user experience for pending, rejected, and fulfilled states of asynchronous requests.

What's Next

Wednesday: Side Effects + Asynchronous UX Design Patterns

Project 2, Final Milestone released