Lesson 9

REACT INTRODUCTION

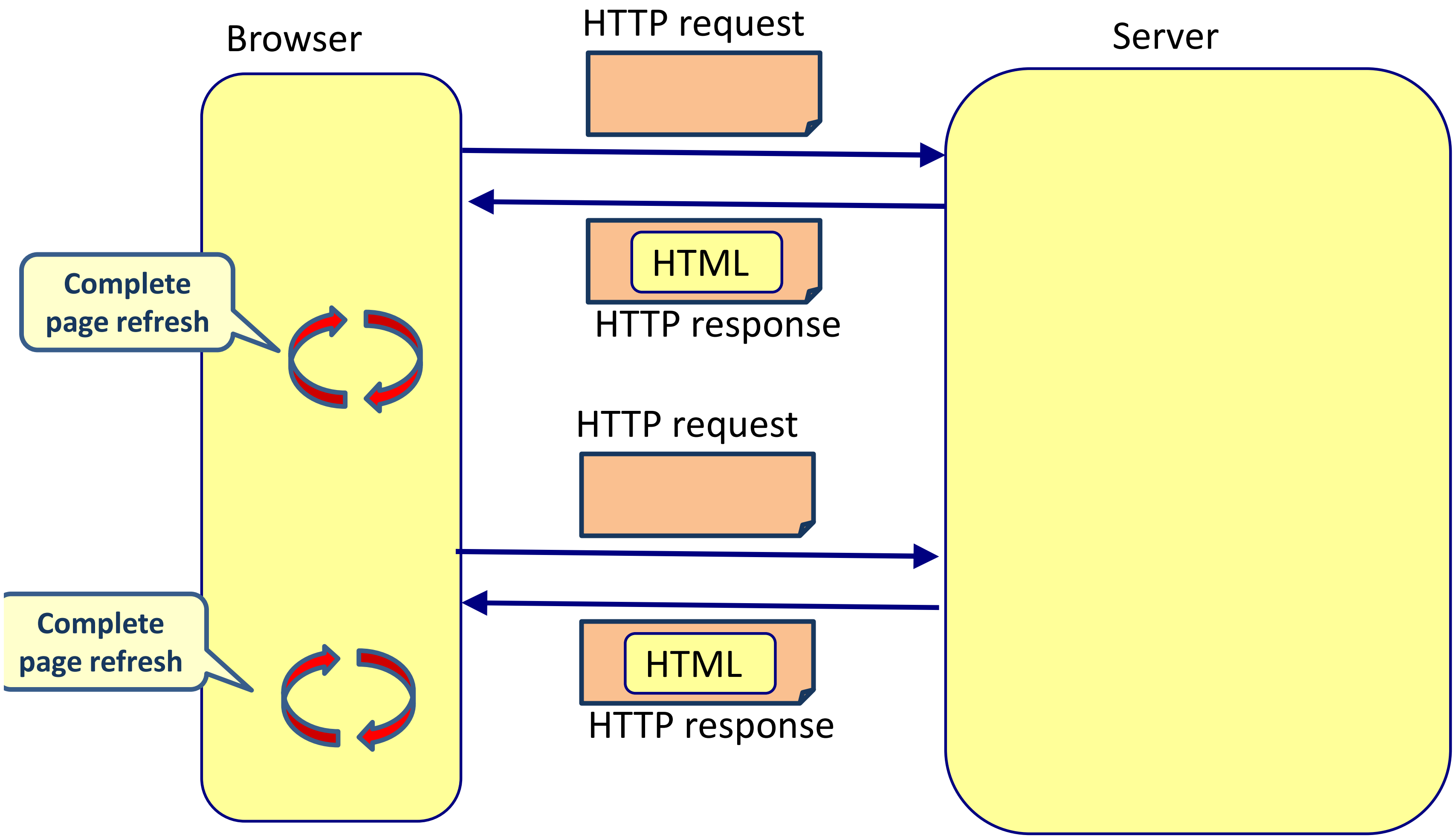
What is React?

- A Javascript library for creating web user interfaces for a Single Page Application (SPA)
- Declarative
  - You focus only on what your component should look like/do, rather than how to access certain elements in the DOM.
- Component-based

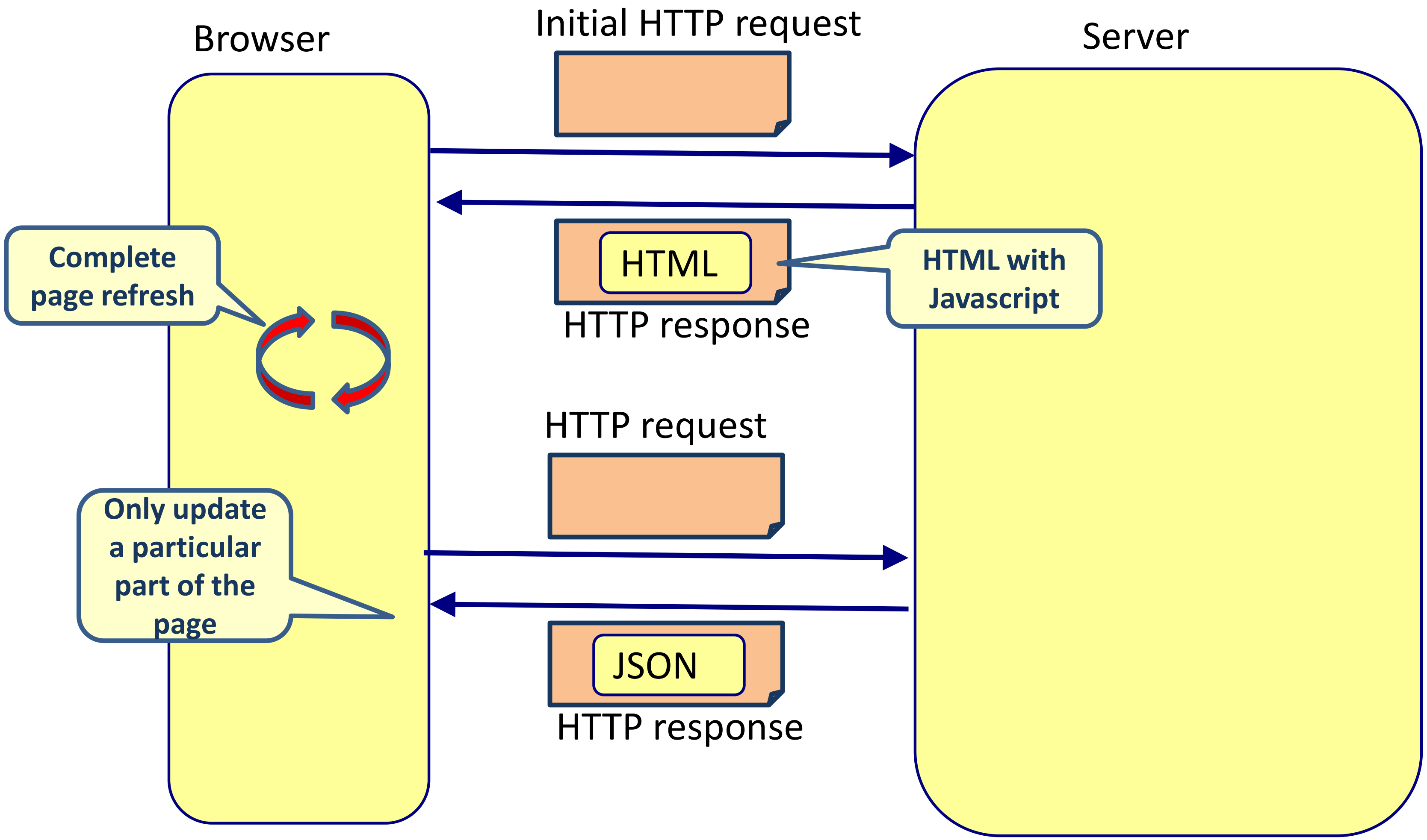
What is React?

- Initially developed by Facebook
  - Used in WhatsApp & Instagram
- Now open source
  - Used by Netflix, Airbnb, Yahoo!Mail, Dropbox,…
- Simple to learn
- Fast performance
- Small in size

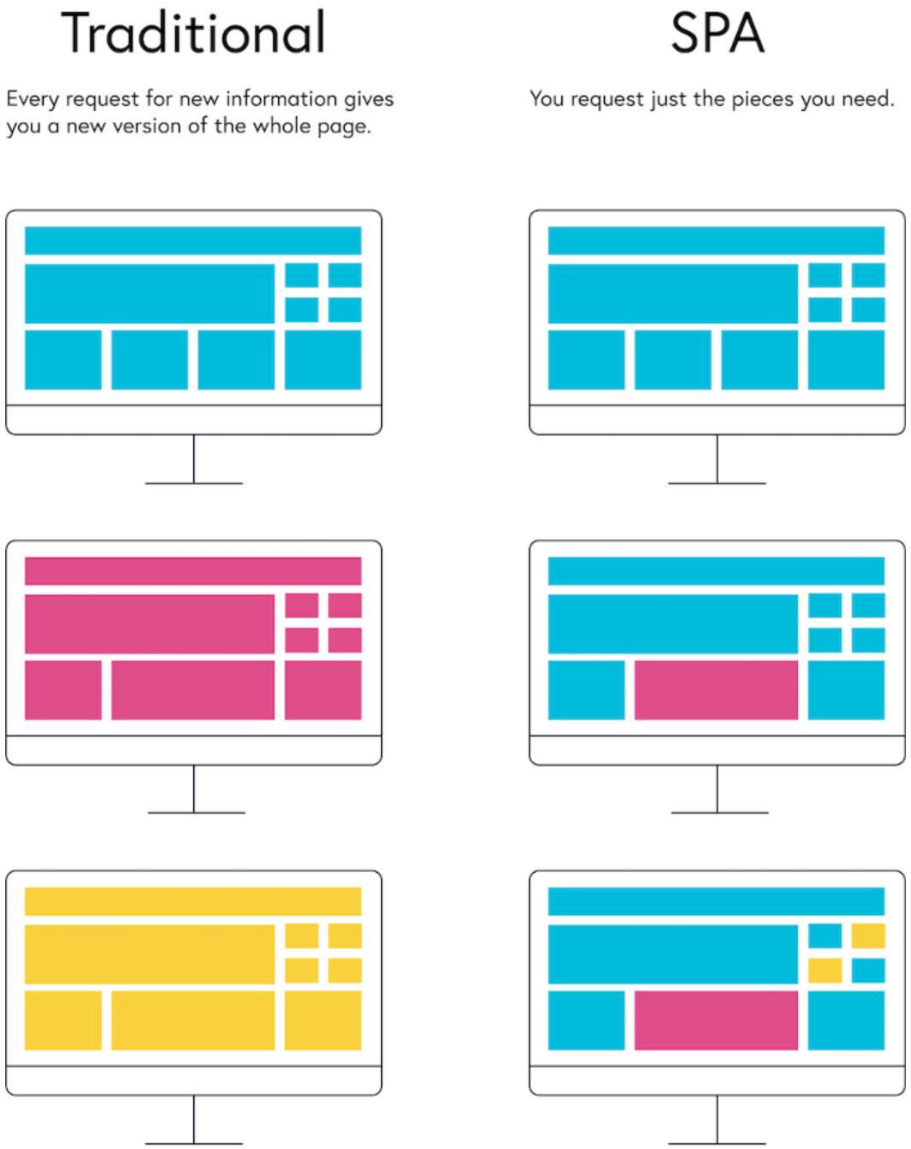
Spring MVC


Browser
HTTP request
Server
HTML
HTTP response
Complete page refresh
HTTP request
Complete page refresh
HTML
HTTP response

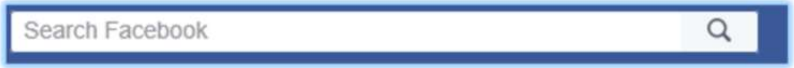
Single Page Application (SPA)



Spring MVC vs. React

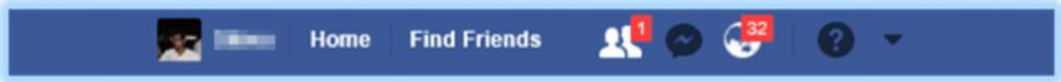

Traditional
Every request for new information gives you a new version of the whole page.
SPA
You request just the pieces you need.

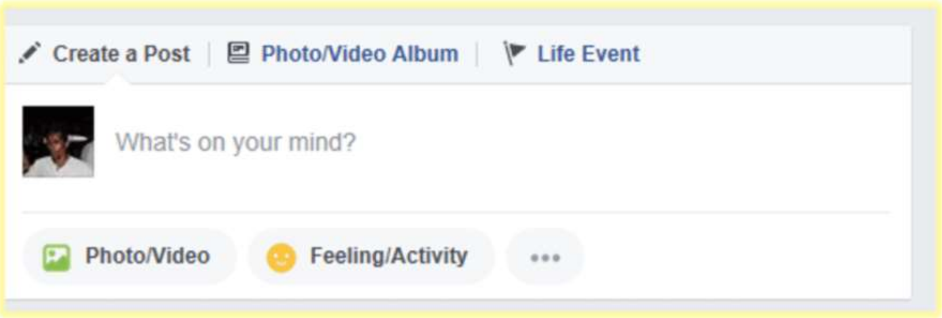
Component based

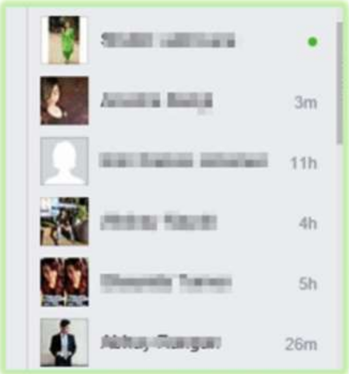


Search Bar

Notifications Bar







Add Post

Chat Window

JSX

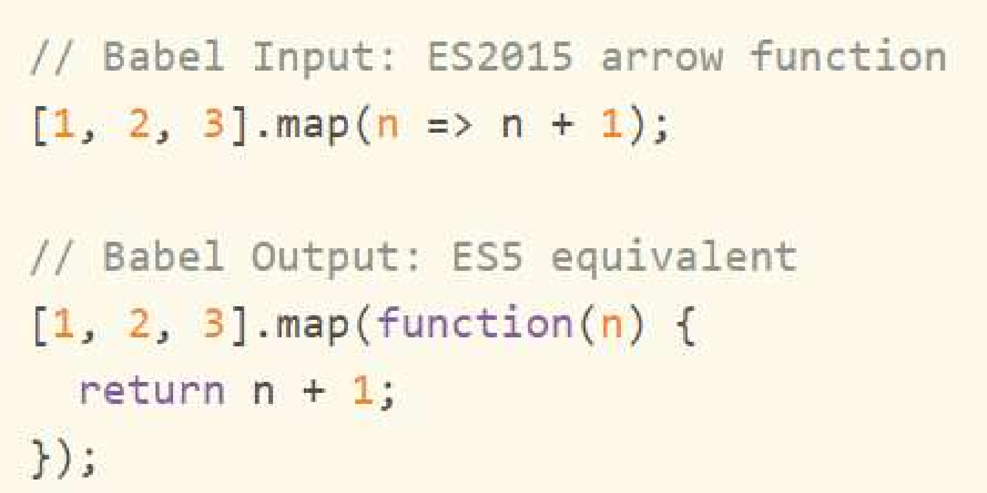
- Javascript XML
- JSX allows us to write HTML elements in JavaScript and place them in the DOM without any createElement() and/or appendChild() methods.

```
let isMorning = (new Date()).getHours() < 12;
let greetingElement = isMorning
? <h3>Good Morning</h3>
: <h3>Good Evening</h3>

function App() {
  return (
    <div>
        {greetingElement}
        <p>
          Hello world
        </p>
    </div>
  );
}
```

HTML in JavaScript

Babel

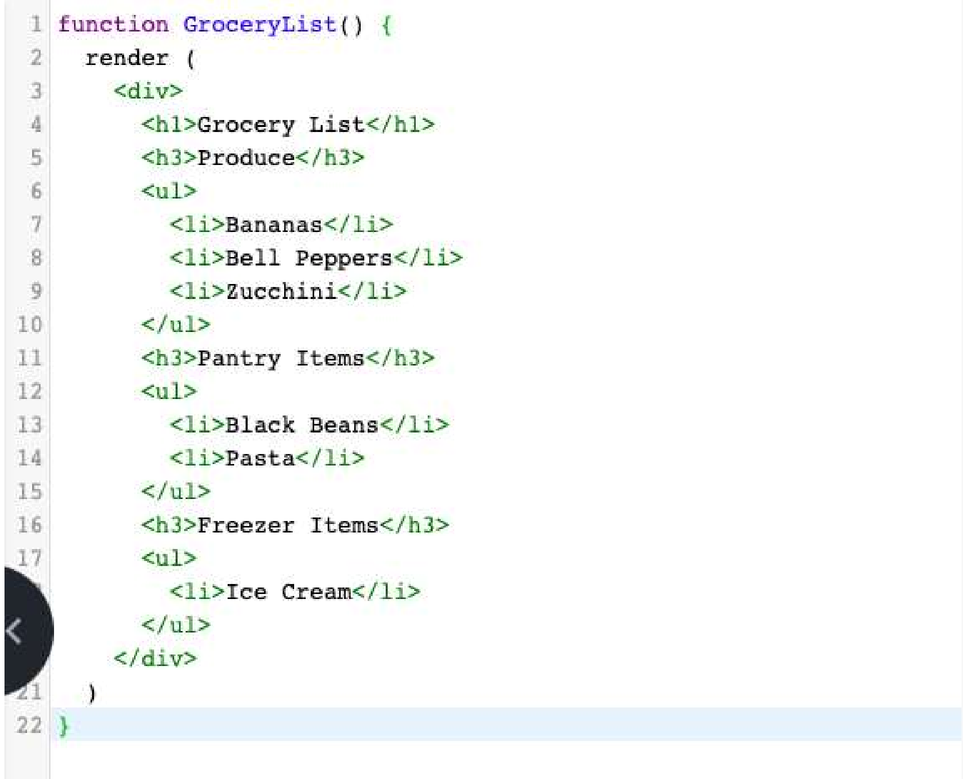
- Translates modern JavaScript (ES 2015+) to JavaScript that still works on older browsers



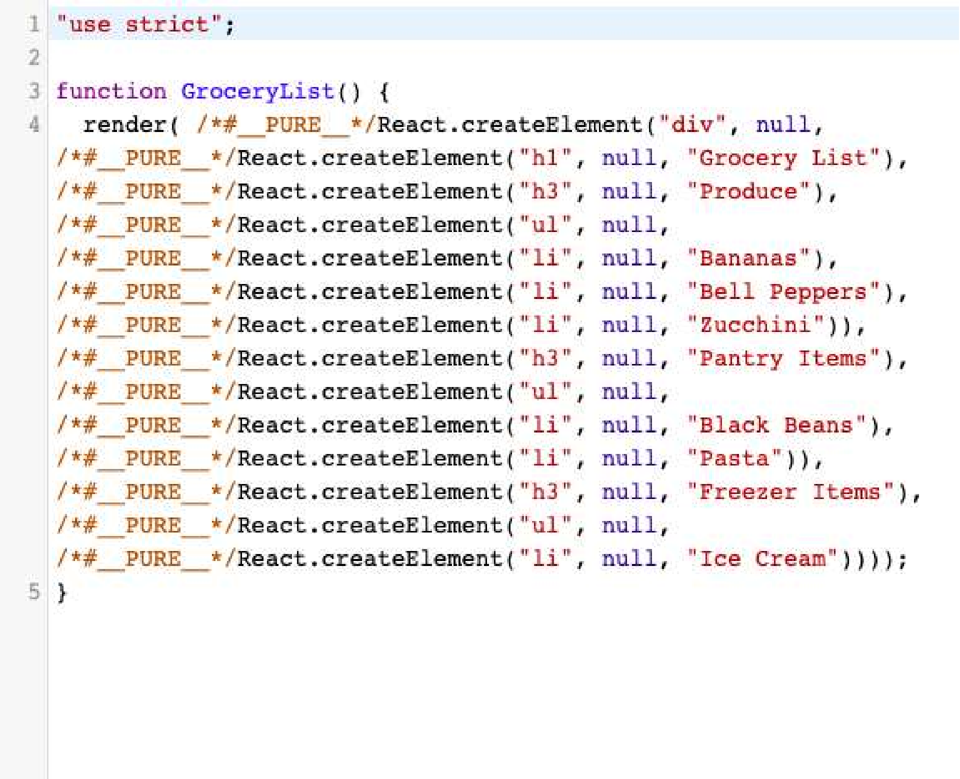
```
// Babel Input: ES2015 arrow function
[1, 2, 3].map(n => n + 1);

// Babel Output: ES5 equivalent
[1, 2, 3].map(function(n) {
  return n + 1;
});
```

Babel

- Translates JSX to regular JavaScript



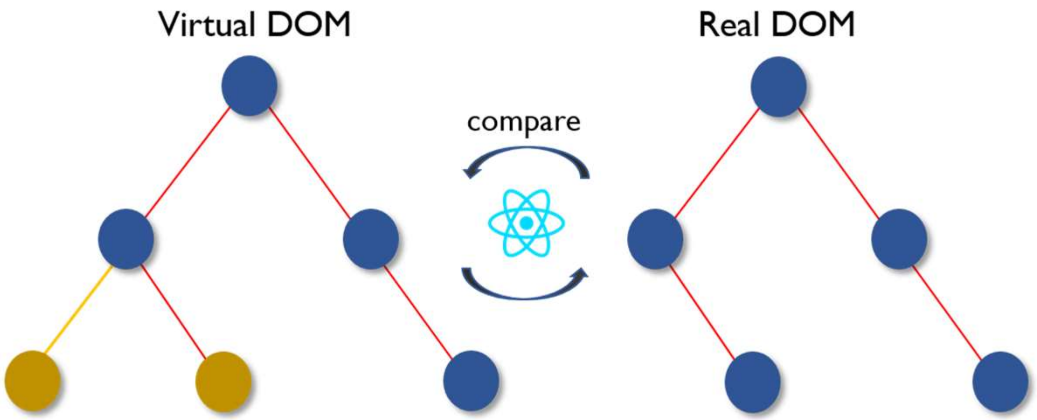
```
function GroceryList() {
  render (
    <div>
      <h1>Grocery List</h1>
      <h3>Produce</h3>
      <ul>
        <li>Bananas</li>
        <li>Bell Peppers</li>
        <li>Zucchini</li>
      </ul>
      <h3>Pantry Items</h3>
      <ul>
        <li>Black Beans</li>
        <li>Pasta</li>
      </ul>
      <h3>Freezer Items</h3>
      <ul>
        <li>Ice Cream</li>
      </ul>
    </div>
  )
}
```



```
"use strict";

function GroceryList() {
  render( /*#__PURE__*/React.createElement("div", null,
/*#__PURE__*/React.createElement("h1", null, "Grocery List"),
/*#__PURE__*/React.createElement("h3", null, "Produce"),
/*#__PURE__*/React.createElement("ul", null,
/*#__PURE__*/React.createElement("li", null, "Bananas"),
/*#__PURE__*/React.createElement("li", null, "Bell Peppers"),
/*#__PURE__*/React.createElement("li", null, "Zucchini")),
/*#__PURE__*/React.createElement("h3", null, "Pantry Items"),
/*#__PURE__*/React.createElement("ul", null,
/*#__PURE__*/React.createElement("li", null, "Black Beans"),
/*#__PURE__*/React.createElement("li", null, "Pasta")),
/*#__PURE__*/React.createElement("h3", null, "Freezer Items"),
/*#__PURE__*/React.createElement("ul", null,
/*#__PURE__*/React.createElement("li", null, "Ice Cream"))));
}
```

Virtual DOM

- When the state of a component changes, React updates the virtual DOM tree. Once the virtual DOM has been updated, React then compares the current version of the virtual DOM with the previous version of the virtual DOM.



HELLO WORLD REACT

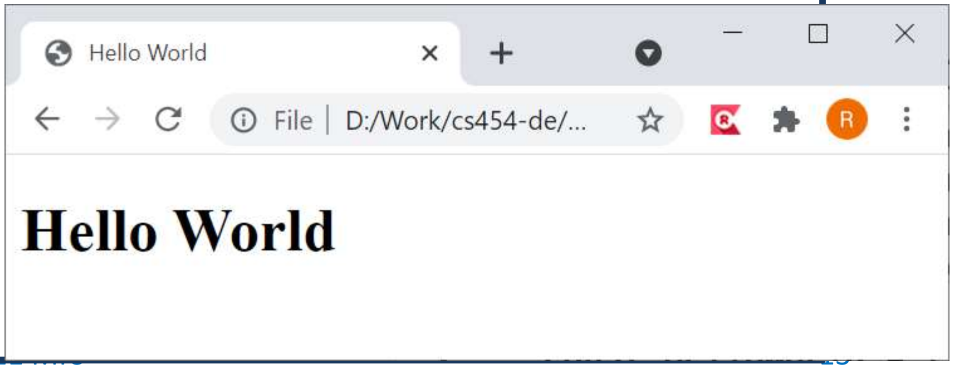
Minimal Hello World React

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="utf-8" />
  <title>Hello World</title>
  <script src="https://unpkg.com/react@15/dist/react.js"></script>
  <script src="https://unpkg.com/react-dom@15/dist/react-dom.js"></script>
  <script src="https://unpkg.com/babel-standalone/babel.min.js"></script>
  <script type="text/babel">

    const HelloWorld = () => {
      return (
        <h1>Hello World</h1>
      );
    }

    ReactDOM.render(
      <HelloWorld />,
      document.getElementById("content")
    );
  </script>
</head>
<body>
  <div id="content"></div>
</body>
</html>
```

Just open this file in the browser

Component

Render the component in the DOM element with id “content”



Hello World

JavaScript

- Node
  - A JavaScript runtime that enables us to run JavaScript outside of a browser.
  - It also enables us to run JavaScript on the server-side
- NPM
  - Stands for Node Package Manager and is a tool that allows us to install and manage node packages
- NPX
  - NPX is an NPM package runner that makes it really easy to install any sort of package

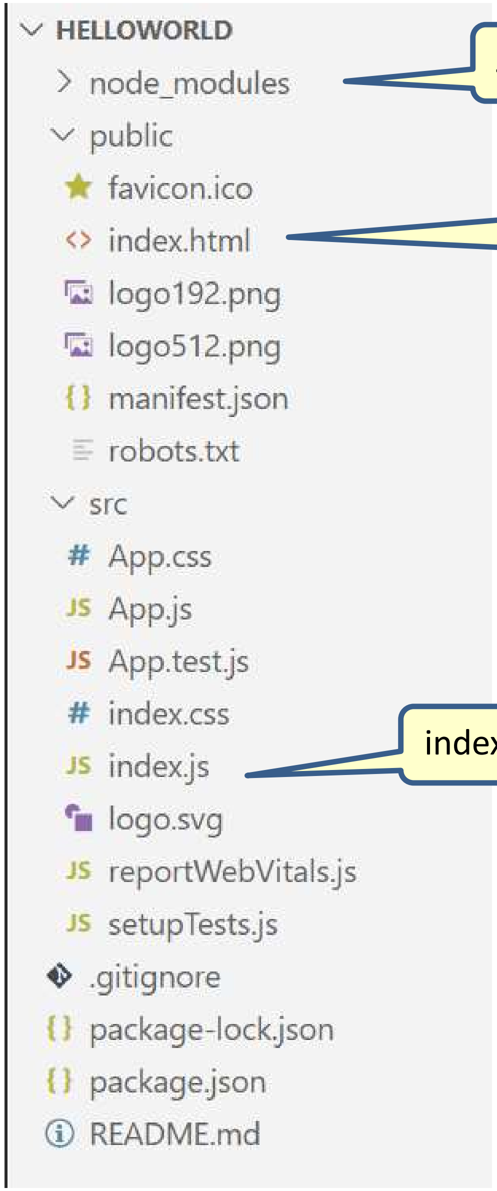
Creating a React application

- ***$ npx create-react-app my-app***
- Generate a react app, named **my-app**, in the path that the command was run in using the create-react-app package.
- This will create a react application including all necessary packages and dependencies
- For details see
  - https://create-react-app.dev/docs/getting-started

Starting a React application

- ***$ npm start***
- Start a webserver and run the current react app (index.html) on this webserver at port localhost:3000

create-react-app



```
HELLOWORLD
  > node_modules
  v public
      favicon.ico
      index.html
      logo192.png
      logo512.png
      manifest.json
      robots.txt
  v src
      App.css
      App.js
      App.test.js
      index.css
      index.js
      logo.svg
      reportWebVitals.js
      setupTests.js
    .gitignore
    package-lock.json
    package.json
    README.md
```

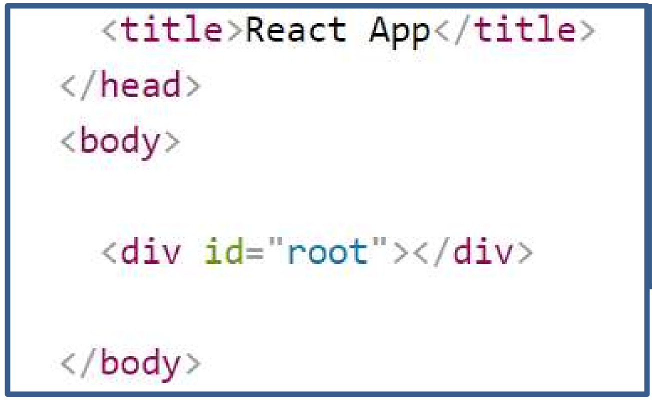
Javascript modules

index.html is the single page in the SPA and is shown by default

index.js is rendered in index.html

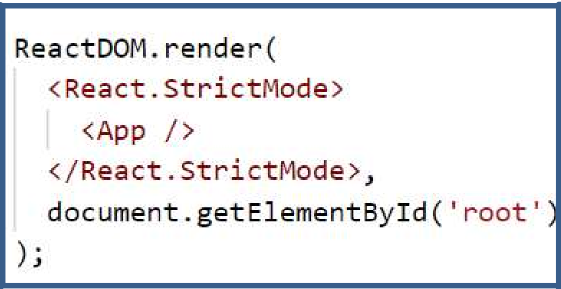
create-react-app

index.html



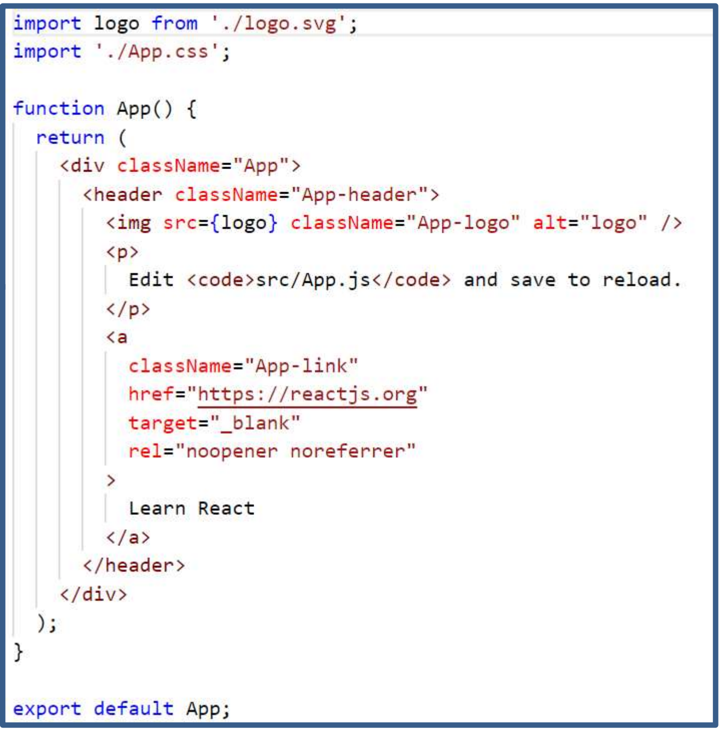
```
  <title>React App</title>
</head>
<body>

  <div id="root"></div>

</body>
```

index.js



```
ReactDOM.render(
  <React.StrictMode>
    <App />
  </React.StrictMode>,
  document.getElementById('root')
);
```

app.js



```
import logo from './logo.svg';
import './App.css';

function App() {
  return (
    <div className="App">
      <header className="App-header">
        <img src={logo} className="App-logo" alt="logo" />
        <p>
          Edit <code>src/App.js</code> and save to reload.
        </p>
        <a
          className="App-link"
          href="https://reactjs.org"
          target="_blank"
          rel="noopener noreferrer"
        >
          Learn React
        </a>
      </header>
    </div>
  );
}

export default App;
```

Show the App component in index.html at the element with id “root”

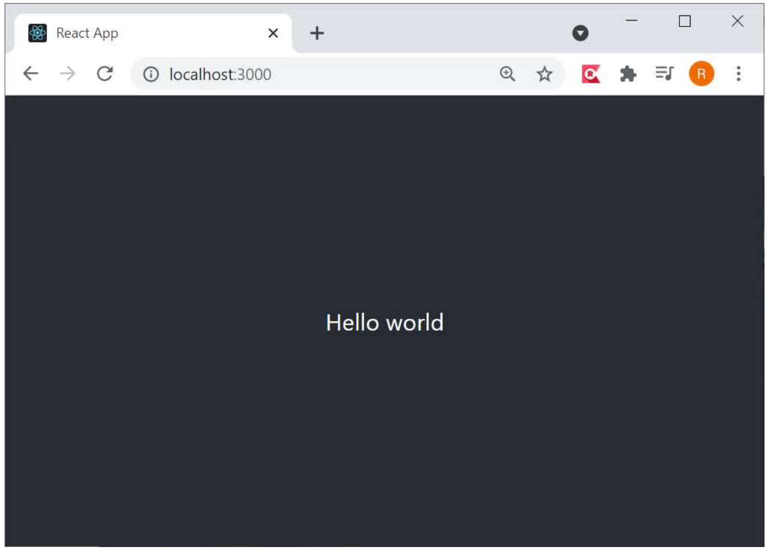
Hello World React

App.js

```
import './App.css';

function App() {
  return (
    <div>
      <header>
        <p>
          Hello world
        </p>
      </header>
    </div>
  );
}

export default App;
```

JSX code

React component that is shown on the page



Hello world

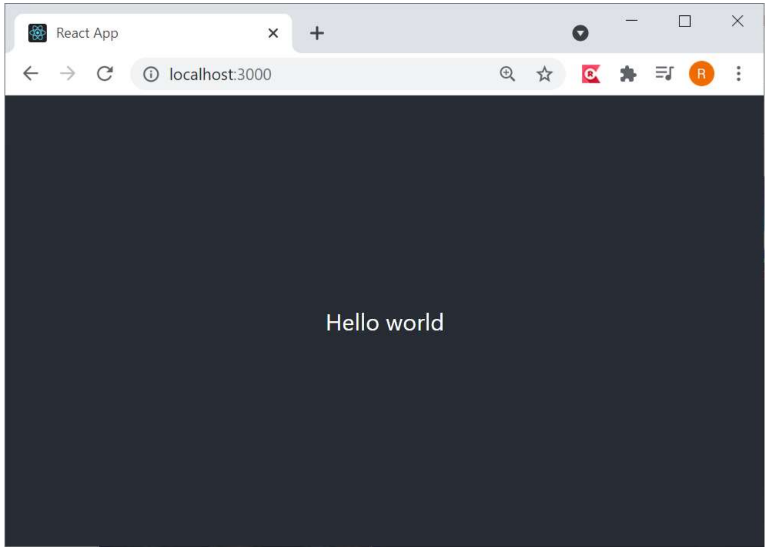
Hello World React

App.js

```
import './App.css';
let message = "Hello world";

function App() {
  return (
    <div>
      <header>
        <p>
          {message}
        </p>
      </header>
    </div>
  );
}

export default App;
```

Define a variable

Show the variable



Hello world

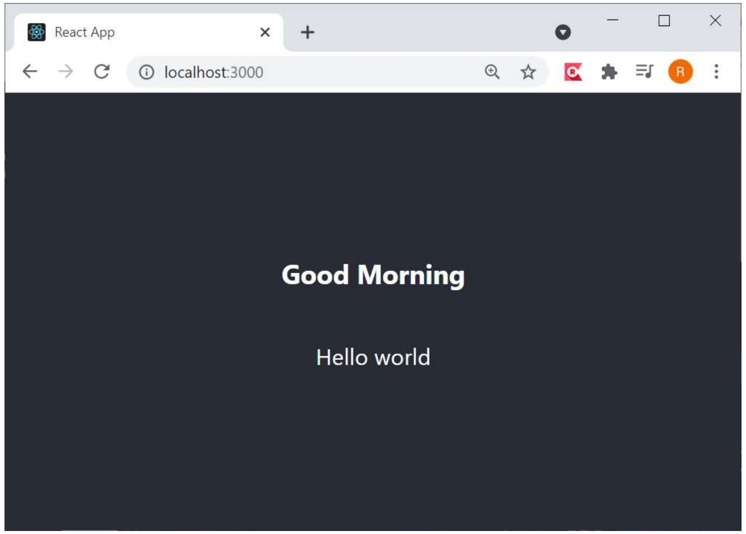
Hello World React

App.js

```
import './App.css';
let isMorning = (new Date()).getHours() < 12;
let greetingElement = isMorning
? <h3>Good Morning</h3>
: <h3>Good Evening</h3>

function App() {
  return (
    <div>
      <header>
        {greetingElement}
        <p>
          Hello world
        </p>
      </header>
    </div>
  );
}

export default App;
```

Define a variable

Show the variable

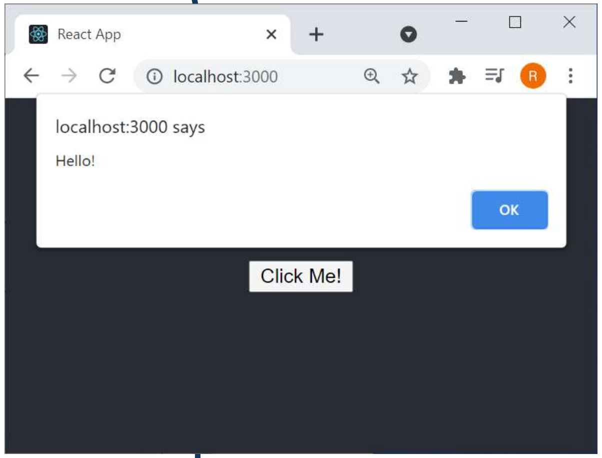


```
Good Morning

Hello world
```

Button clicks

App.js

```
import './App.css';


function App() {
  const displayAlert = () => {
    alert('Hello!');
  }

  return (
    <div>
      <header>
        <p>
          <button onClick={displayAlert}>Click Me!</button>
        </p>
      </header>
    </div>
  );
}

export default App;
```



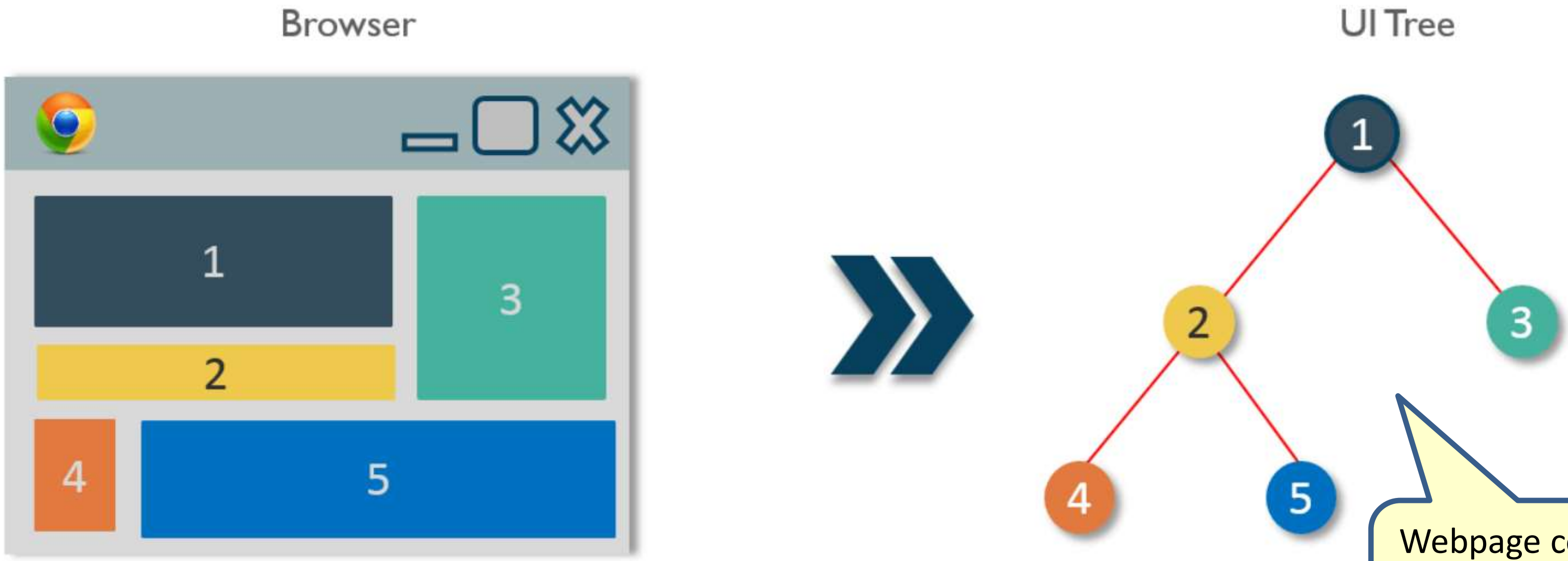
localhost:3000 says

Hello!

REACT COMPONENTS

React components

- In react everything is a component
- Components have their own state
- Components are rendered individually



Webpage consists of a tree of components

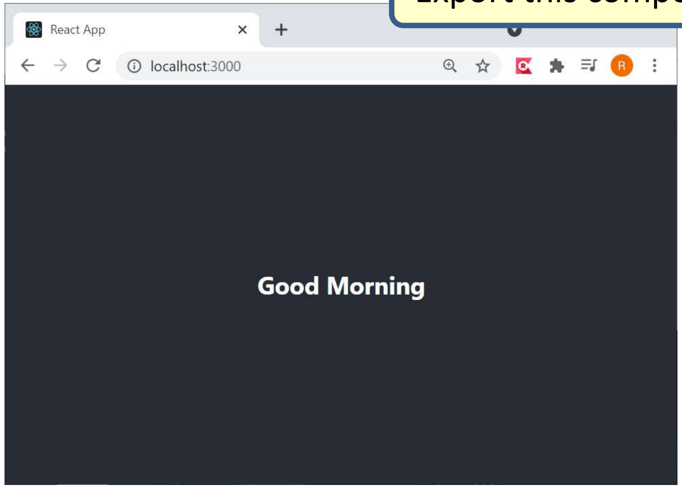
Simple component

Greeting.js

```
import React from 'react';

function Greeting(){
    let isMorning = (new Date()).getHours() < 12;
    let greetingElement = isMorning
       ? <h3>Good Morning</h3>
       : <h3>Good Evening</h3>;
    return greetingElement ;
}

export default Greeting;
```

This import is always needed

Export this component



App.js

Import component

```
import './App.css';
import Greeting from './Greeting';

function App() {
  return (
    <div className="App">
      <header className="App-header">
        <p>
          <Greeting />
        </p>
      </header>
    </div>
  );
}

export default App;
```

Show component on page

Arrow function

Greeting.js

```
import React from 'react';

export const Greeting = () =>{
    let isMorning = (new Date()).getHours() < 12;
    let greetingElement = isMorning
       ? (
       <>
         <h3>Good Morning</h3>
         <h4>Enjoy your day</h4>
       </>
       )
       : (
        <>
          <h3>Good Evening</h3>
          <h4>Enjoy your day</h4>
       </>
       );
    return greetingElement ;
 }
```

Arrow function

Named import

App.js

```
import './App.css';
import {Greeting} from './Greeting';

function App() {
  return (
    <div className="App">
      <header className="App-header">
        <p>
          <Greeting />
        </p>
      </header>
    </div>
  );
}

export default App;
```

Class and function components

```
import React, {Component} from 'react';
export class HelloComponentClass extends Component{
    render(){
        return(
            <h1>Hello World</h1>
        );
    }
}
```

Class component

```
import React from 'react';
export function HelloComponentSimpleFunction () {
    return (
        <h1>Hello World</h1>
    );
}
```

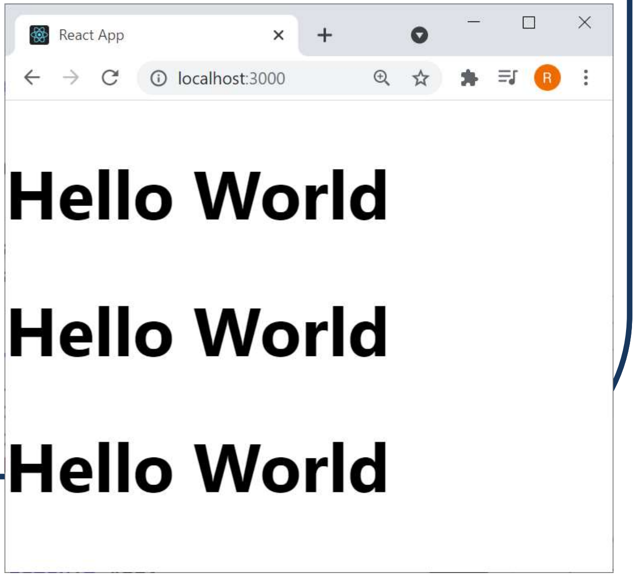
Functional component

```
import React from 'react';
export const HelloComponentFunction = () => {
    return  (
        <h1>Hello World</h1>
    );
}
```

Functional component using arrow notation

Class and function components

```
import './App.css';
import {HelloComponentClass} from './pages/HelloComponentClass';
import {HelloComponentFunction} from './pages/HelloComponentFunction';
import {HelloComponentSimpleFunction} from './pages/HelloComponentSimpleFunction';


function App() {
  return (
    <div>
      <header>
        <HelloComponentClass />
        <HelloComponentFunction />
        <HelloComponentSimpleFunction />
      </header>
    </div>
  );
}

export default App;
```



Hello World

Hello World

Hello World

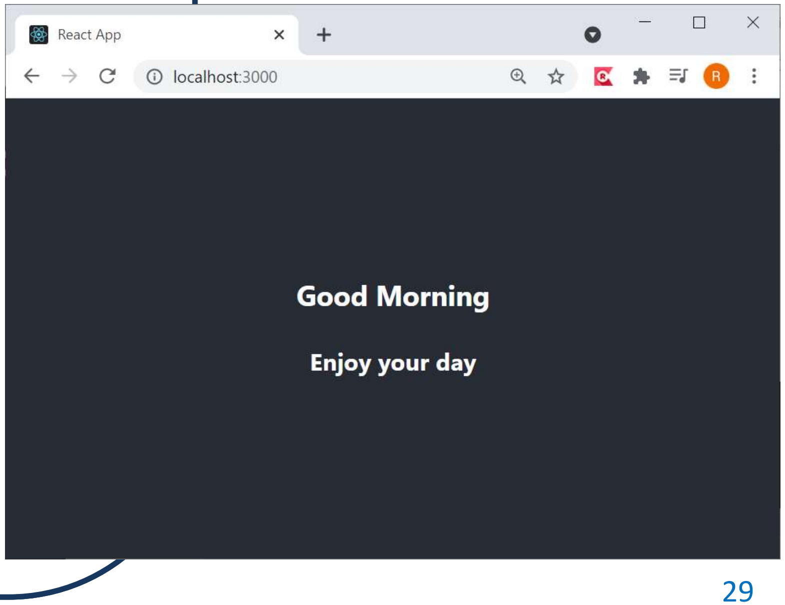
Simple component

Greeting.js

```
import React from 'react';

function Greeting(){
    let isMorning = (new Date()).getHours() < 12;
    let greetingElement = isMorning
       ? (
       <>
         <h3>Good Morning</h3>
         <h4>Enjoy your day</h4>
       </>
       )
       : (
        <>
          <h3>Good Evening</h3>
          <h4>Enjoy your day</h4>
       </>
       );
    return greetingElement ;

}

export default Greeting;
```

A component should have a top-level element

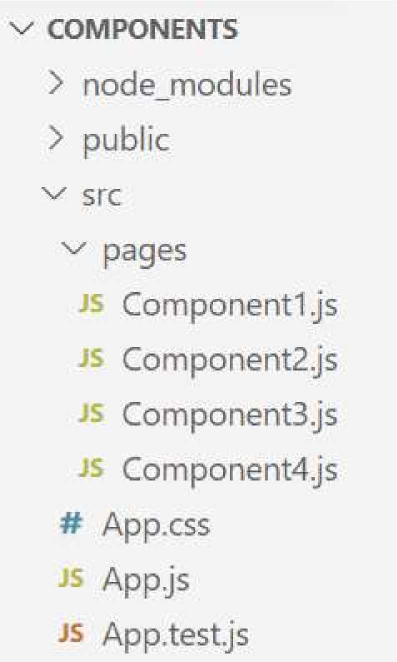
Wrap 2 elements together



Good Morning

Enjoy your day

Multiple components



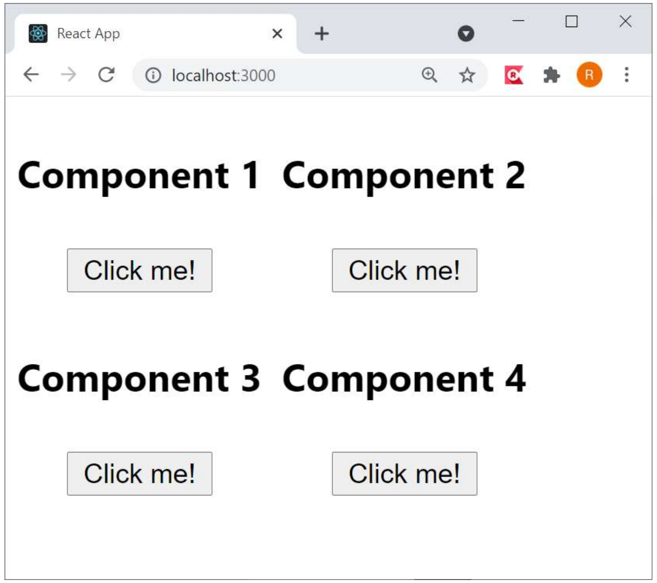
```
COMPONENTS
  node_modules
  public
  src
    pages
      Component1.js
      Component2.js
      Component3.js
      Component4.js
    App.css
    App.js
    App.test.js
```

App.js

```
import {Component1} from './pages/Component1';
import {Component2} from './pages/Component2';
import {Component3} from './pages/Component3';
import {Component4} from './pages/Component4';
import './App.css';

function App() {
  return (
    <table>
    <tr>
      <td><Component1 /></td>
      <td><Component2 /></td>
    </tr>
    <tr>
      <td><Component3 /></td>
      <td><Component4 /></td>
    </tr>
  </table>
  );
}
```

Import component

Show components on page

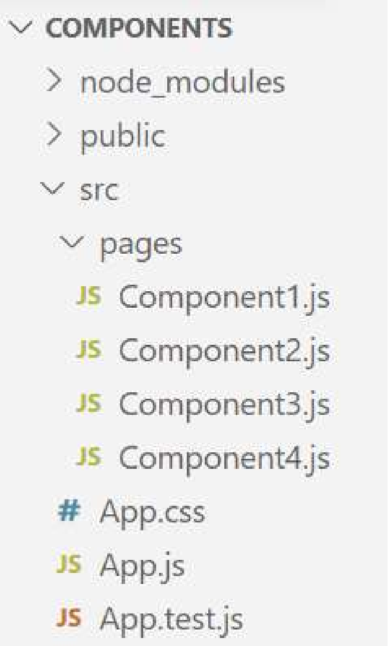


```
Component 1  Component 2

  Click me!    Click me!

Component 3  Component 4

  Click me!    Click me!
```

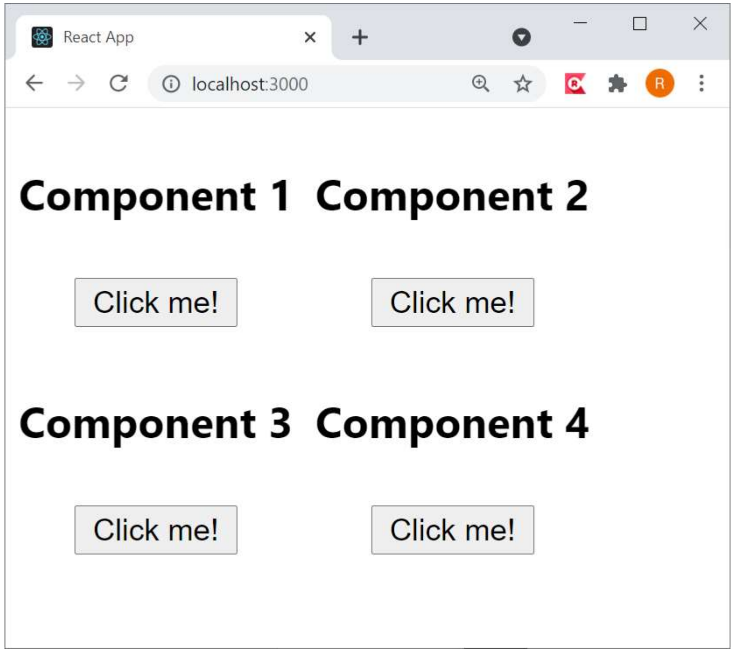
Multiple components

Component1.js

```
import React from 'react';

export const Component1 = () => {
  let component = (
      <table>
        <tr>
          <th><h3>Component 1</h3></th>
        </tr>
        <tr>
          <th><button>Click me!</button></th>
        </tr>
      </table>
  );
  return component;
}
```



```
COMPONENTS
  node_modules
  public
  src
    pages
      Component1.js
      Component2.js
      Component3.js
      Component4.js
    App.css
    App.js
    App.test.js
```

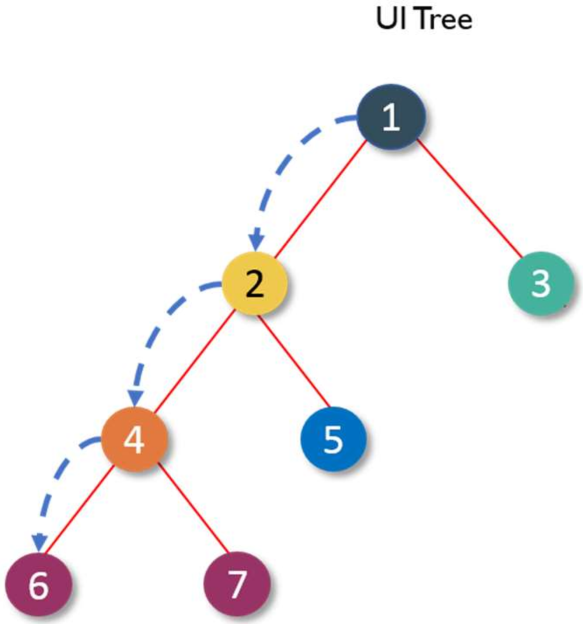


Component 1	Component 2
Click me!	Click me!
Component 3	**Component 4**
Click me!	Click me!

PROPERTIES

props

- Props stand for properties
- Props is a way of passing data from parent to child component
  - Like arguments being passed into a function
- All properties are combined into a single object.
- Props are read-only inside of a component.



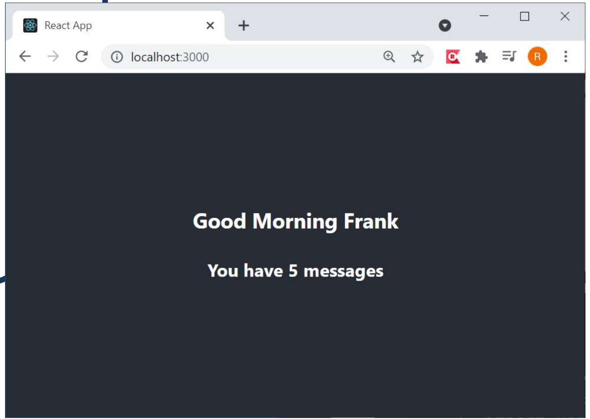
Pass props to components

Greeting.js

```
import React from 'react';

export const Greeting = (props) =>{
    let isMorning = (new Date()).getHours() < 12;
    let greetingElement = isMorning
       ? (
       <>
         <h3>Good Morning {props.name}</h3>
         <h4>You have {props.nrOfMessages} messages</h4>
       </>
       )
       : (
        <>
          <h3>Good Evening {props.name}</h3>
          <h4>You have {props.nrOfMessages} messages</h4>
       </>
       );
    return greetingElement ;
}
```

Object that contains all properties

Use the properties



Good Morning Frank

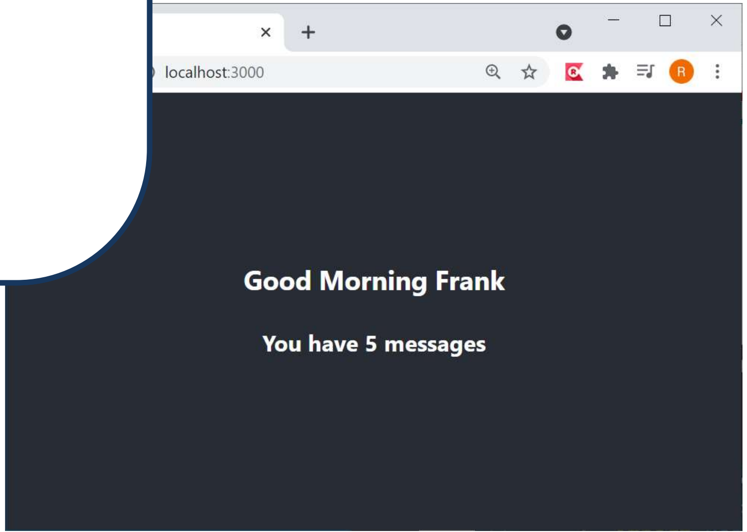
You have 5 messages

Pass props to components

App.js

```
import './App.css';
import {Greeting} from './Greeting';

function App() {
  return (
    <div className="App">
      <header className="App-header">
        <p>
          <Greeting name="Frank" nrOfMessages = {5}/>
        </p>
      </header>
    </div>
  );
}

export default App;
```

Call component with properties



Good Morning Frank

You have 5 messages

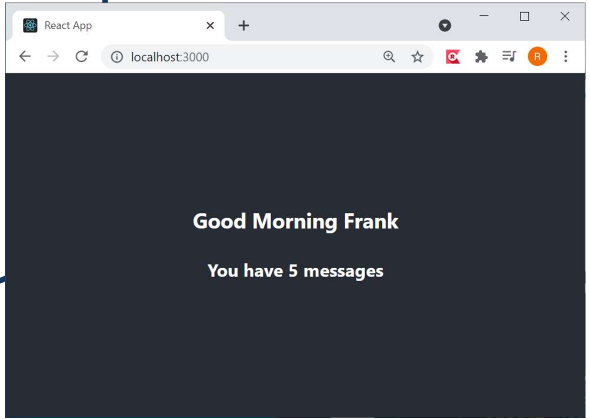
Pass props to components

Greeting.js

```
import React from 'react';

export const Greeting = (props) =>{
    const {name, nrOfMessages } = props;
    let isMorning = (new Date()).getHours() < 12;
    let greetingElement = isMorning
       ? (
       <>
         <h3>Good Morning {name}</h3>
         <h4>You have {nrOfMessages} messages</h4>
       </>
       )
       : (
        <>
          <h3>Good Evening {name}</h3>
          <h4>You have {nrOfMessages} messages</h4>
       </>
       );
    return greetingElement ;
}
```

Better way

You do not have to put props for every property



Good Morning Frank

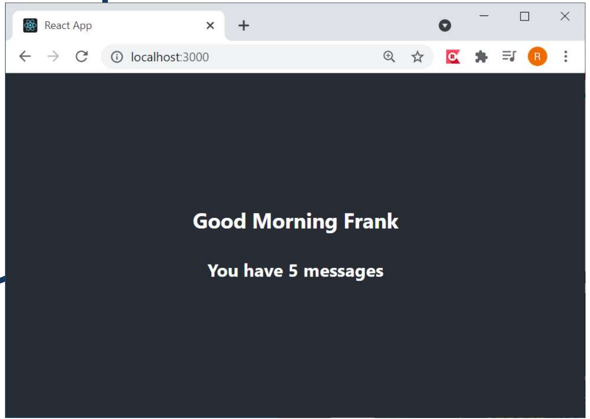
You have 5 messages

Pass props to components

Greeting.js

Even better way

```
import React from 'react';

export const Greeting = ({name, nrOfMessages } ) =>{
    let isMorning = (new Date()).getHours() < 12;
    let greetingElement = isMorning
       ? (
       <>
         <h3>Good Morning {name}</h3>
         <h4>You have {nrOfMessages} messages</h4>
       </>
       )
       : (
        <>
          <h3>Good Evening {name}</h3>
          <h4>You have {nrOfMessages} messages</h4>
       </>
       );
    return greetingElement ;
}
```



Good Morning Frank

You have 5 messages

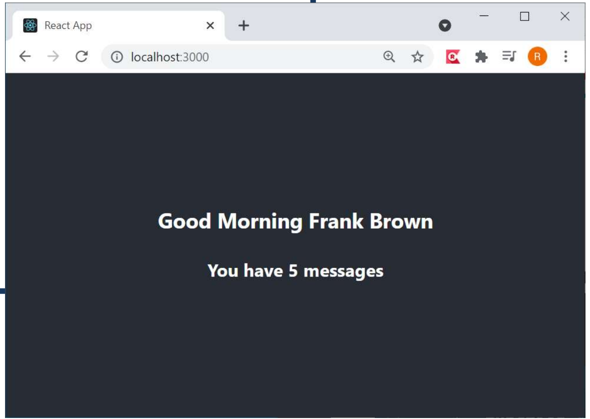
Passing an object

Greeting.js

object

object

```
import React from 'react';

export const Greeting = ({person, nrOfMessages }) =>{
    let isMorning = (new Date()).getHours() < 12;
    let greetingElement = isMorning
       ? (
       <>
         <h3>Good Morning {person.firstName} {person.lastName}</h3>
         <h4>You have {nrOfMessages} messages</h4>
       </>
       )
       : (
        <>
          <h3>Good Evening {person.firstName} {person.lastName}</h3>
          <h4>You have {nrOfMessages} messages</h4>
       </>
       );
    return greetingElement ;
}
```



Good Morning Frank Brown

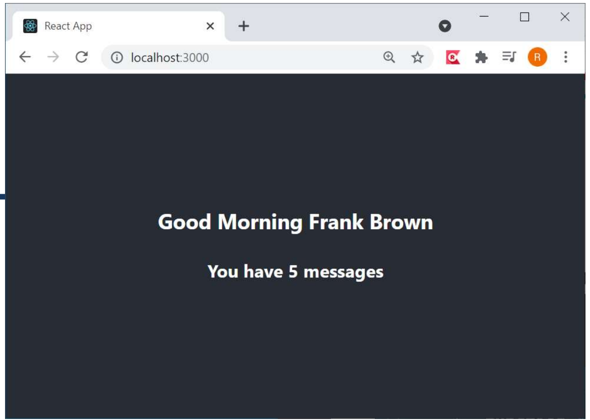
You have 5 messages

Passing an object

App.js

```
import './App.css';
import {Greeting} from './Greeting';

function App() {
  return (
    <div className="App">
      <header className="App-header">
        <p>
          <Greeting person={{ firstName:"Frank", lastName:"Brown"}} nrOfMessages = {5}/>
        </p>
      </header>
    </div>
  );
}

export default App;
```

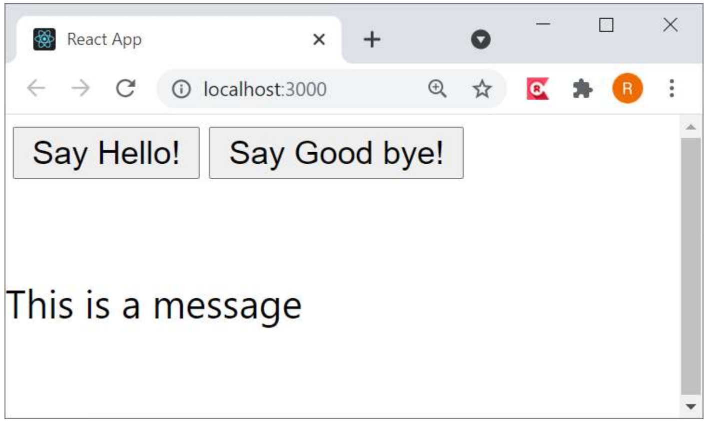
Pass an object



Good Morning Frank Brown

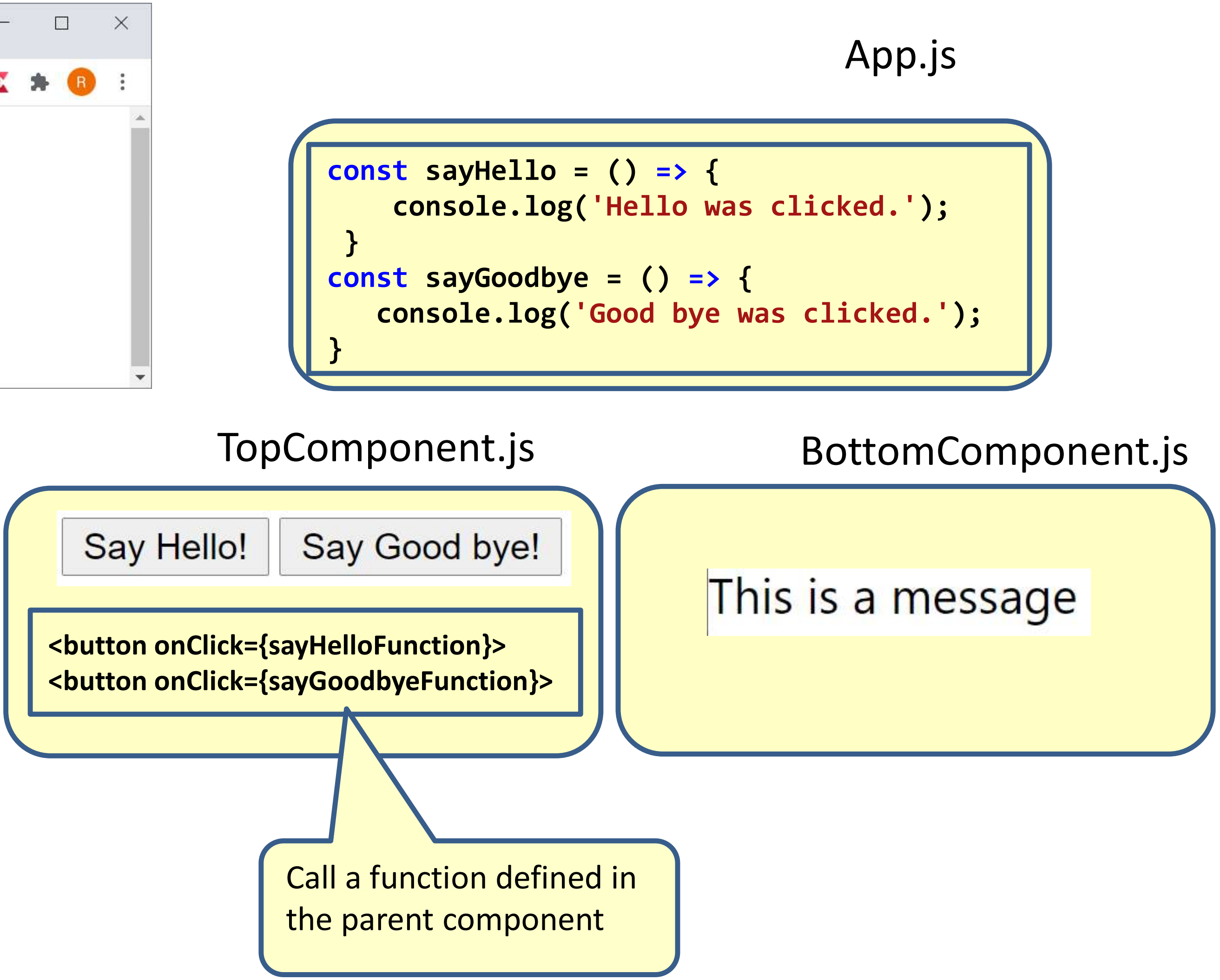
You have 5 messages

Passing a function



Say Hello! Say Good bye!

This is a message


App.js

```
const sayHello = () => {
    console.log('Hello was clicked.');
 }
const sayGoodbye = () => {
   console.log('Good bye was clicked.');
}
```

TopComponent.js

Say Hello! Say Good bye!

```
<button onClick={sayHelloFunction}>
<button onClick={sayGoodbyeFunction}>
```

BottomComponent.js

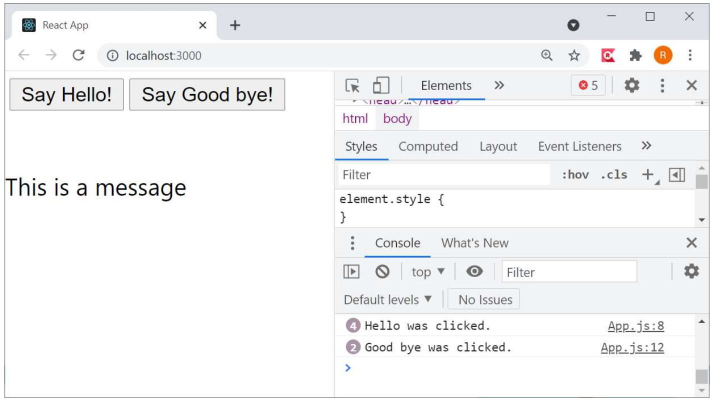
This is a message

Call a function defined in the parent component

Passing a function

App.js

```
import './App.css';
import { TopComponent } from './pages/TopComponent';
import { BottomComponent } from './pages/BottomComponent';

function App() {

 const sayHello = () => {
    console.log('Hello was clicked.');
 }

const sayGoodbye = () => {
   console.log('Good bye was clicked.');
}

  return (
    <div>
      <TopComponent sayHelloFunction={sayHello} sayGoodbyeFunction={sayGoodbye} />
      <BottomComponent/>
    </div>
  );
}

export default App;
```



This is a message

```
element.style {
}
```

```
4 Hello was clicked.        App.js:8
2 Good bye was clicked.     App.js:12
```

Pass a function

Pass a function

Passing a function

Pass a function

Pass a function

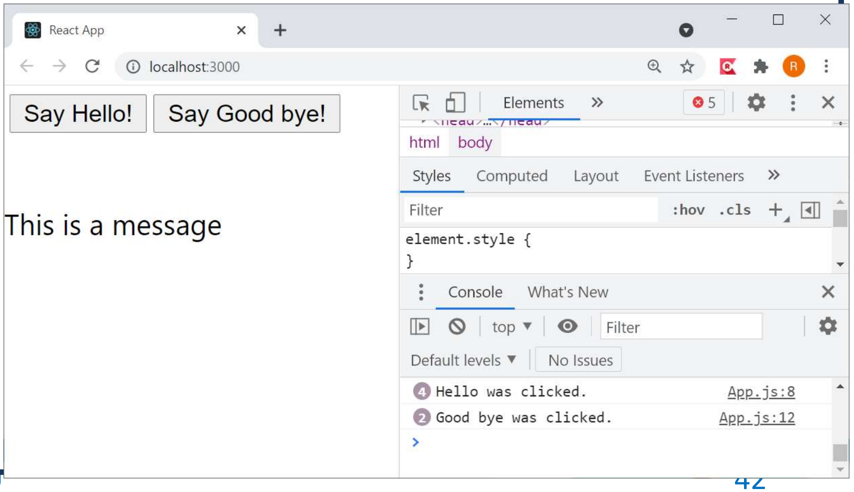
TopComponent.js

```
import React from 'react';

export const TopComponent= ({sayHelloFunction,sayGoodbyeFunction} )  => {
    let content =
       <table>
        <tr>
          <th><button onClick={sayHelloFunction}>Say Hello!</button></th>
          <th><button onClick={sayGoodbyeFunction}>Say Good bye!</button></th>
        </tr>
      </table>
    return content ;
}
```

Call the function in the parent component

BottomComponent.js

```
import React from 'react';
export const BottomComponent = () =>{
    let message = "This is a message";

    let content =
       <div>
         <p>
          {message}
        </p>
       </div>
    return content ;
}
```



This is a message

```
element.style {
}
```

```
4 Hello was clicked.        App.js:8
2 Good bye was clicked.     App.js:12
```

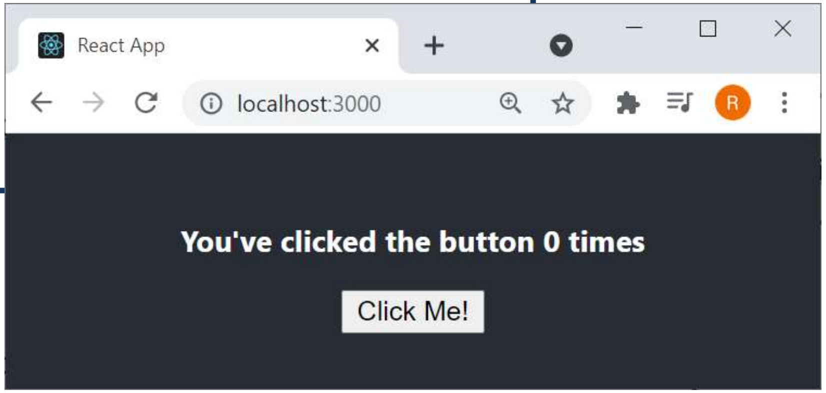
STATE IN COMPONENTS

Use state in components

```
import React from 'react';

export const Counter = () =>{
    let numberOfClicks=0;

    const increment = () =>{
      numberOfClicks = numberOfClicks + 1;
      console.log(numberOfClicks);
    }

    let counterElement = (
       <>
         <h3>You've clicked the button {numberOfClicks} times</h3>
         <button onClick={increment} >Click Me!</button>
       </>
       );
    return counterElement ;
}
```

The page will not show the updated value of numberOfClicks

React will only render a component if the value of the props or the value of one of the hooks change



You've clicked the button 0 times

React Hooks

- Built-in functions that allow React developers to use state and lifecycle methods inside functional components
  - Makes working with state and lifecycle methods easier in functional components
- Important hooks
  - useState
  - useEffect

useState hook

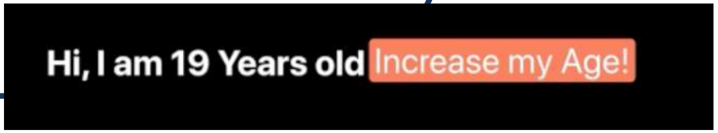
Variable age

Function for updating variable age

Initial value of age

```
function App() {

    const [age, setAge] = useState(19);

    const handleClick = () => setAge(age + 1)

    return (
        <div>
            I am {age} Years Old
          <div>
          <button onClick={handleClick}>Increase my age! </button>
        </div>
     </div>
     )
  }
```

Update age



Hi, I am 19 Years old

Use state in components

Import the useState hook

Hook

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

export const Counter = () =>{
    const [numberOfClicks, setNumberOfClicks] = useState(0);

    const increment = () => setNumberOfClicks(numberOfClicks + 1);

    let counterElement = (
       <>
         <h3>You've clicked the button {numberOfClicks} times</h3>
         <button onClick={increment} >Click Me!</button>
       </>
       );
    return counterElement ;
}
```

increment method

Call the increment method

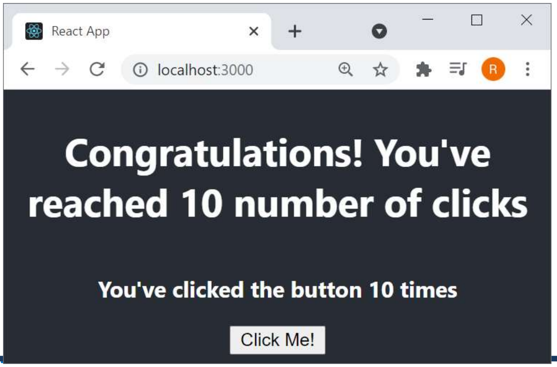
Use state in components

```
import React, {useState} from 'react';
import {Counter} from './Counter';
import {CongratulationsMessage} from './CongratulationsMessage';
import './App.css';

function App() {
  const [numberOfClicks, setNumberOfClicks] = useState(0);

  const increment = () => setNumberOfClicks(numberOfClicks + 1);

  return (
    <div className="App">
      <header className="App-header">
        <CongratulationsMessage threshold={10} numberOfClicks={numberOfClicks} />
        <Counter numberOfClicks={numberOfClicks} onIncrement={increment}/>
      </header>
    </div>
  );
}

export default App;
```

Put state in the parent

Pass data

Pass a function



Congratulations! You've reached 10 number of clicks

You've clicked the button 10 times

Use state in components

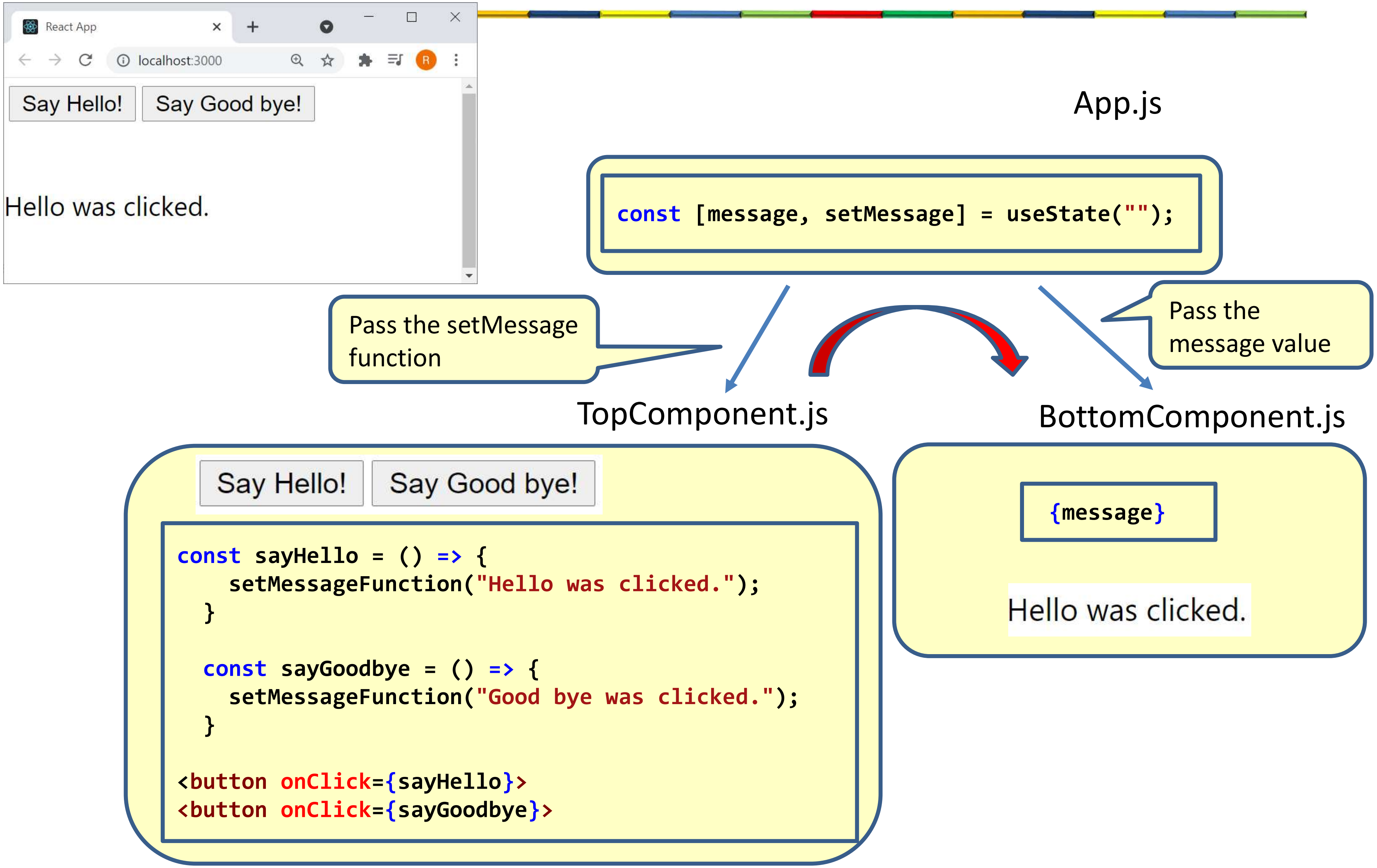
Pass data

Pass a function

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

export const Counter = ({numberOfClicks, onIncrement}) =>{

    let counterElement = (
        <>
            <h3>You've clicked the button {numberOfClicks} times</h3>
            <button onClick={onIncrement} >Click Me!</button>
        </>
    );
    return counterElement ;
}
```

```
import React from 'react';

export const CongratulationsMessage = ({numberOfClicks, threshold}) =>{

    let messageElement = numberOfClicks >= threshold
         ? <h1>Congratulations! You've reached {threshold} number of clicks</h1>
         : null;
    return messageElement ;
}
```

Passing data between components



Hello was clicked.

App.js

```
const [message, setMessage] = useState("");
```

Pass the setMessage function

Pass the message value

TopComponent.js

```
const sayHello = () => {
    setMessageFunction("Hello was clicked.");
  }

  const sayGoodbye = () => {
    setMessageFunction("Good bye was clicked.");
  }

<button onClick={sayHello}>
<button onClick={sayGoodbye}>
```

BottomComponent.js

```
{message}
```

Hello was clicked.

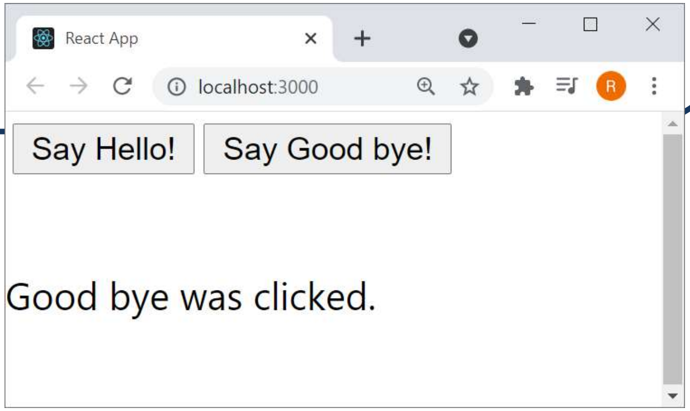
Use state in components

```
import './App.css';
import React, {useState} from 'react';
import { TopComponent } from './pages/TopComponent';
import { BottomComponent } from './pages/BottomComponent';

function App() {
  const [message, setMessage] = useState("");

  return (
    <div>
      <TopComponent setMessageFunction={ setMessage} />
      <BottomComponent message={message} />
    </div>
  );
}

export default App;
```

State in the top component

Pass state change function

Pass state



Good bye was clicked.

Use state in components

TopComponent.js

```
import React from 'react';

export const TopComponent = ({ setMessageFunction }) => {

  const sayHello = () => {
    setMessageFunction("Hello was clicked.");
  }

  const sayGoodbye = () => {
    setMessageFunction("Good bye was clicked.");
  }

  let content =
    <table>
      <tr>
        <th><button onClick={sayHello}>Say Hello!</button></th>
        <th><button onClick={sayGoodbye}>Say Good bye!</button></th>
      </tr>
    </table>

  return content;
}
```

Pass a function

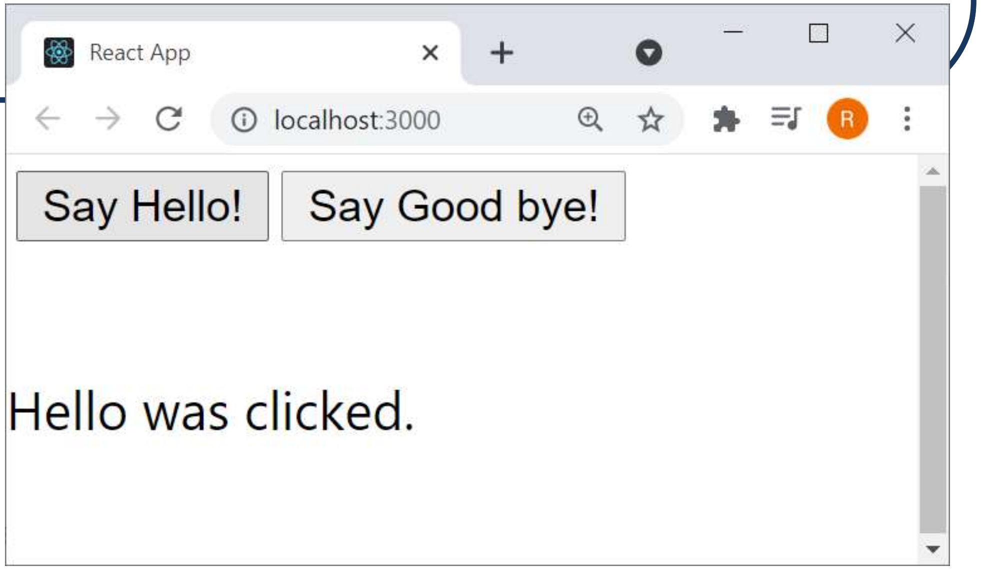
Call the passed function

Use state in components

BottomComponent.js

```
import React from 'react';

export const BottomComponent = ({ message }) => {

    let content =
       <div>
         <p>
          {message}
        </p>
       </div>
    return content ;
}
```

Pass the message



Hello was clicked.