React & Single Page Apps

Frontend Programming

Purpose

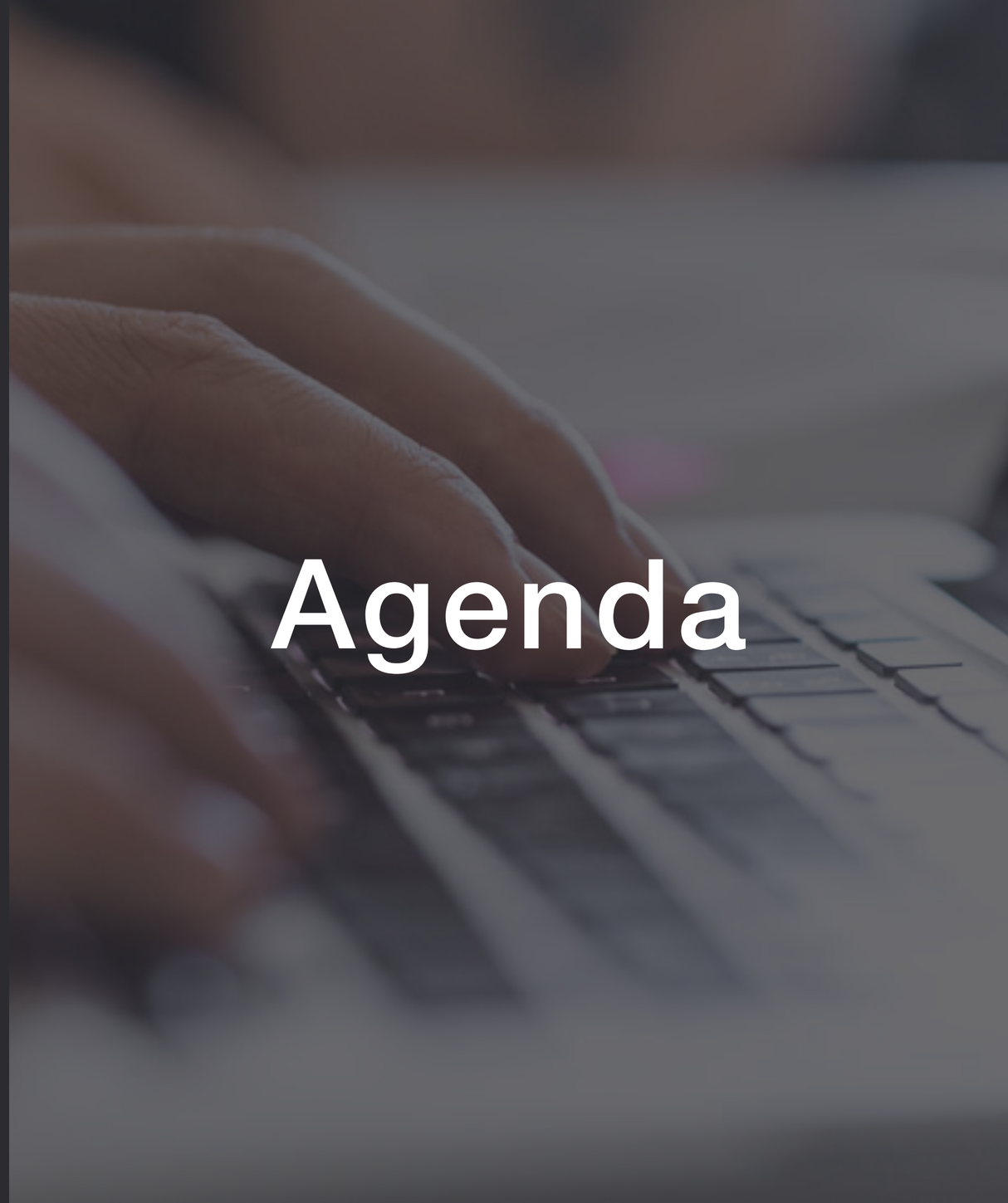
Wrap up some JS Basics

Introduce you to React & React Basics

Single Page Apps & Routing

Agenda

- Recap on JS Basics
- Introduction to React
- Thinking in React
- Single Page Apps & React Router



- Array.map(...)
- JS Fetch Posts
- Your First React App
- Component Page Layout
- Add Props
- Tryout useState
- React Fetch Posts

JS & React Fun

RACE, slow down, please!

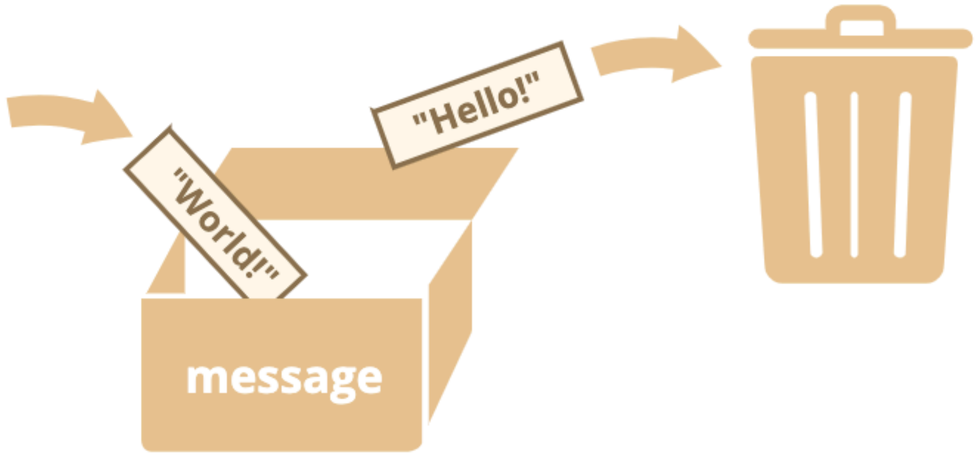
HTML & CSS Basics, CSS Layouts, Grids & Flexbox, Selectors
Variables, Objects, Arrays, Loops, Functions, DOM-
Manipulation, Template String, ES6+ Features, fetch, API, JSON,
Web Apps, Single Page Apps, Routing, CRUD, Forms & Events

Recap On

Variables, Objects, Arrays & Array Methods, Loops, Functions, DOM-Manipulation, Template String & Fetch

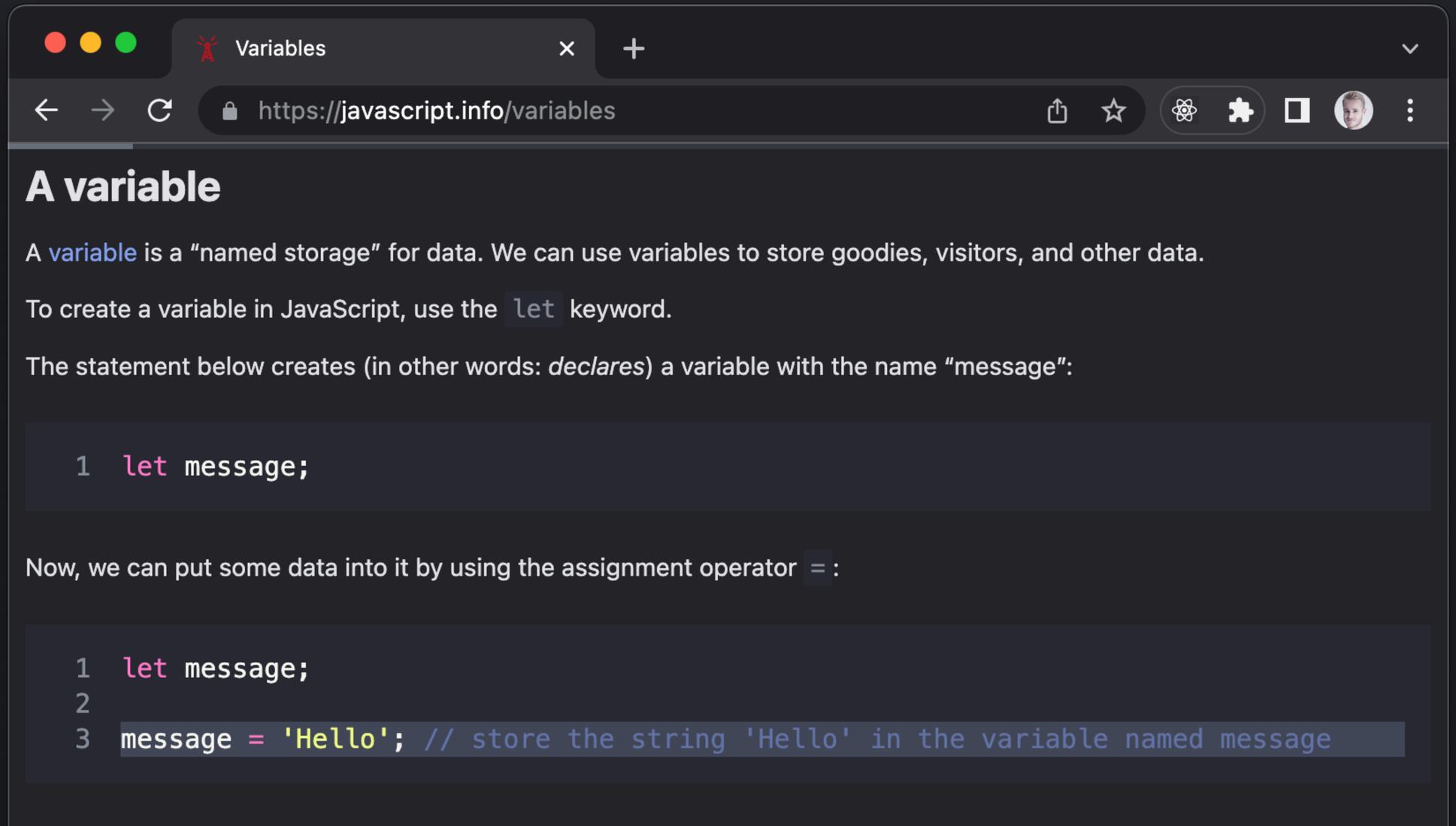
VARIABLE

A variable is a “named storage” and stored in the memory of the browser.



We can change the value of the variables as many times as we want.

JavaScript.info/Variables



CONST

Const is an unchanging variable.

```
const myBirthday = "12-03-1990";
myBirthday = "12-03-1989";
// Uncaught TypeError: can't reassign the constant!
```

`const` cannot be reassigned.

If you try to, an `error` will be thrown.

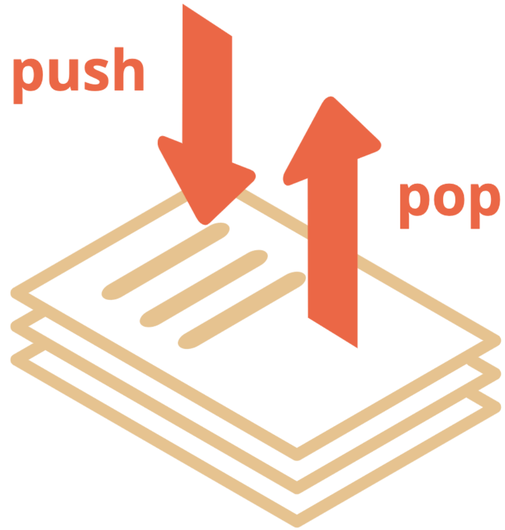
OBJECTS

Objects are used to store keyed collections of various data

Containers for named values called properties. A property is a “`key: value`” pair

ARRAYS

Arrays are ordered collections



An array is a way to hold more than one value at a time we have a 1st, a 2nd, a 3rd, a 4th element and so on.

Array Methods to know

.push(…)

.map(…)

.filter(…)

.find(…)

.sort(…)

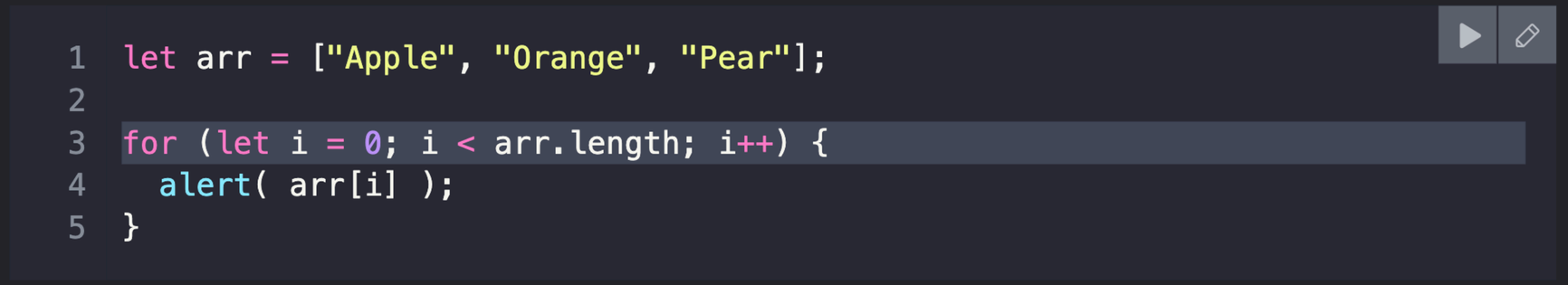
Computer science student

Senior developer, 10+ years experience

https://www.instagram.com/p/BxWAgatgSmn/

JavaScript.info/array#loops

One of the oldest ways to cycle array items is the `for` loop over indexes:



```
let arr = ["Apple", "Orange", "Pear"];

for (let i = 0; i < arr.length; i++) {
  alert( arr[i] );
}
```

But for arrays there is another form of loop, `for..of`:

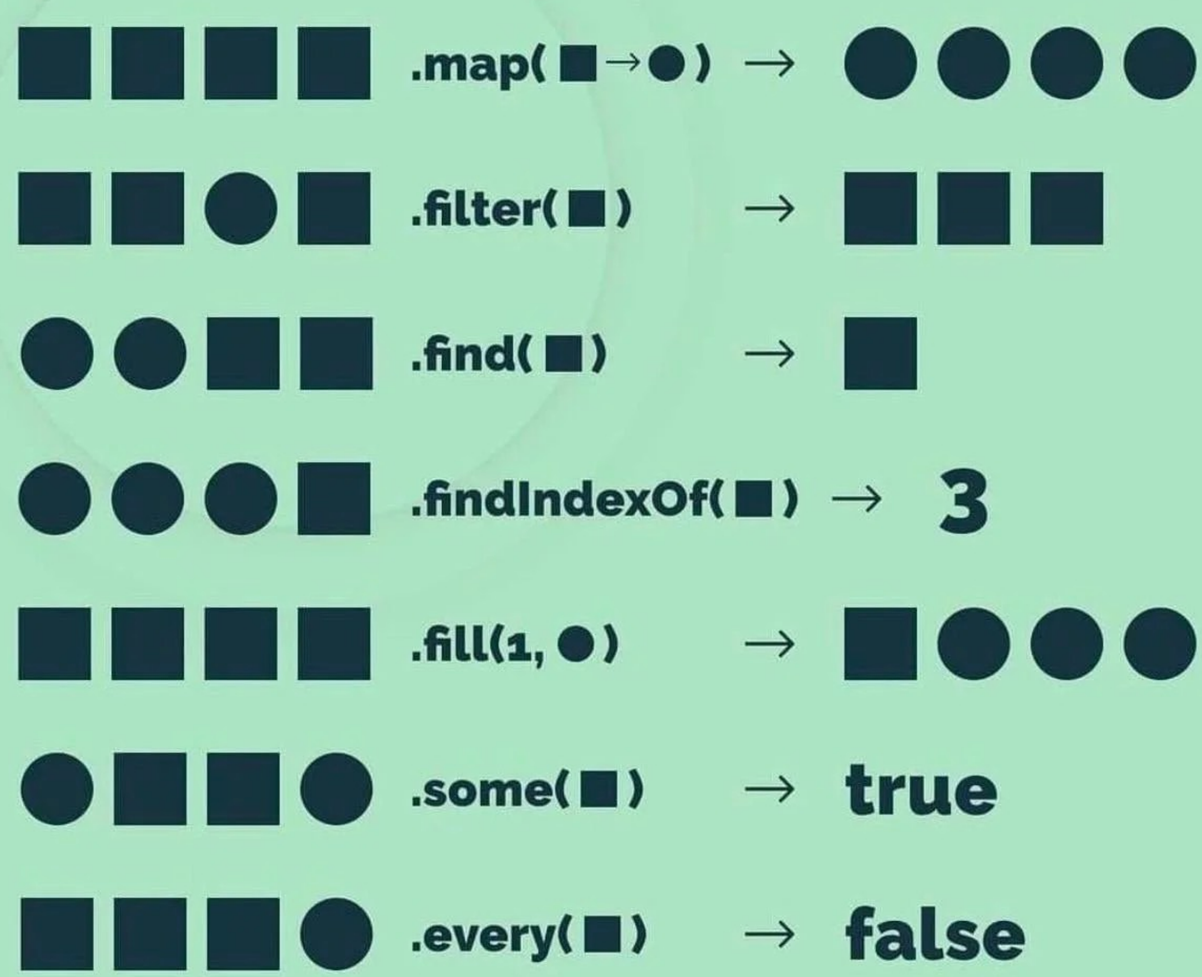
```
let fruits = ["Apple", "Orange", "Plum"];

// iterates over array elements
for (let fruit of fruits) {
  alert( fruit );
}
```

Array.map(...)

...iterate over an array and modify each element.
Array.map(...) calls a callback function for each element in the array.

```
const persons = [
    { firstname: "Birgitte", lastname: "Iversen" },
    { firstname: "Lykke", lastname: "Dahlen" },
    { firstname: "Rasmus", lastname: "Cederdorff" }
];

const mapped = persons.map(person => {
    return {
        name: `${person.firstname} ${person.lastname}`
    };
});

console.log(mapped);
```

```
▼ (3) [{…}, {…}, {…}] i
  ▶ 0: {name: 'Birgitte Iversen'}
  ▶ 1: {name: 'Lykke Dahlen'}
  ▶ 2: {name: 'Rasmus Cederdorff'}
    length: 3
```



https://javascript.info/array-methods
https://medium.com/@mandeepkaur1/a-list-of-javascript-array-methods-145d09dd19a0

Array.map(...)

- Project template: `array-map`
- Use `.map` to map over the `persons` array and concatenate `firstName` and `lastName` to a new property called `name`.
- `console.log()` the result
- Add a property called `birthYear` for each `person` object. Use `map` to map over the array and add the property `birthYear` dynamically based on `birthDate` (hint: use `String.split(…)` or `.slice(…)`).

```
const persons = [
    {
        firstName: "Jane",
        lastName: "Doe",
        birthDate: "1992-03-04"
    },
    {
        firstName: "Jens",
        lastName: "Jensen",
        birthDate: "1992-07-04"
    },
    {
        firstName: "Birgitte",
        lastName: "Iversen",
        birthDate: "1990-10-04"
    },
    {
        firstName: "Lykke",
        lastName: "Dahlen",
        birthDate: "1987-06-04"
    },
    {
        firstName: "Kasper",
        lastName: "Topp",
        birthDate: "1989-03-07"
    }
];

const result = persons.map(person => {
    console.log(person);
    // manipulate and return value
});
```

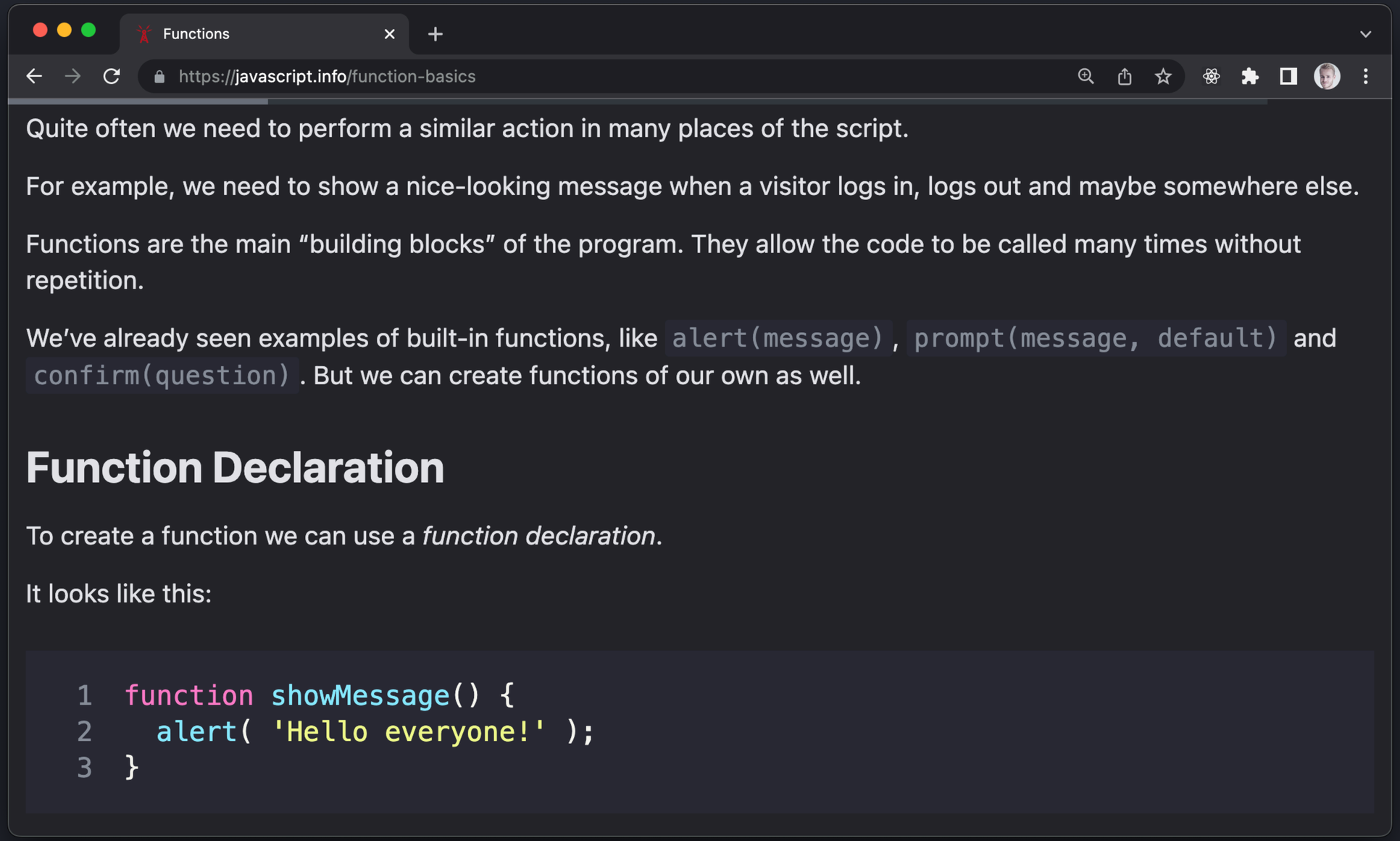
`template string`

“Template literals are literals delimited with backtick (`) characters, allowing for multi-line strings, for string interpolation with embedded expressions, and for special constructs called tagged templates.”

```
let name = "Alicia";
let age = 6;

console.log(name + " is " + age + " years old.");

console.log(`${name} is ${age} years old.`);
```

```
Alicia is 6 years old.          main.js:10
Alicia is 6 years old.          main.js:12
>
```

JavaScript.info/Function-Basics



JavaScript.info/function-basics#parameters

We can pass arbitrary data to functions using parameters.

In the example below, the function has two parameters: `from` and `text`.

```
1  function showMessage(from, text) { // parameters: from, text
2    alert(from + ': ' + text);
3  }
4
5  showMessage('Ann', 'Hello!'); // Ann: Hello! (*)
6  showMessage('Ann', "What's up?"); // Ann: What's up? (**)
```

JavaScript.info/function-basics#local-variables

Scopes:

- Local Variable
- Global Variable

Local variables

A variable declared inside a function is only visible inside that function.

For example:

```
1  function showMessage() {
2    let message = "Hello, I'm JavaScript!"; // local variable
3
4    alert( message );
5  }
6
7  showMessage(); // Hello, I'm JavaScript!
8
9  alert( message ); // <-- Error! The variable is local to the function
```

Outer variables

A function can access an outer variable as well, for example:

```
1  let userName = 'John';
2
3  function showMessage() {
4    let message = 'Hello, ' + userName;
5    alert(message);
6  }
7
8  showMessage(); // Hello, John
```

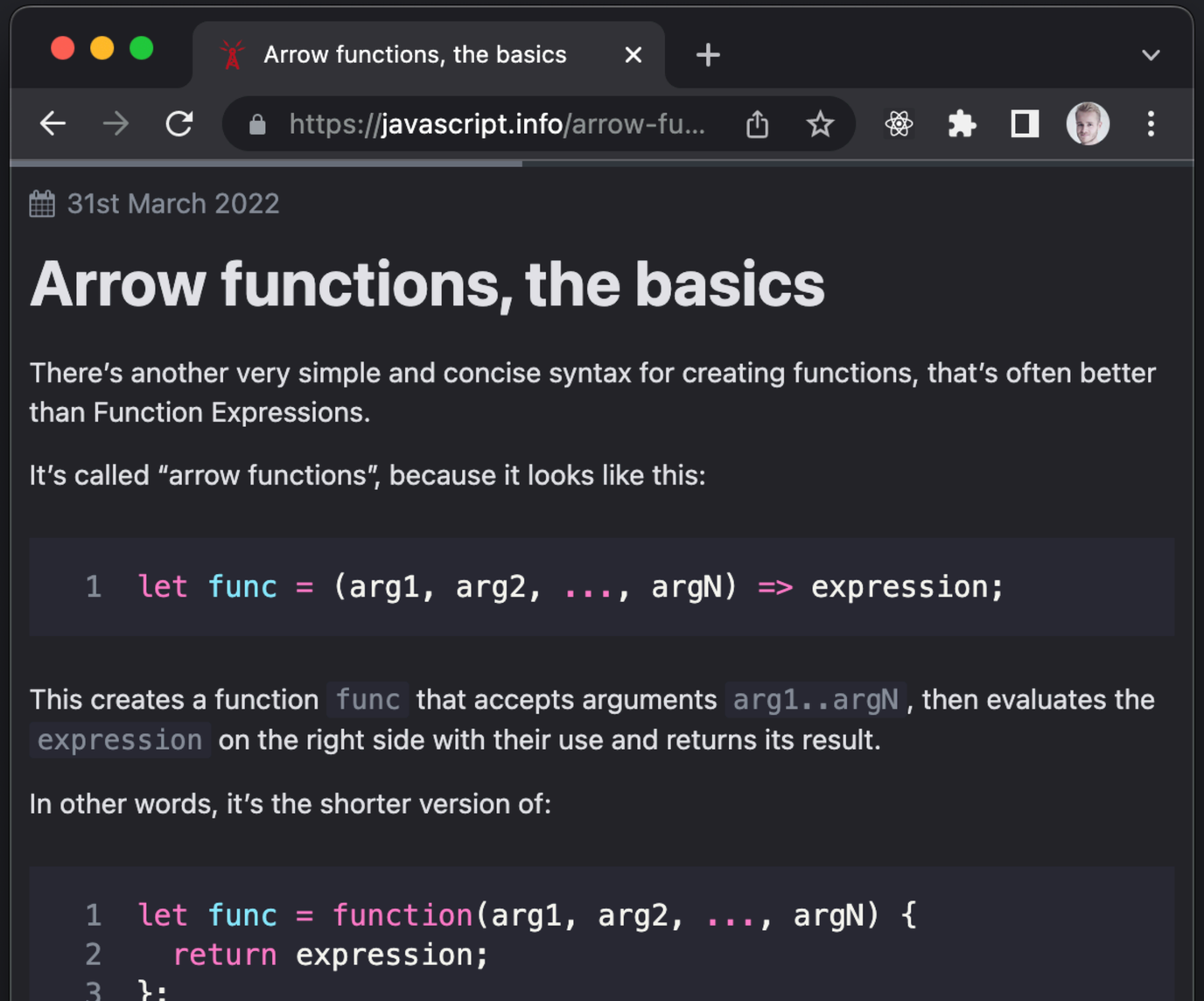
Function called by another function

Use the name of the function to call / execute

```
let users = [⋯
    }];

function appendUsers(users) {
    let htmlTemplate = "";
    for (const user of users) {
        console.log(user);
        htmlTemplate += /*html*/`
            <article>
                <img src="${user.avatar_url}">
                <h2>${user.name}</h2>
                <a href="mailto:${user.email}">${user.email}</a>
                <p>Role: ${user.enrollment_type}</p>
            </article>
        `;
    }
    document.querySelector("#users").innerHTML = htmlTemplate;
}

function initApp() {
    appendUsers(users);
}

initApp();
```

`users` refers to our declared variable, `users`, (global variable)

Javascript.info/Arrow-Functions-Basics



Fetch

... get & post data from and to a data source

```
// Simple javascipt 😄

//Synchronous fetch using async/await.

// Usual way
✓ const jsonData = fetch('URL')
                    .then(response ⇒ response.json())
                    .then(json ⇒ console.log(json));

// Using await
✓ const jsonData = await fetch('URL').then(res ⇒ res.json())


// Shorter syntax 😍
✓ const jsonData = await (await fetch('URL')).json();
```

https://www.instagram.com/p/B0nxQjXj9Zi/

Fetch

... can perform network requests to a server

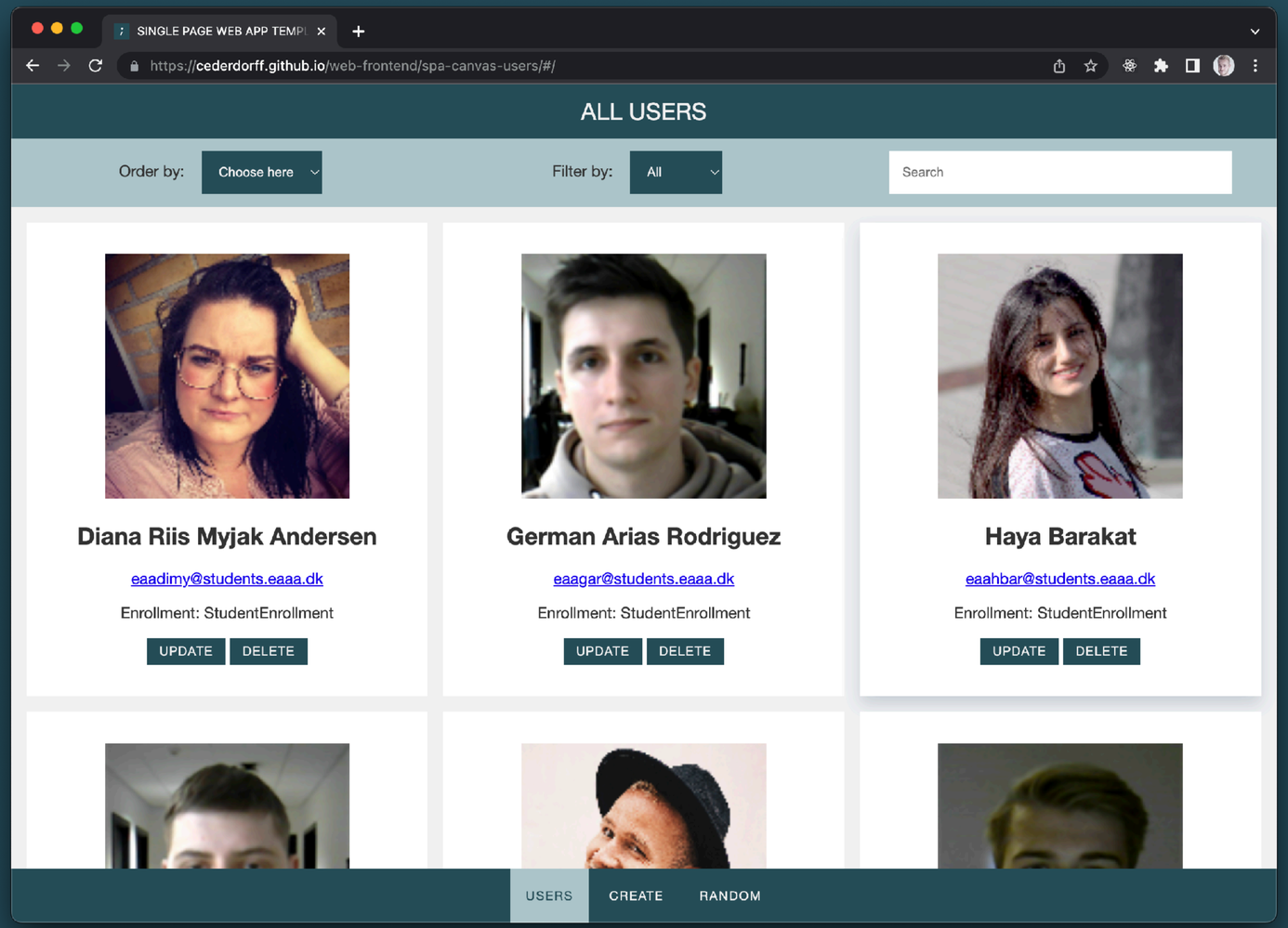
```
1  let promise = fetch(url, [options])
```

- `url` – the URL to access.
- `options` – optional parameters: method, headers etc.

Without `options`, this is a simple GET request, downloading the contents of the `url`.

https://javascript.info/fetch

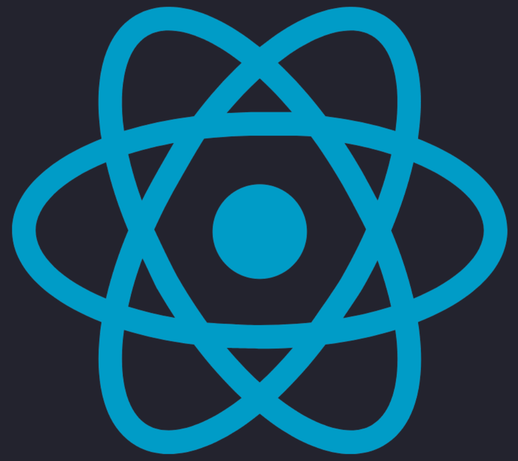
Canvas Users SPA Case



Template: `spa-canvas-users-template`

Solution: `spa-canvas-users`

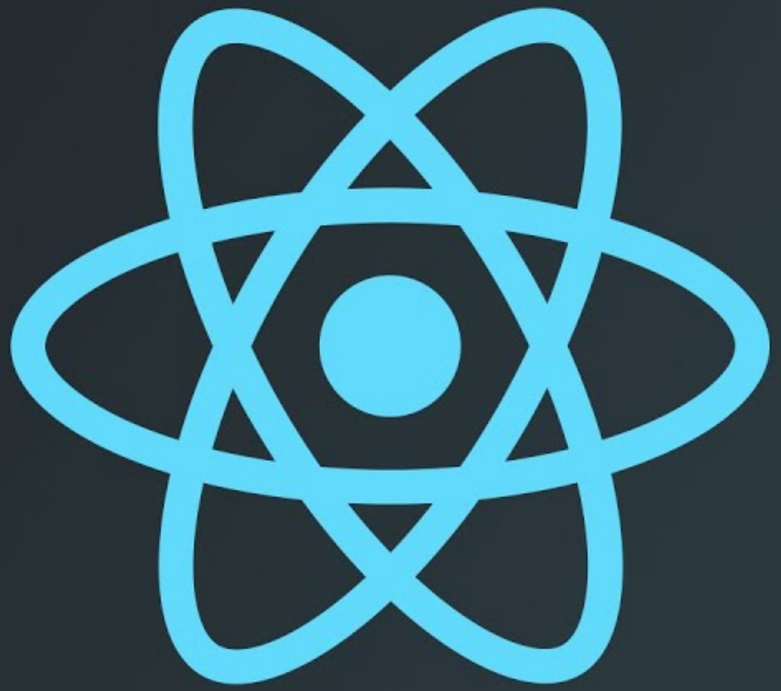
1. Make a copy of `project-template` and use it as your codebase.
2. In JS, declare a global variable called `_posts`.
3. Create a function called `getPosts` fetching from the URL. Save the fetched post data in the global variable.
4. Create a function called `appendPosts`, using a for-of loop to loop through `_posts` and append them to the DOM. All Posts must be displayed in a grid or flexbox.
5. Create a search bar. On `keyup` call a function named `searchPosts`, searching through `_posts` and finding all matches on `post.title.includes(searchValue)`. Make sure the search logic works on all type of characters. Update the DOM using `appendPosts` with the filtered result array.
6. Reimplement `appendPersons` using `Array.map(…)` to generate HTML of every post and append the HTML to the DOM.
7. Extra: Implement creating a new post, using a form with input fields. Add `onsubmit` event on the form calling a function named `createPost` using `_posts.push(…)` to add a new `post`. Make sure the DOM is updated.

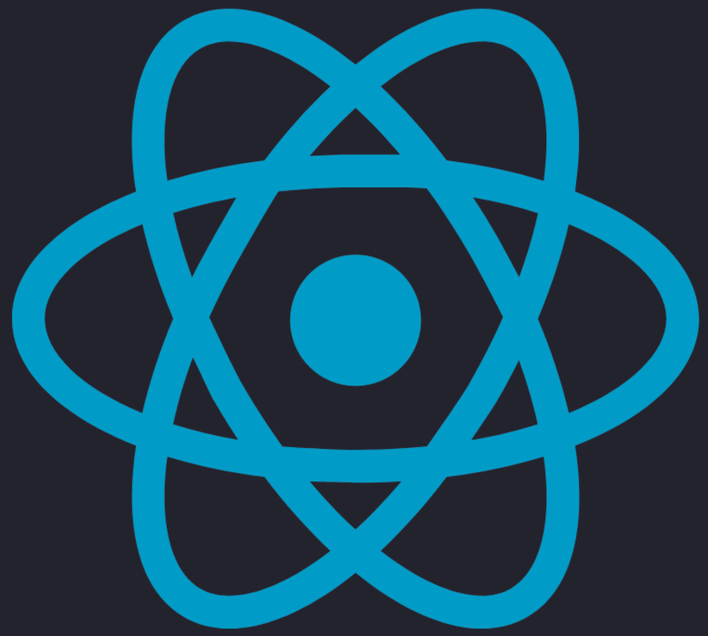


React

A JavaScript library for building User Interfaces

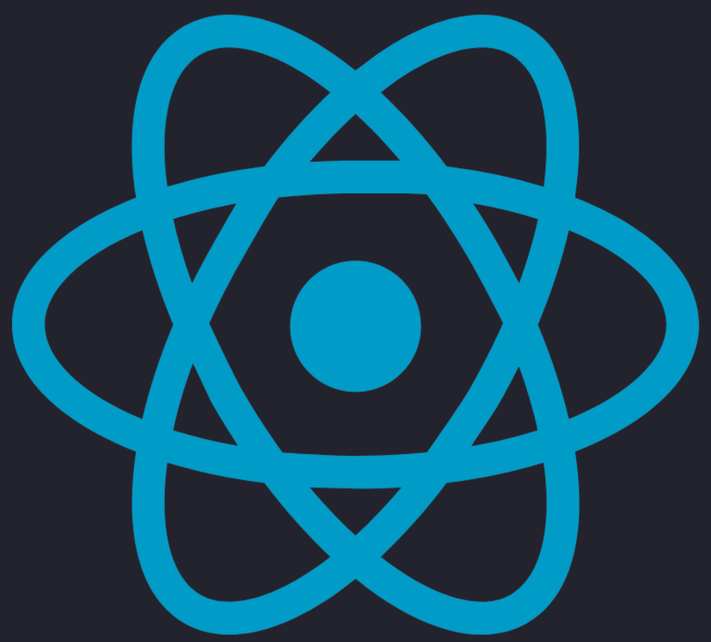
100 SECONDS OF





What is React?

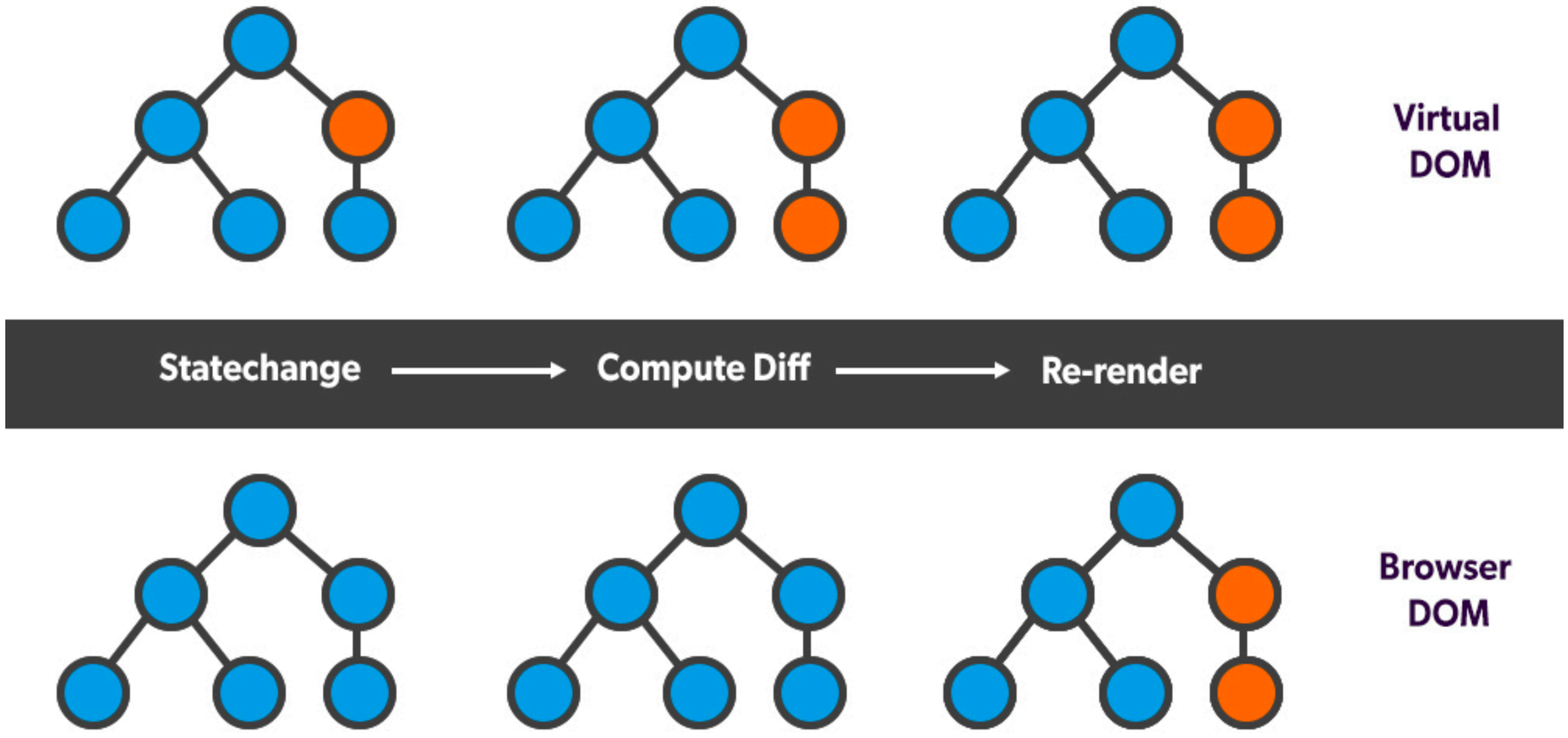
- A JavaScript library for building User Interfaces.
- Allow us to create reusable UI Components.
- Single Page Apps



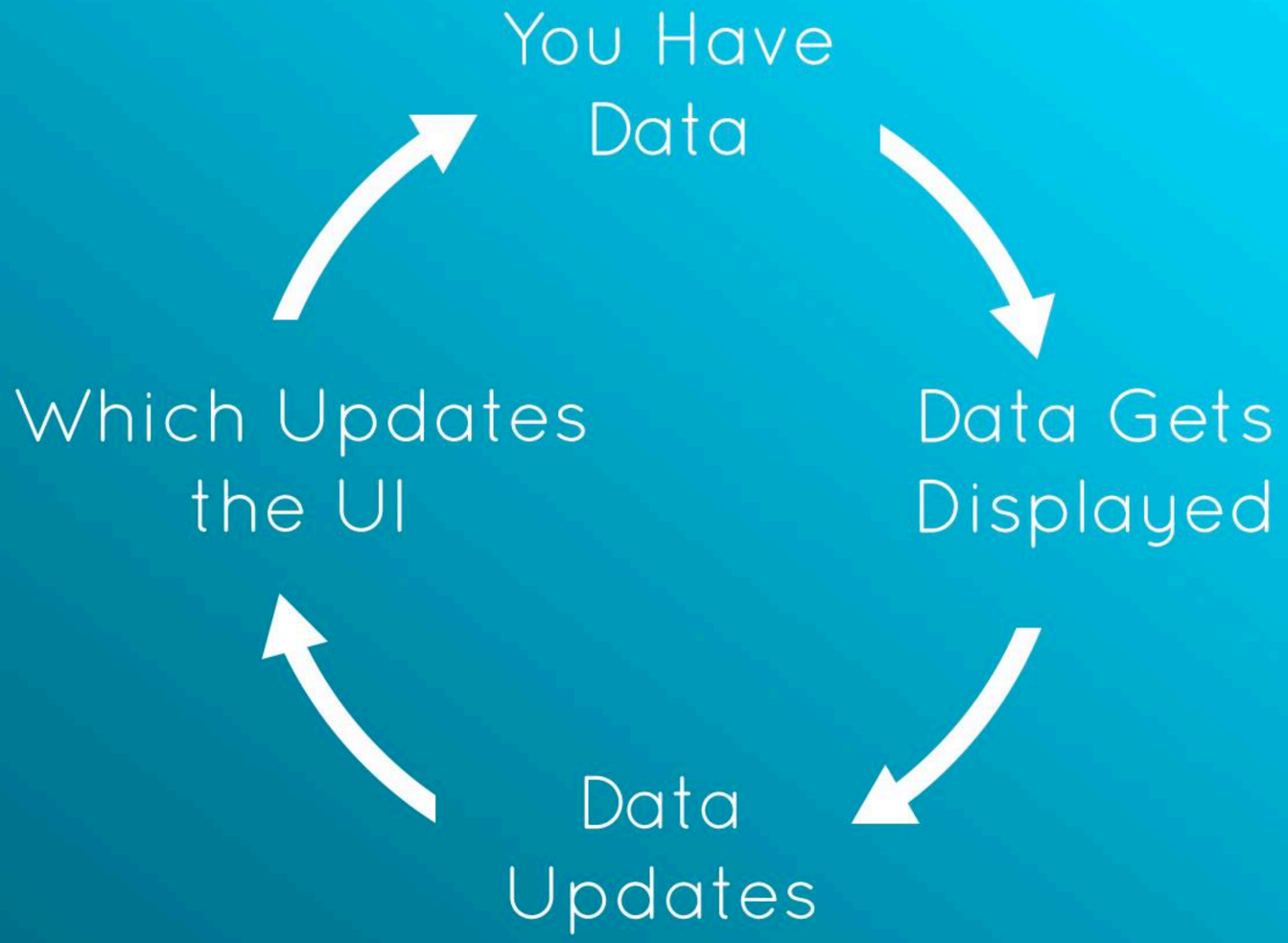
But how?

- React creates a Virtual DOM instead of manipulating directly with the browser's DOM.
- React makes the changes in Virtual DOM and compares it to the browser DOM.
- Then React detects what’s needs to be changed in the browser DOM and changes **only** what needs to be changed!

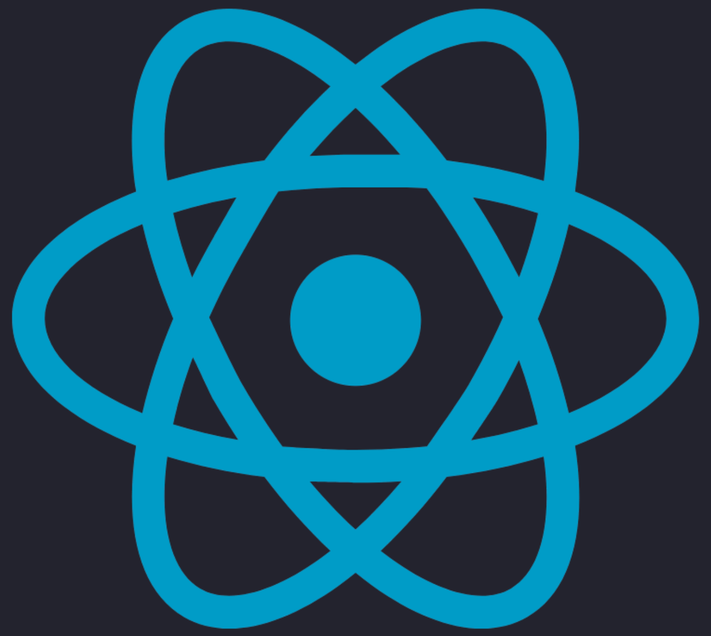
React Virtual DOM



The React UI Cycle



This happens AUTOMATICALLY once you define components



But why?

- It’s so hard to work with the DOM
- You must make sure the DOM is constantly updated and synchronised with the state of your data.
- React *reacts* to **changes** and then updates the DOM automatically and performant without rerendering all elements - only the needed elements.

1. Copy and explore the following template: react-cdn-template
2. In `app.jsx` and `App` component, replace the value of `name` attribute in the `Greeting` component.
3. Repeat the `Greeting` component and type another name value.
4. Create a new component called `Person`. Inside of the `Person` component, define a `const name` with a value. Return the `name` variable in an `h2` wrapped in an `article` tag.

Your First React App

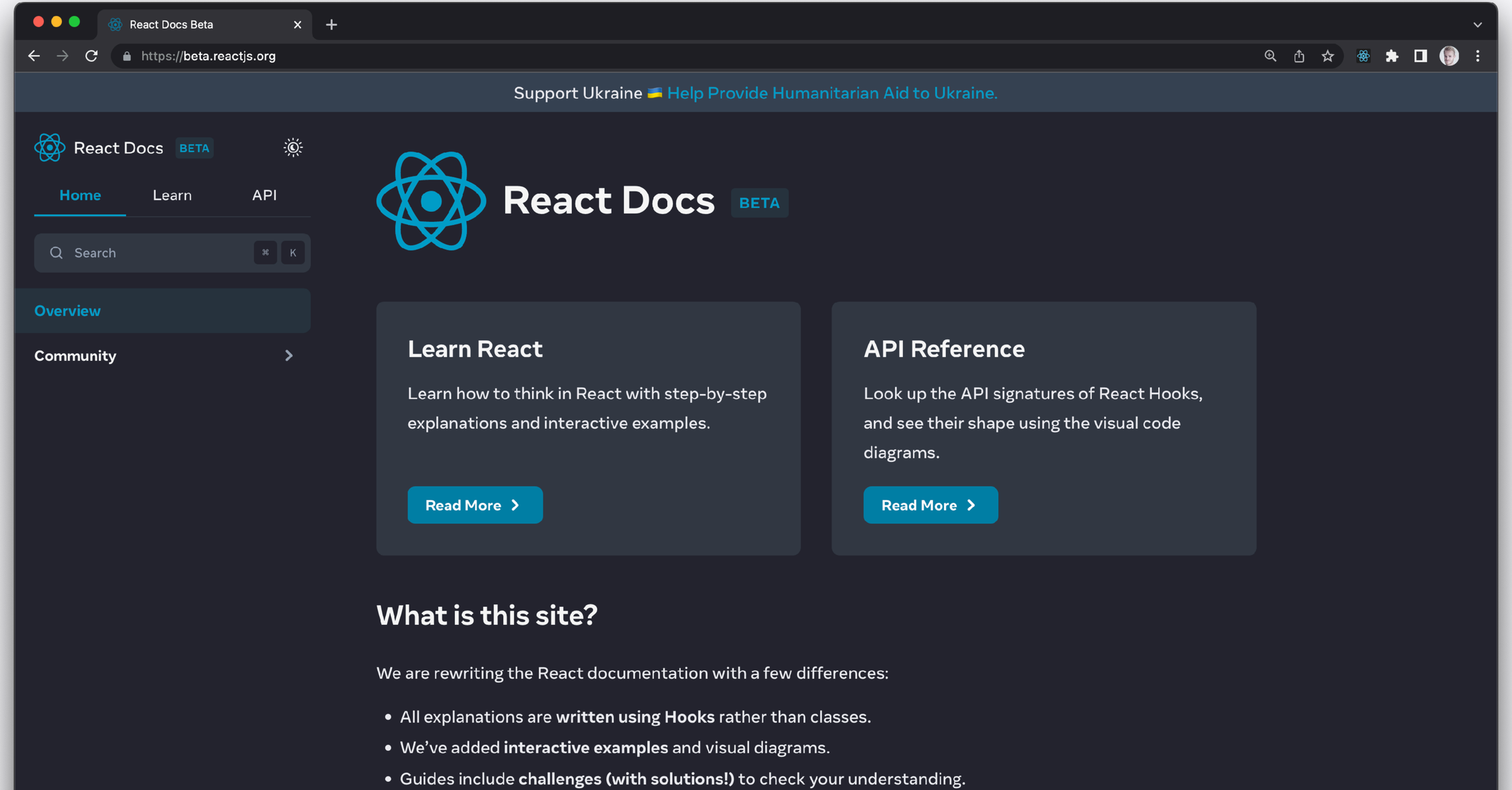
Resources

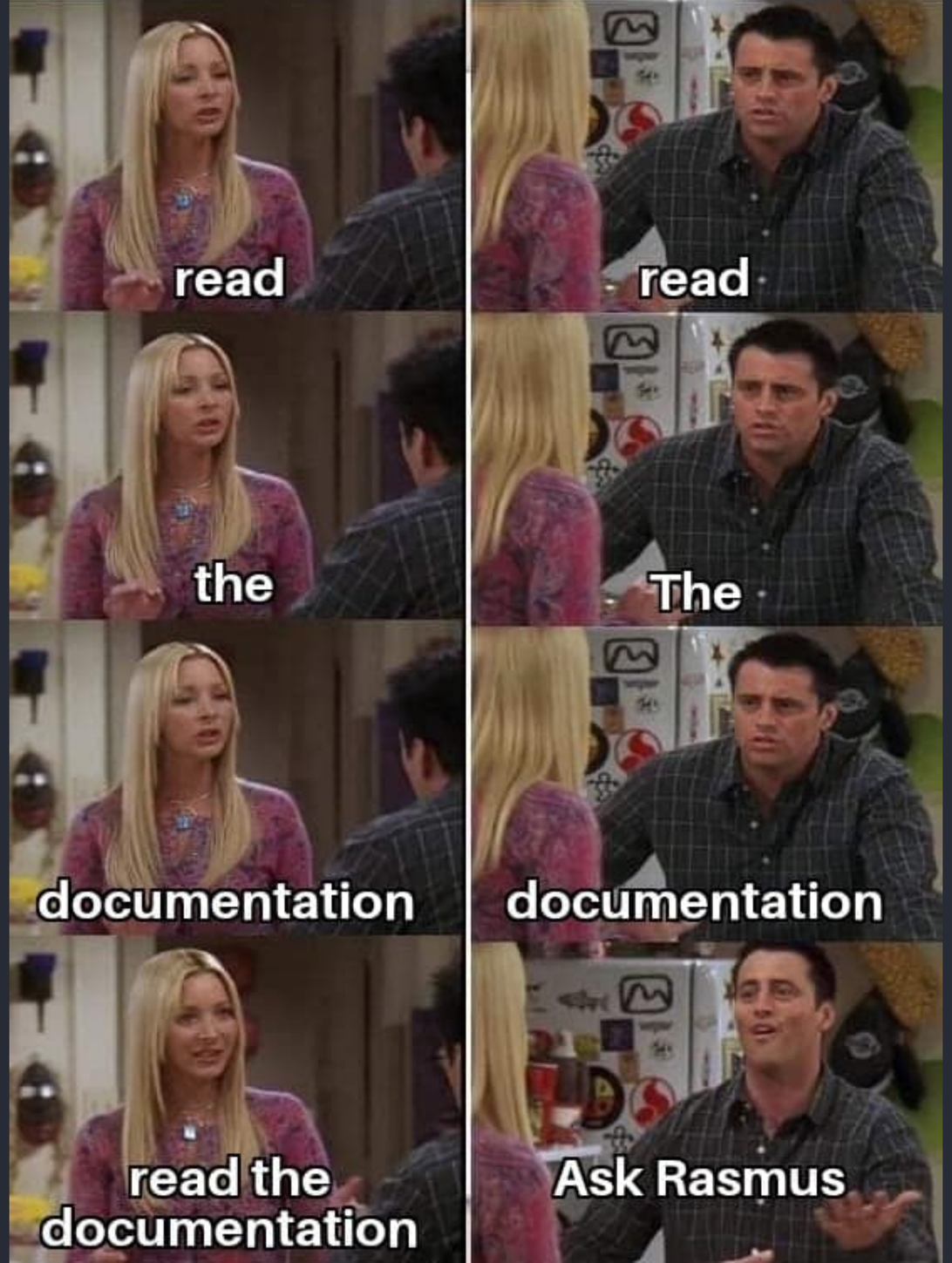
React Resources

React Self-study

Guides & Tutorials

React Beta Docs




read
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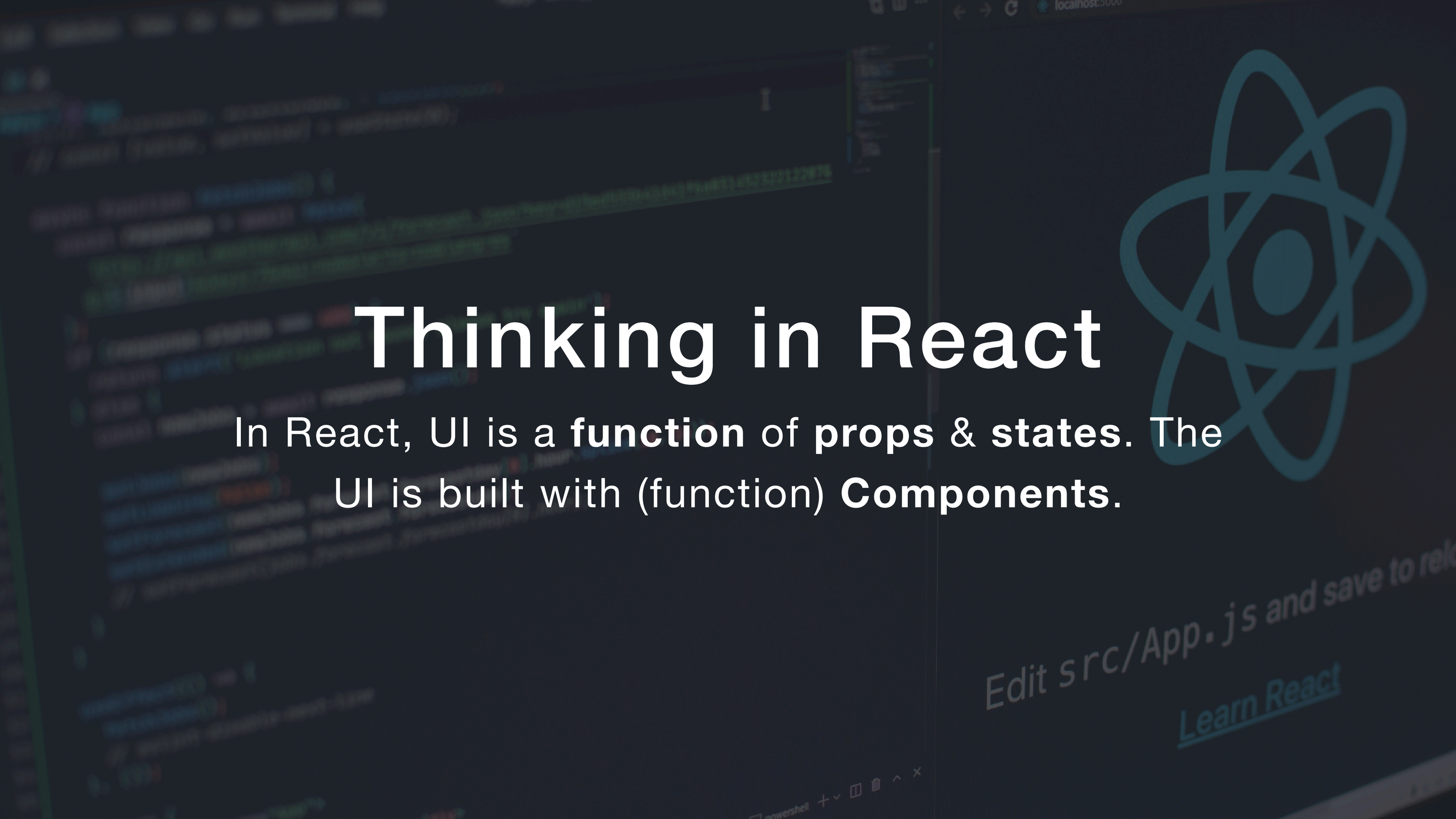
read the documentation
Ask Rasmus

Thinking in React

In React, UI is a **function** of **props** & **states**. The UI is built with (function) **Components**.

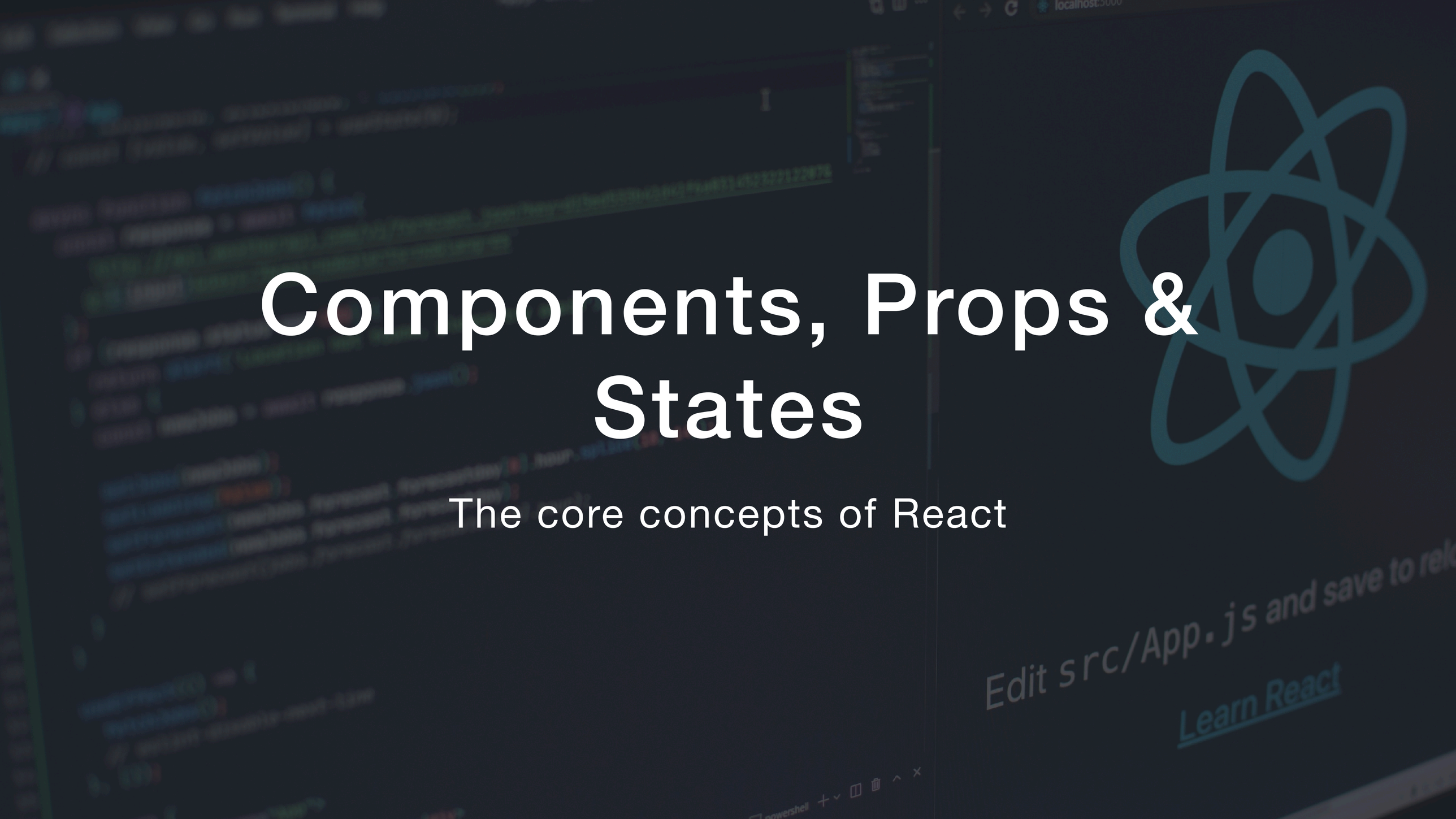


JS Nice to know for React

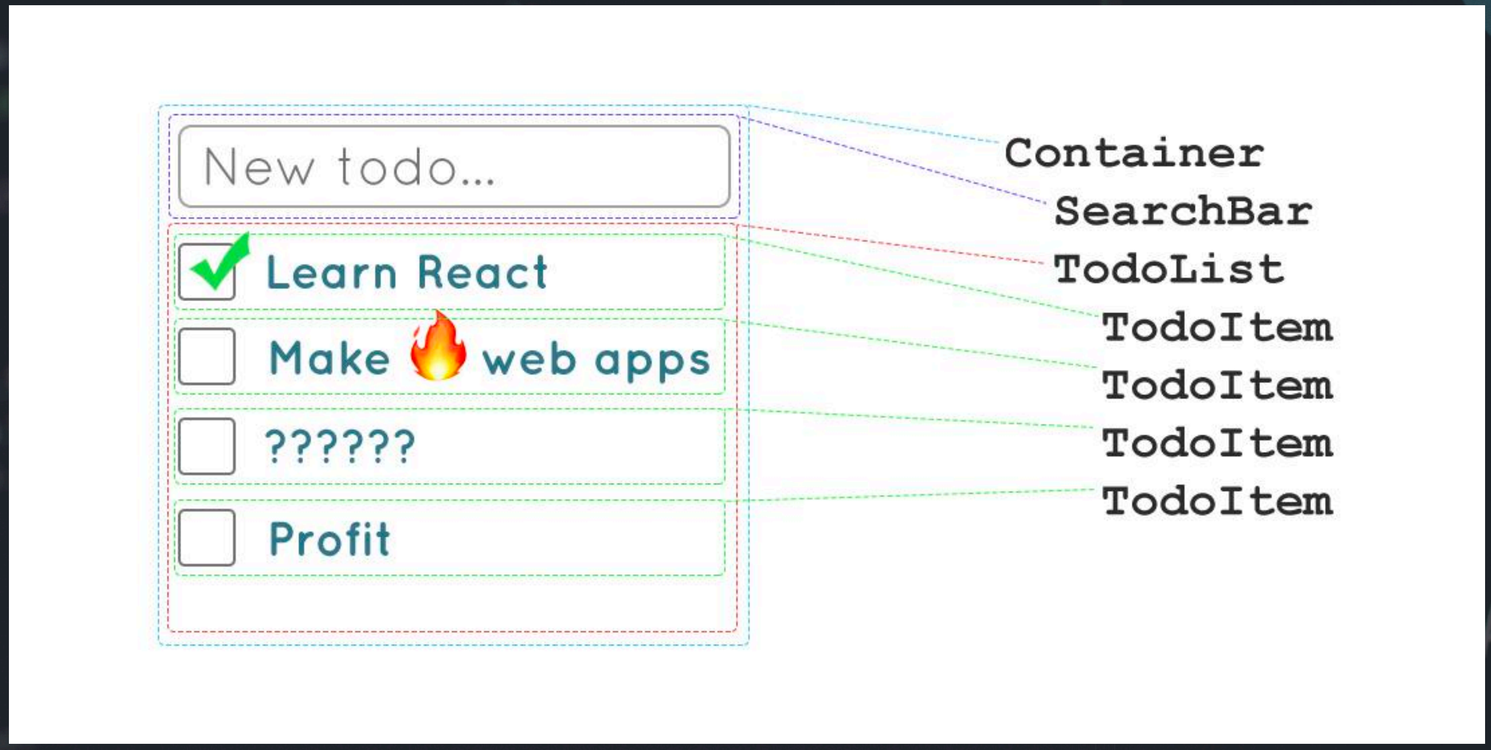
RACE: From Vanilla JavaScript to React Developer

Components, Props & States

The core concepts of React



How to Think in React



Function Component

A Component is simply just a function that returns HTML (JSX).

Components are independent blocks of code.

Components MUST return a single element. We can wrap in a parent element or use <></>.

```
function MyComponent() {
    const name = "RACE";

    return (
        <section>
            <h1>Hello, {name}</h1>
        </section>
    );
}
```

JSX

Java**S**cript **X**ML

- Allow us to write HTML in JavaScript.
- Makes it easier to write and add HTML in React.
- We can create our own tags.
- We MUST close all tags.

```
// With JSX

const myelement = <h1>I Love JSX!</h1>;

ReactDOM.render(myelement, document.getElementById("root"));
```

```
// Without JSX

const myelement = React.createElement("h1", {}, "I do not use JSX!");

ReactDOM.render(myelement, document.getElementById("root"));
```

Function Component

https://twitter.com/chrisachard/status/1175022111758442497

Function Component

```
function Greeting() {
  return (
    <div>
      <h1>Hello, React!</h1>
    </div>
  );
}
```

Define the component “Greeting”

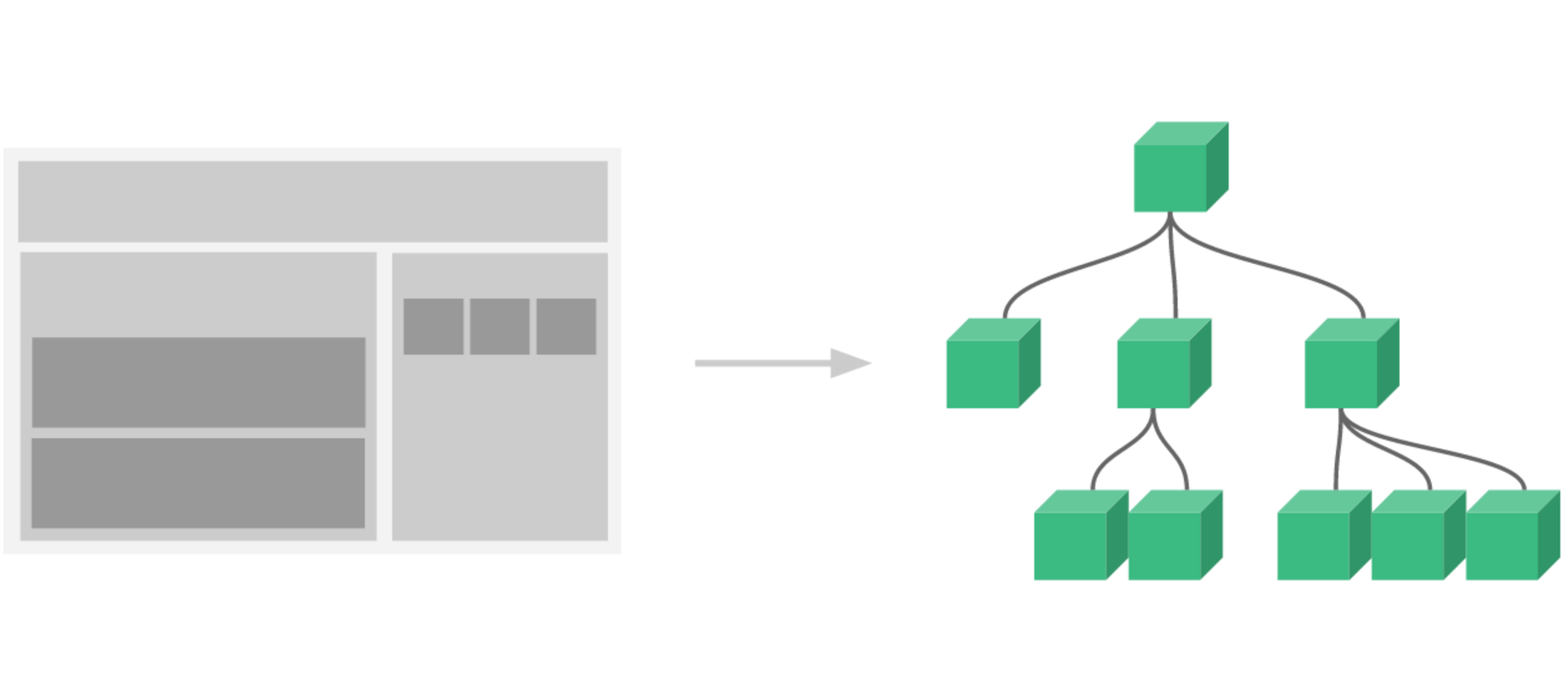
```
function App() {
  return (
    <div>
      <Greeting />
      <div>
        <Greeting />
      </div>
    </div>
  );
}
```

Use Greeting component in another component

Components without a closing tag REQUIRE a closing slash

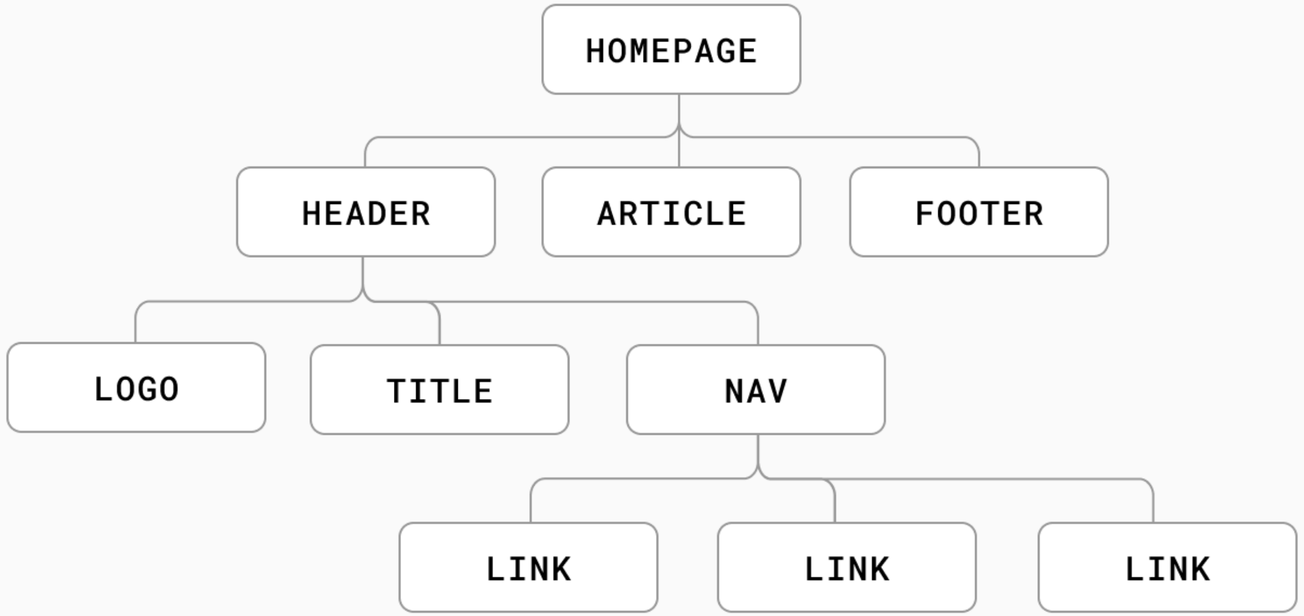
https://twitter.com/chrisachard/status/1175022111758442497

Components, Components, Components



Build Reusable Components

UI can be broken down to small block or modules called components



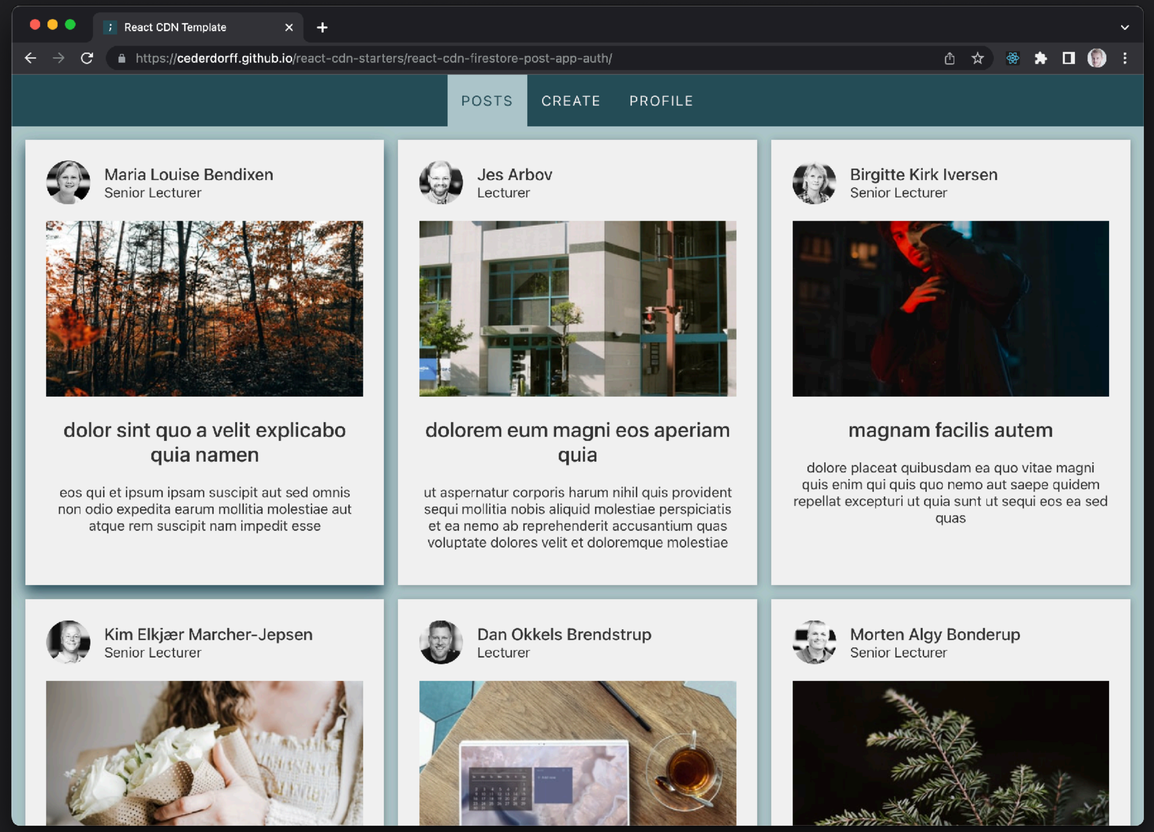
It’s all Components!

```
function Navigation() {
    return (
        <nav>
            <a href="#">Home</a>
        </nav>
    );
}

function Header() {
    return (
        <header>
            <h1>React Page Template</h1>
        </header>
    );
}

function PageContent() {
    return (
        <section>
            <h2>Here goes some page content</h2>
        </section>
    );
}

function Footer() {
    return (
        <footer>
            <p>This is my Footer</p>
        </footer>
    );
}
```

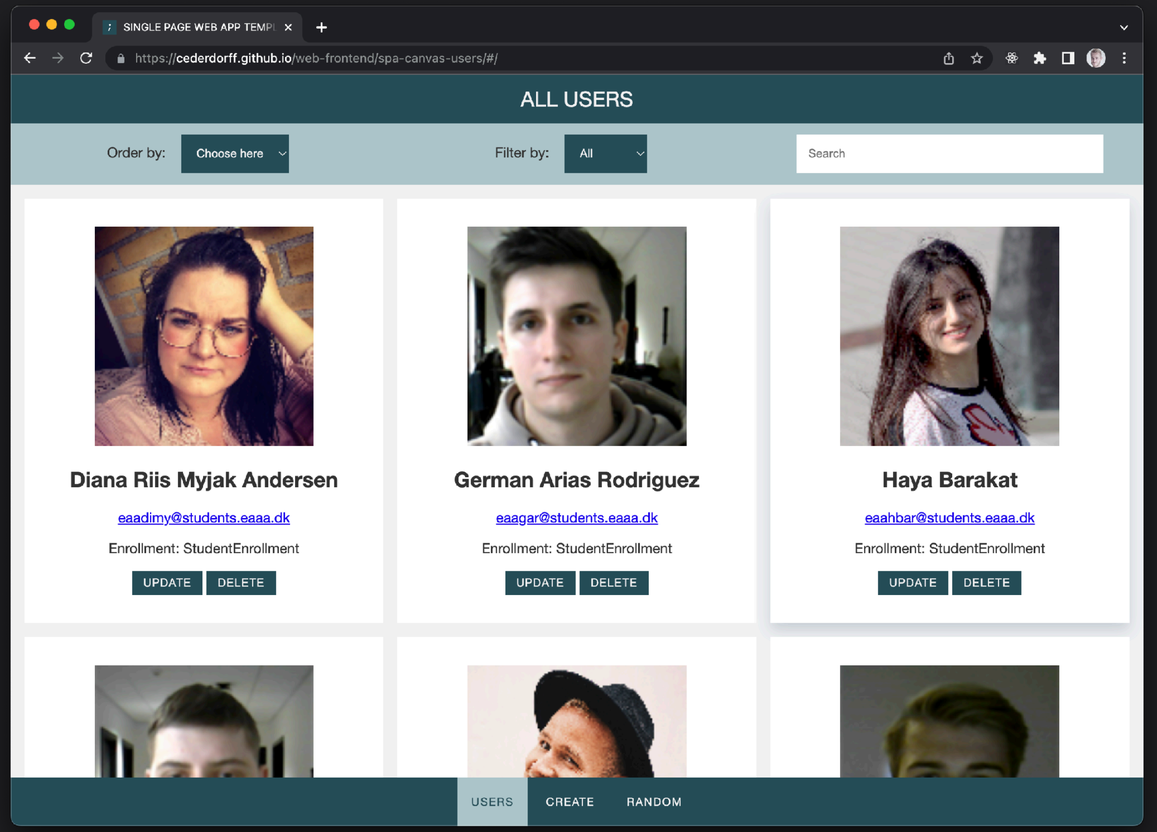
```
function App() {
    return (
        <>
            <Navigation />
            <Header />
            <PageContent />
            <Footer />
        </>
    );
}

ReactDOM.render(<App />, document.getElementById("root"));
```

react-cdn-page-template

Components?



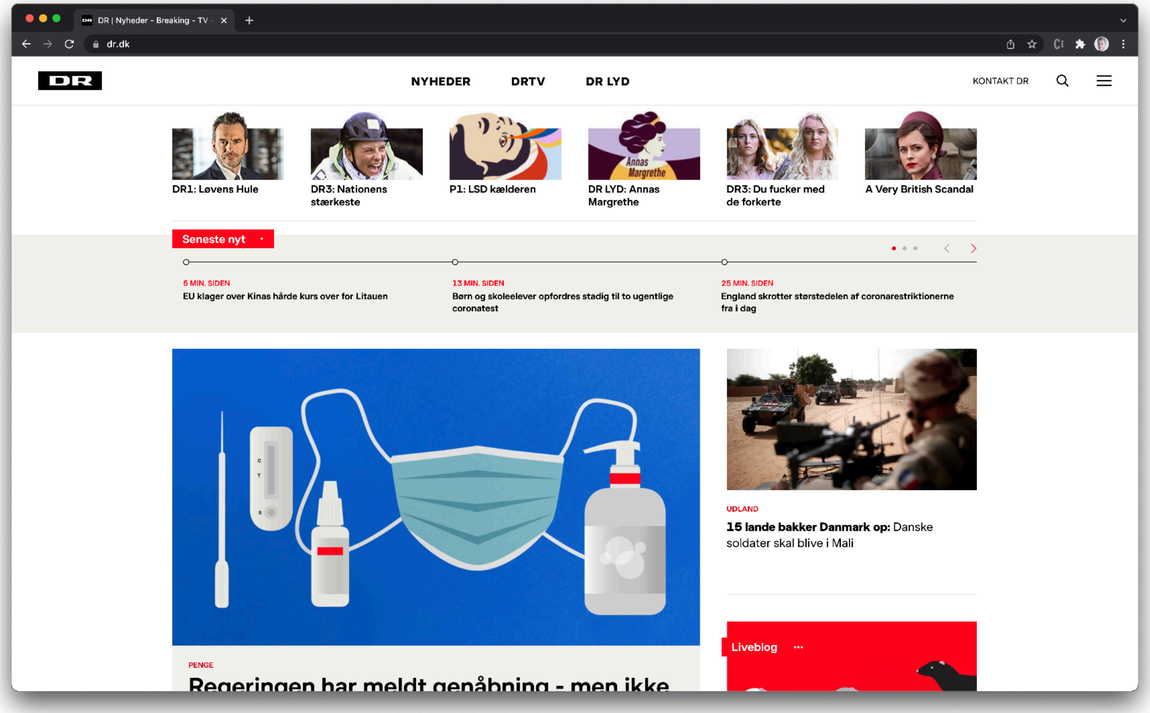
react-cdn-firestore-post-app-auth

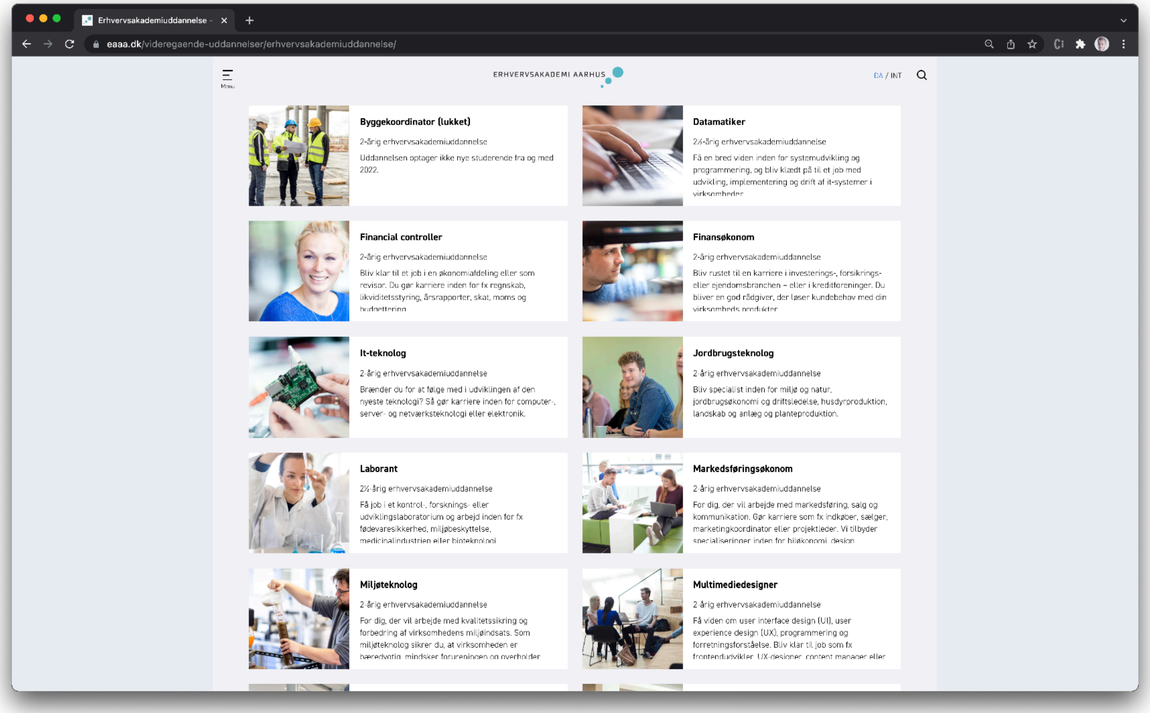


Template: `spa-canvas-users-template`

Solution: spa-canvas-users

And?

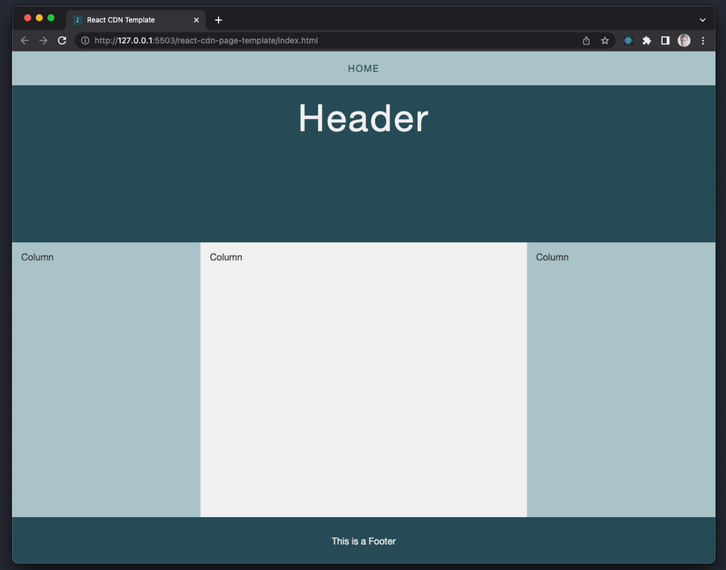




... but we thought it was all objects and array?

Component Page Layout

1. Use react-cdn-template
2. Implement a page layout and create the following components: `Navigation`, `Header`, `MainContent` & `Footer`
3. Add some placeholder content in every component like headlines and/or text. `MainContent` should consist of 3 columns (use the CSS classes `left`, `middle` & `right`).
4. Make sure to render all components in the `App` component.
5. Style your page layout using a grid, flexbox or use the existing CSS styling from app.css (`.page-layout`, `nav`, `header`, `footer`, `left`, `middle` & `right`)




```
function App() {
    return (
        <main className="page-layout">
            <Navigation />
            <Header />
            <MainContent />
            <Footer />
        </main>
    );
}

ReactDOM.render(<App />, document.getElementById("root"));
```

Props

... arguments passed into a React Component. Props are passed to components via HTML attributes.

```
function Greeting({ name }) {
    return <h1>Hello, {name}</h1>;
}

function App() {
    return <Greeting name="world" />;
}
```

Function Component with Props

```jsx
function Greeting(props) {
  return (
    <div>
      <h1>Hello, {props.name}!</h1>
    </div>
  );
}

function App() {
  return (
    <div>
      <Greeting name="React" />
      <div>
        <Greeting name="Chris" />
      </div>
    </div>
  );
}
```

props is first argument to function components

Access props inside of curly braces to show value

Set a prop on a child component by passing an attribute

Different instances of component can have different prop values

https://twitter.com/chrisachard/status/1175022111758442497

Add Props

1. Use your implemented Page Layout or `react-cdn-page-template`.
2. Add a prop to your `Header` component called `title`. Make sure the component (function) takes in an argument. The `title` prop must be rendered in the JSX inside the `h1`.
3. Locate the `Header` component in `App` and add the attribute `title` and pass in a `title` (“My Title”, “Your Name” etc.).
4. Test your solution and try to change the `title` attribute value.
5. Implement and try out props for some of the other components in your Page Layout.

```
function Greeting({ name }) {
    return <h1>Hello, {name}</h1>;
}

function App() {
    return <Greeting name="world" />;
}
```

Hooks

useState & useEffect

https://www.youtube.com/watch?v=TNhaISOUy6Q

useState

... a hook that allows us to track states in a function component. The purpose is to handle reactive data. When data in a state change, React reacts and re-renders the UI.

useState(...)

... a hook that allows us to track states in a function component.

The purpose is to handle reactive data. When data in a state change, React reacts and re-renders the UI.

https://twitter.com/chrisachard/status/1175022111758442497

When States & Props change, your components automatically is updated!

React *reacts* to the changes.

```jsx
import React, { useState } from "react";

function Greeting(props) {
  const [count, setCount] = useState(0)

  const updateCount = () => {
    setCount(count + 1)
  }

  return (
    <div>
      <h1>Hello, {props.name}!</h1>
      <p>You've clicked {count} times</p>
      <button onClick={updateCount}>
        Click me
      </button>
    </div>
  );
}
```

Call the update function with a new value to set the state. NEVER set the value directly

count will update AUTOMATICALLY!

Use curly braces to set attribute to JS value

Set onClick attribute of a button to a custom function

https://twitter.com/chrisachard/status/1175022111758442497

Tryout useState

1. In your previous React project, create a component called `Counter`.
2. The Counter component should have a similar structure as the component to the right, with a count state, `updateCount` function, displaying the count state and a button calling `updateCount`.
3. Render the `Counter` component in your `PageComponent`.
4. Test and think of the pros of using React and states compared to Vanilla JS.
5. Try to render the `Counter` in another component.


```jsx
import React, { useState } from "react";

function Greeting(props) {
  const [count, setCount] = useState(0)

  const updateCount = () => {
    setCount(count + 1)
  }

  return (
    <div>
      <h1>Hello, {props.name}!</h1>
      <p>You've clicked {count} times</p>
      <button onClick={updateCount}>
        Click me
      </button>
    </div>
  );
}
```

List, loop and map

```
const DATA = [
  { id: 4, title: 'A New Hope' },
  { id: 5, title: 'The Empire Strikes Back' },
  { id: 6, title: 'Return of the Jedi' }
]

const App = () => <MyList items={DATA} />

function MyList(props) {
  return (
    <div>
      {
        props.items.map(item => {
          return <p key={item.id}>{item.title}</p>
        })
      }
    </div>
  )
}
```

Wrap entire JS in curly braces

Map over data that was passed in as props

Return JSX from each iteration

Pass unique key attribute to each element

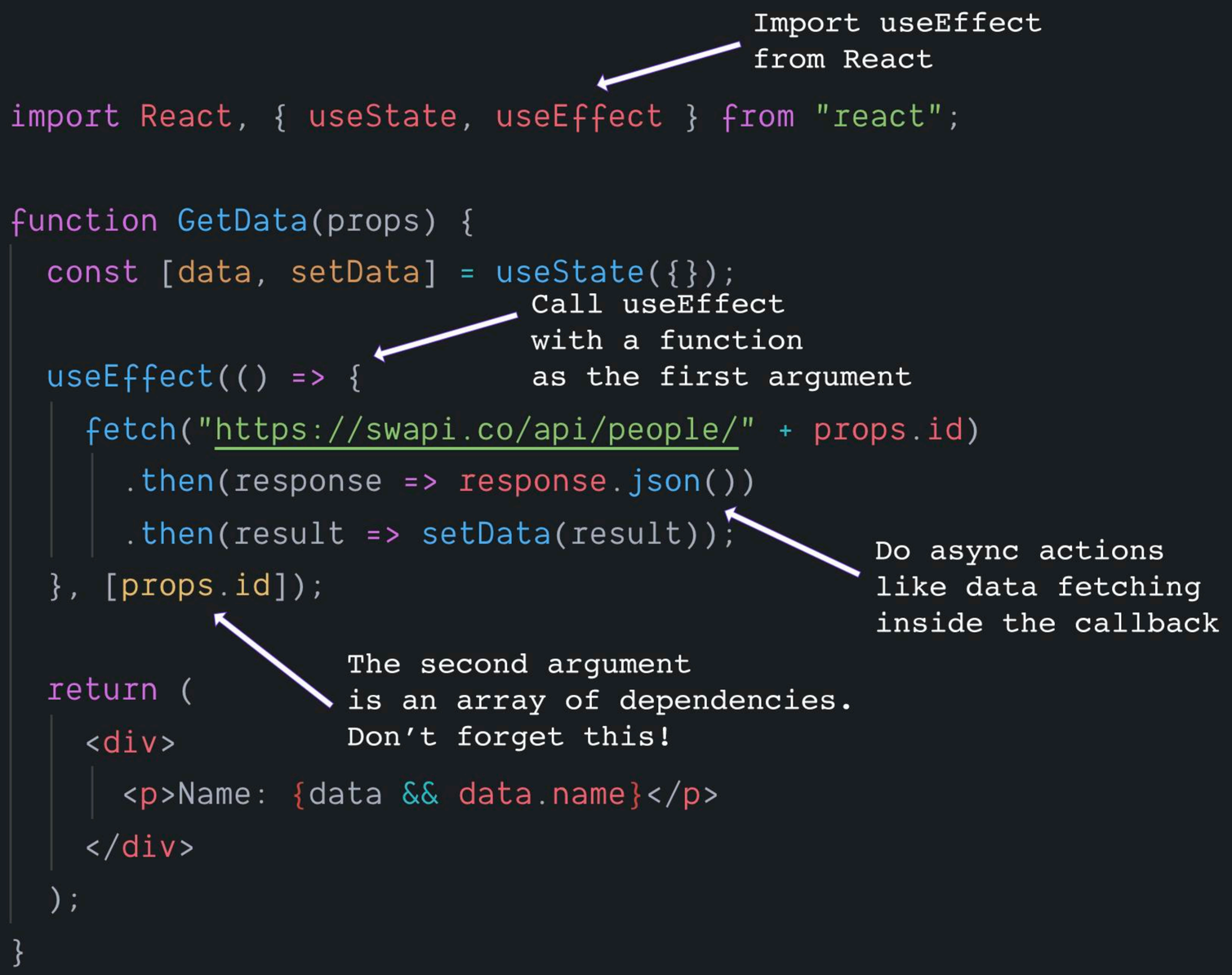
Use curly braces like normal to display data

https://twitter.com/chrisachard/status/1175022111758442497

https://www.youtube.com/watch?v=TNhaISOUy6Q

useEffect(...)

... a hook that allows us to do side effects in a component, like fetching data, directly updating the DOM, and timers.



https://twitter.com/chrisachard/status/1175022111758442497

useEffect(...)

useEffect accepts two arguments.

We should always include the second parameter which accepts an array of dependencies.

useEffect runs on every render and when the dependencies change.

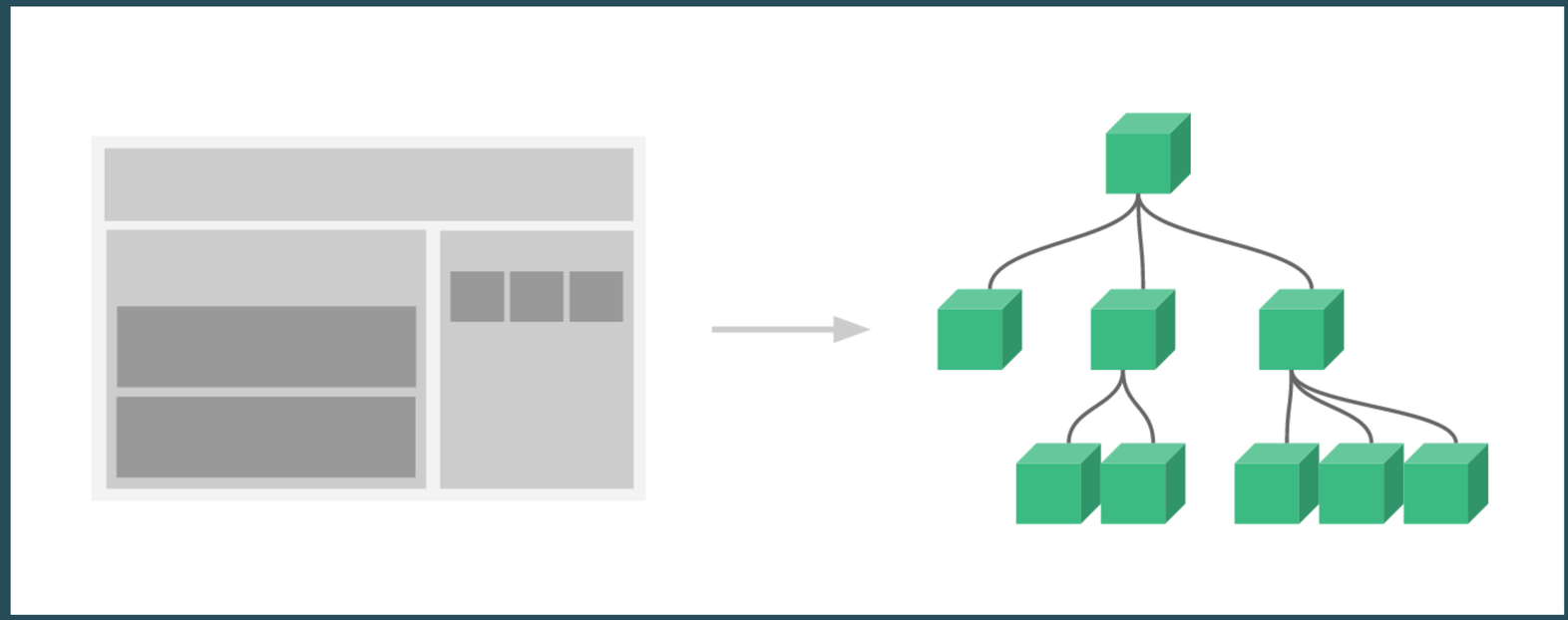
```
useEffect(() => {
    //Runs on every render
});

useEffect(() => {
    //Runs only on the first render
}, []);

useEffect(() => {
    //Runs on the first render
    //And any time any dependency value changes
}, [prop, state]);
```

https://www.w3schools.com/react/react_useeffect.asp

1. Use `react-cdn-template` or `react-cdn-page-template`. The goal is to fetch and display a grid of posts using `useState` and `useEffect`. Similar to the JS Fetch Posts. You can use the predefined grid styling in app.css
2. Create a component called Posts returning a `section` with an `h1` (with a title) and another section as your grid container. Render the Post component in the App and test it in the browser.
3. In `Posts` component, implement a state called `posts`. The state must be initialised with an empty array in `useState`.
4. Use useEffect to fetch post data from the URL to the right. Save the fetched posts in the state. Use console.log(...) to test your fetch call.
5. In the grid container, map through the `posts` state and create an `article` for every post (similar to the JS Fetch Posts exercise). Display the properties image, title and body in matching HTML tags inside of the article tag. Also add a key attribute on the `article` tag using the `post.id` value.

Build Reusable Components

UI can be broken down to small block or modules called components. We strive for independent (and small) components.



6. Split your `Posts` component into more components. Start by creating a new component called `PostCard`.
7. Extract the post article logic from the `Posts` component to the `PostCard` component (only the article not the `.map` part).
8. Make sure `PostCard` takes in a prop called `post`. Use the prop to render the post in `PostCard`.
9. Inside of your `.map` in your Posts component render a `PostCard` and pass in `post` as a prop. A `PostCard` component will be rendered for every `post`. Remember to add a `key` attribute on the `PostCard`. (and remove it from the `article`).

Style your component

Regular Stylesheet

```
import "./styles.css";

function NormalCSS() {
  return <p className="big-text">
    BIG!
  </p>;
}
```

Use className instead of class, because class is a restricted word in javascript

Inline Styles

```
function InlineStyle() {
  return (
    <p
      style={{
        fontSize: 20,
        color: "#0000ff"
      }}
    >
      Blue Text
    </p>
  );
}
```

Double curly braces because you're defining a JS object inside of JSX

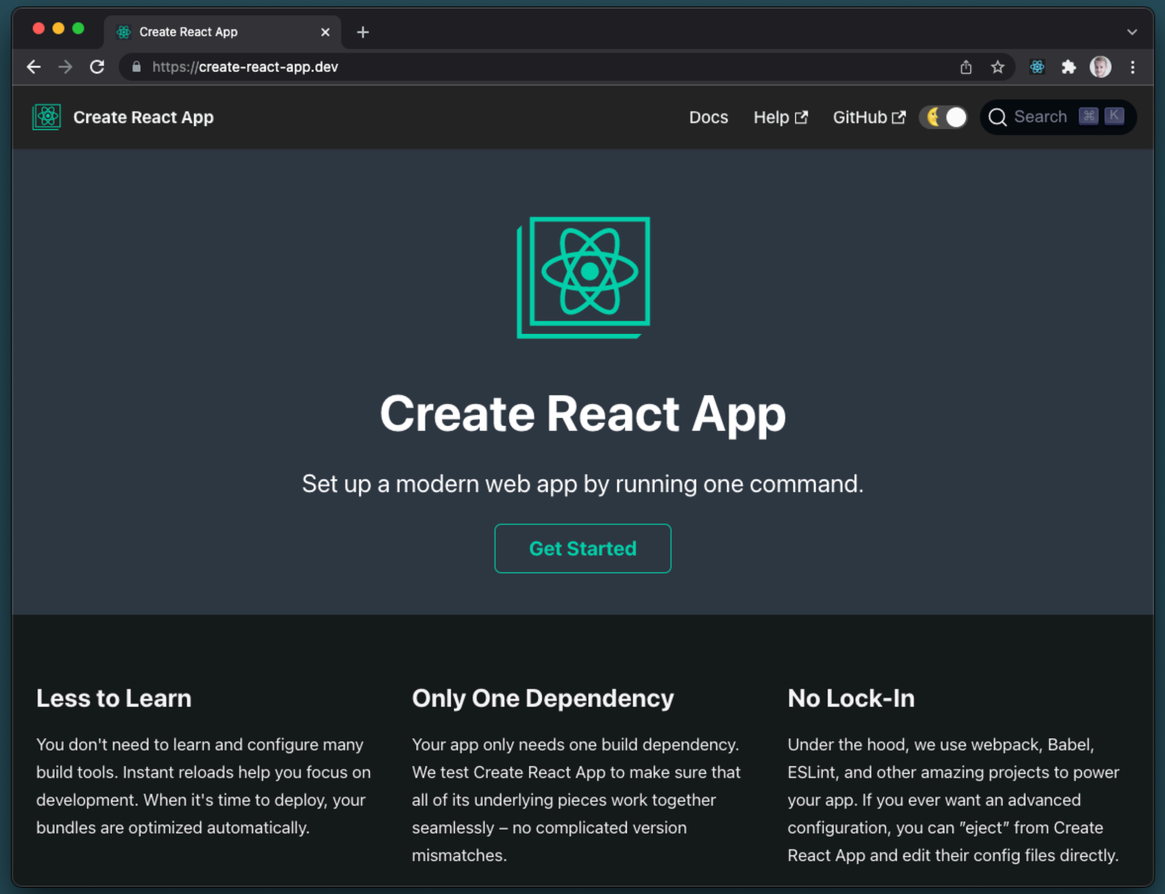
Camel case attributes

Values like colors must be in strings

https://twitter.com/chrisachard/status/1175022111758442497

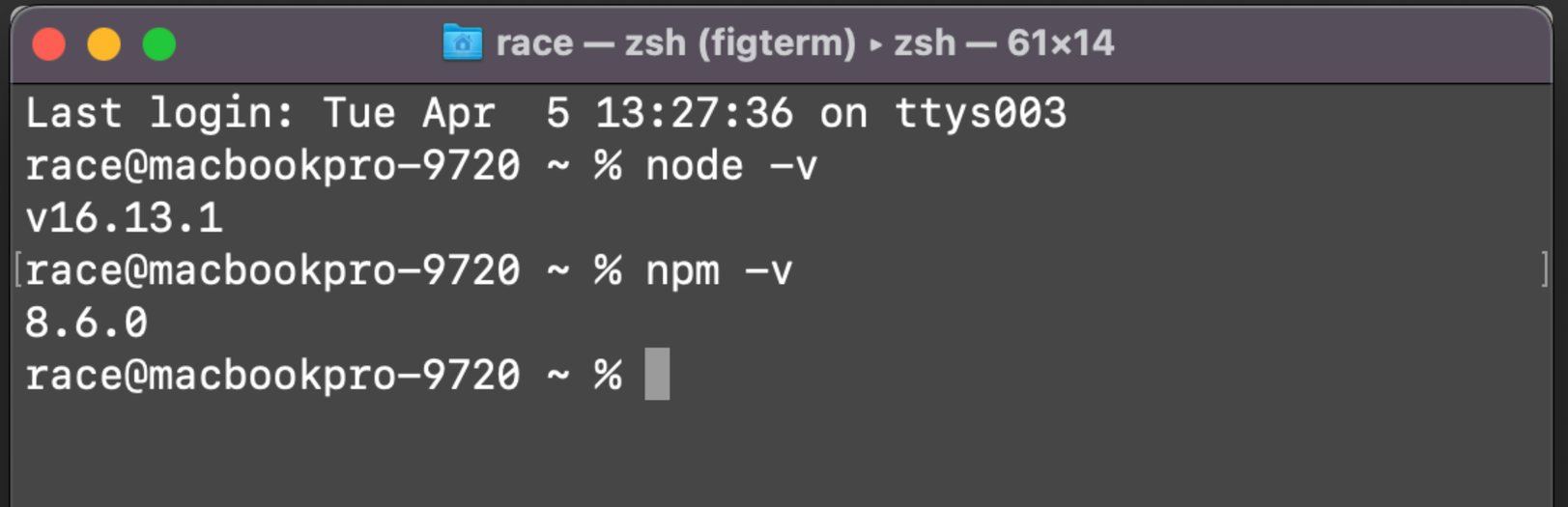
create-react-app

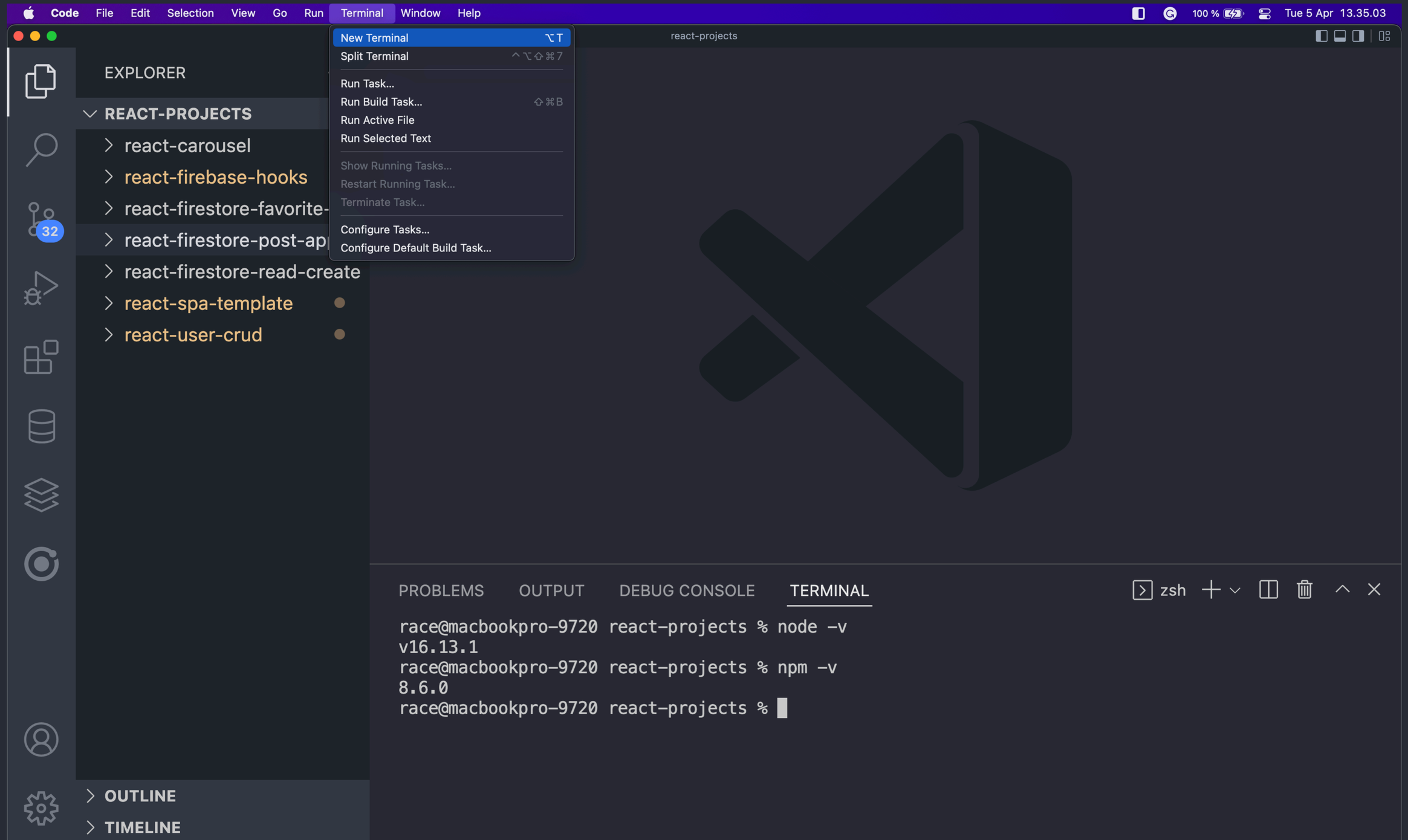
Starter template for your react app



Generate create-react-app

1. Download & install Node.js & npm: nodejs.org/en/
2. Check your version of npm & Node.js



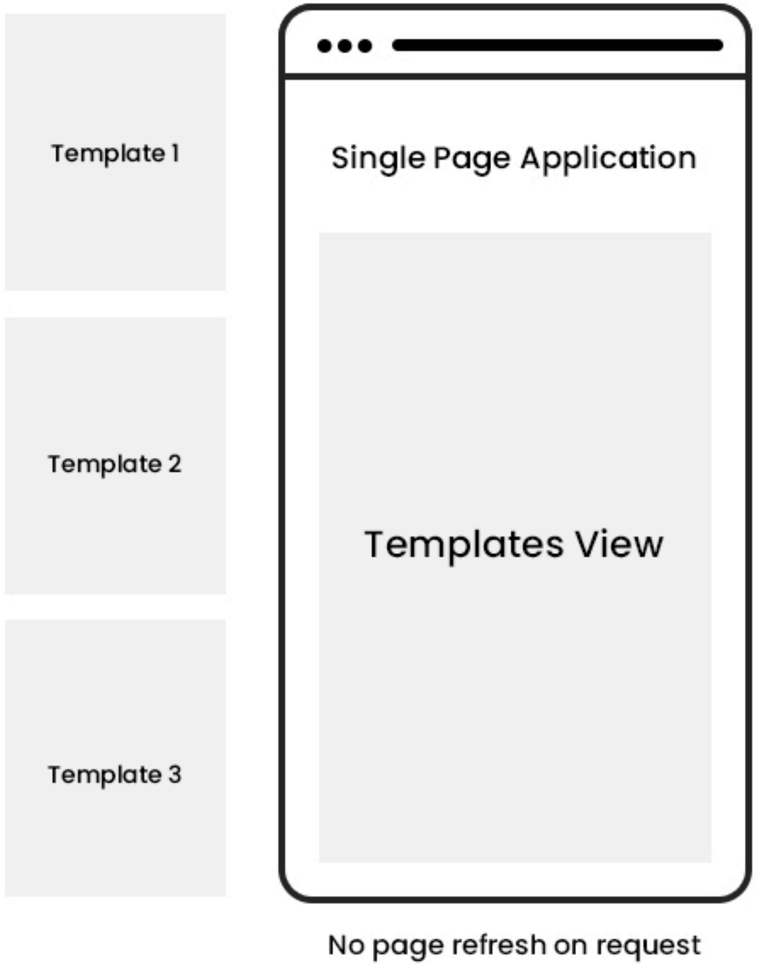

Code File Edit Selection View Go Run Terminal Window Help
100 % Tue 5 Apr 13.35.03
New Terminal ⌥T
Split Terminal ^⌥⇧⌘7
Run Task...
Run Build Task... ⇧⌘B
Run Active File
Run Selected Text
Show Running Tasks...
Restart Running Task...
Terminate Task...
Configure Tasks...
Configure Default Build Task...
react-projects
EXPLORER
REACT-PROJECTS
react-carousel
react-firebase-hooks
react-firestore-favorite-
react-firestore-post-ap
react-firestore-read-create
react-spa-template
react-user-crud
OUTLINE
TIMELINE
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
zsh
race@macbookpro-9720 react-projects % node -v
v16.13.1
race@macbookpro-9720 react-projects % npm -v
8.6.0
race@macbookpro-9720 react-projects %

Single Page Apps

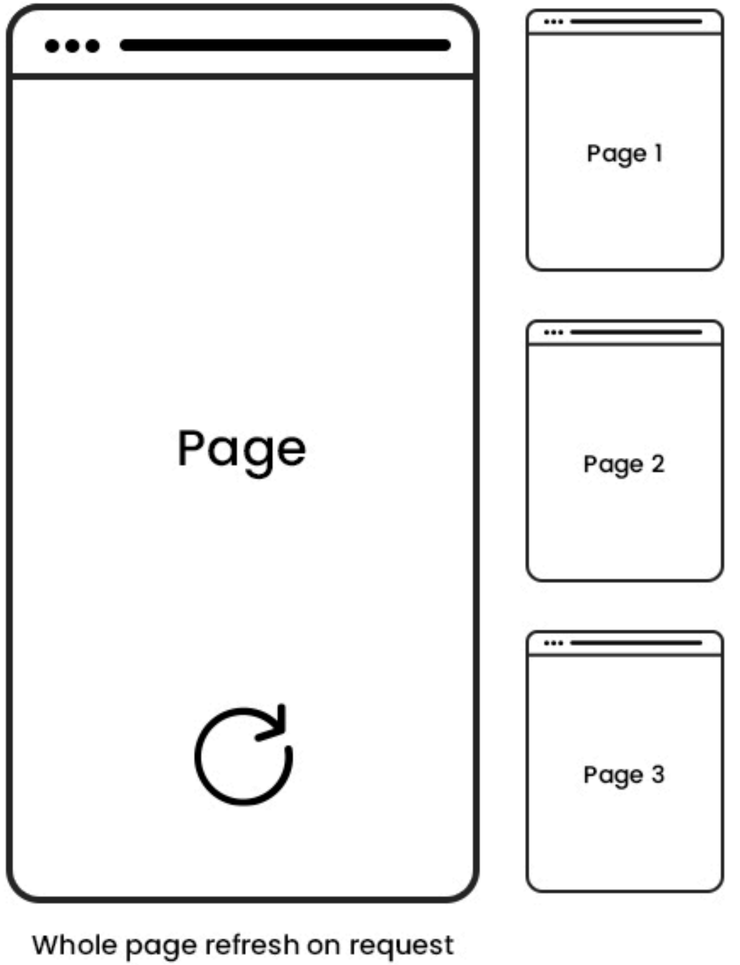
“A single-page application is an application that loads a single HTML page and all the necessary assets (such as JavaScript and CSS) required for the application to run. Any interactions with the page or subsequent pages do not require a round trip to the server which means the page is not reloaded.”

https://reactjs.org/docs/glossary.html#single-page-application

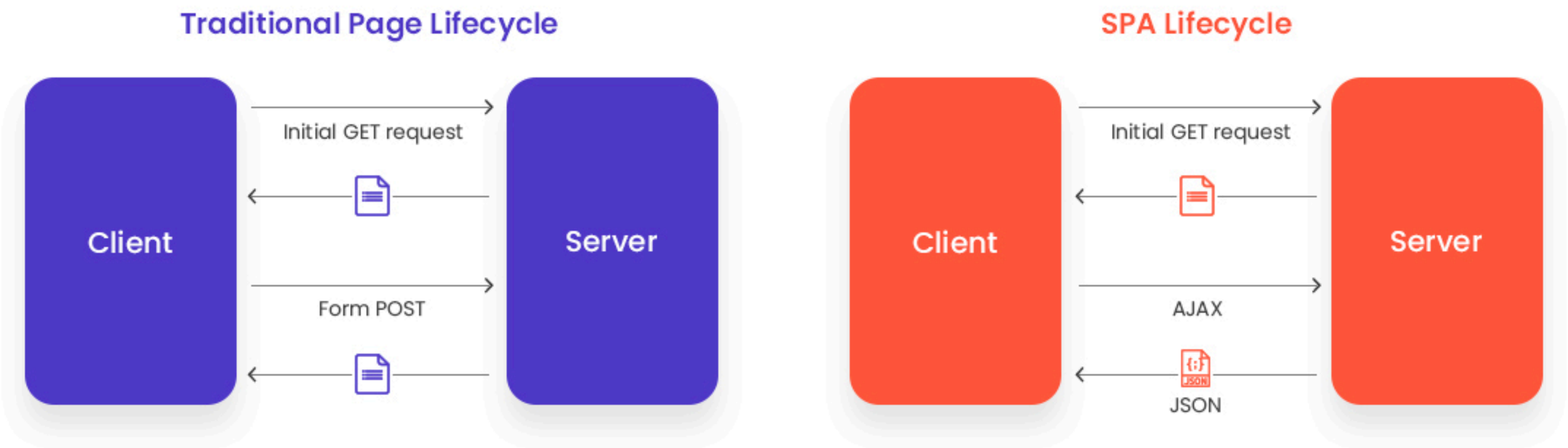
SPA



MPA



excellentwebworld.com/what-is-a-single-page-application



excellentwebworld.com/what-is-a-single-page-application

React Router

... a client & server-side routing library for React

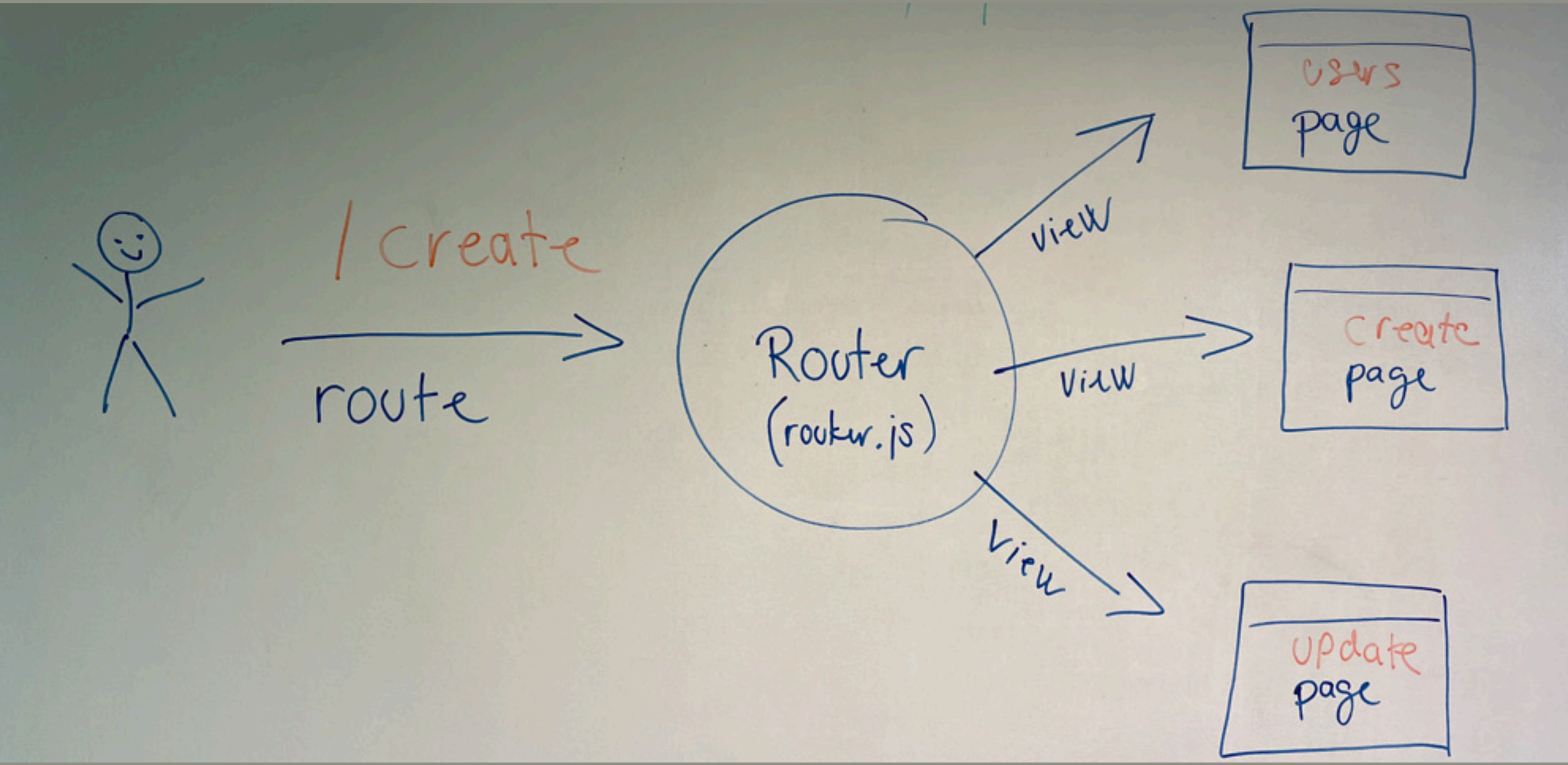
```
<Routes>
    <Route path="/" element={<HomePage />} />
    <Route path="about" element={<AboutPage />} />
    <Route path="*" element={<Navigate to="/" />} />
</Routes>
```

What’s a Router?

“*It is the piece of software in charge to organize the states of the application, switching between different views.*”

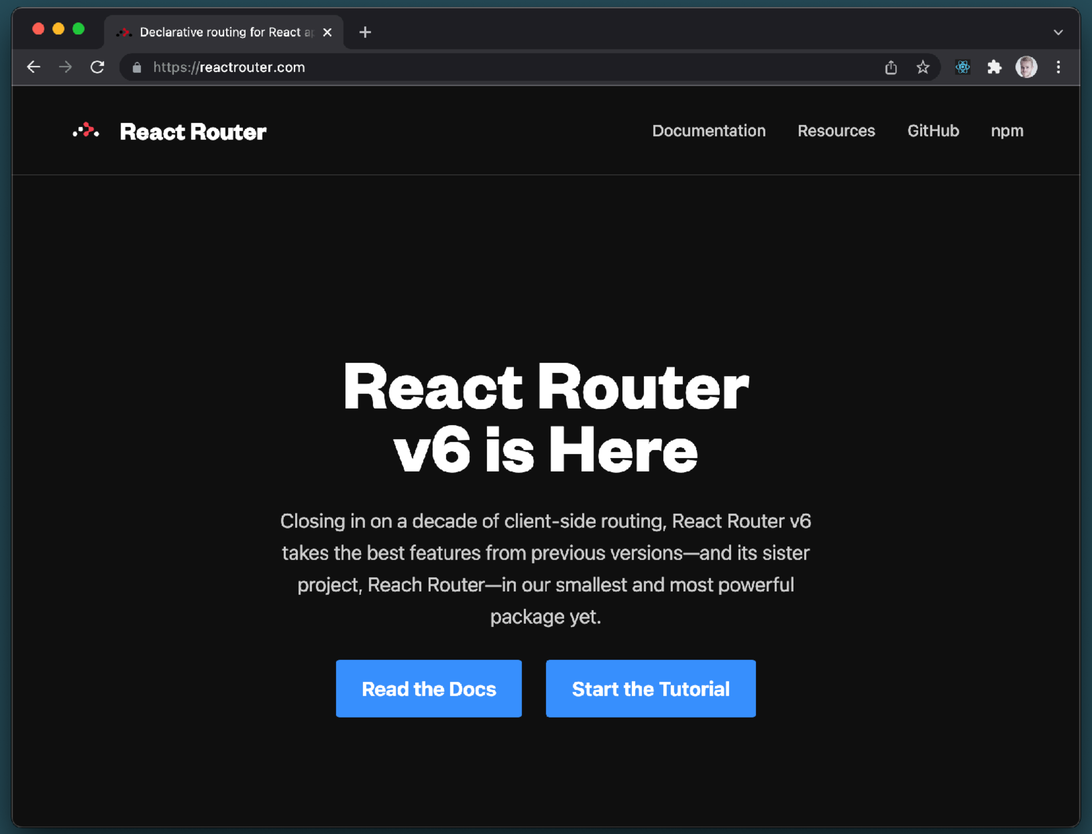
It’s a key component in Single Page Applications.

https://medium.com/@fro_g/routing-in-javascript-d552ff4d2921


/create
route
Router
(router.js)
view
view
view
users
page
create
page
update
page

Create React SPA

With React Router

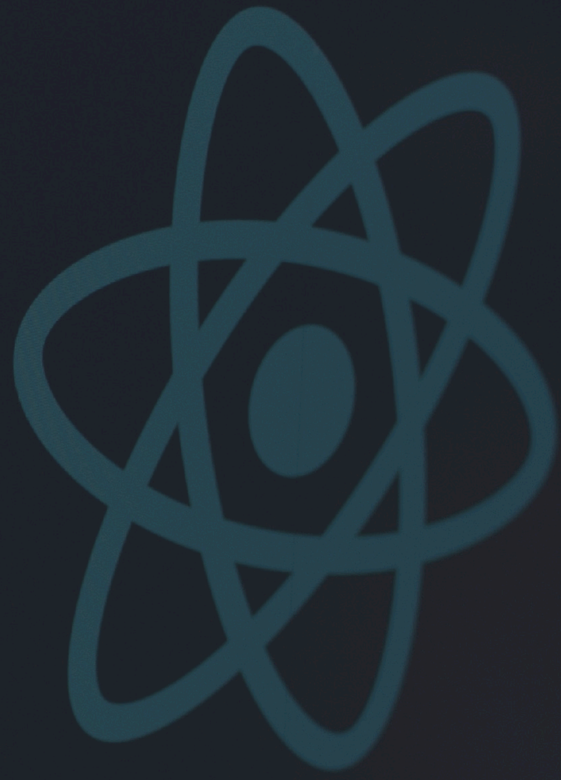


Create React SPA

React Pratice

Practice your React knowledge with create-react-app and react-router:

1. Build a Portfolio site template with pages (components) like Home, Projects, About and Contact.
2. Do a remake of Canvas Users SPA with React. You can find inspiration on GitHub: `react-starters` and `react-cdn-starters`
3. Checkout React Self-study and Guides & Tutorials



Code Every Day