Using REST APIs

Course: Java

S1

Asynchronous HTTP in the browser changed everything.

Asynchronous HTTP

Before it was available, browsers fully reloaded their view each time a data interaction was required.

- Many UI events required a GET or POST that delivered a completely new HTML payload.
- The browser's JavaScript couldn't take advantage of its asynchronous nature.
- The HTML in a new view might just slightly differ from the original document.
- It was a waste of bandwidth.

Worse, it could be slow.

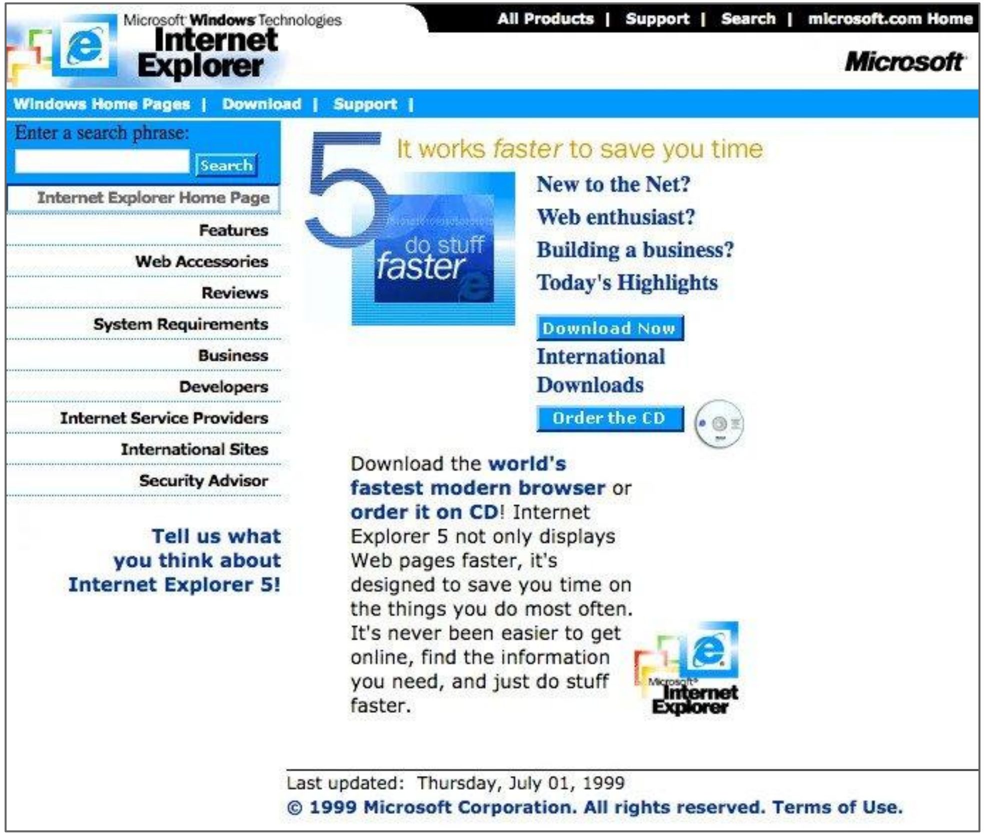
Depending on the network and HTTP server load, editing a single field could make the browser lock up and just...wait.

Asynchronous HTTP (continued)

Microsoft introduced asynchronous HTTP in 1999 with XMLHttpRequest.

The industry recognized a good thing.

But, it took another full decade before asynchronous responses were common and reliable.



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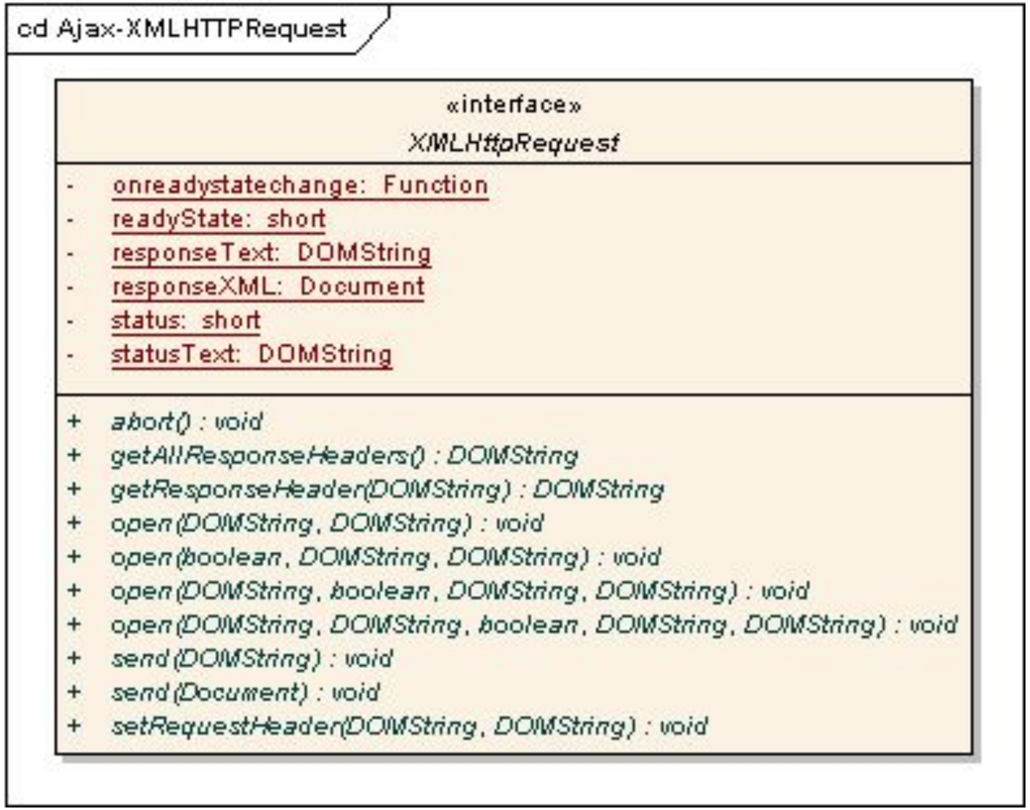


```
cd Ajax-XMLHTTPRequest

«interface»
XMLHttpRequest

-  onreadystatechange:  Function
-  readyState:  short
-  responseText:  DOMString
-  responseXML:  Document
-  status:  short
-  statusText:  DOMString

+  abort() : void
+  getAllResponseHeaders() : DOMString
+  getResponseHeader(DOMString) : DOMString
+  open(DOMString, DOMString) : void
+  open(boolean, DOMString, DOMString) : void
+  open(DOMString, boolean, DOMString, DOMString) : void
+  open(DOMString, DOMString, boolean, DOMString, DOMString) : void
+  send(DOMString) : void
+  send(Document) : void
+  setRequestHeader(DOMString, DOMString) : void
```

Asynchronous HTTP (continued)

React takes full advantage of JavaScript’s asynchronous features.

- It’s possible to build an entire application with a single synchronous request (and many asynchronous requests).
- Async responses require us to think differently.
- We can’t rely on data if we don't know when it will arrive.
- React’s `useEffect` hook is one possible tool for async problem solving.

Learning Outcomes

By the end of this lesson, you will be able to:

01 Use `useEffect` to fetch initial state from a back-end service.

02 Send GET, POST, PUT, and DELETE `fetch` requests.

03 On `fetch` success, update state to the appropriate values.

04 Handle `fetch` failures.

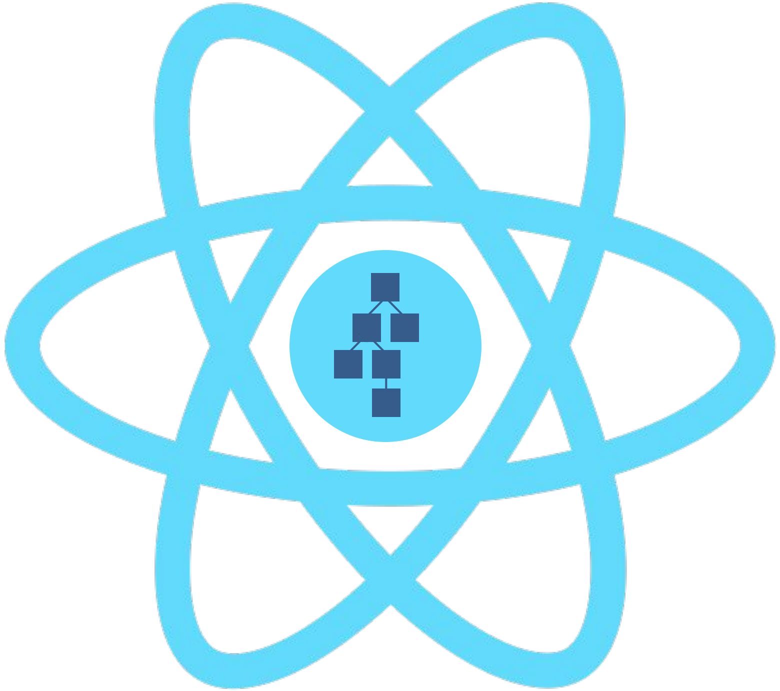
Fetch

React and DOM Updates

Before we talk about asynchronous HTTP, we need to understand how React thinks about the DOM.

React prefers that:

- We never use the DOM API directly.
- We build JSX expressions based on state.
- State updates are predictable.



Side Effects

It's possible this code will work, but it's full of side effects.

A **side effect** is something outside of the React pipeline.

In the first case, we're manipulating the DOM directly.

In the second, we're populating state from scratch every time the component renders.

`fetch` will run again and again any time the parent's props change or state changes. The code might work, but it's an infinite loop of data fetches.

```
function DomModifier() {

    const [state, setState] = useState([]);

    // Not great: direct DOM manipulation
    const div = document.createElement("div");
    div.textContent = `New div created: ${new Date()}.`
    document.querySelector("#target").appendChild(div);

    // Not great: Runs every time the component
    // renders, not just once.
    fetch(url)
        .then(response => response.json())
        .then(result => setState(result));

    return (
        <>
            <h1>I modify the DOM.</h1>
            <div>State: {state}</div>
            <div id="target"></div>
        </>
    );
}
```

useEffect

The `useEffect` hook manages side effects.

It lets React know to expect a side effect.

It follows the hook rules.

Warning! This is only an example. We still should never modify the DOM directly.

```
function DomModifier() {

    const [clicks, setClicks] = useState(0);

    useEffect(() => {
        const div = document.createElement("div");
        div.textContent = `New div created: ${new Date()}.`
        document.body.appendChild(div);
    }, [clicks]);

    return (
        <>
            <h1>I modify the DOM.</h1>
            <button onClick={() => setClicks(clicks + 1)}>
                Clicks: {clicks}
            </button>
        </>
    );
}
```

useEffect Arguments

Our use of the `useEffect` hook is pretty limited. We only ever initialize state with `fetch`. The second argument is always `[ ]`.

The first argument is a callback function that may cause a side effect.

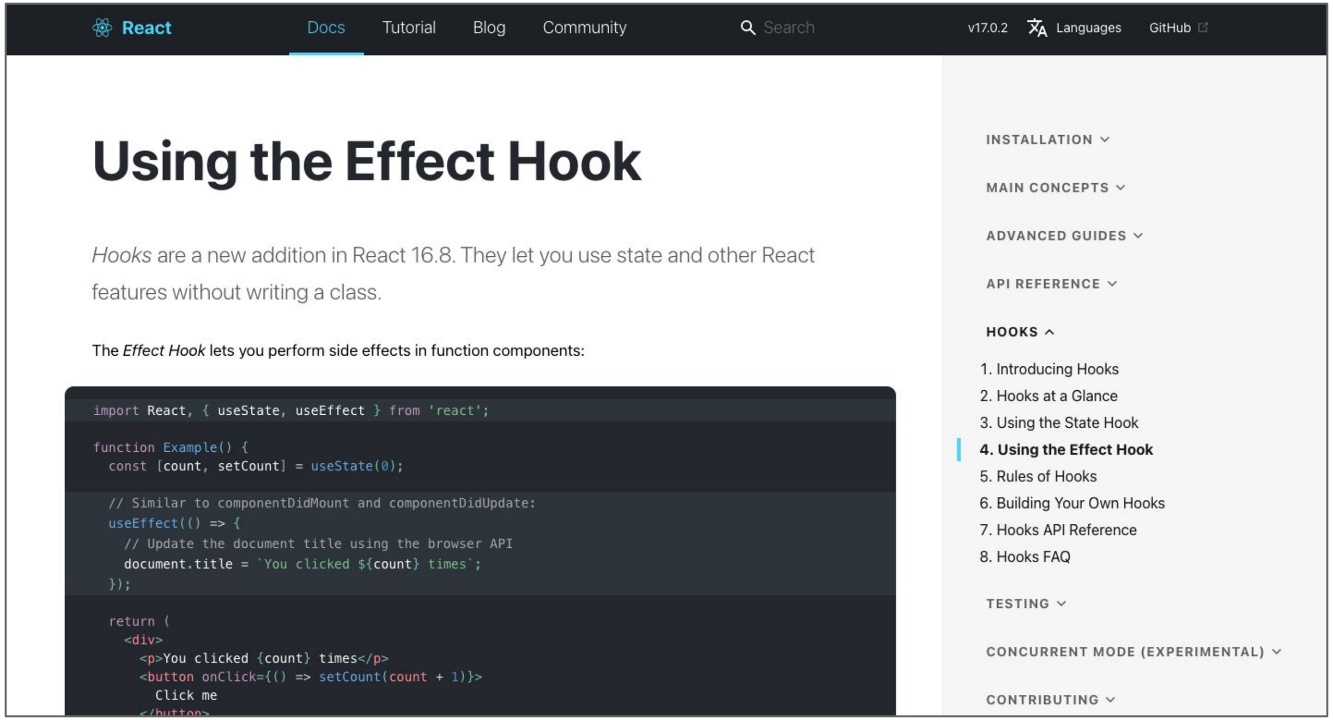
The second is an array of state variables.

- A change of a variable in the array executes the callback.
- Omitting the array executes the callback on every render.
- An empty array only executes the callback once.

```
// first: a callback
// second: array of state whose
// change triggers the callback
useEffect(() => {
    // do work
}, [state1, state2, stateN]);

// executes once
useEffect(() => {
}, []);

// executes on every render
useEffect(() => {
});
```

useEffect Arguments (continued)

Let's review the `document.title` example from React's useEffect docs.



Using the Effect Hook

Hooks are a new addition in React 16.8. They let you use state and other React features without writing a class.

The *Effect Hook* lets you perform side effects in function components:

```
import React, { useState, useEffect } from 'react';

function Example() {
  const [count, setCount] = useState(0);

  // Similar to componentDidMount and componentDidUpdate:
  useEffect(() => {
    // Update the document title using the browser API
    document.title = `You clicked ${count} times`;
  });

  return (
    <div>
      <p>You clicked {count} times</p>
      <button onClick={() => setCount(count + 1)}>
        Click me
      </button>
```

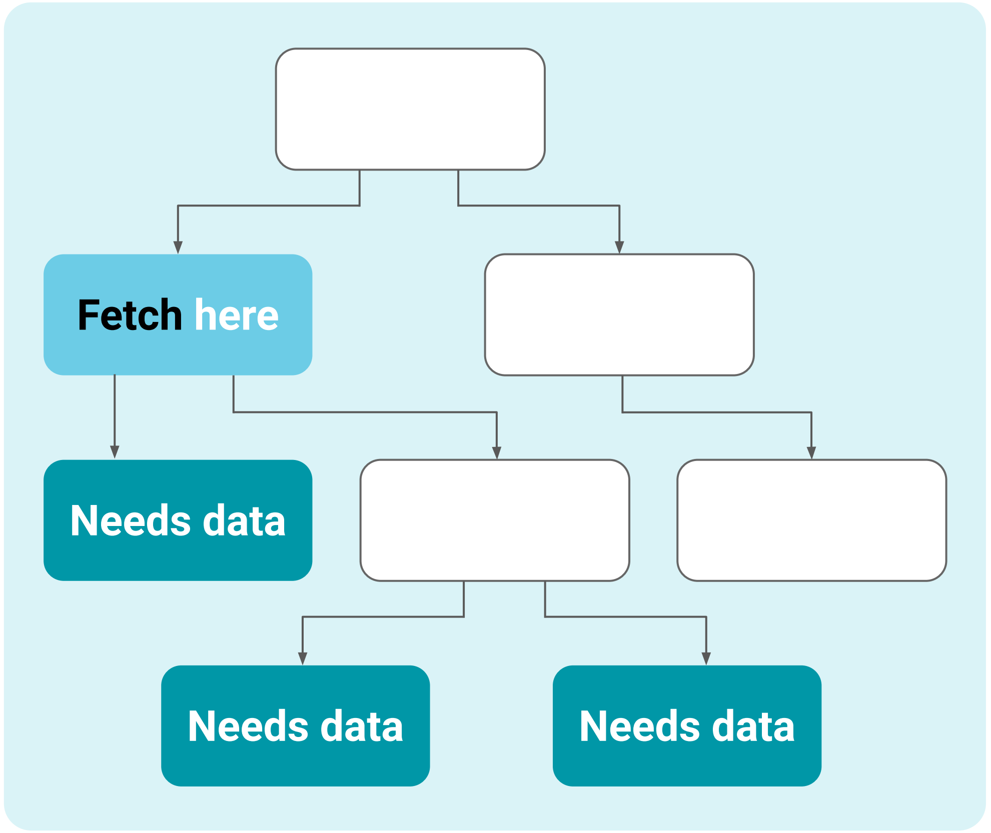
Fetching Initial State

- Use the `useEffect` hook with an empty state array to `fetch` data once and only once.
- It's also possible to force additional data `fetch`es by adding a state trigger, such as `(useEffect(() => {}, [forceRefresh]);`.
- Never omit the second argument, or your `fetch` will happen again and again.

```
const [todos, setTodos] = useState([]);
const [waiting, setWaiting] = useState(true);

// executes only once
useEffect(() => {
    fetch("http://localhost:8080/api/todo")
        .then(response => response.json())
        .then(result => {
            setTodos(result);
            setWaiting(false);
        })
        .catch(console.log);
}, []);
```

Where to Fetch Initial Data

- Components have a hierarchy.
- We want to share data with all components that need it instead of tracking independent state.
- Fetch initial data in the first common ancestor.



Create, Update, and Delete

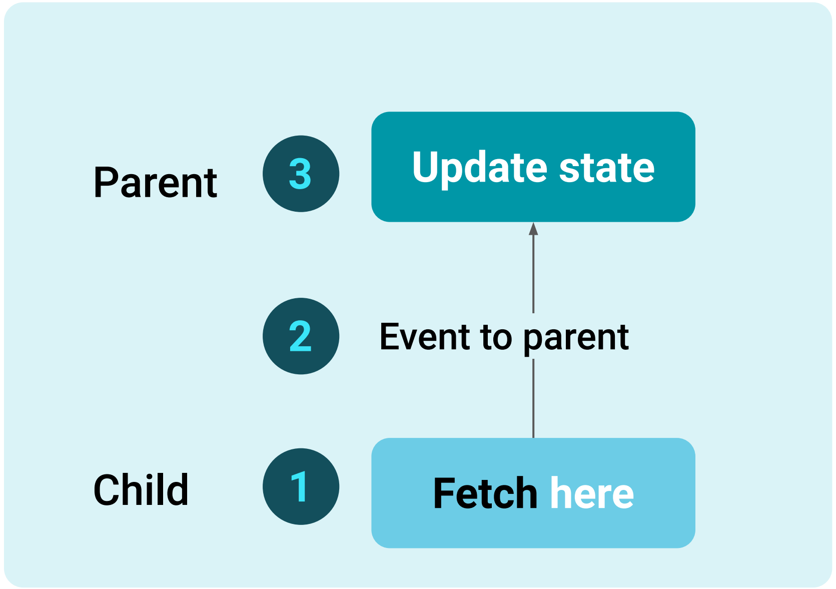
- Other CRUD operations should be protected with a function.
- `fetch` only fails on a network failure, so it's important to check the expected status.
- On failure or bad status, acknowledge this in the UI.
- On success, update state.

```
function add(todo) {

    const init = {
        method: "POST",
        headers: {
            "Content-Type": "application/json",
            "Accept": "application/json"
        },
        body: JSON.stringify(todo)
    };

    fetch("http://localhost:8080/api/todo", init)
        .then(response => {
            if (response.status === 201) {
                return response.json();
            }
            // could check other statuses...
            return Promise.reject("ToDo was not created.");
        })
        .then(result => setTodos([...todos, result]))
        .catch(console.log)
        .finally(() => setWaiting(false));
}
```

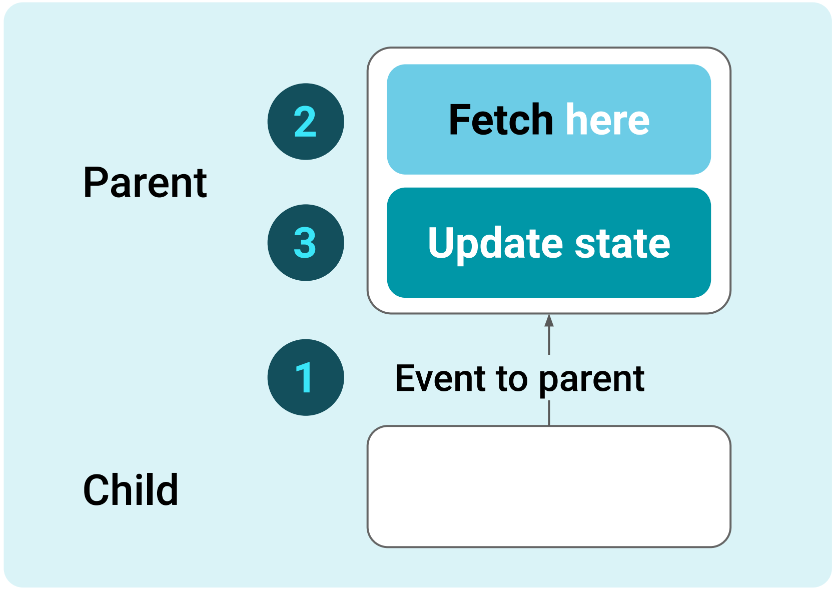
Where to Create, Update, or Delete

Two options exist, but most teams prefer one or the other.

POST, PUT, DELETE in the child; execute the parent's callback; the parent updates state.



Execute the parent's callback; POST, PUT, DELETE in the parent; the parent updates state.



Break

Fetch Activities

Time to Code

ToDo with a REST API Walkthrough

Suggested Time:

30 Minutes

Questions?

Activity: Paranormal Investigator

Suggested Time:

60 Minutes

Time’s Up! Let’s Review.

Questions?

RECAP

Recap

Recap questions:

- What is a side effect in React? (What is a side effect in other programming?)
- What problem does the `useEffect` function solve?
- What are `useEffect`'s arguments?
- What happens if we don't put our initial `fetch` inside of `useEffect`?
- Where is the correct place to put `fetch` GET, POST, PUT, and DELETE operations?
- When does the `fetch` promise resolve in relation to the current component's render?

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The End