ACADE MIND

What Is React? And Why Would We Use It?

ACADEMIND

React is a JavaScript library for
building user interfaces

ACADEMIND

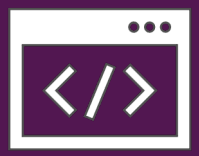
React makes building complex, interactive and reactive user interfaces simpler

ACADEMIND

What is React.js?

React.js

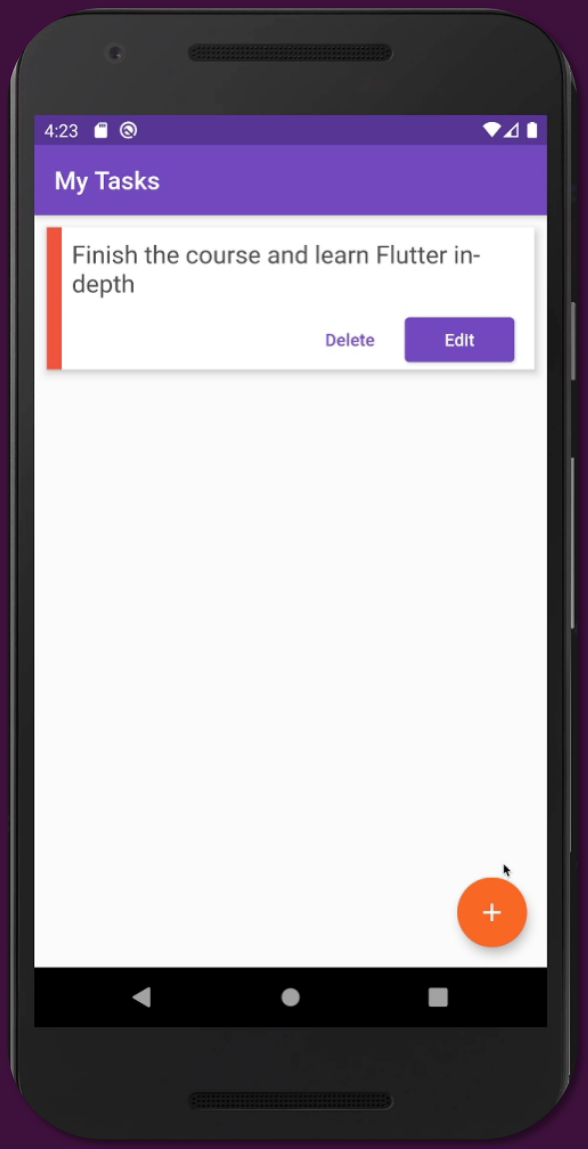
A client-side JavaScript library



All about building modern, reactive user interfaces for the web

Declarative, component-focused approach

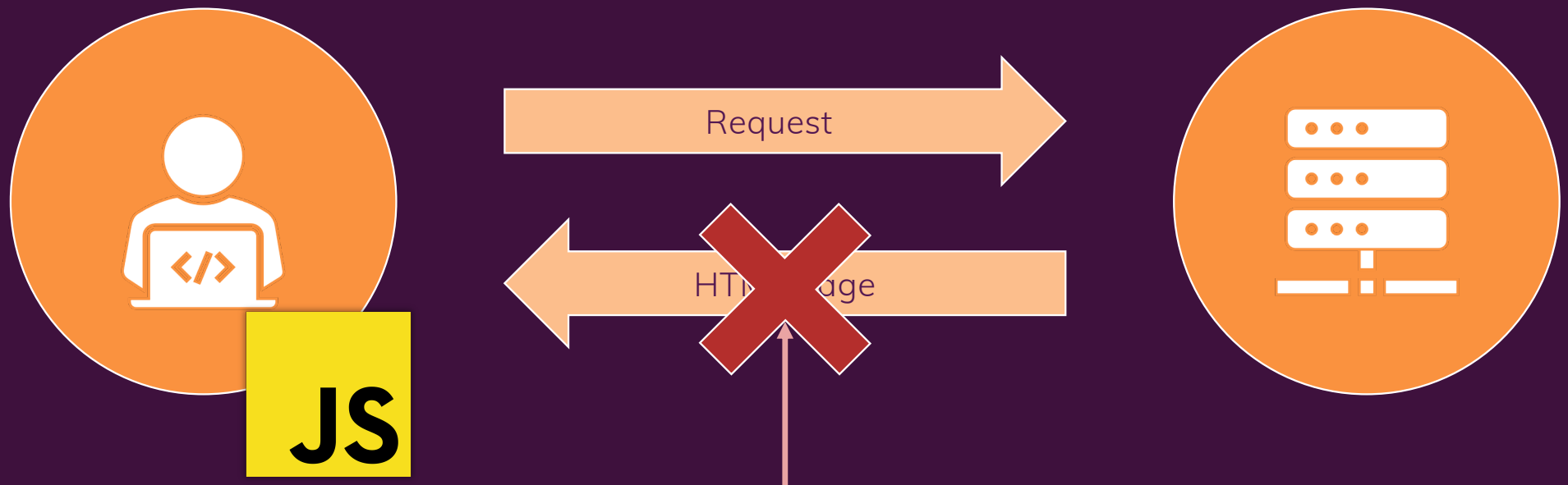
ACADEMIND



Mobile apps and desktop apps feel very "reactive": Things happen instantly, you don't wait for new pages to load or actions to start.

Traditionally, in web apps, you click a link and wait for a new page to load. You click a button and wait for some action to complete.

JavaScript To The Rescue!



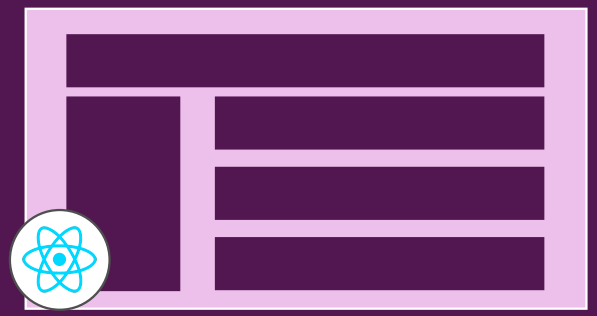
JavaScript runs in the browser – on the loaded page.

You can manipulate the HTML structure (DOM) of the page.

No (visible) request to the server required, no need to wait for a new HTML page as a response.

Building Single-Page-Applications (SPAs)

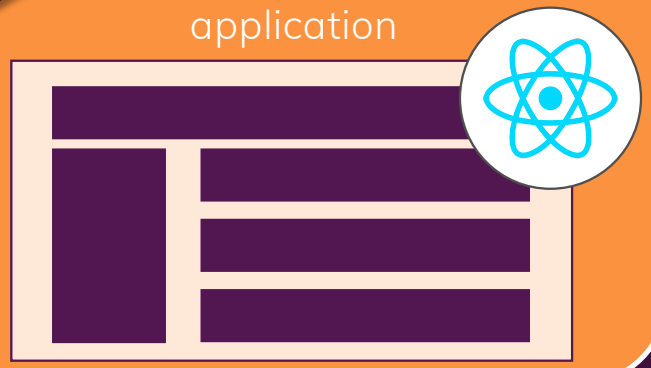
React can be used to **control parts** of HTML pages or entire pages.



"**Widget**" approach on a multi-page-application.
(Some) pages are still **rendered on and served by a backend server**.

In this course!

can also be used to **control the entire frontend** of a web application



"Single-Page-Application" (**SPA**) approach. Server **only sends one HTML page**, thereafter, React takes over and controls the UI.

ACADEMIND

HTML, CSS & JavaScript are about building user interfaces as well

ACADEMIND

React.js Alternatives

Angular

Complete component-based UI framework, packed with features. Uses TypeScript. Can be overkill for smaller projects.

React.js

Lean and focused component-based UI library. Certain features (e.g. routing) are added via community packages.

Vue.js

Complete component-based UI framework, includes most core features. A bit less popular than React & Angular.

ACADEMIND

About This Course & Course Outline

Theory / Small Demos & Examples + **More Realistic (Bigger) Example Projects** + **Challenges & Exercises**

Basics & Foundation *(Introducing Key Features)*	Advanced Concepts *(Building for Production)*	Summaries & Refreshers *(Optimizing your Time)*
Components & Building UIs	Side Effects, “Refs” & More React Hooks	JavaScript Refresher
Working with Events & Data: “props” and “state”	React’s Context API & Redux	ReactJS Summary
Styling React Apps & Components	Forms, Http Requests & ”Custom Hooks”	React Hooks Summary
Introduction into “React Hooks”	Routing, Deployment, NextJS & More	

ACADEMIND

Taking This Course: Two Options

Standard Approach
(Recommended)

- Start with lecture 1 in section 1 and go through the course step by step
- Skip JavaScript refresher module if you don't need it
- Use React summary module at the end to summarize what you learned or to refresh knowledge in the future

Summary Approach
(If you're in a hurry)

- Skip forward to the React summary module
- Optionally also take JavaScript refresher module if you need it
- Go through the entire course after going through the summary module and / or if you got more time in the future

ACADEMIND

How To Get The Most Out Of The Course

Watch the Videos
(choose your pace)

Code Along & Practice
(also without me telling you)

Debug Errors & Explore Solutions
(also use code attachments)

Help Each Other & Learn Together
(Discord, Q&A Board)

In this module, I provided a brief introduction into some core next-gen JavaScript features, of course focusing on the ones you'll see the most in this course. Here's a quick summary!

let & const

Read more about `let` : https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Statements/let

Read more about `const` : https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Statements/const

`let` and `const` basically replace `var` . You use `let` instead of `var` and `const` instead of `var` if you plan on never re-assigning this "variable" (effectively turning it into a constant therefore).

ES6 Arrow Functions

Read more: https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Functions/Arrow_functions

Arrow functions are a different way of creating functions in JavaScript. Besides a shorter syntax, they offer advantages when it comes to keeping the scope of the `this` keyword (see here).

Arrow function syntax may look strange but it's actually simple.

```
function callMe(name) {
    console.log(name);
}
```

which you could also write as:

```
const callMe = function(name) {
    console.log(name);
}
```

becomes:

```
const callMe = (name) => {
    console.log(name);
}
```

Important:

When having **no arguments**, you have to use empty parentheses in the function declaration:

```
const callMe = () => {
    console.log('Max!');
}
```

When having **exactly one argument**, you may omit the parentheses:

```
const callMe = name => {
    console.log(name);
}
```

When **just returning a value**, you can use the following shortcut:

```
const returnMe = name => name
```

That's equal to:

```
const returnMe = name => {
    return name;
}
```

Exports & Imports

In React projects (and actually in all modern JavaScript projects), you split your code across multiple JavaScript

files - so-called modules. You do this, to keep each file/module focused and manageable.

To still access functionality in another file, you need `export` (to make it available) and `import` (to get access) statements.

You got two different types of exports: **default** (unnamed) and **named**exports:

default => `export default ...;`

named => `export const someData = ...;`

You can import **default exports** like this:

```
import someNameOfYourChoice from './path/to/file.js';
```

Surprisingly, `someNameOfYourChoice` is totally up to you.

Named exports have to be imported by their name:

```
import { someData } from './path/to/file.js';
```

A file can only contain one default and an unlimited amount of named exports. You can also mix the one default with any amount of named exports in one and the same file.

When importing **named exports**, you can also import all named exports at once with the following syntax:

```
import * as upToYou from './path/to/file.js';
```

`upToYou` is - well - up to you and simply bundles all exported variables/functions in one JavaScript object. For example, if you `export const someData = ...` (`/path/to/file.js`) you can access it on `upToYou` like this: `upToYou.someData`.

Classes

Classes are a feature which basically replace constructor functions and prototypes. You can define blueprints for JavaScript objects with them.

Like this:

```
class Person {
    constructor () {
        this.name = 'Max';
    }
}

const person = new Person();
console.log(person.name); // prints 'Max'
```

In the above example, not only the class but also a property of that class (=> `name`) is defined. They syntax you see there, is the "old" syntax for defining properties. In modern JavaScript projects (as the one used in this course), you can use the following, more convenient way of defining class properties:

```
class Person {
    name = 'Max';
}

const person = new Person();
console.log(person.name); // prints 'Max'
```

You can also define methods. Either like this:

```
class Person {
    name = 'Max';
    printMyName () {
        console.log(this.name); // this is required to refer to the class!
    }
}

const person = new Person();
person.printMyName();
```

Or like this:

```
class Person {
    name = 'Max';
    printMyName = () => {
        console.log(this.name);
    }
}

const person = new Person();
person.printMyName();
```

The second approach has the same advantage as all arrow functions have: The `this` keyword doesn't change its reference.

You can also use **inheritance** when using classes:

```
class Human {
    species = 'human';
}

class Person extends Human {
    name = 'Max';
    printMyName = () => {
        console.log(this.name);
    }
}

const person = new Person();
```

```
person.printMyName();
console.log(person.species); // prints 'human'
```

Spread & Rest Operator

The spread and rest operators actually use the same syntax: `...`

Yes, that is the operator - just three dots. It's usage determines whether you're using it as the spread or rest operator.

Using the Spread Operator:

The spread operator allows you to pull elements out of an array (=> split the array into a list of its elements) or pull the properties out of an object. Here are two examples:

```
const oldArray = [1, 2, 3];
const newArray = [...oldArray, 4, 5]; // This now is [1, 2, 3, 4, 5];
```

Here's the spread operator used on an object:

```
const oldObject = {
    name: 'Max'
};
const newObject = {
    ...oldObject,
    age: 28
};
```

`newObject` would then be

```
{
    name: 'Max',
    age: 28
}
```

The spread operator is extremely useful for cloning arrays and objects. Since both are reference types (and not

primitives), copying them safely (i.e. preventing future mutation of the copied original) can be tricky. With the spread operator you have an easy way of creating a (shallow!) clone of the object or array.

Destructuring

Destructuring allows you to easily access the values of arrays or objects and assign them to variables.

Here's an example for an array:

```
const array = [1, 2, 3];
const [a, b] = array;
console.log(a); // prints 1
console.log(b); // prints 2
console.log(array); // prints [1, 2, 3]
```

And here for an object:

```
const myObj = {
    name: 'Max',
    age: 28
}
const {name} = myObj;
console.log(name); // prints 'Max'
console.log(age); // prints undefined
console.log(myObj); // prints {name: 'Max', age: 28}
```

Destructuring is very useful when working with function arguments. Consider this example:

```
const printName = (personObj) => {
    console.log(personObj.name);
}
printName({name: 'Max', age: 28}); // prints 'Max'
```

Here, we only want to print the name in the function but we pass a complete person object to the function. Of course this is no issue but it forces us to call personObj.name

inside of our function. We can condense this code with destructuring:

```
.   const printName = ({name}) => {
.       console.log(name);
.   }
.   printName({name: 'Max', age: 28}); // prints 'Max')
```

We get the same result as above but we save some code. By destructuring, we simply pull out the `name` property and store it in a variable/ argument named `name` which we then can use in the function body.

ACADEMIND

React is a JavaScript library for
building user interfaces

ACADEMIND

HTML, CSS & JavaScript are about building user interfaces as well

ACADEMIND

React makes building complex, interactive and reactive user interfaces simpler

ACADEMIND

React is all about “Components”

What is a “Component”?

ACADEMIND

React is all about “Components”

Because all user interfaces in the end are made up of components

ACADEMIND

Why Components?

Reusability

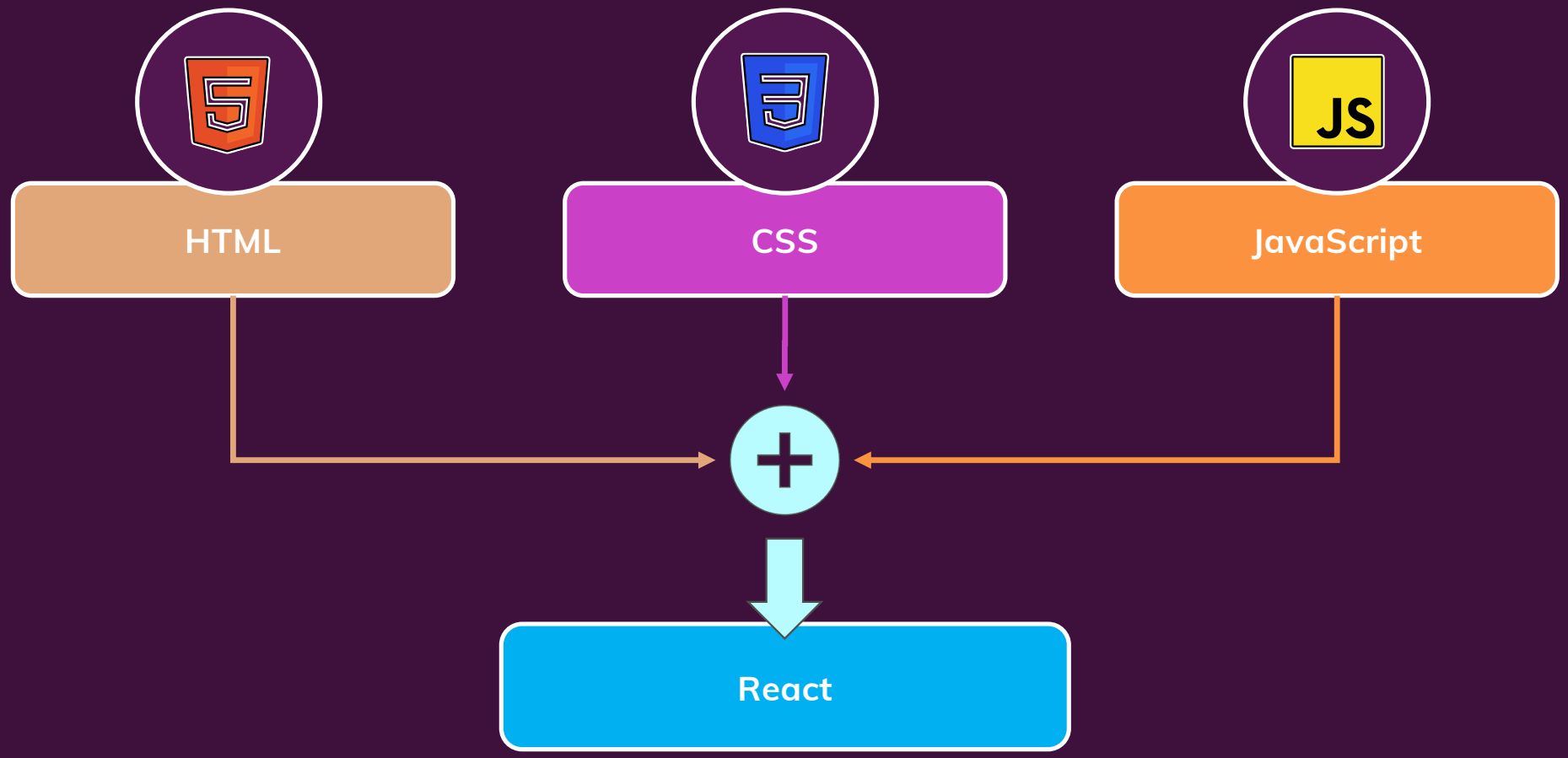
Don’t repeat yourself

Separation of Concerns

Don’t do too many things in one and the same place (function)

Split big chunks of code into multiple smaller functions

How Is A Component Built?



React & Components

React allows you to create **re-usable and reactive components** consisting of **HTML and JavaScript** (and CSS)

Declarative Approach

Define the desired target state(s) and let React figure out the actual JavaScript DOM instructions

ACADEMIND

Build your own, custom HTML Elements

ACADEMIND

JSX = “HTML in JavaScript”

Understanding JSX

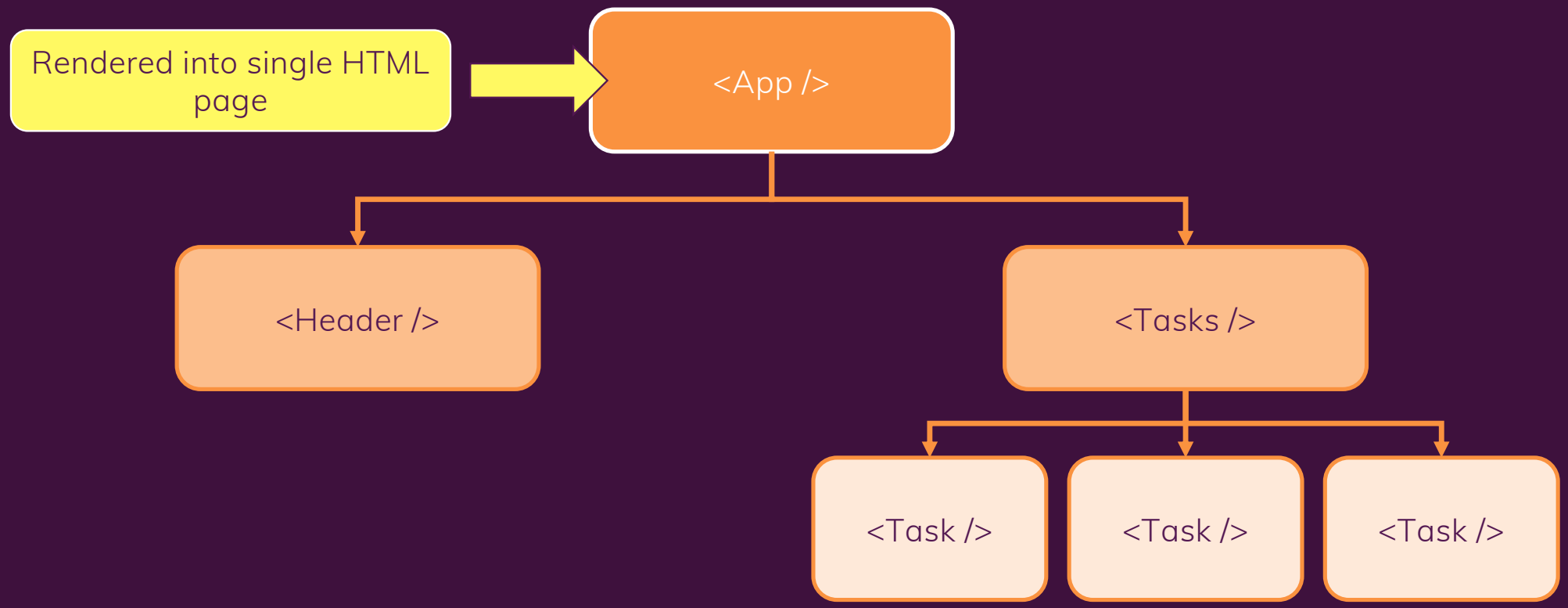
```
<p title="Intro text">
React.js is a library for
building user interfaces.
</p>
```

```
React.createElement(
        'p',
  { title: 'Intro text' },
'React.js is a library for
building user interfaces.'
        );
```

"**Syntactic sugar**", does **not run** in the browser like this!

Real JavaScript code, would run in the browser like this. Not nice to use for more complex than "HTML code".

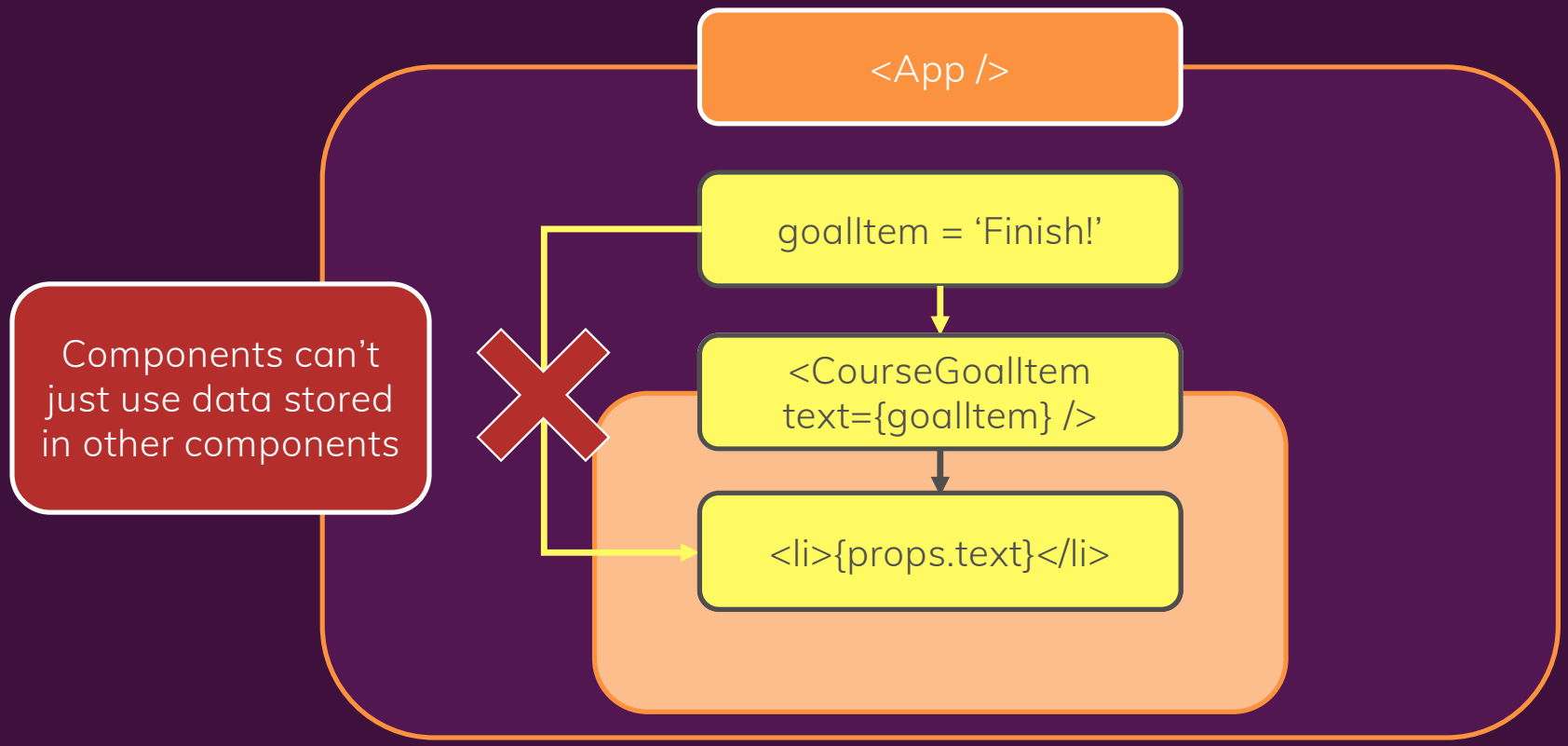
You Build A Component Tree



ACADEMIND

Props are the “attributes” of your “custom HTML elements” (Components)

Passing Data via “Props”



ACADEMIND

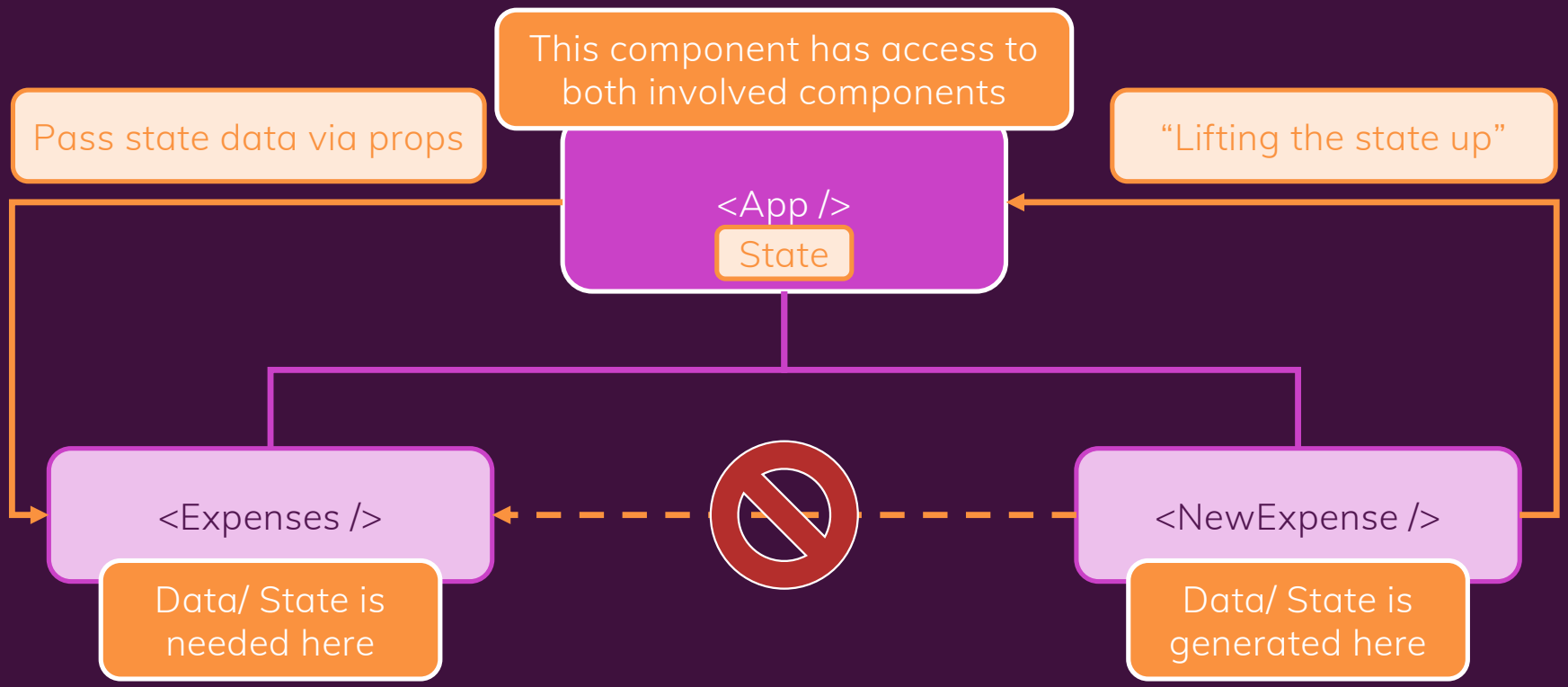
Updating Data via "State"

By default, React does not care about changes of variables inside of components. It does not re-evaluate the component's JSX markup.

"State" is data managed by React, where changes of the data do force React to re-evaluate ("re-render") the component where the data changed.

Child components of components where state changed are also re-evaluated.

Lifting State Up



ACADEMIND

Stateful vs Stateless Components

Stateful Components

React components that manage internal state

Typically, you have only a couple of these

Also called “smart” components or “containers”.

Stateless Components

React components which only (possibly) use props, output JSX and add styling.

Typically, you have plenty of these.

Also called “dumb” or “presentational” components.

ACADEMIND

An Alternative Way Of Building Components

Functional Components

- JavaScript Functions which return JSX
- React executes them for you (initially and upon state changes)
- Use “React Hooks” for state management

Class-based Components

- JavaScript classes as blueprints for components.
- render() method for outputting JSX (called by React)
- Historically (React <16.8), the only way of managing state!

ACADEMIND

JSX Limitations

```
return (
  <h2>Hi there!</h2>
  <p>This does not work :-(</p>
);
```

You **can't return more than one "root" JSX element** (you also can't store more than one "root" JSX element in a variable).

Because this also isn't valid JavaScript

```
return (
  React.createElement('h2', {}, 'Hi there!')
  React.createElement('p', {}, 'This does not work :-(')
);
```

The Solution: Always Wrap Adjacent Elements

```
return (
  <div>
    <h2>Hi there!</h2>
    <p>This does not work :-(</p>
  </div>
);
```

Important: Doesn't have to be a - ANY element will do the trick.

A New Problem: “ Soup”

```
<div>
  <div>
    <div>
      <div>
        <h2>Some content - yeah, this can really happen.</h2>
      </div>
    </div>
  </div>
</div>
```

In bigger apps, you can easily end up with **tons of unnecessary **s (or other elements) which add **no semantic meaning or structure** to the page but **are only there because of React’s/ JSX’ requirement**.

Introducing Fragments

```
return (
  <React.Fragment>
    <h2>Hi there!</h2>
    <p>This does not work :-(</p>
  </React.Fragment>
);
```

OR

```
return (
  <>
    <h2>Hi there!</h2>
    <p>This does not work :-(</p>
  </>
);
```

It's an **empty wrapper component**: It **doesn't render** any real HTML element to the DOM. But it **fulfills React's/ JSX' requirement**.

Understanding React Portals

```
return (
  <React.Fragment>
    <MyModal />
    <MyInputForm />
  </React.Fragment>
);
```

Real DOM

```
<section>
  <h2>Some other content … </h2>
  <div class="my-modal">
    <h2>A Modal Title!</h2>
  </div>
  <form>
    <label>Username</label>
    <input type="text" />
  </form>
</section>
```

Semantically and from a "clean HTML structure" perspective, having this nested modal isn't ideal. It is an **overlay to the entire page** after all (that's similar for side-drawers, other dialogs etc.).

Understanding React Portals

It's a bit like styling a like a <button> and adding an event listener to it: It'll work, but it's not a good practice.

```
<div onClick={clickHandler}>Click me, I'm a bad button</div>
```

ACADEMIND

Understanding React Portals

```
return (
  <React.Fragment>
    <MyModal />
    <MyInputForm />
  </React.Fragment>
);
```

Real DOM

```
<section>
  <h2>Some other content … </h2>
  <div class="my-modal">
    <h2>A Modal Title!</h2>
  </div>
  <form>
    <label>Username</label>
    <input type="text" />
  </form>
</section>
```

Understanding React Portals

```
return (
  <React.Fragment>
    <MyModal />
    <MyInputForm />
  </React.Fragment>
);
```

Real DOM

```
<div class="my-modal">
  <h2>A Modal Title!</h2>
</div>
<section>
  <h2>Some other content … </h2>
  <form>
    <label>Username</label>
    <input type="text" />
  </form>
</section>
```

ACADEMIND

Rules of Hooks

Only call React Hooks in **React Functions**

- React Component Functions
- Custom Hooks (covered later!)

Only call React Hooks at the **Top Level**

- Don't call them in nested functions
- Don't call them in any block statements

+ extra, unofficial Rule for **useEffect()**: ALWAYS add everything you refer to inside of useEffect() as a dependency!

What is an “Effect” (or a “Side Effect”)?

Main Job: Render UI & React to User Input

Evaluate & Render JSX
Manage State & Props
React to (User) Events & Input
Re-evaluate Component upon State & Prop Changes

This all is “baked into” React via the “tools” and features covered in this course (i.e. useState() Hook, Props etc).

Side Effects: Anything Else

Store Data in Browser Storage
Send Http Requests to Backend Servers
Set & Manage Timers
...

These tasks **must happen outside of the normal component evaluation** and render cycle – especially since they might block/ delay rendering (e.g. Http requests)

ACADEMIND

Handling Side Effects with the useEffect() Hook

```
useEffect(() => { … }, [ dependencies ]);
```

A function that should be executed AFTER every component evaluation IF the specified dependencies changed

Dependencies of this effect – the function only runs if the dependencies changed

Your side effect code goes into this function.

Specify your dependencies of your function here

ACADEMIND

Introducing useReducer() for State Management

Sometimes, you have **more complex state** – for example if it got **multiple states**, **multiple ways of changing** it or **dependencies** to other states

useState() then often **becomes hard or error-prone to use** – it's easy to write bad, inefficient or buggy code in such scenarios

useReducer() can be used as a **replacement** for useState() if you need "**more powerful state management**"

Understanding useReducer()

```
const [state, dispatchFn] = useReducer(reducerFn, initialState, initFn);
```

The state snapshot used in the component re-render/ re-evaluation cycle

A function that can be used to dispatch a new action (i.e. trigger an update of the state)

The initial state

A function to set the initial state programmatically

```
(prevState, action) => newState
```

A function that is **triggered automatically** once an action is **dispatched** (via `dispatchFn()`) – it **receives the latest state snapshot** and **should return the new, updated state**.

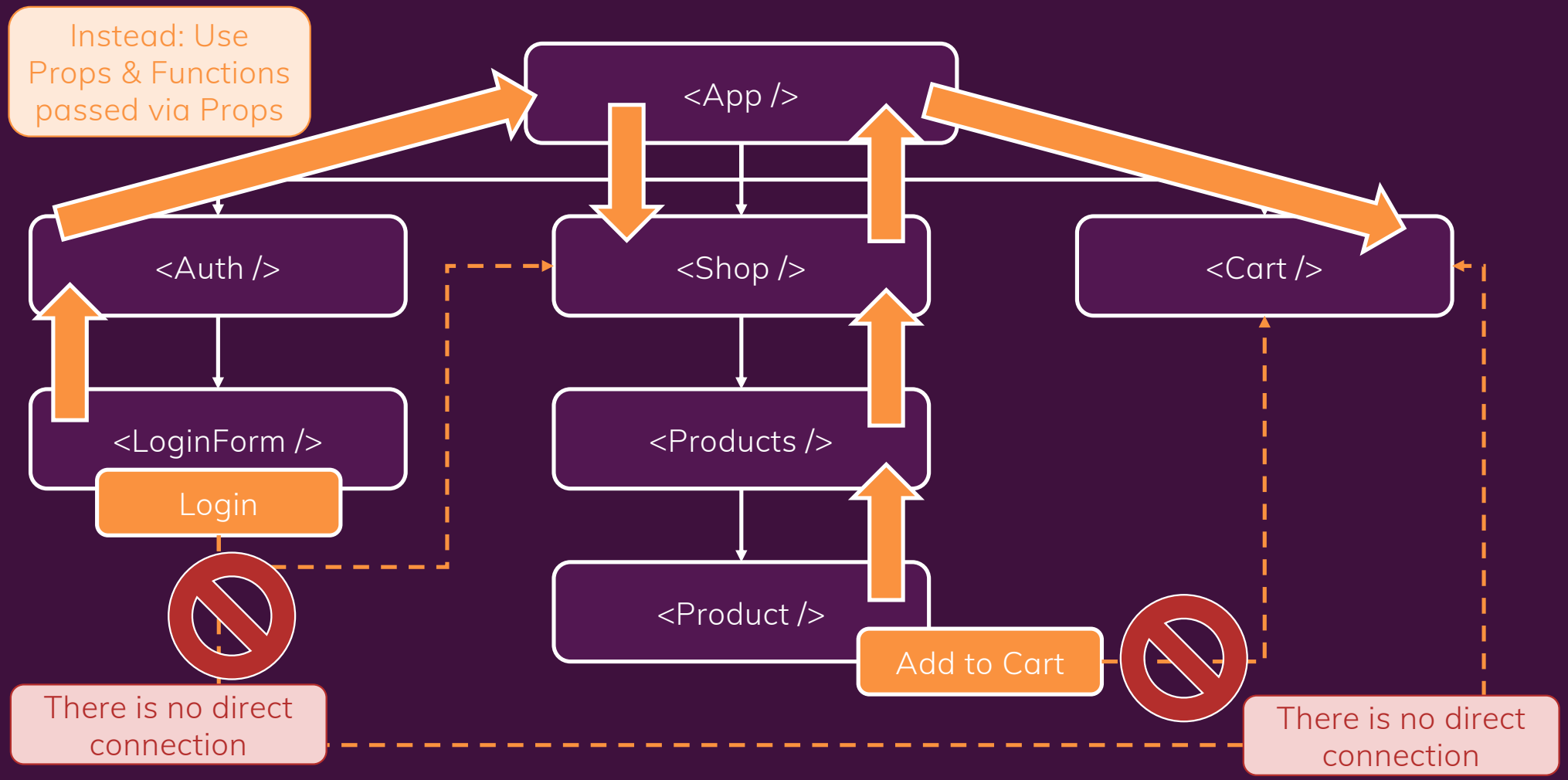
ACADEMIND

useState() vs useReducer()

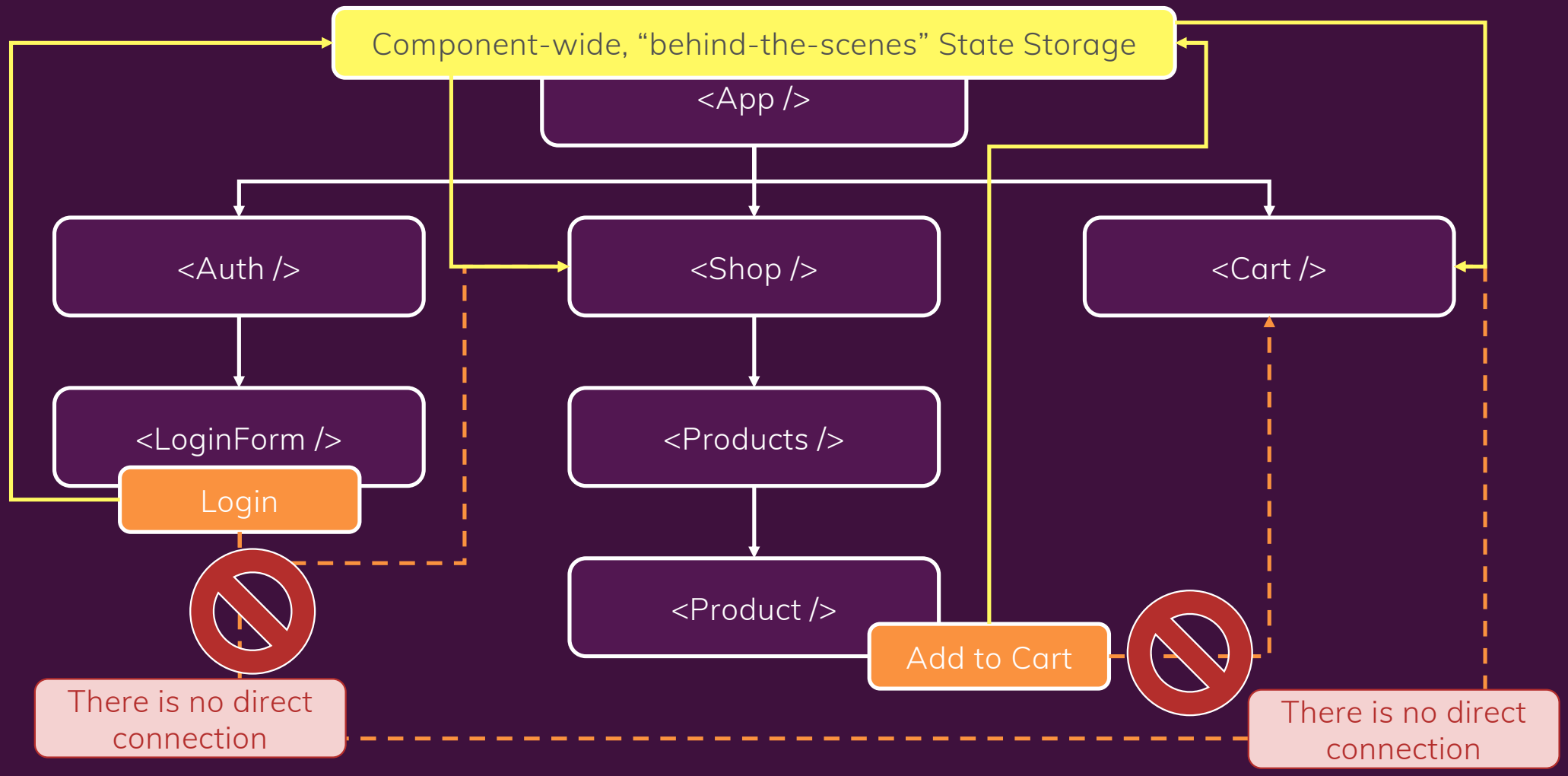
Generally, you'll know when you need useReducer() (➔ when using useState() becomes cumbersome or you're getting a lot of bugs/ unintended behaviors)

useState()	useReducer()
The main state management "tool"	Great if you need "more power"
Great for independent pieces of state/ data	Should be considered if you have related pieces of state/ data
Great if state updates are easy and limited to a few kinds of updates	Can be helpful if you have more complex state updates

Component Trees & Component Dependencies



Context to the Rescue!



ACADEMIND

Context Limitations

React Context is **NOT optimized** for high frequency changes!

We'll explore a better tool for that, later

React Context also **shouldn't be used to replace ALL** component communications and props

Component should still be configurable via props and short "prop chains" might not need any replacement

ACADEMIND

Rules of Hooks

Only call React Hooks in **React Functions**

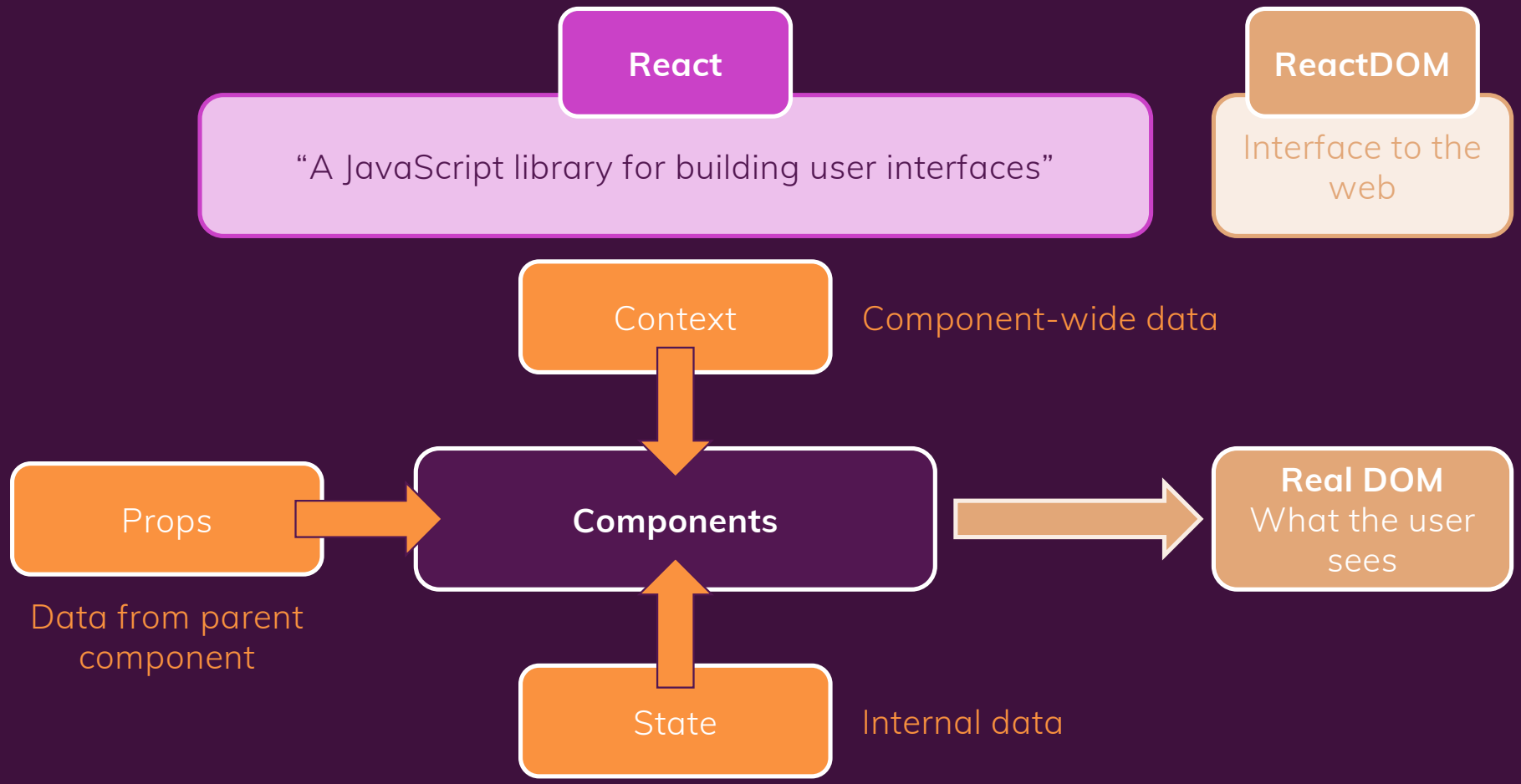
- React Component Functions
- Custom Hooks (covered later!)

Only call React Hooks at the **Top Level**

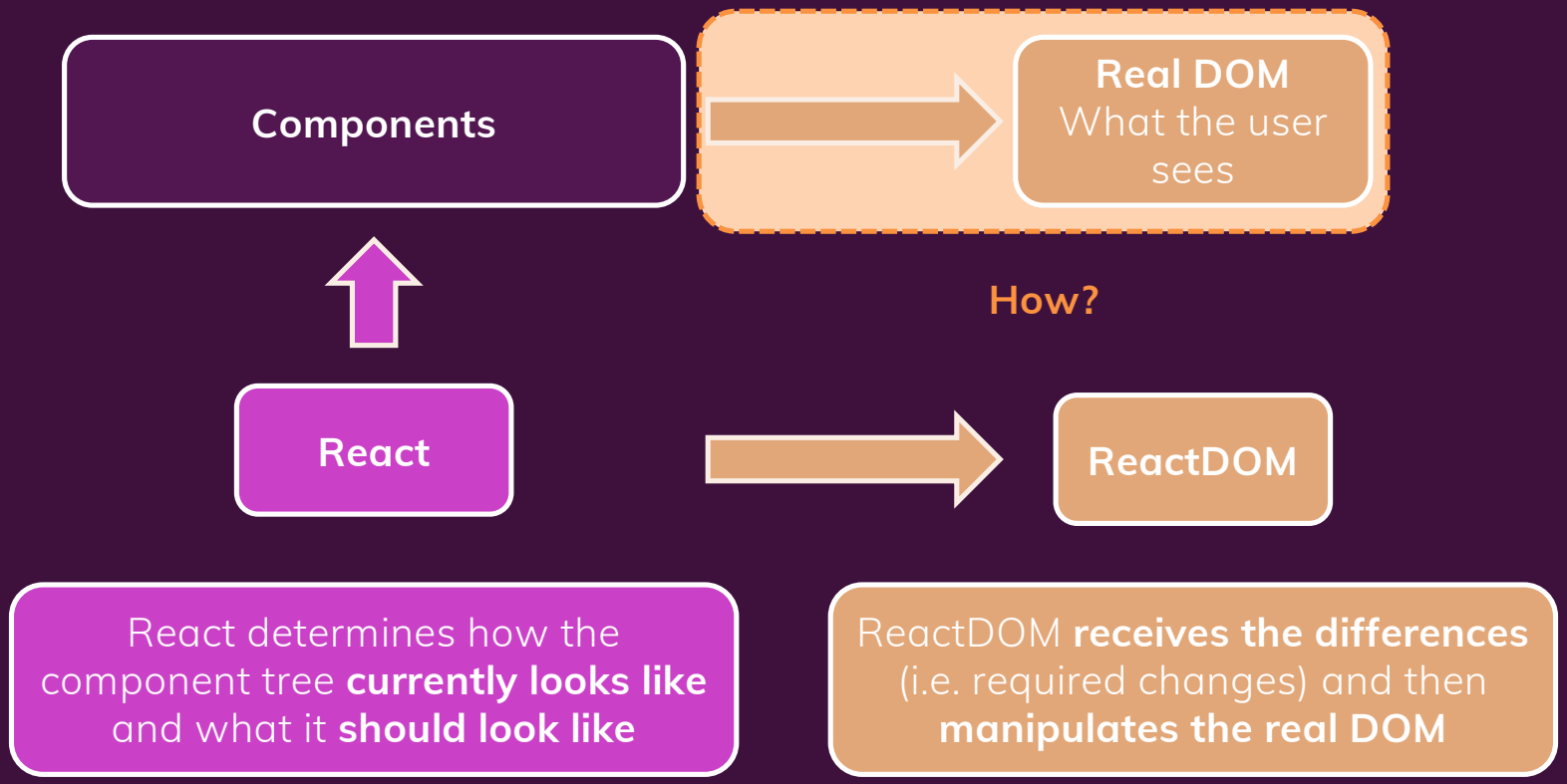
- Don't call them in nested functions
- Don't call them in any block statements

+ extra, unofficial Rule for **useEffect()**: ALWAYS add everything you refer to inside of useEffect() as a dependency!

How Does React Work?



How Does React Work?



Re-Evaluating Components !== Re-Rendering the DOM

Components

Re-evaluated whenever props, state or context changes

React executes component functions

Real DOM

Changes to the real DOM are only made for **differences between evaluations**

Virtual DOM Diffing

Previous Evaluation Result

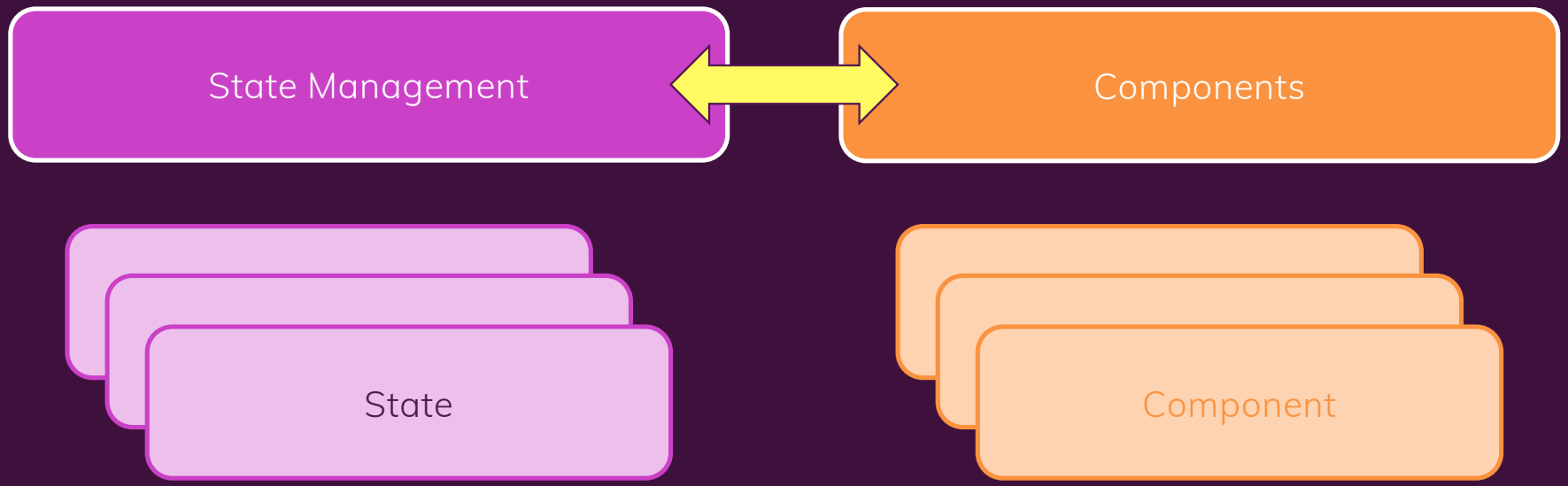
```
<div>
  <h1>Hi there!</h1>
</div>
```

Current Evaluation Result

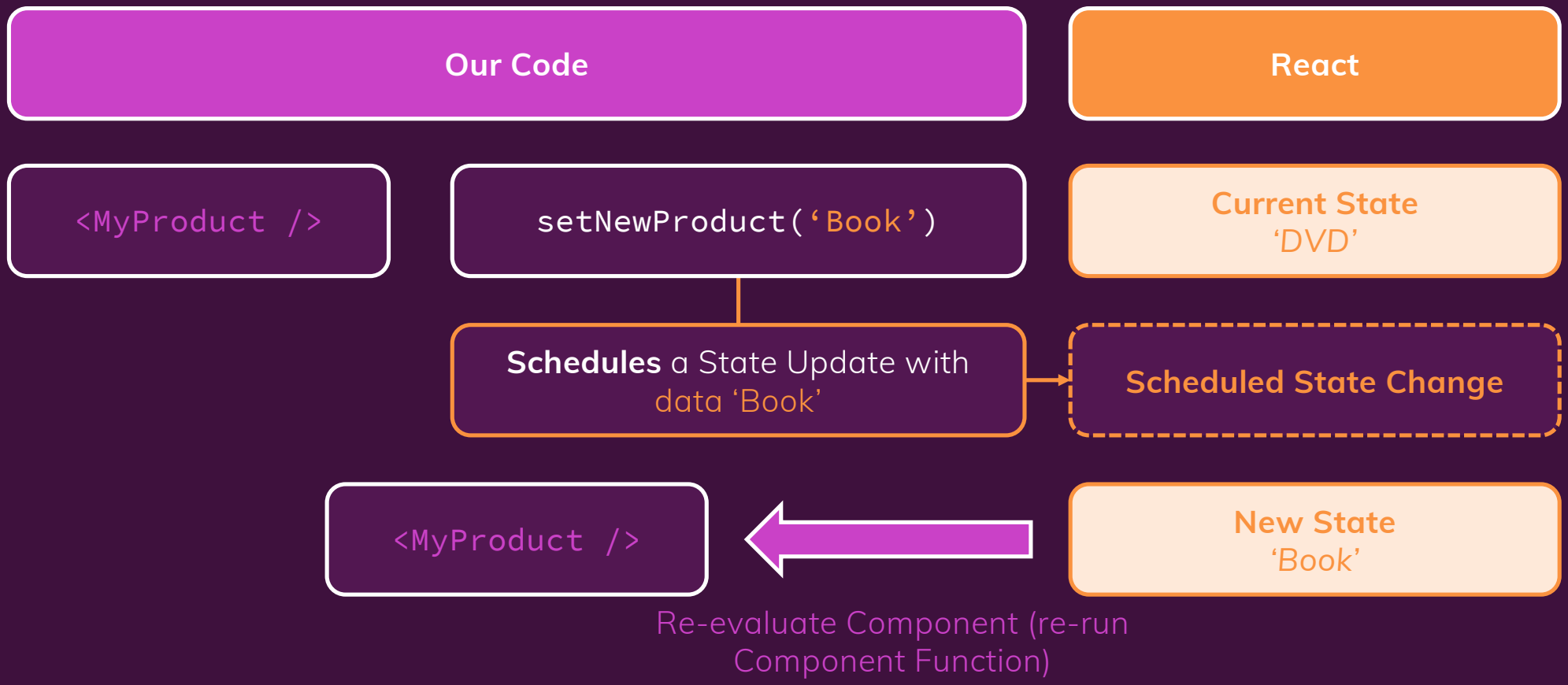
```
<div>
  <h1>Hi there!</h1>
  <p>This is new!</p>
</div>
```

Changes are required
<p> should be inserted in DOM (the rest should stay unchanged)

Components & State



State Updates & Scheduling



State Updates & Scheduling

React

Current State
'DVD'

Scheduled State Change

Scheduled State Change

New State
'Book'

Multiple updates can be scheduled at the same time!

Class-based Components: An Alternative To Functions

Default & Most Modern Approach!

Functional Components

```
function Product(props) {
  return <h2>A Product!</h2>
}
```

Components are regular JavaScript functions which return renderable results (typically JSX)

Was Required In The Past

Class-based Components

```
class Product extends Component {
  render() {
    return <h2>A Product!</h2>
  }
}
```

Components can also be defined as JS classes where a render() method defines the to-be-rendered output

ACADEMIND

Traditionally (React < 16.8), you had to use Class-based Components to manage "State"

ACADEMIND

React 16.8 introduced "React Hooks" for Functional Components

ACADEMIND

Class-based Components Can't Use React Hooks!

Class-based Component Lifecycle

Side-effects in Functional Components: **useEffect()**

Class-based Components can't use React Hooks!

componentDidMount()	Called once component mounted (was evaluated & rendered)	useEffect(..., [])
componentDidUpdate()	Called once component updated (was evaluated & rendered)	useEffect(..., [someValue])
componentWillUnmount()	Called right before component is unmounted (removed from DOM)	useEffect(() => { return () => {...}}, [])

ACADE MIND

You don’t have to use Functional Components – it is fine to use Class-based Ones instead

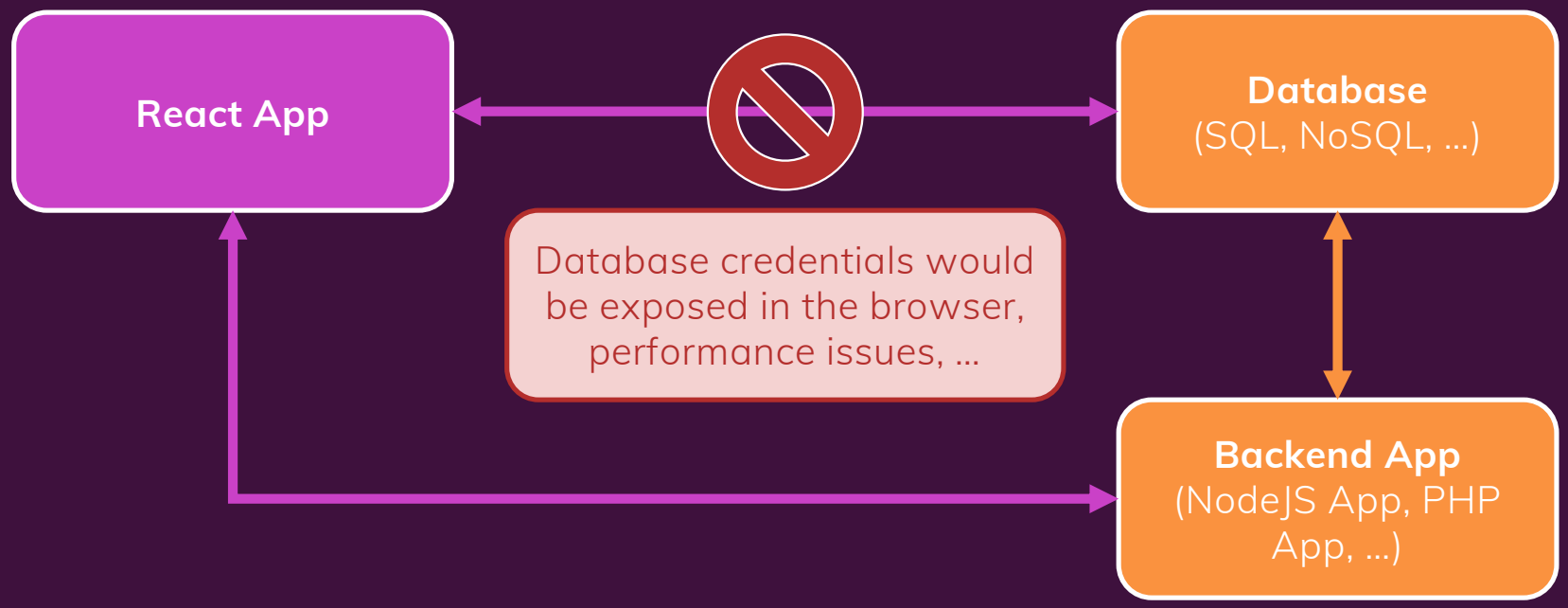
Class-based vs. Functional Components

Prefer functional components

Use class-based if...

- ...you prefer them
- ...you're working on an existing project or in a team where they're getting used
- ...you build an "Error Boundary"

Browser-side Apps Don't Directly Talk To Databases



ACADEMIND

Rules of Hooks

Only call React Hooks in **React Functions**

- React Component Functions
- Custom Hooks (covered later!)

Only call React Hooks at the **Top Level**

- Don't call them in nested functions
- Don't call them in any block statements

+ extra, unofficial Rule for **useEffect()**: ALWAYS add everything you refer to inside of useEffect() as a dependency!

ACADEMIND

What are “Custom Hooks”?

Outsource **stateful** logic into **re-usable functions**

Unlike ”regular functions”, custom hooks can use other React hooks and React state

What's Complex About Forms?

Forms and inputs can assume different states

One or more inputs are invalid

Output input-specific error messages & highlight problematic inputs

Ensure form can't be submitted / saved

All inputs are valid

Allow form to be submitted / saved

ACADEMIND

When To Validate?

When form is **submitted**

Allows the user to enter a valid value before warning him / her

Avoid unnecessary warnings but maybe present feedback "too late"

When a input is **losing focus**

Allows the user to enter a valid value before warning him / her

Very useful for untouched forms

On **every keystroke**

Warns user before he / she had a chance of entering valid values

If applied only on invalid inputs, has the potential of providing more direct feedback

ACADEMIND

What is “Redux”?

A state management system for cross-component or app-wide state

What Is Cross-Component / App-Wide State?

Local State	Cross-Component State	App-Wide State
State that belongs to a single component	State that affects multiple components	State that affects the entire app (most/ all components)
E.g. listening to user input in a input field; toggling a "show more" details field	E.g. open/ closed state of a modal overlay	E.g. user authentication status
Should be managed component-internal with useState() / useReducer()	Requires "prop chains" / "prop drilling"	Requires "prop chains" / "prop drilling"

OR: React Context or Redux

What is “Redux”?

A state management system for cross-component or app-wide state

Don’t we have “React Context” already?

React Context – Potential Disadvantages

Complex Setup / Management

In more complex apps, managing React Context can lead to deeply nested JSX code and / or huge “Context Provider” components

Performance

React Context is not optimized for high-frequency state changes

React Context – Complex Setup

```
return (
  <AuthContextProvider>
    <ThemeContextProvider>
      <UIInteractionContextProvider>
        <MultiStepFormContextProvider>
          <UserRegistration />
        </MultiStepFormContextProvider>
      </UIInteractionContextProvider>
    </ThemeContextProvider>
  </AuthContextProvider>
);
```

React Context – Complex Setup

```
function AllContextProvider() {
  const [isAuth, setIsAuth] = useState(false);
  const [isEvaluatingAuth, setIsEvaluatingAuth] = useState(false);
  const [activeTheme, setActiveTheme] = useState('default');
  const [ ... ] = useState(...);

  function loginHandler(email, password) { ... };

  function signupHandler(email, password) { ... };

  function changeThemeHandler(newTheme) { ... };

  ...

  return (
    <AllContext.Provider>

    </AllContext.Provider>
  )
}
```

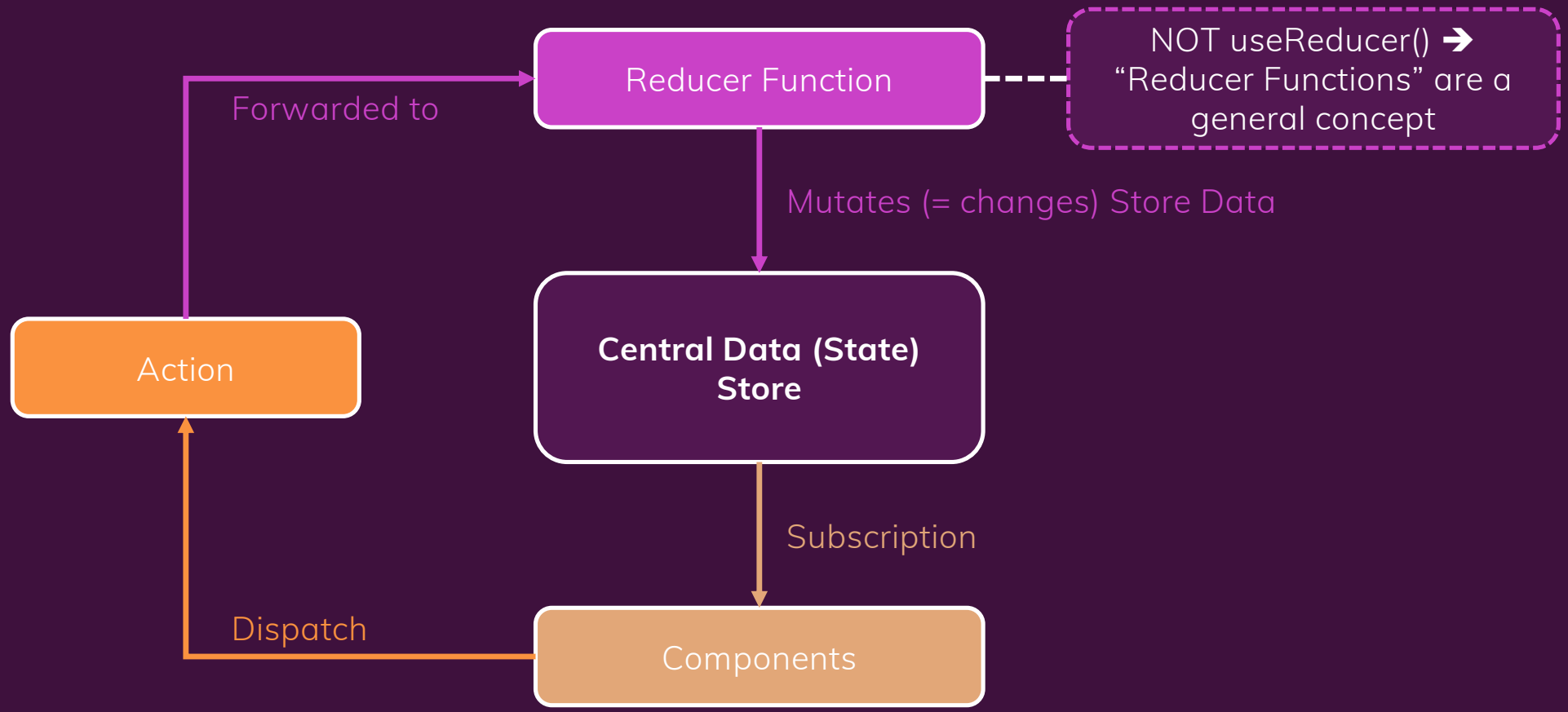
React Context – Performance

sebmarkbage commented on 18 Dec 2018 Member

My personal summary is that new context is ready to be used for low frequency unlikely updates (like locale/theme). It's also good to use it in the same way as old context was used. I.e. for static values and then propagate updates through subscriptions. It's not ready to be used as a replacement for all Flux-like state propagation.

👍 55 ❤️ 4

Core Redux Concepts



The Reducer Function

Should be a pure function → Same input leads to same output

Inputs: Old State + Dispatched Action

↓

Output: New State Object

The Role Of Immutability

State updates must be done in an immutable way!

Objects and arrays are reference values in JavaScript

↓

Changes made to an object property affect ALL places where the object gets used

New object / array copies (also of nested objects / arrays) must be created when producing a new state

Side Effects, Async Tasks & Redux

Reducers must be **pure**, **side-effect free**, **synchronous** functions

Input (Old State + Action) → Output (New State)

Where should side-effects and async tasks be executed?

- Inside the **components** (e.g. useEffect())
- Inside the **action creators**

Fat Reducers vs Fat Components vs Fat Actions

Where should our logic (code) go?

Synchronous, side-effect free code (i.e. data transformations)

Prefer Reducers

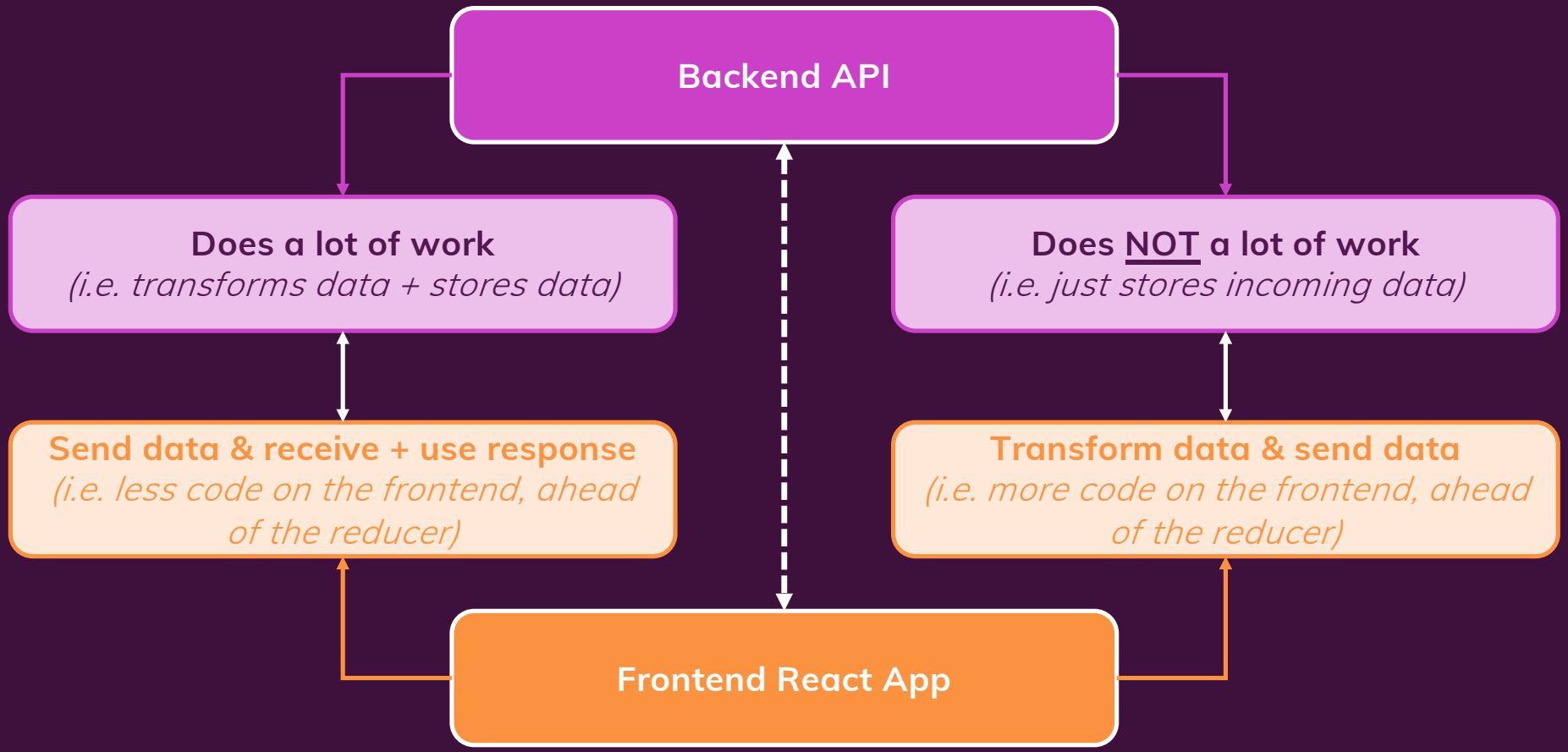
Avoid Action Creators or Components

Async code or code with side-effects

Prefer Action Creators or Components

Never use Reducers

Frontend Code Depends On Backend Code

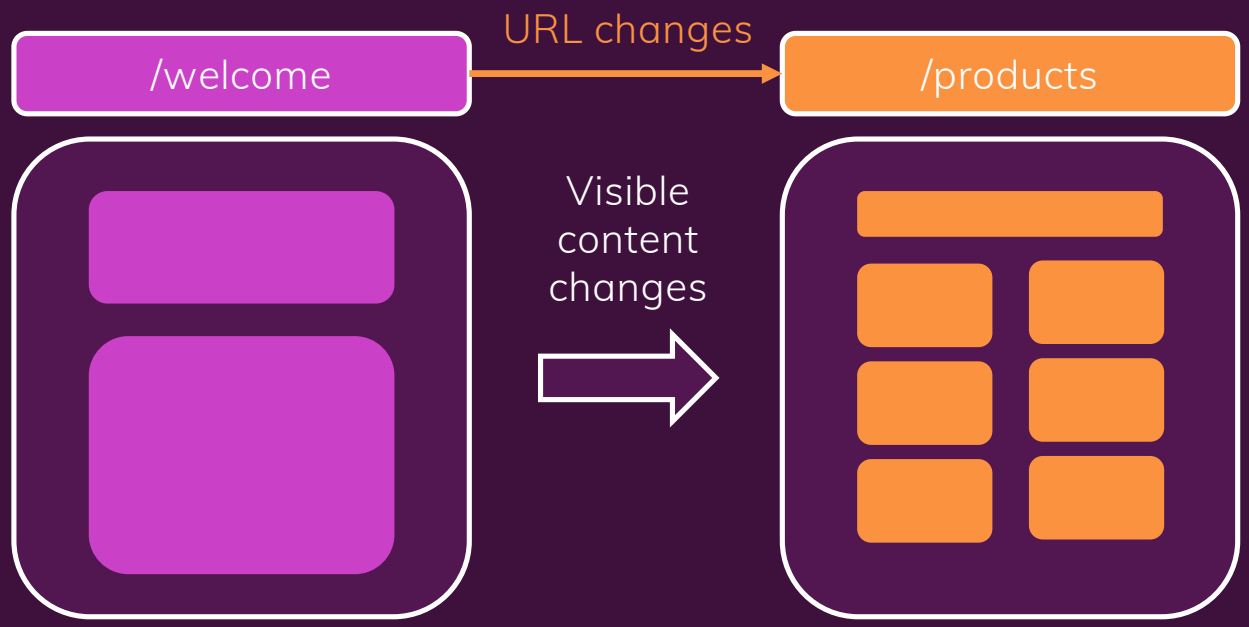


What is a “Thunk”?

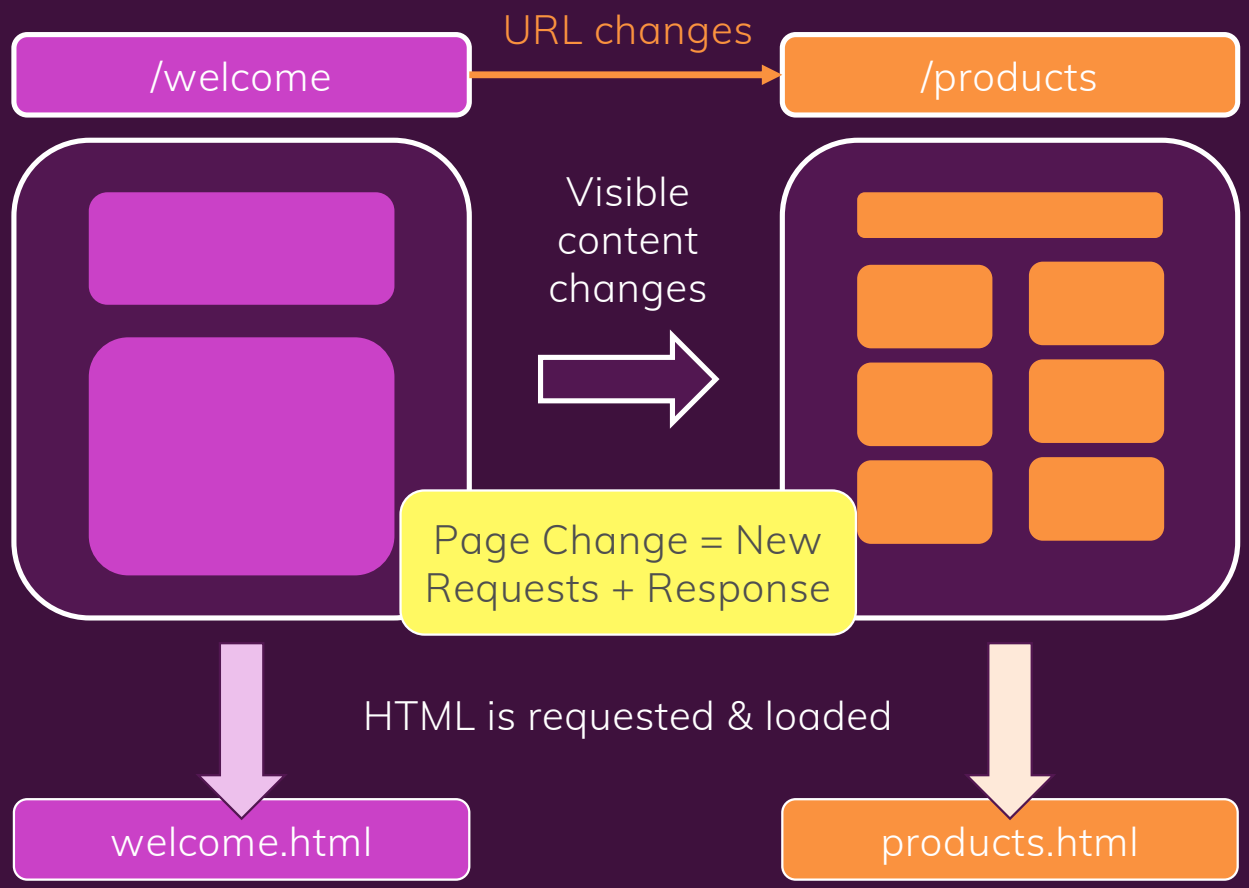
A function that delays an action until later

An action creator function that does NOT return the action itself but another function which eventually returns the action

What Is Routing?



Multi-Page Routing



Building SPAs

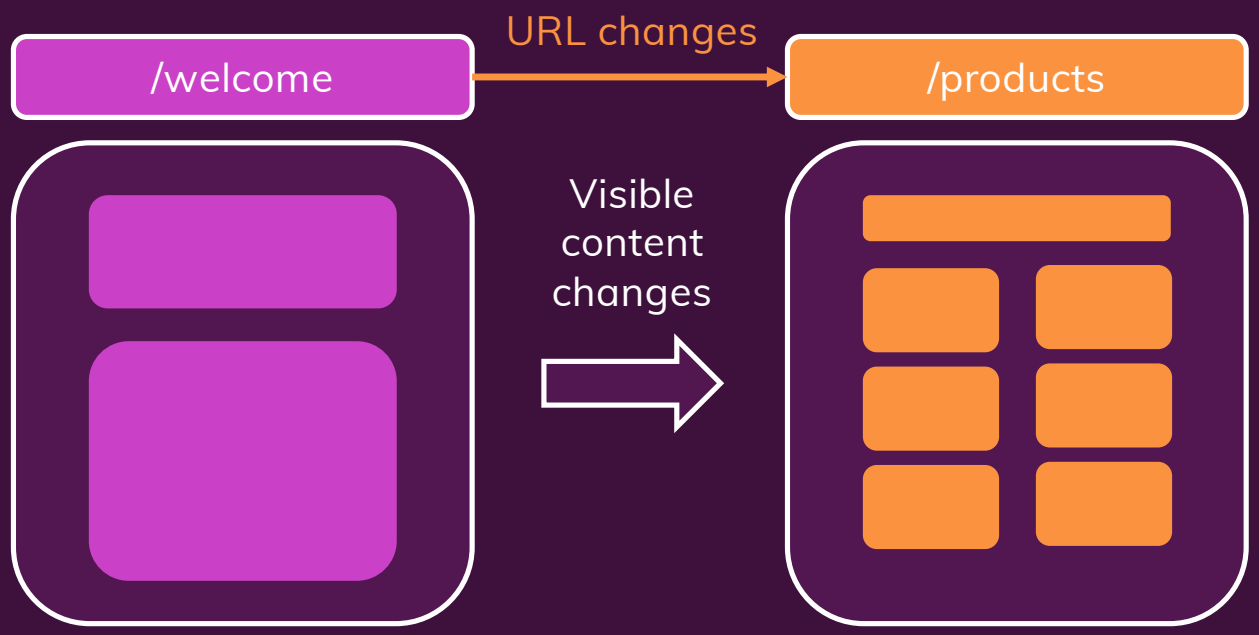
When building complex user interfaces, we typically build **Single Page Applications (SPAs)**

Only one initial HTML request & response

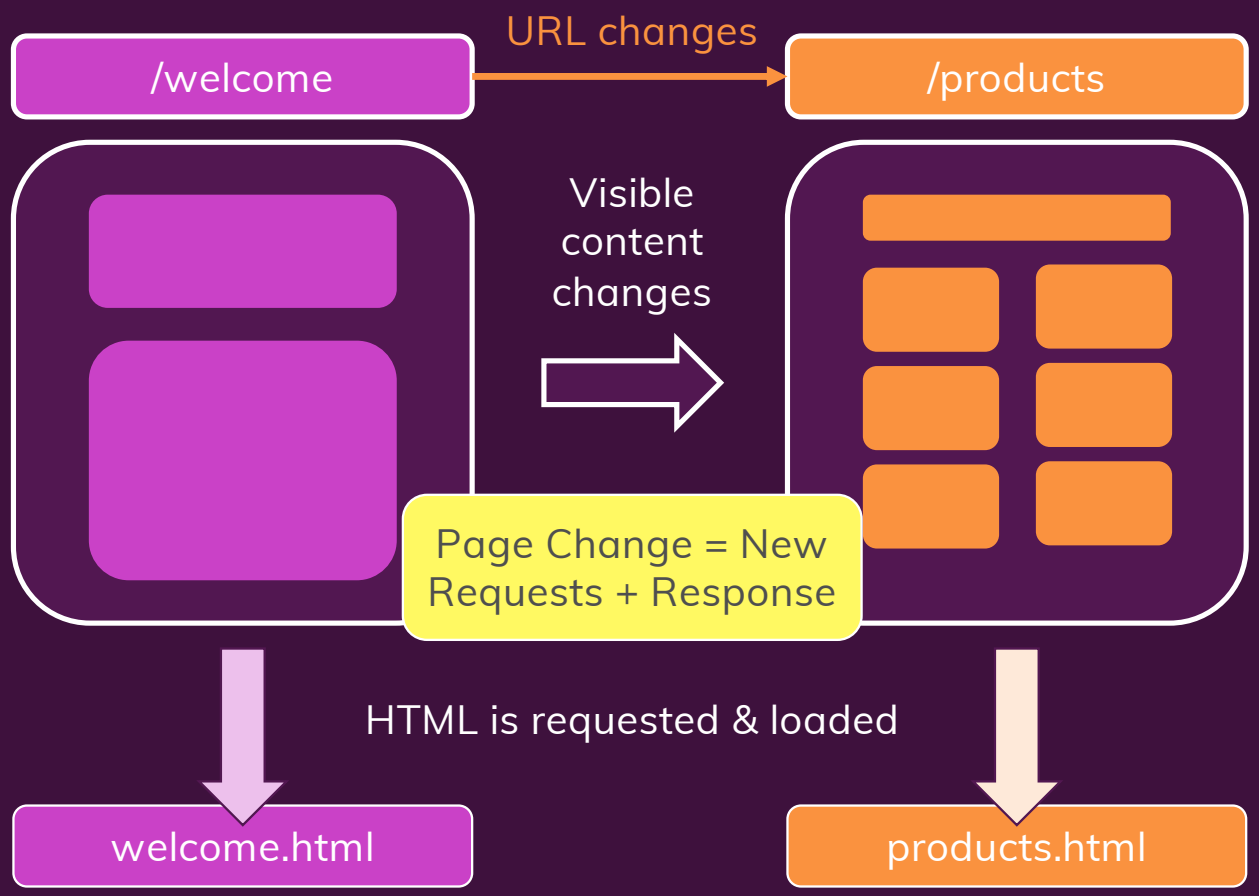
Page (URL) changes are then handled by client-side (React) code

Changes the visible content without fetching a new HTML file

What Is Routing?



Multi-Page Routing



ACADEMIND

Building SPAs

When building complex user interfaces, we typically build **Single Page Applications (SPAs)**

Only one initial HTML request & response

Page (URL) changes are then handled by client-side (React) code

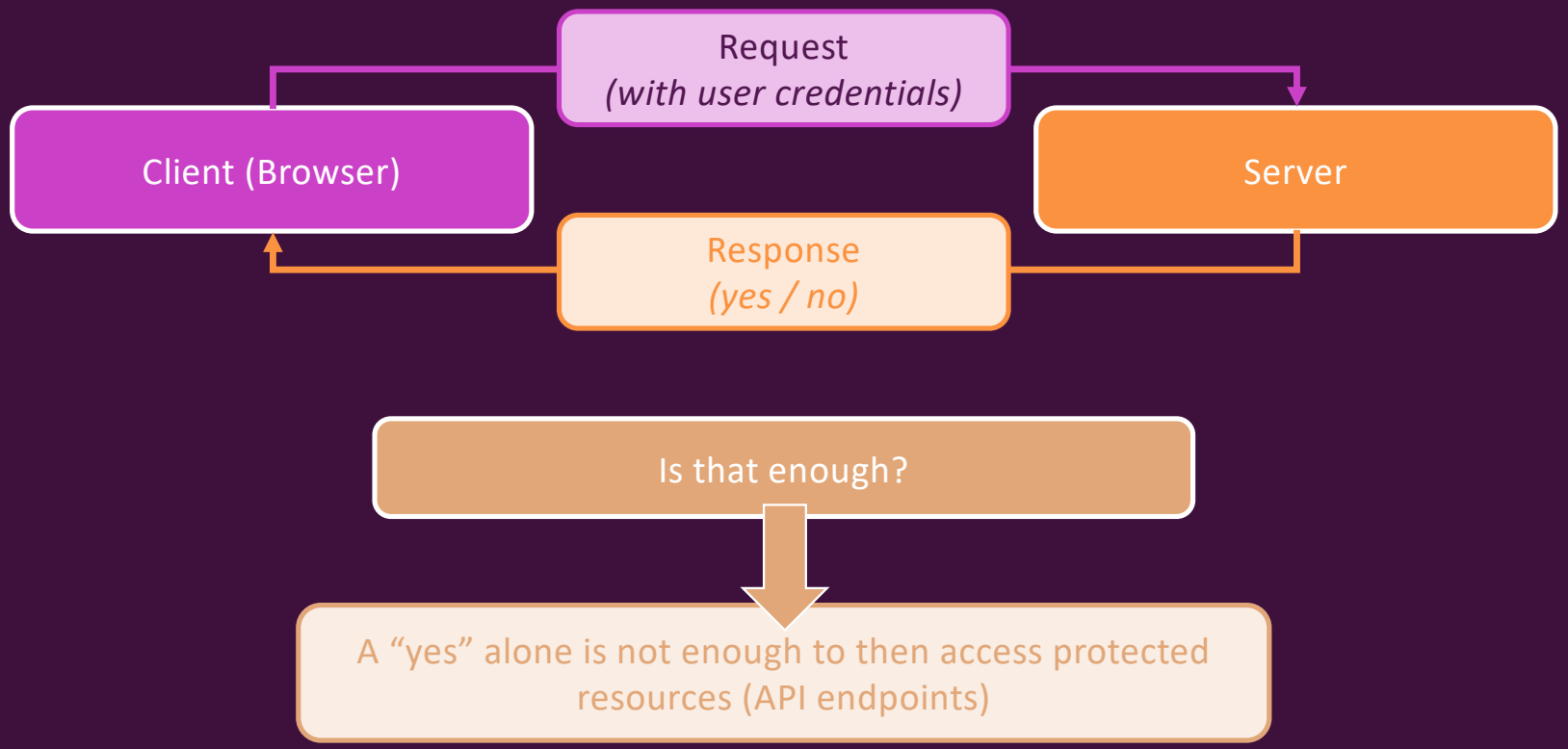
Changes the visible content without fetching a new HTML file

ACADEMIND

Authentication is needed if content should be protected

(not accessible by everyone)

Getting Permission



How Does Authentication Work?

We can't just save and use the "yes"

We could send a fake "yes" to the server to request protected data

Server-side Sessions

Store unique identifier on server, send same identifier to client

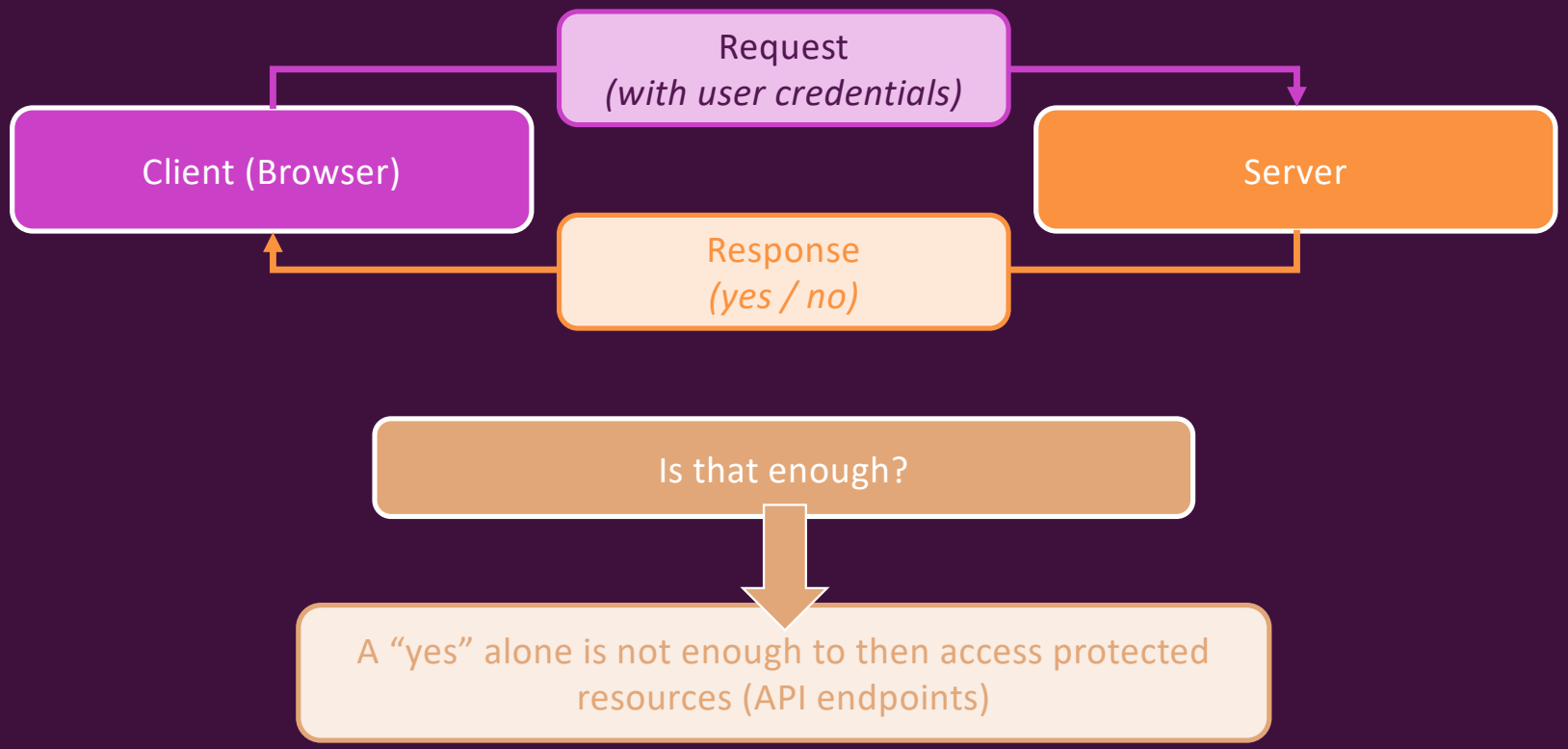
Client sends identifier along with requests to protected resources

Authentication Tokens

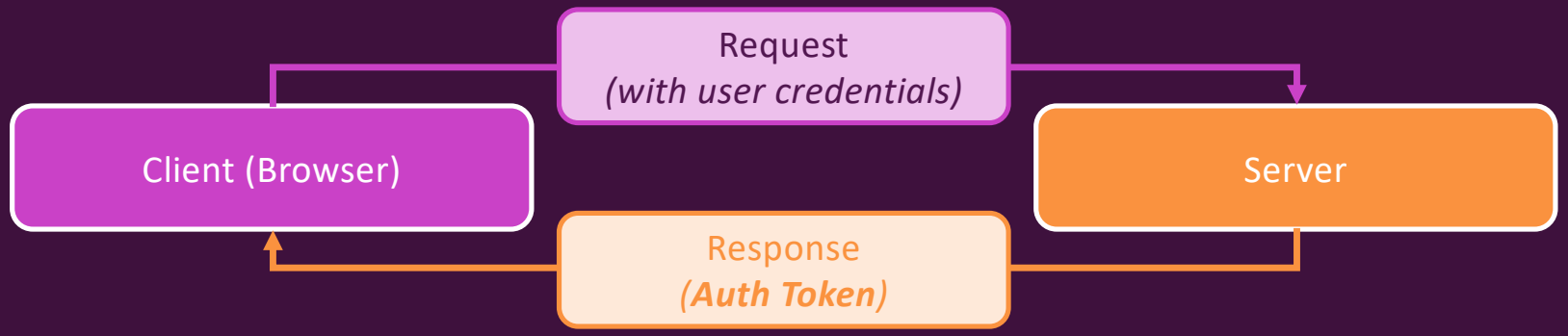
Create (but not store) "permission" token on server, send token to client

Client sends token along with requests to protected resources

Getting Permission



Getting Permission



ACADEMIND

Deployment Steps

- **Test** Code
- **Optimize** Code
- **Build** App for Production
- **Upload** Production Code to Server
- **Configure** Server

ACADEMIND

Lazy Loading

Load code only when it’s needed

ACADEMIND

A React SPA is a “Static Website”

Only HTML, CSS & JavaScript

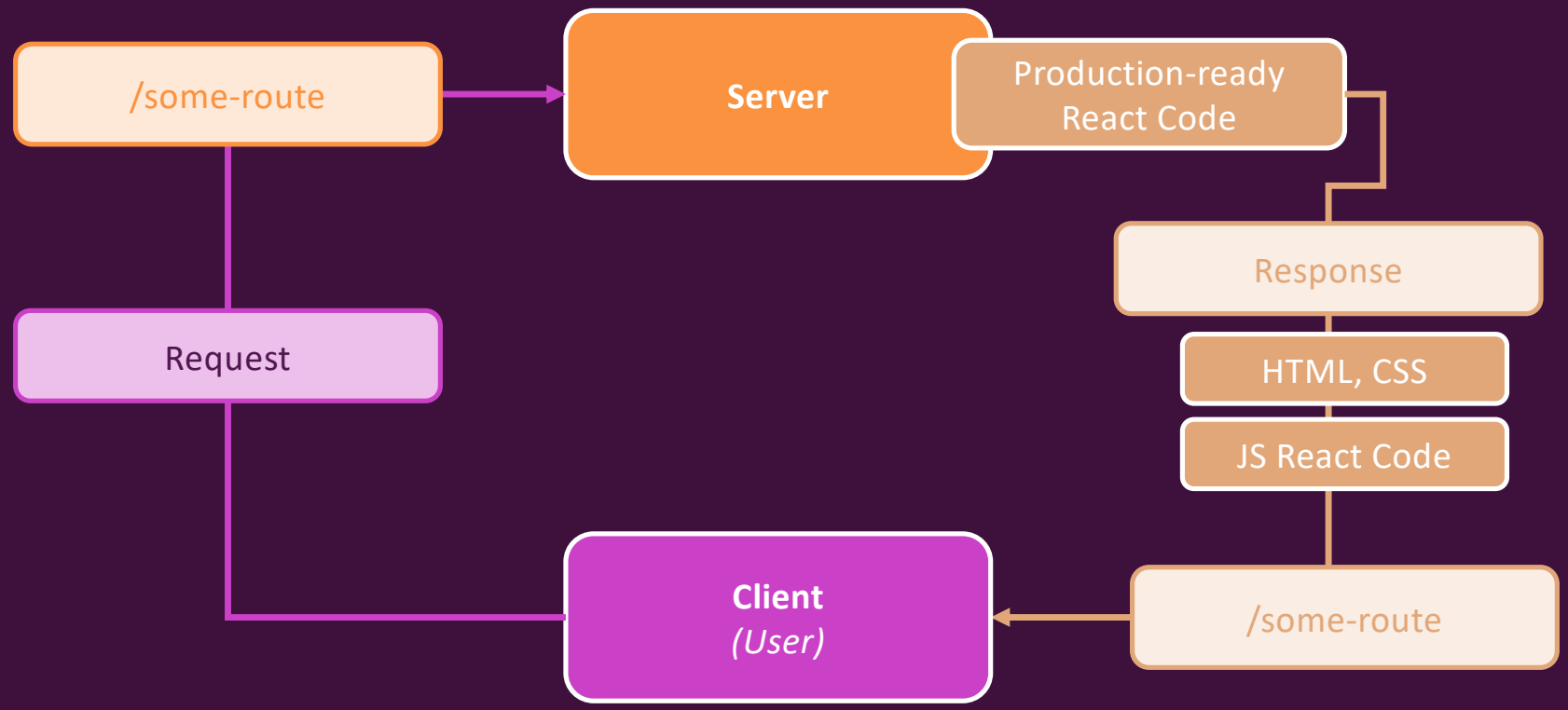
ACADEMIND

A React SPA is a "Static Website"

Only HTML, CSS & JavaScript

A Static Site Host Is Needed

Server-side Routing vs Client-side Routing



Server-side Routing with SPAs

The server must be configured to **always return the index.html** file and ignore the route

Then, React Router (client-side) can take over and render the correct page content

ACADEMIND

What is NextJS?

ACADEMIND

The React Framework for Production

A fullstack framework for ReactJS

ACADEMIND

NextJS solves common problems and makes building React apps easier!

ACADEMIND

The React Framework for Production

You still write React code, you still build React components and use React features (props, state, context, ...)

NextJS just enhances your React apps and adds more features

Lots of built-in features (e.g. routing) that help you solve common problems & clear guidance on how to use those features

There are certain problems which you will need to solve for almost all production-ready React apps: NextJS solves those for you

ACADEMIND

NextJS – Key Features & Benefits

File-based Routing

Define pages and routes with files and folders instead of code

Less code, less work, highly understandable

Server-side Rendering

Automatic page pre-rendering: Great for SEO and initial load

Blending client-side and server-side: Fetch data on the server and render finished pages

Fullstack Capabilities

Easily add backend (server-side) code to your Next / React apps

Storing data, getting data, authentication etc. can be added to your React projects

What is “Testing”?

Manual Testing

Write Code <> Preview & Test in Browser

Very important: You see what your users will see

Error-prone: It’s hard to test all possible combinations and scenarios

Automated Testing

Code that tests your code

You test the individual building blocks of your app

Very technical but allows you to test ALL building blocks at once

ACADEMIND

Different Kinds Of Automated Tests

Unit Tests	Integration Tests	End-to-End (e2e) Tests
Test the **individual building blocks** (functions, components) **in isolation**	Test the **combination** of multiple building blocks	Test complete scenarios in your app as the user would experience them
Projects typically contain dozens or hundreds of unit tests	Projects typically contain a couple of integration tests	Projects typically contain only a few e2e tests
The most common / important kind of test	Also important, but focus on unit tests in most cases	Important but can also be done manually *(partially)*

What To Test

What?

Test the different building blocks

Unit Tests: The smallest building blocks that make up your app

+

How?

Test success and error cases, also test rare (but possible) results

Required Tools & Setup

We need a tool for running our tests and asserting the results

+

We need a tool for “simulating” (rendering) our React app / components

Jest

React Testing Library

Both tools are already set up for you when using create-react-app

ACADEMIND

Writing Tests – The Three "A"s

Arrange → Set up the test data, test conditions and test environment

Act → Run logic that should be tested (e.g. execute function)

Assert → Compare execution results with expected results

What & Why?

ACADEMIND

TypeScript is a “superset” to JavaScript

ACADEMIND

TypeScript adds static typing to JavaScript

ACADEMIND

JavaScript on its own is
dynamically typed

ACADEMIND

What Is React.js?

Creating New React Project

React code includes syntax that's **not browser compatible**!

Various **optimizations** should be applied before deploying React websites

More complex project setup required

Projects with tools for improving developer experience & transforming / optimizing the code

Input & Output

Developer Code

```
function App() {
  return <h1>Hello World!</h1>
}
```

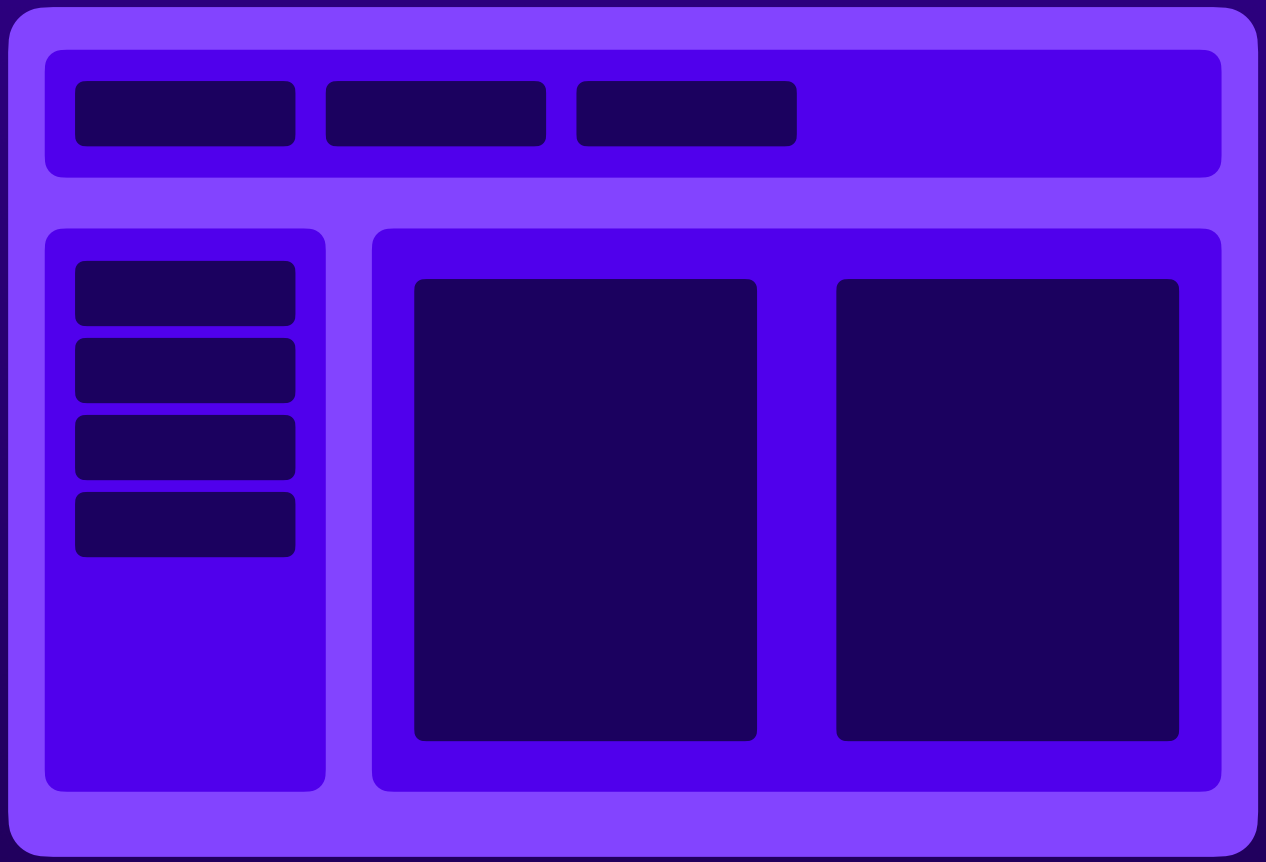
Browser Code
(simplified)

```
const el = document.createElement('h1')
el.textContent = 'Hello World!'
body.append(el)
```

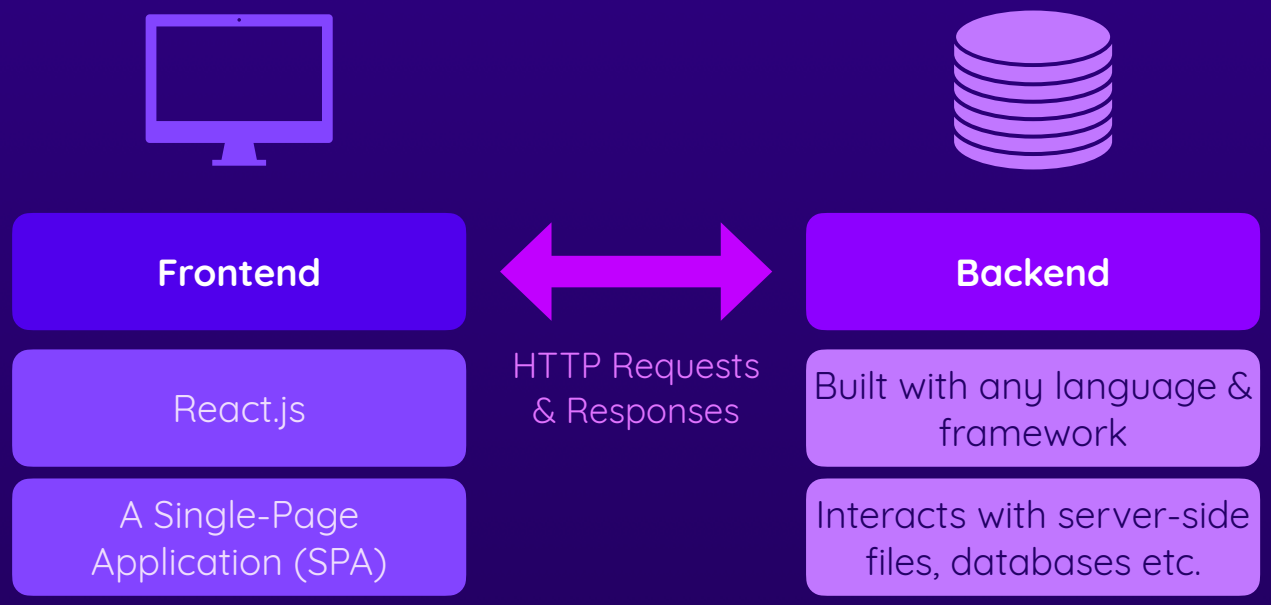
React Project

Converts your developer-friendly code to browser-compatible code

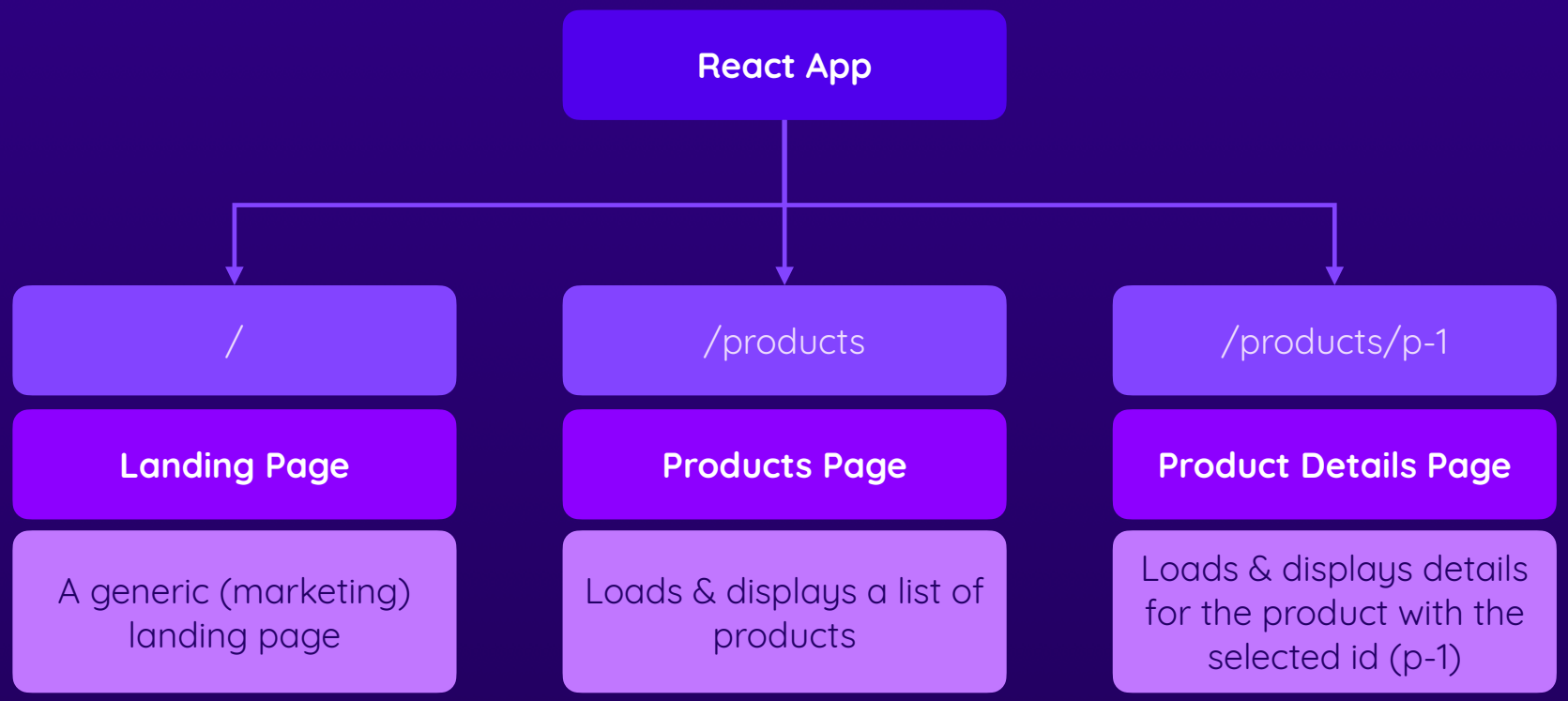
Understanding Components



React, Client-Side & Backends



Adding Routing



Adding Routing