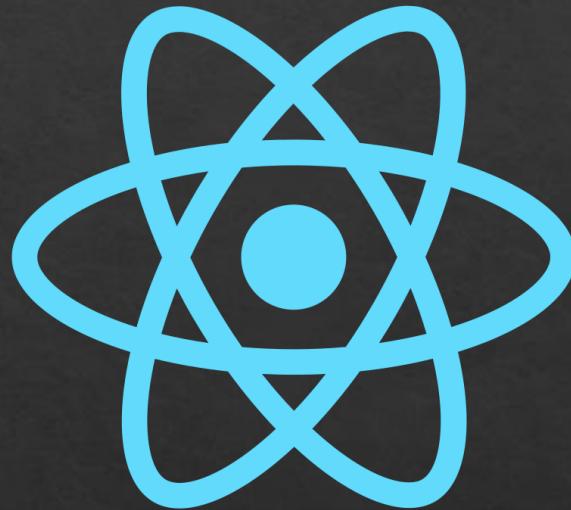
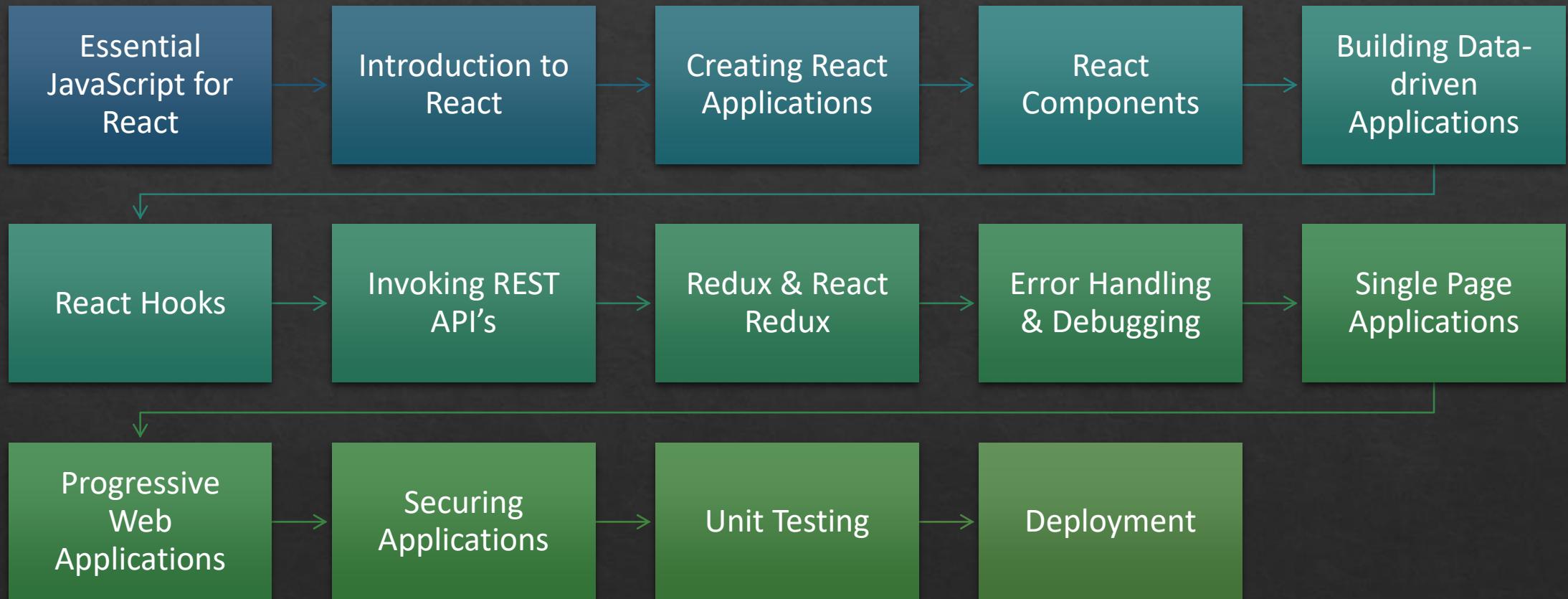


React



ANIL JOSEPH

Agenda



Anil Joseph

Introduction

- ❖ Over 20 years of experience in the industry
- ❖ Technologies
 - ❖ C, C++
 - ❖ Java, Enterprise Java
 - ❖ .NET & .NET Core
 - ❖ **UI Technologies: React, Angular, jQuery, ExtJs**
 - ❖ Mobile: Native Android, React Native
- ❖ Worked on numerous projects
- ❖ Conducting trainings for corporates (700+)

Software

Node.js & NPM

Yarn
(Optional)

JavaScript Editor
(Visual Studio Code)

Browsers(Chromium)

JavaScript

An interpreted language

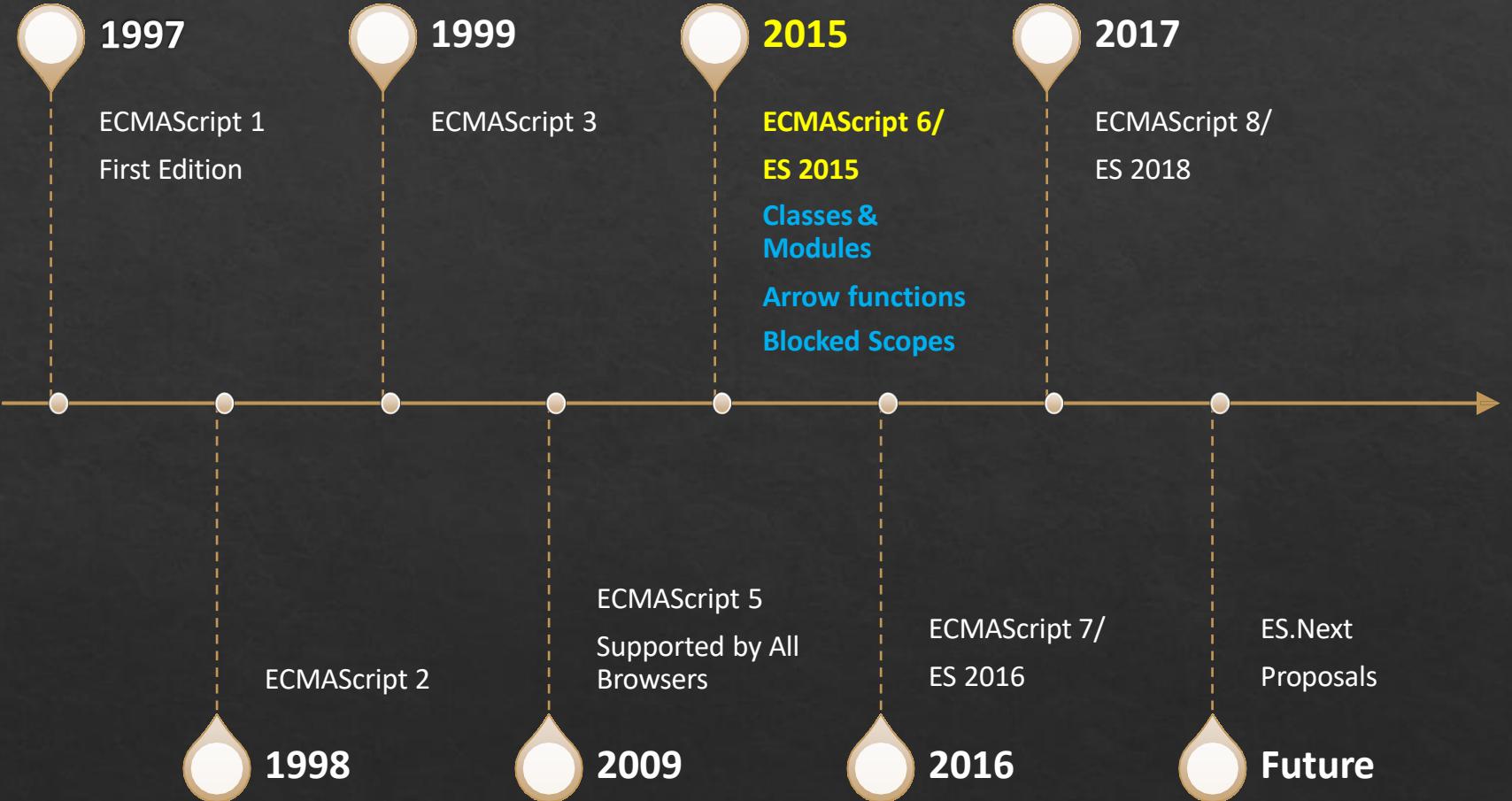
Dynamic

Object-oriented

Supports Functional style of programming

Available on the browsers and Node.js

ECMAScript Versions



ES6/7 Features (Used in React)

Block Scoped
Constructs

Classes

Arrow functions

Spread and Rest
Operator

Modules

Block Scoped Constructs

- ❖ **Scope** determines the accessibility (visibility) of variables.
- ❖ ES5 supports two scopes
 - ❖ Global
 - ❖ Functional
- ❖ ES 6 introduces the block scoped constructs
 - ❖ **let**
 - ❖ **const**

Arrow Function

Represents a function expression

An arrow function expression has a shorter syntax than a function expression.

They do not receive the implicit arguments “this” and “arguments”.

Used widely for asynchronous and functional programming

Spread Operator

- ❖ Allows an iterable such as an array expression or string to be expanded in places where zero or more arguments or elements are expected.

ES6 Classes

- ❖ ES 6 supports class based object-oriented programming
- ❖ Classes in ES6
 - ❖ Constructor
 - ❖ Properties
 - ❖ Methods
 - ❖ Static methods
 - ❖ Inheritance
- ❖ Classes are just syntactic sugar of constructor functions.

Modules

- ❖ Use the import and export statements.

```
let foo = function(){  
    //some code  
}
```

```
export default foo;
```

one.js

```
import foo from './one';  
  
foo();
```

two.js

```
import bar from './one';  
  
bar();
```

three.js

Modules

```
export let foo = function(){  
    //some code  
}  
  
export let bar = function(){  
    //some code  
}
```

one.js

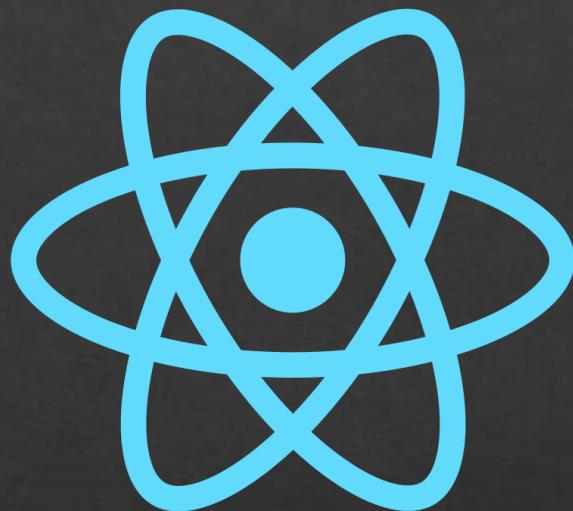
```
import {foo, bar} from './one';  
  
foo();  
bar();
```

two.js

NPM Package vs Module

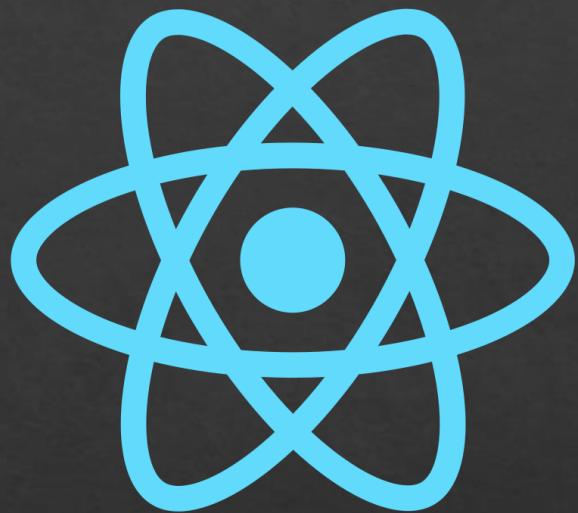
- ❖ Module
 - ❖ Single JavaScript file with some reasonable functionality
- ❖ Package
 - ❖ A directory with one or more modules
 - ❖ package.json file contains metadata about the package

What is React?



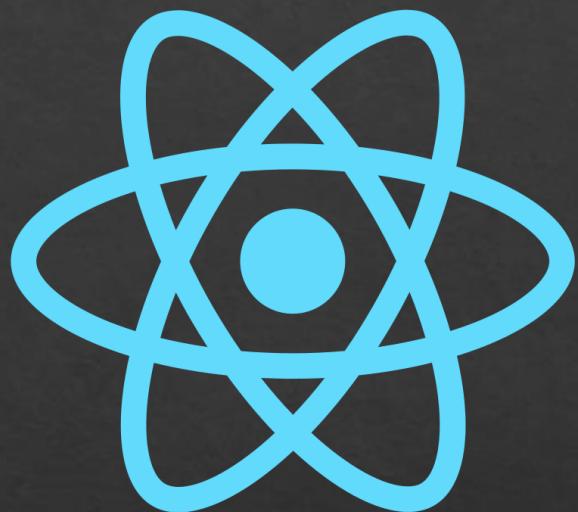
- ❖ A JavaScript library to build *User Interfaces*.
- ❖ Building applications for the *browser*.
- ❖ React allows to create custom HTML elements called *components*.
- ❖ Components are used to build *complex User Interface*
- ❖ Reacts promotes writing *maintainable, manageable and reusable code*.

Why React?



- ❖ React handles *State*
 - ❖ UI State is difficult to handle with JavaScript
- ❖ React focuses on business logic
 - ❖ Focus on business logic
- ❖ React is *fast*.
 - ❖ Apps made in React can handle complex updates and still feel quick and responsive.

Why React?



- ❖ React is *modular*
 - ❖ Instead of writing large, dense files of code, you can write many smaller, reusable files.
- ❖ React is *scalable*.
 - ❖ Large programs that display a lot of changing data are where React performs best.
- ❖ React has a Huge ecosystem, community

History

React was created by **Jordan Walke**, a software engineer at Facebook.

It was first deployed on **Facebook's** newsfeed in 2011

Later on **Instagram** in 2012.

It was open-sourced in 2013.

Getting Started

Two React Libraries

- React
- ReactDOM

JSX

- A JavaScript extension syntax allowing quoting of HTML

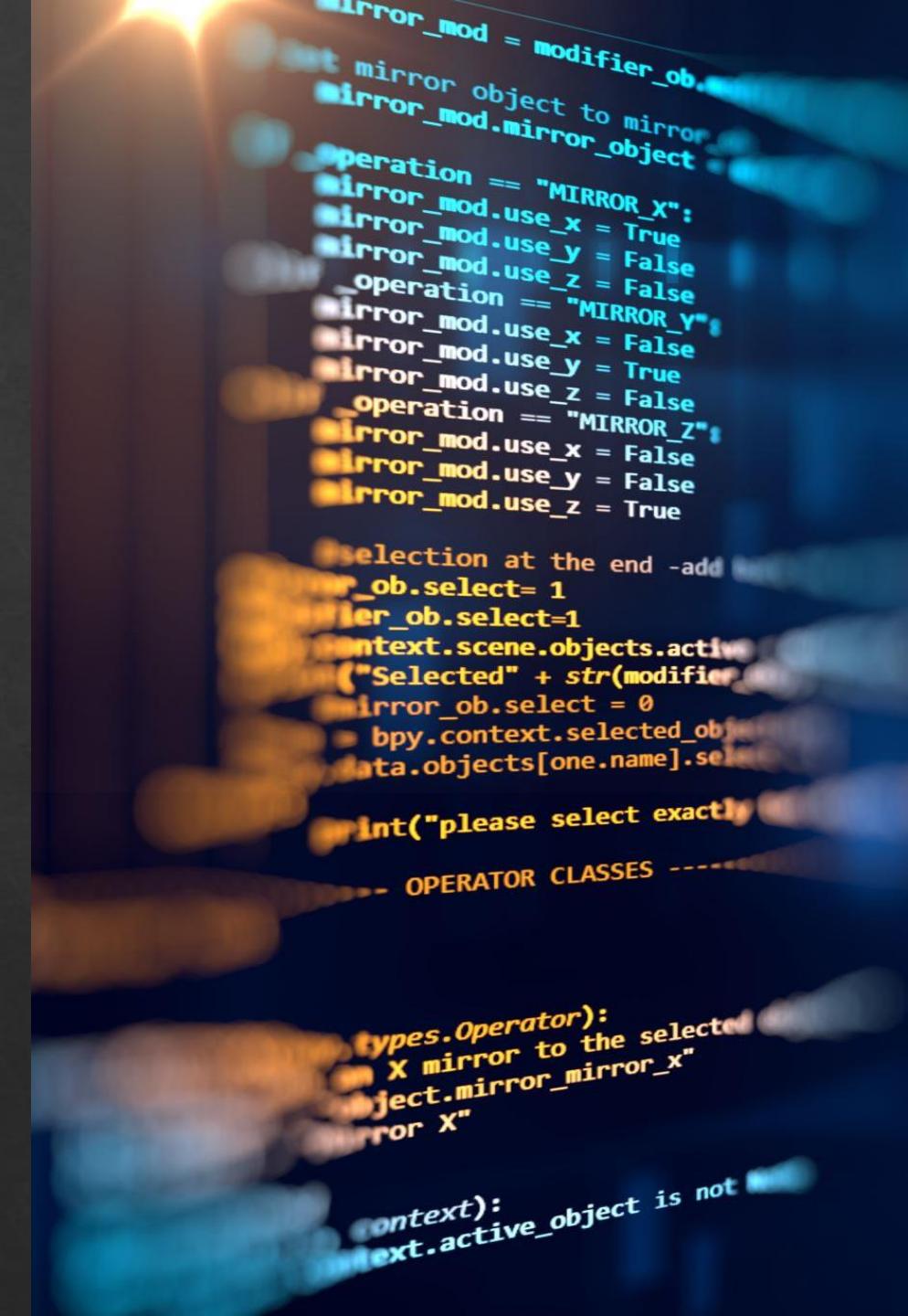
Babel

- The compiler for writing next generation JavaScript.
- Compiles JSX to JavaScript

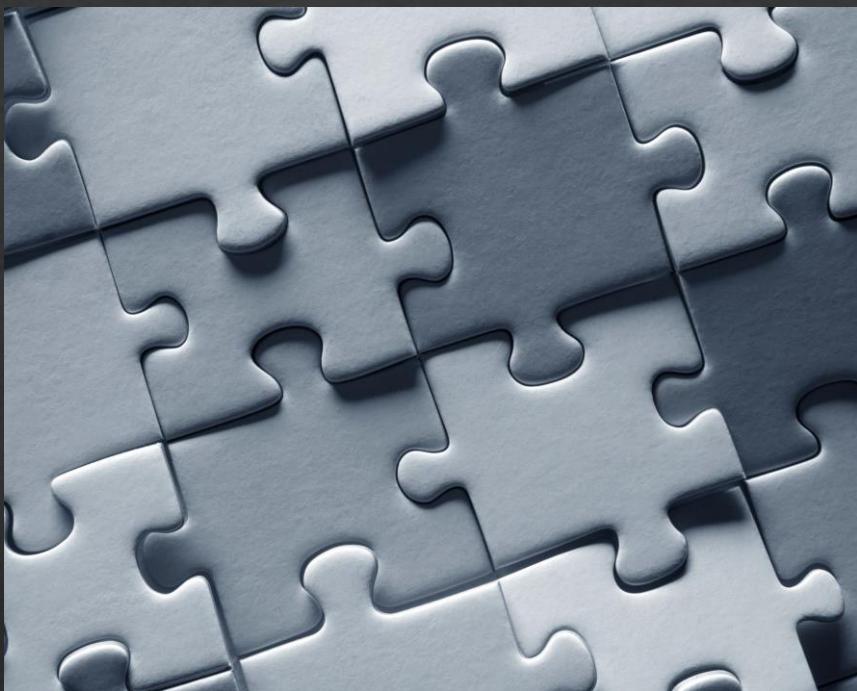
Creating a React Project

Tool Chains

- ❖ A toolchain is a set of programming tools that is used to perform a complex software development task or to create a software product.(Wiki)
- ❖ Using a toolchain provides a better developer experience
- ❖ Advantages of Tool Chains
 - ❖ Scaling to many files and components.
 - ❖ Using third-party libraries from npm.
 - ❖ Detecting common mistakes early.
 - ❖ Live-editing CSS and JS in development.
 - ❖ Optimizing the output for production.



Create React App



- ❖ Create React App is an officially supported way to *create single-page React applications*.
- ❖ It offers a modern build setup with no configuration.
- ❖ Sets up the development environment to use the latest JavaScript features.
- ❖ Optimizes the application for production.
- ❖ Integrates the tools: NPM, Babel, Webpack, Webpack development server

Create Project

1

Install NodeJs

- Runtime to run/execute JavaScript on the machine/server
- This installation also installs npm(Node Package Manager)

2

Install Toolchain

- **Install create-react-app**
- **npm install create-react-app -g**

3

Create React Application

- **create-react-app the-react-app**

4

Start the Application

- **cd the-react-app**
- **npm start**

Create Project

1

Install NodeJs

- Runtime to run/execute JavaScript on the machine/server
- This installation also installs npm(Node Package Manager)

2

Create React Application

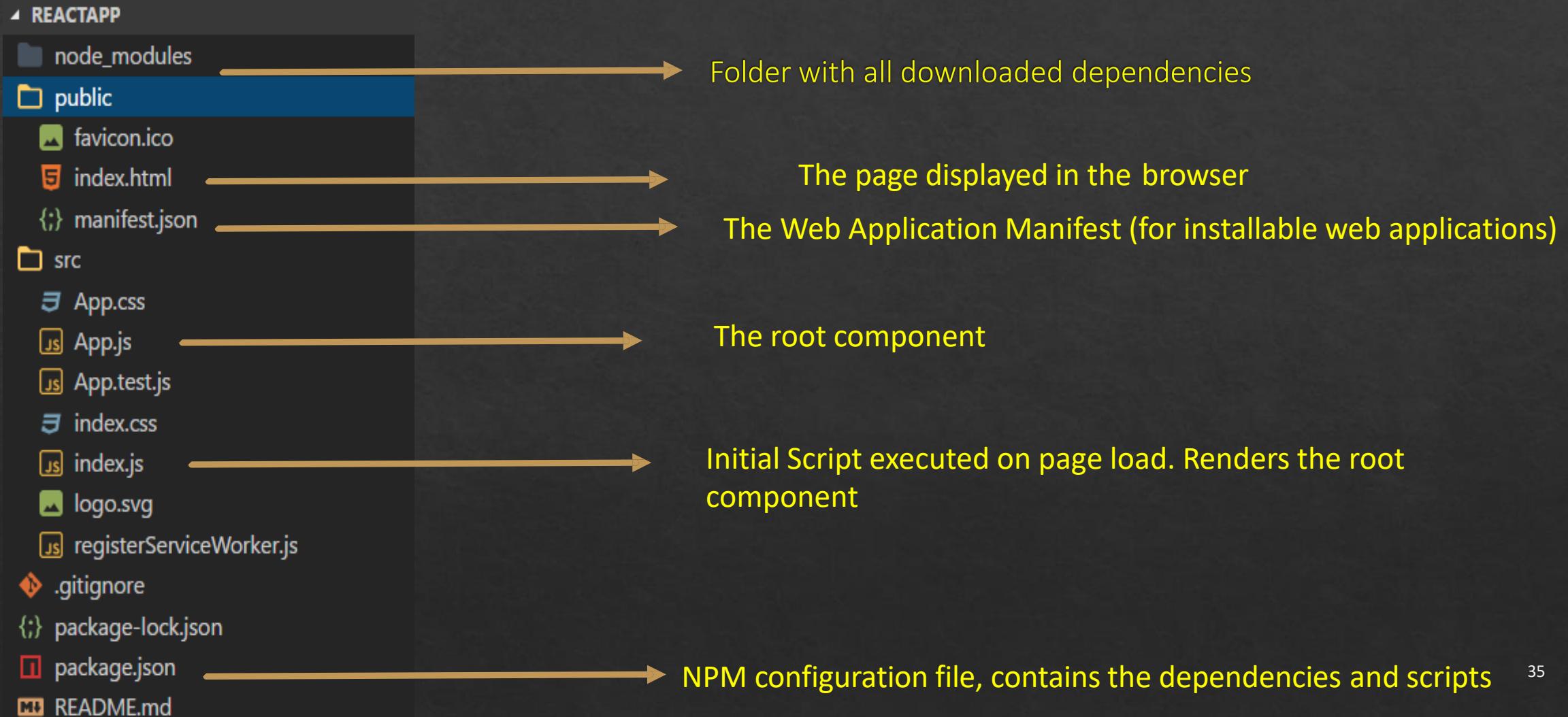
- **npx create-react-app the-react-app**

3

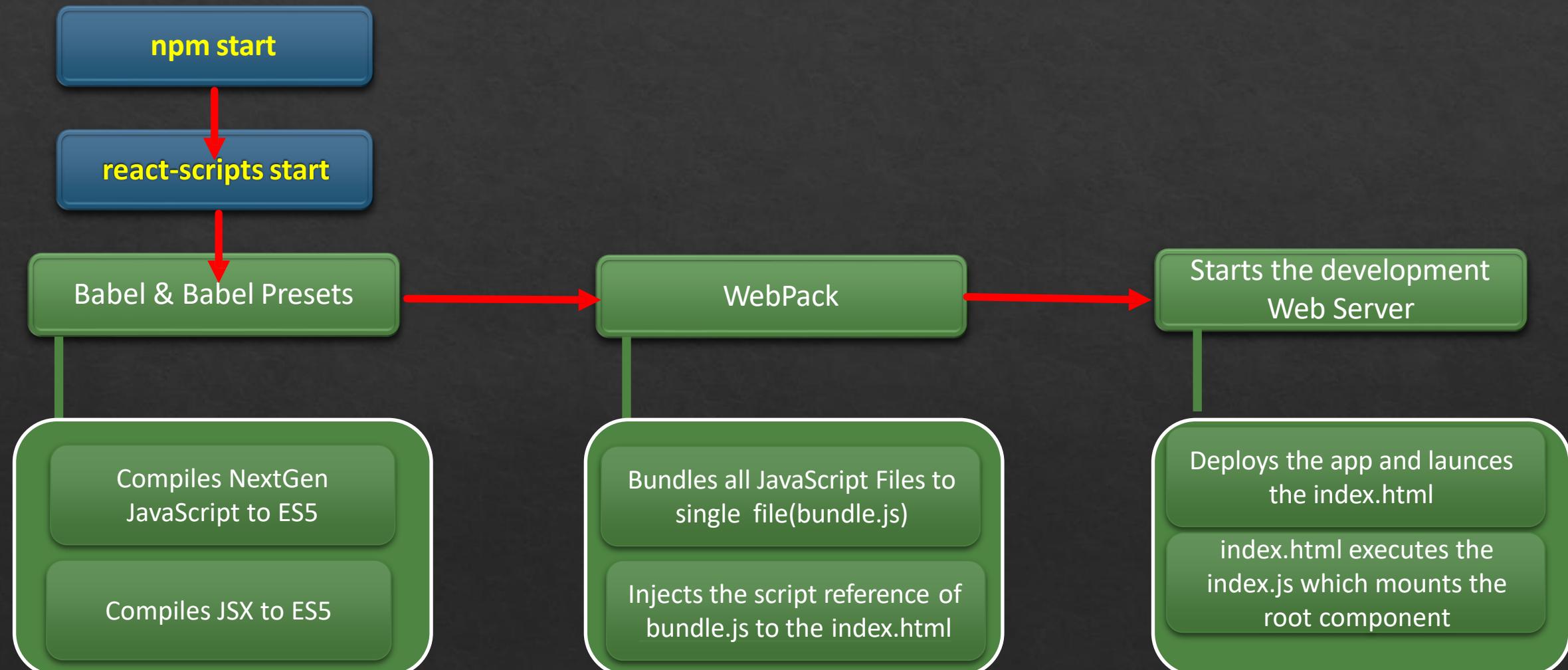
Start the Application

- **cd the-react-app**
- **npm start**

Project Structure

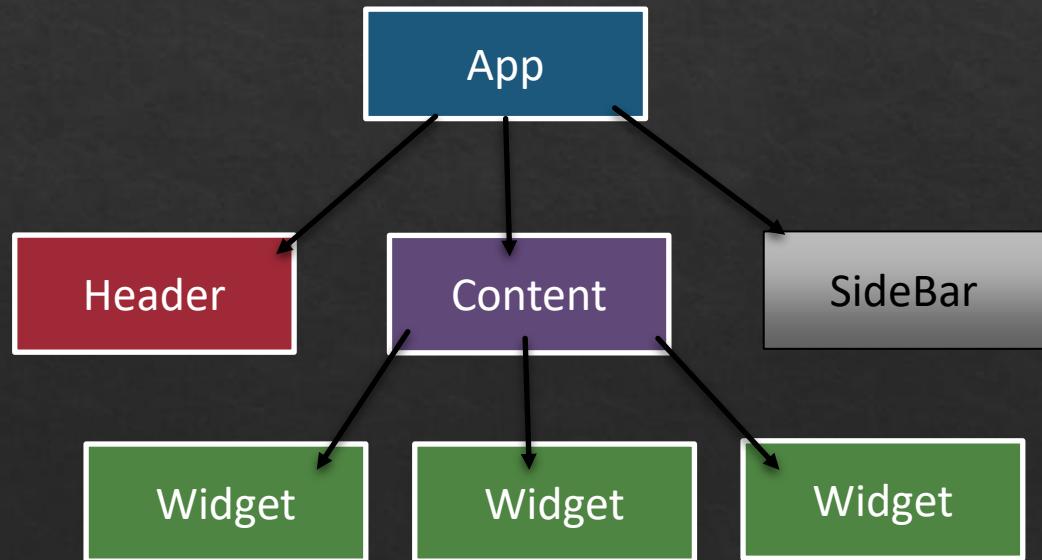
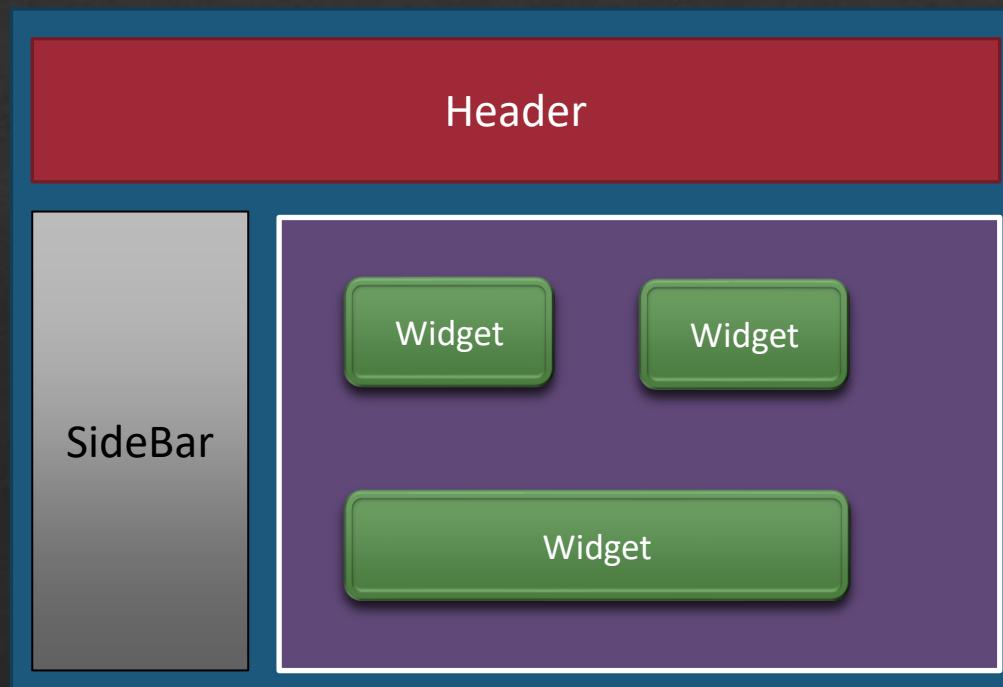


Project Execution



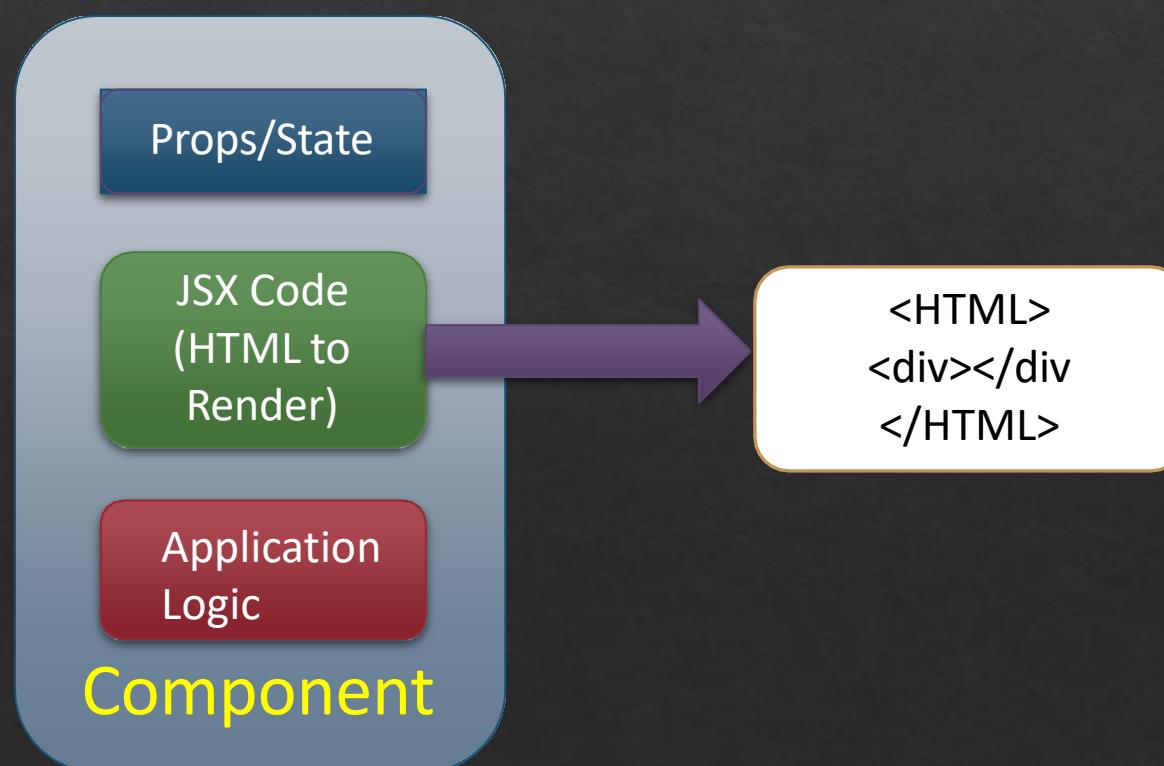
React Components

- ❖ Components are the core building blocks in React
- ❖ Creating a React applications is all about designing and implementing components
- ❖ A React application can be depicted as a component tree.



React Components

- ❖ The UI in a React Application is composed of components, the building blocks.
- ❖ Components are designed to be reusable



Types of Components

Functional

- Presentational
- Stateless (till React 16.8)
- Stateful (using React Hooks)

Class based

- Containers
- Stateful

JSX

- ◊ JSX is a syntax extension for JavaScript.
- ◊ It was written to be used with React.
- ◊ JSX code looks a lot like HTML.
 - ◊ **It's actually JavaScript**
- ◊ A JSX *compiler* will translate any JSX into regular JavaScript.
- ◊ JSX elements are treated as JavaScript *expressions*.
 - ◊ They can go anywhere that JavaScript expressions can go.
- ◊ That means that a JSX element can be
 - ◊ Saved in a variable
 - ◊ Passed to a function
 - ◊ Stored in an object or array

Components: Dynamic Content

- ❖ Dynamic content is outputted in the JSX using an expression.
- ❖ The syntax
 - ❖ `{ expression }`
- ❖ This can be any one line expression
- ❖ Complex functionalities can be done by calling functions
 - ❖ `{ invokeSomeMethod() }`

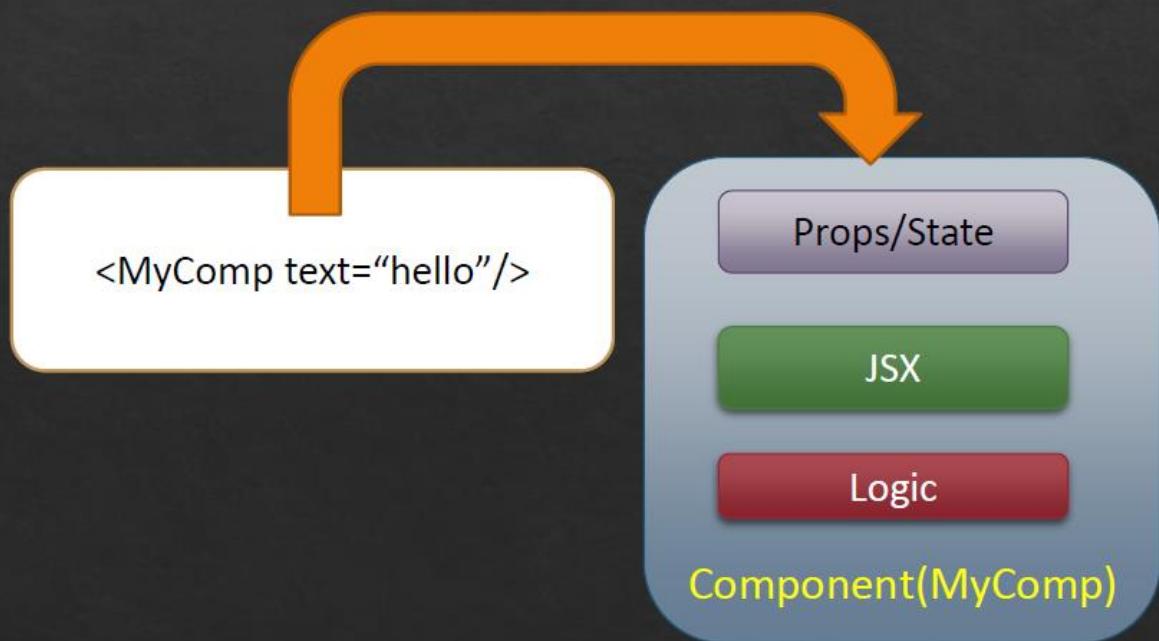
Components: Properties(props)

Most components can be customized with different parameters when they are created.

These creation parameters are called “*props*”.

Props are used similar to HTML attributes.

Changes to props will automatically re-render the component.



Component State

State holds information about the component

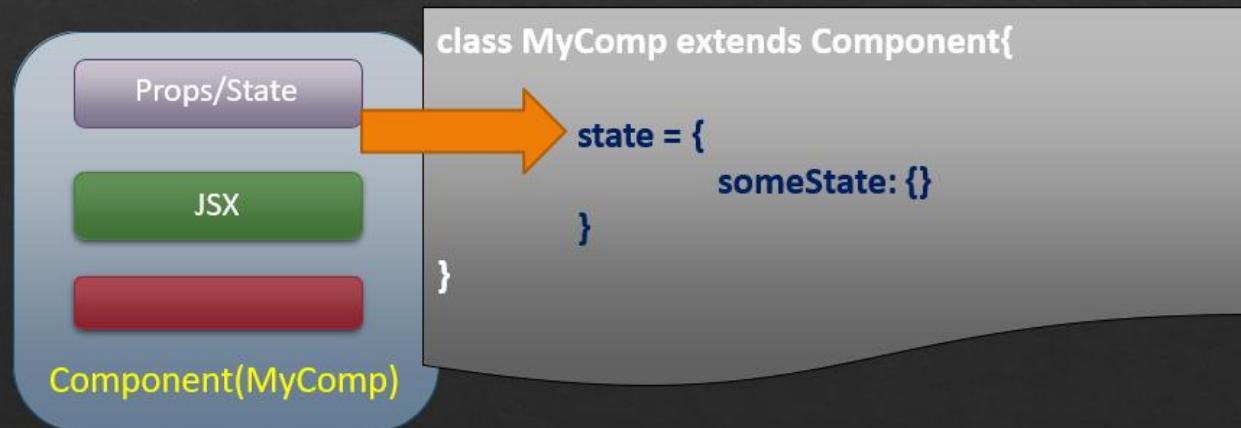
State is used when a component needs to keep track of information between renderings.

State is created and initialized in the component itself.

State is available only with Stateful components(Class Based).

Component state should be always updated using the setState method

State updates trigger a rerender of the component.



Props and State

“props” and “state” are CORE concepts of React.

Only changes in “props” and/ or “state” trigger React to re-render the components and potentially update the DOM in the browser

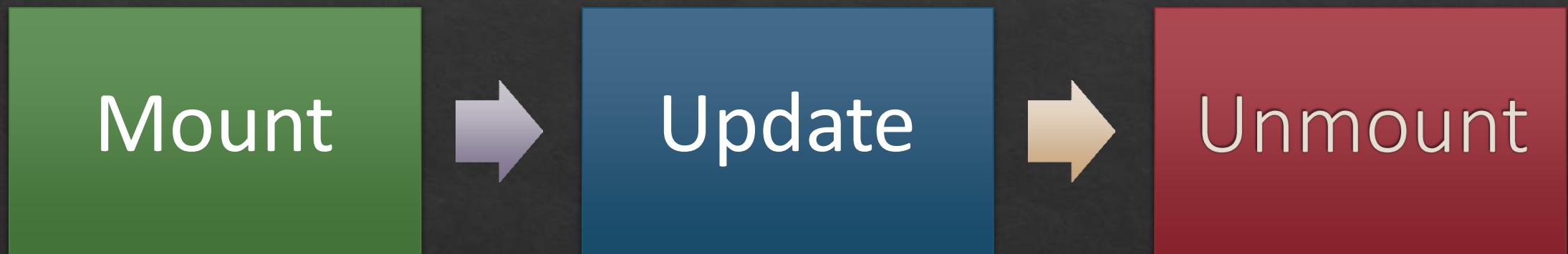
props allow you to pass data from a parent (wrapping) component to a child (embedded) component.

State is used to change the component from within.

Event Handling

- ❖ Handling events with React elements is very similar to handling events on DOM elements with some syntactic differences.
- ❖ React events are named using camelCase, rather than lowercase.
- ❖ With JSX you pass a function as the event handler, rather than a string.
- ❖ Event handlers will be passed instances of ***SyntheticEvent***
 - ❖ A cross-browser wrapper around the browser's native event
 - ❖ Details
 - ❖ <https://reactjs.org/docs/events.html>

Component Lifecycle



Component Lifecycle(Mount)

constructor

- Setup State
- Don't cause side-effects

componentWillMount

- Setup State
- Don't cause side-effects
- Configuration

render

- Prepare and Structure the View

Render Child Components

componentDidMount

- Cause side-effects
- Initialize anything that relies on the DOM

Component Lifecycle(Update)

componentWillReceiveProps(nextProps)

- Sync State to Props
- Don't Cause Side-Effects

shouldComponentUpdate(nextProps, nextState)

- Decide whether to Continue or Not
- Don't Cause Side-Effects

componentWillUpdate(nextProps, nextState)

- Sync State to Props
- Don't Cause Side-Effects

render()

Update/Render Child Components

componentDidUpdate

- Cause Side-Effects
- Don't update state

Component Lifecycle(Unmount)

- ❖ componentWillUnmount
 - ❖ Remove Listeners
 - ❖ Cancel Active network calls
 - ❖ Invalidate Timers

AJAX and APIs

- ❖ React does not have any API's for AJAX calls.
- ❖ We have to use an AJAX Library for server communications
- ❖ Popular Libraries
 - ❖ Axios
 - ❖ jQuery AJAX
 - ❖ Fetch API
- ❖ In a component AJAX calls to fetch data from the server should be made in the ***componentDidMount*** lifecycle method.

axios

- ❖ Promise based HTTP client for the browser and node.js
- ❖ Installation
 - ❖ npm install axios
- ❖ Features
 - ❖ Make http requests
 - ❖ Supports the Promise API
 - ❖ Intercept request and response
 - ❖ Transform request and response data
 - ❖ Cancel requests
 - ❖ Automatic transforms for JSON data
 - ❖ Client side support for protecting against XSRF

axios methods

axios.request({config})

axios.get(url, {config})

axios.post(url,{data}, {config})

axios.delete(url, {config})

axios.put(url,{data}, {config})

axios global defaults

Base URL

- `axios.defaults.baseURL = 'https://abc.com';`

Headers

- `axios.defaults.headers.common['Authentication'] = AUTH_TOKEN;`

Headers for specific methods

- `axios.defaults.headers.post['Content-Type'] = 'application/json';`

AJAX and APIs

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React Hooks



React hooks was introduced in version 16.8



Many React features like state, lifecycle hooks etc. were available only with class-based components prior to 16.8.



Hooks let us use state and other React features in a functional component.



React team recommends the functional components over class-based since they can be highly optimized by the tools.

React Hooks

State Hooks(useState)

- Equivalent of state in class-based components

Effect Hooks(useEffect)

- Used to perform side-effects in a function
- component
- Equivalent to lifecycle hooks in class-based components

Context Hooks(useContext)

- Used to access the React Context;

React Hooks

Callback Hooks(useCallback)

- Returns a memoized callback.
- Used to optimize the components

Memo Hooks(useMemo)

- Returns a memoized value.
- Used to optimize the components

Ref Hooks(useRef)

- Returns a mutable ref object

Custom Hooks

- A functions
- Uses Other Hooks

Debugging

- ❖ Error Messages
 - ❖ Messages generated by React during development mode
- ❖ Browser Developer Tools
- ❖ React Tools
 - ❖ Tools for Chrome and Firefox
- ❖ Error Boundaries
 - ❖ Error boundaries are React components that **catch JavaScript errors anywhere in their child component tree**
 - ❖ **Log errors**
 - ❖ **Display a fallback UI**

Virtual DOM

The Virtual DOM (VDOM)

- Where a “virtual”, representation of a UI is kept in memory
- This is synced with the “real” DOM.
- This process is called reconciliation.

Reconciliation

- When the render() function is called it creates a tree of React elements.
- On the next update render() will return a different tree
- React then figures out how to efficiently update the UI to match the most recent tree.
- Uses the Diff algorithm

Higher-order Components

- ❖ A Higher Order Component is just a React Component that wraps another one.
- ❖ Higher Order Components is a Pattern used extensively with React
- ❖ Uses
 - ❖ Code reuse, logic and bootstrap abstraction
 - ❖ Render Highjacking
 - ❖ State abstraction and manipulation
 - ❖ Props manipulation
- ❖ Its basically a functions that returns a class component with the Wrapped Component.

Single Page Applications



A single-page application is an application that works inside a browser and does not require page reloading during use.



SPA is fast, as most resources (HTML+CSS+Scripts) are only loaded once throughout the lifespan of application. Only data is transmitted back and forth.

Routing

- ❖ Routers allow to navigate between the different views in the application using JavaScript on the client-side.
- ❖ Navigations are updated to the browser history which allows to go back and forward
- ❖ Usage of path and search parameters are allowed
- ❖ React does not provide any API for routing.
- ❖ Many other Libraries available which integrates with React
 - ❖ React-router(The de-facto standard)
 - ❖ Director
 - ❖ Aviator
 - ❖ Finch

React Router v4

- ❖ React Router is a collection of **navigational components** that compose declaratively with your application.
- ❖ Installation
 - ❖ `npm install react-router-dom`

React Router Components

<BrowserRouter>

- A <Router> that uses the HTML5 history to keep your UI in sync with the URL.

<HashRouter>

- A <Router> that uses the hash portion of the to keep your UI in sync with the URL.

<Route>

- The Route component is perhaps the most important component in React Router

<Link>

- Provides declarative, accessible navigation around your application.

<NavLink>

- A special version of the <Link> that will add styling attributes to the rendered element when it matches the current URL.

State Management

React Context

- Available from React 16.3

React Redux

- Library to manage state

Types of State

Local UI State

- Show/Hide UI
- Handled By the Component

Persistent State

- Orders, Blogs
- Stored on Server, can be managed by Redux or React Context

Client State

- IsAuthenticated, Filter Information
- Managed by Redux or React Context

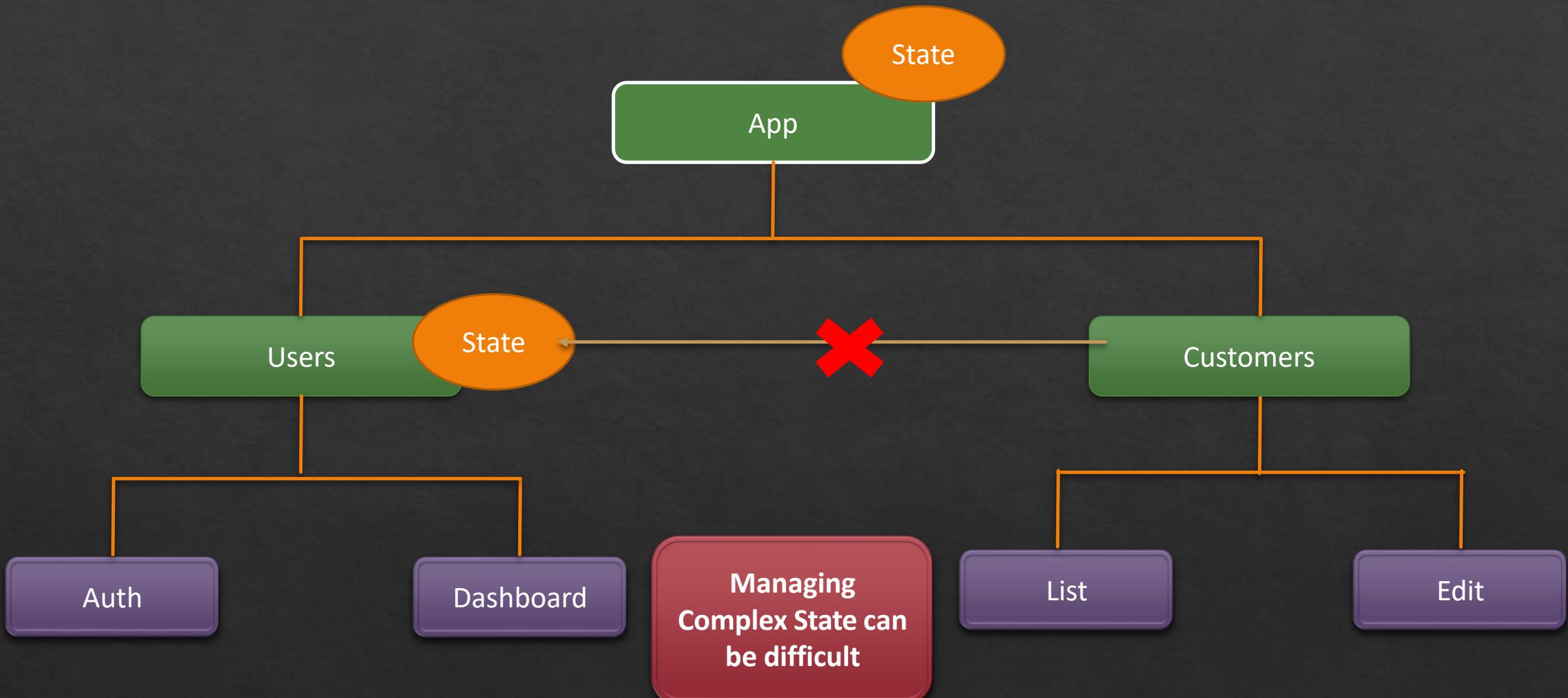
Redux

Redux is an open-source JavaScript library designed for managing application state.

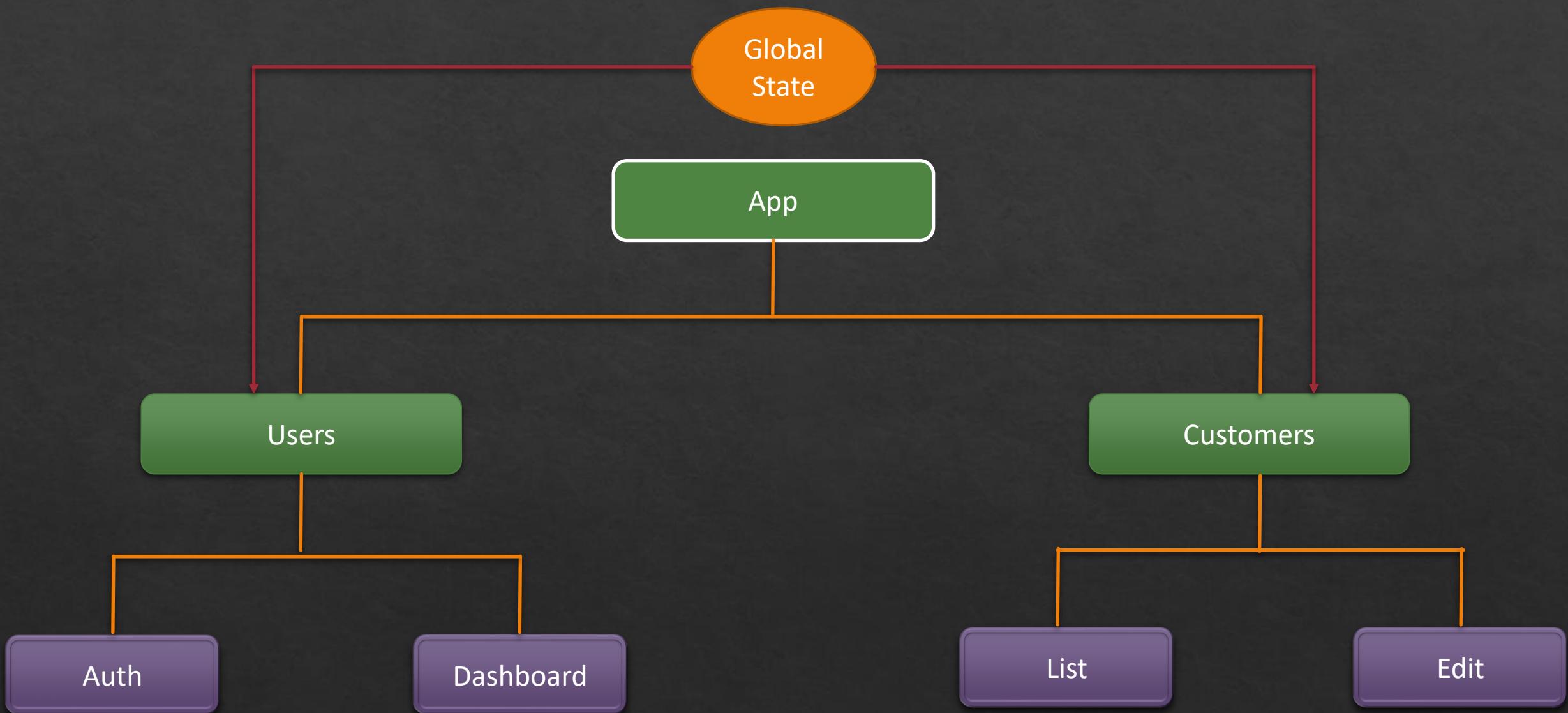
It is primarily used together with React or Angular for building user interfaces.

Redux was built on top of functional programming concepts.

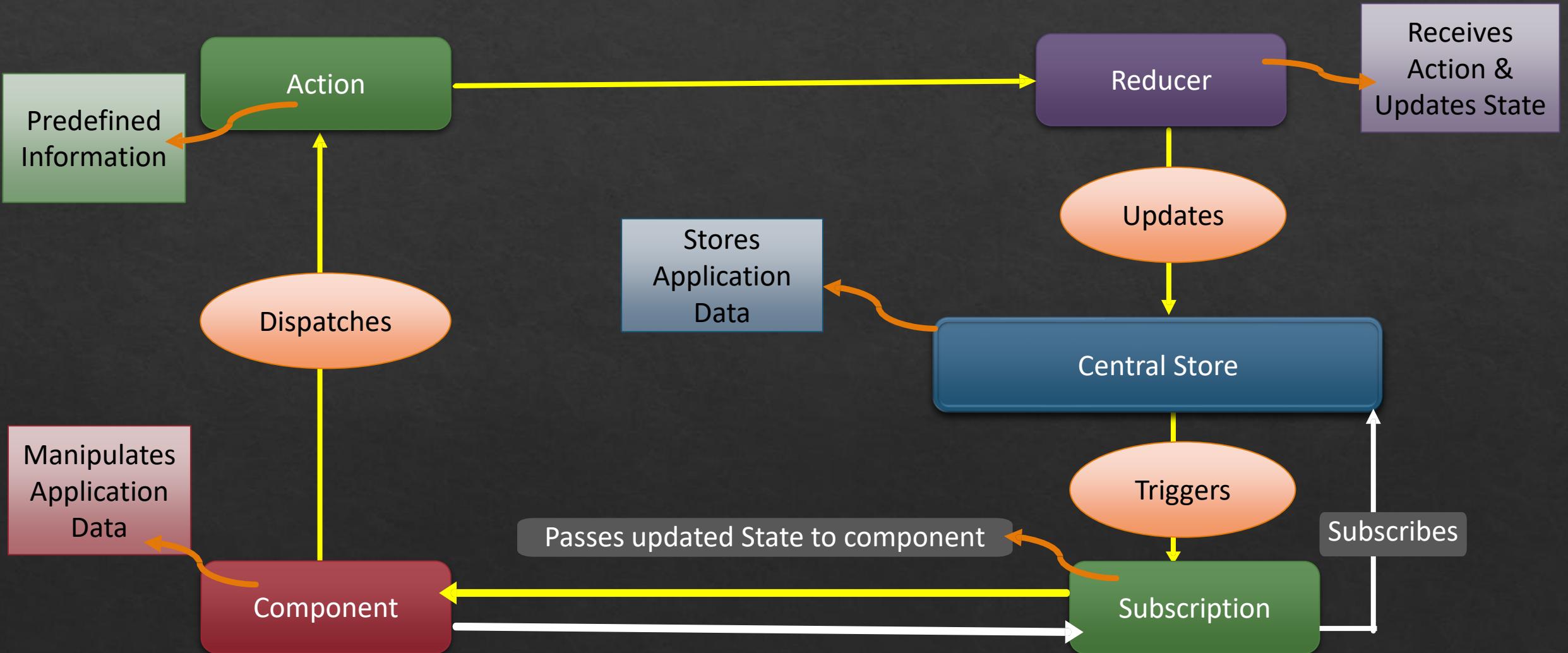
Why Redux?



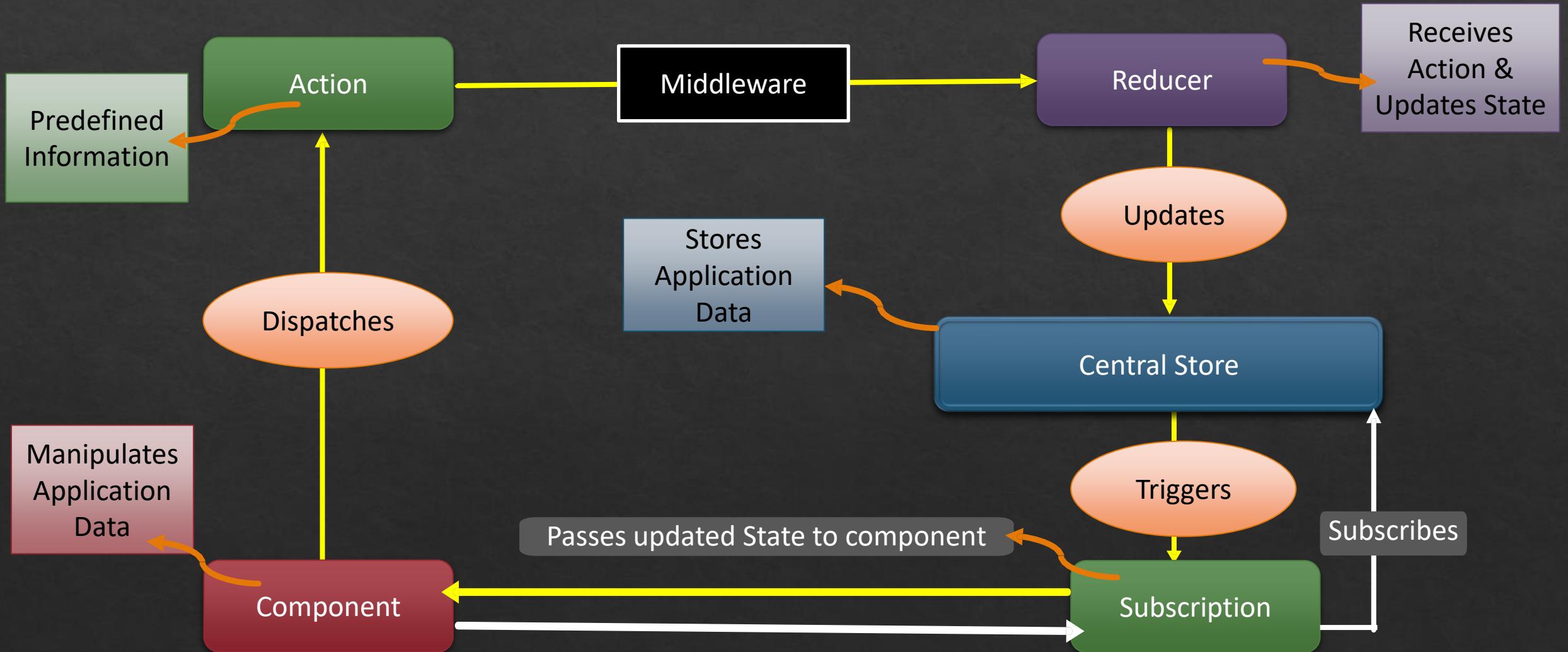
Why Redux?



Redux Flow



Redux Flow



React Redux

- ❖ Redux react is a library that integrates Redux to a React Application
- ❖ Comprises of Components & Functions
- ❖ Installation
 - ❖ npm install react-redux



Error Boundaries

- ❖ Error boundaries are React components that catch JavaScript errors anywhere in their child component tree
 - ❖ Used to log errors
 - ❖ Display a fallback UI
- ❖ Error boundaries do not catch errors for:
 - ❖ Event handlers
 - ❖ Asynchronous code
 - ❖ Server side rendering
 - ❖ Errors thrown in the error boundary itself
- ❖ A class component becomes an error boundary if it defines(either one)
 - ❖ componentDidCatch
 - ❖ static getDerivedStateFromError()

React Context

- ❖ Context provides a way to pass data through the component tree without having to pass props down manually at every level.
- ❖ Example of props to be passed down
 - ❖ Theme
 - ❖ Locale
 - ❖ Authenticated user
- ❖ API
 - ❖ `React.createContext`

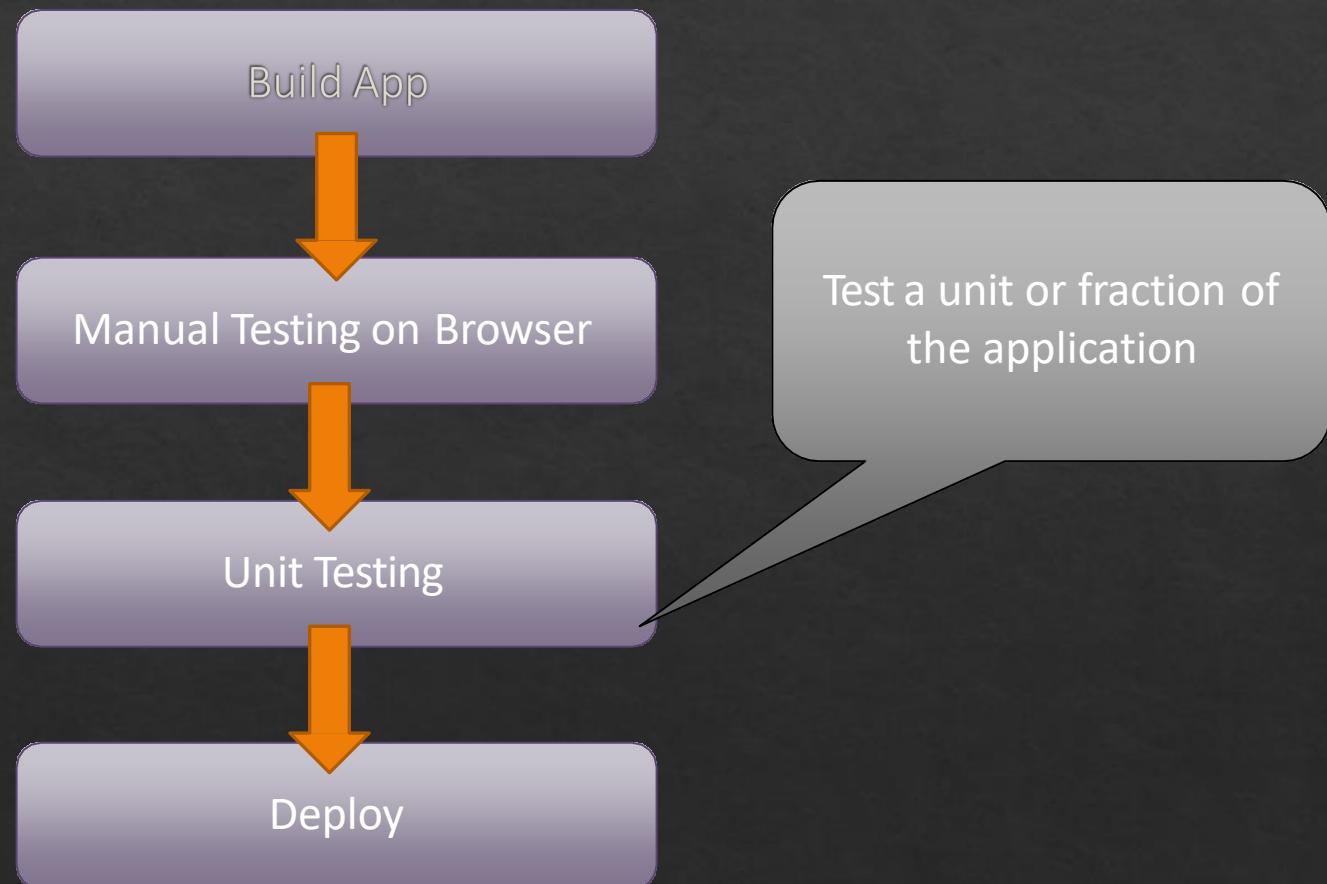
Code Splitting

- ❖ Code splitting allows you to split your app into separate bundles which your users can progressively load.
- ❖ API
 - ❖ React.lazy
 - ❖ Suspense

Using Sass

- ❖ Sass is a style sheet language
- ❖ Install for create-react-app
 - ❖ npm i node-sass
- ❖ Rename .css to .scss

Testing



Testing Tools

Testing API
&
Test Runner

Write the Unit Test.
Executes the Unit Tests.

Jest
(Built over Jasmine)

Test Utilities

Simulate the React App

react-test-renderer

enzyme

testing-library/react

Jest



A testing library and test runner with handy features



Created by the members of the React team and the recommended tool for unit testing react



Built on top of Jasmine/Mocha



Additional features like mocking and snapshot testing

Jest: Identifying Test files

Any files inside a folder named `_tests_` are considered tests

`_test_ / *.js`



Any files with `.spec` or `.test` in their filename are considered tests

`*.spec.js`

`*.test.js`

Jest Global Methods

it

- Method which you pass a function to, that function is executed as block of tests by the test runner.
- Alias name: test

describe

- An optional method for grouping any number of *it* or *test* statements
- Alias name: suite

Setup & Teardown Global functions

`beforeEach` `BeforeEach` runs a block of code before each test

`afterEach` Runs a block of code after each test

`beforeAll` `BeforeAll` runs code just once, before the first test

`afterAll` Runs a block of code after the last test)

What to Test?

Test Isolated
Components

Test Conditional
Outputs

Don't Test Library
Functions

Don't Test Complex
Connection

Installation

```
npm install enzyme react-test-renderer  
enzyme-adapter-react-16
```

End to End Test



End-to-end testing is a methodology used to test whether the flow of an application is performing as designed from start to finish.



The purpose of carrying out end-to-end tests is to identify system dependencies and to ensure that the right information is passed between various system components and systems.s

E2E Tools



Cypress



Puppeteer



Selenium Webdriver



Nightwatch.js

React UI Components

- ❖ There are many UI Libraries available in the React Eco space
- ❖ Libraries
 - ❖ React-bootstrap
 - ❖ Material UI
 - ❖ Grommet
 - ❖ Ant Design React
 - ❖ React Desktop
 - ❖ React Belle

Deployment

Set basePath of Router

- <BrowserRouter basename="/app/">

Set homepage in package.json

- "homepage": "/app"

Build and Optimize npm run build

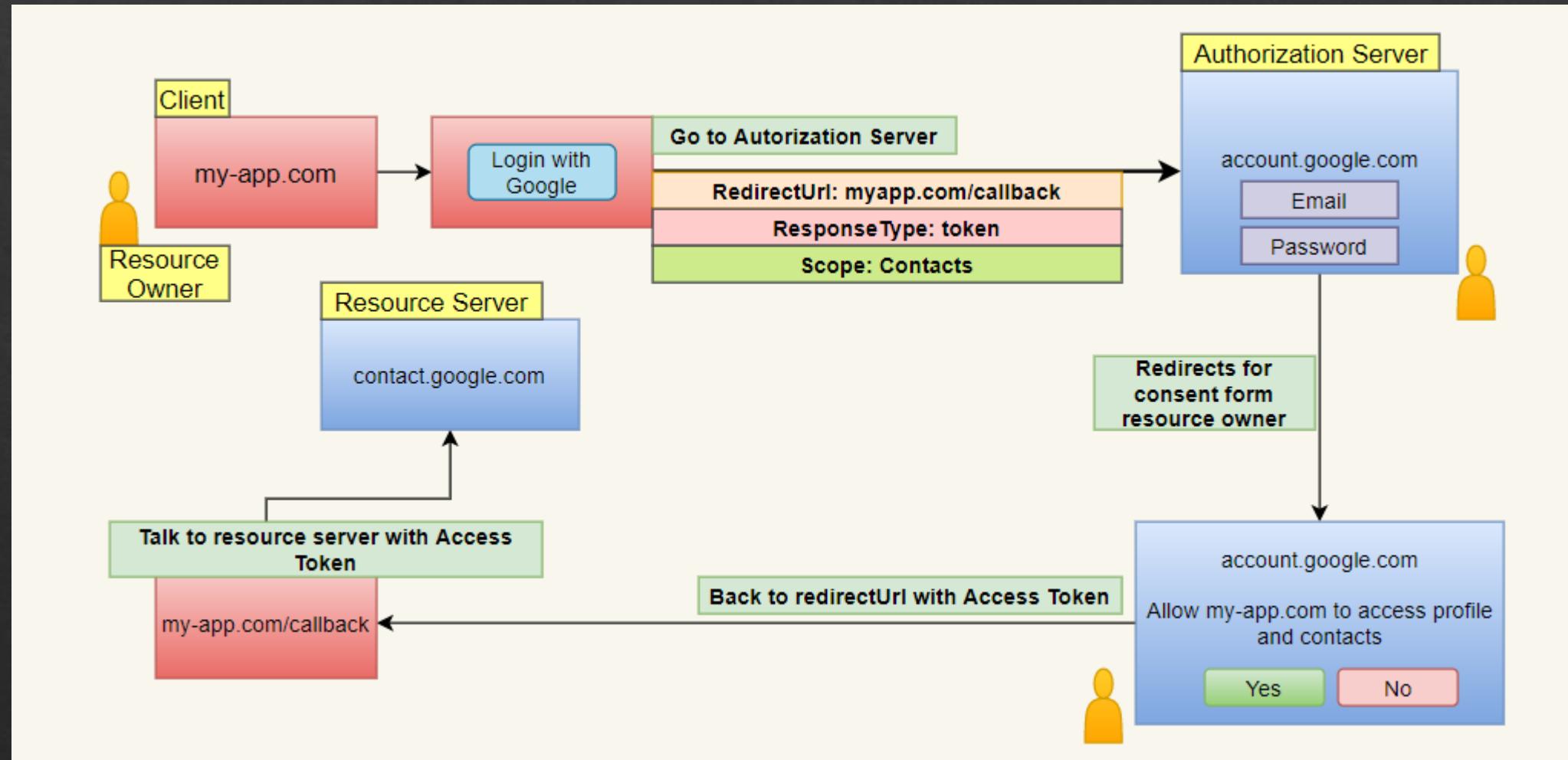
Server must Always serve index.html

Deploy artifacts to Web Server

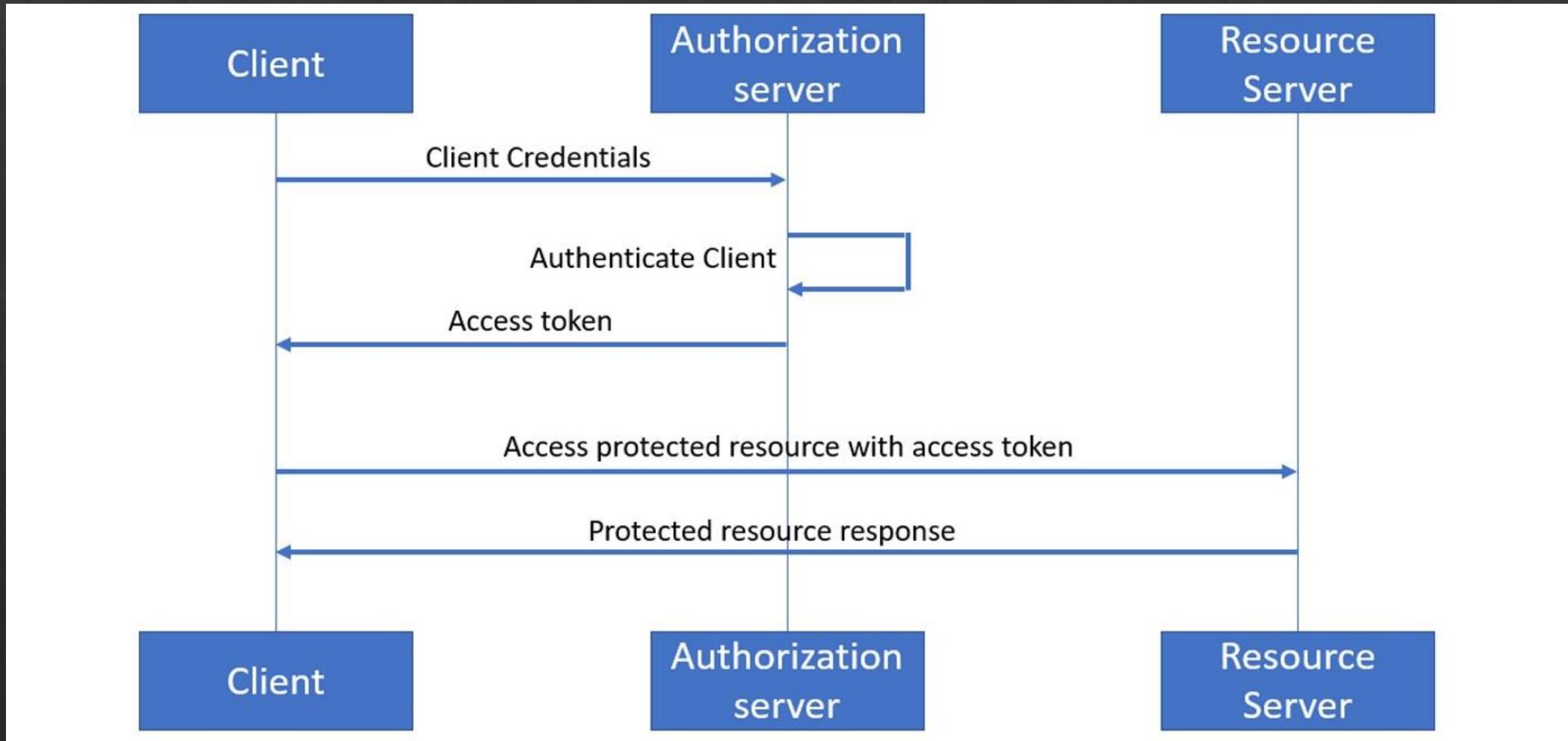
OAuth 2.0

- ❖ OAuth is an open standard for access delegation.
- ❖ Used as a way for Internet users to grant websites or applications access to their information on other websites but without giving them the passwords.
- ❖ Commonly used by companies such as Amazon, Google, Facebook, Microsoft and Twitter to permit the users to share information about their accounts with third party applications or websites.

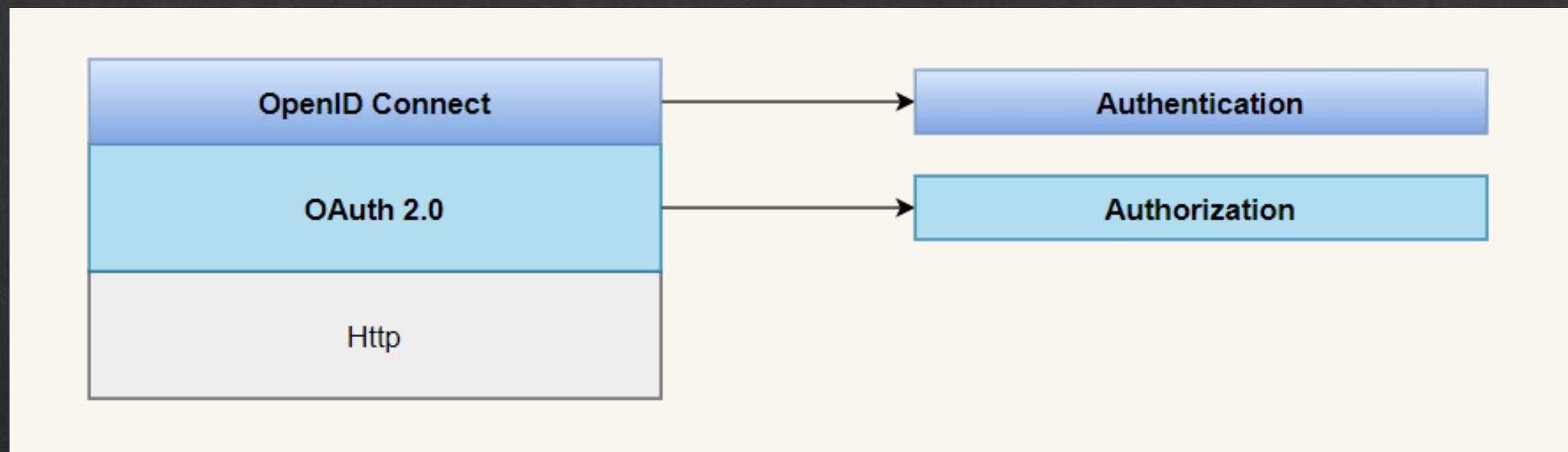
OAuth 2.0



OAuth 2.0



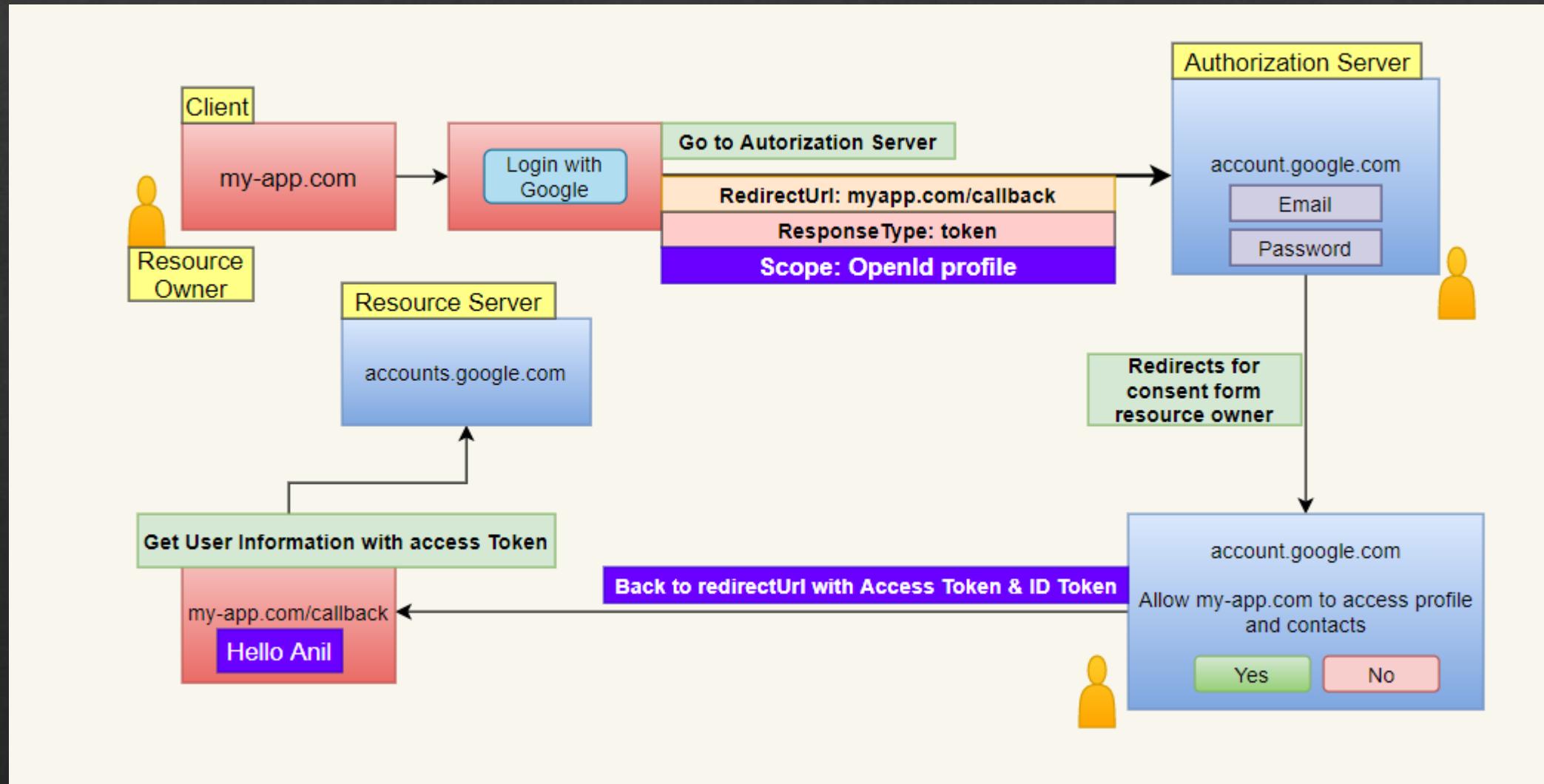
OpenID Connect



OpenID Connect

- ❖ OpenID Connect is a simple identity layer on top of the OAuth 2.0 protocol.
- ❖ Allows Clients to verify the identity of the End-User based on the authentication performed by an Authorization Server.
- ❖ Can obtain basic profile information about the End-User in an interoperable and REST-like manner.

OpenID Connect



Json Web Token

- ❖ JSON Web Token (JWT) is an open standard that defines a compact and self-contained way for securely transmitting information between parties as a JSON object.
- ❖ Digitally Signed
- ❖ Used for Authorization and Information Exchange

JWT

eyJ0eXAiOiJKV1QiLCJhbGciOiJIUzI1NiJ9.

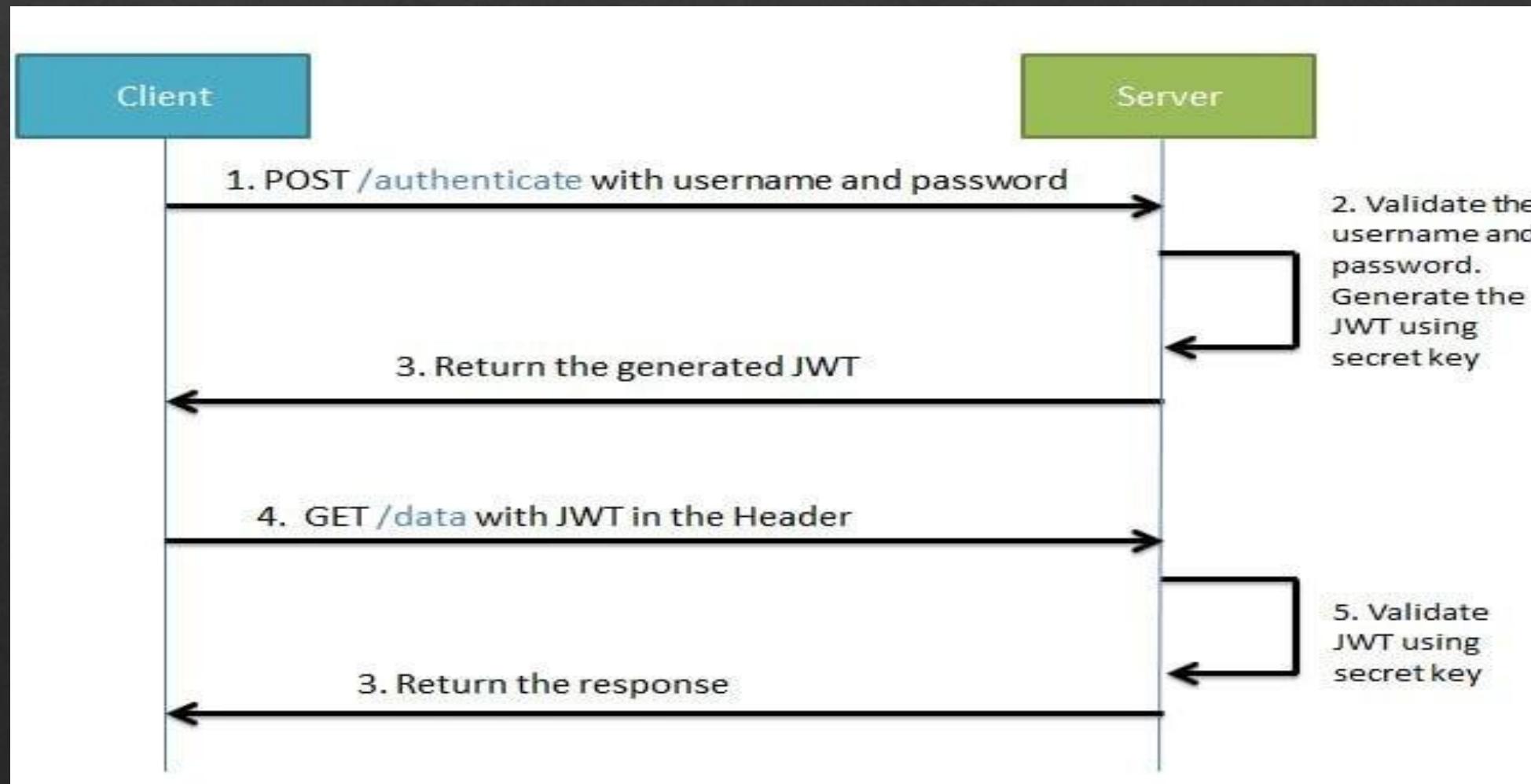
eyJpc3MiOiJPbmxbmUgSldeIEJ1aWxkZXIiLCJpYXQiOjE2
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pbC5jb20iLCJHaXZlbk5hbWUiOiJBbmlsliwiU3VybmFtZSI6I
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FrX-qAOPEDAyDh5IOJ6ipbFsrPBzaBzK7A2Hk5Yd2vk

```
{  
  "typ": "JWT",  
  "alg": "HS256"  
}  
  
{  
  "iss": "Online JWT Builder",  
  "iat": 1600999300,  
  "exp": 1632535300,  
  "aud": "www.my-app.com",  
  "sub": "anil.jos@gmail.com",  
  "GivenName": "Anil",  
  "Surname": "Joseph",  
  "Email": "anil.jos@gmail.com",  
  "Role": "Consultant"  
}
```

Signature

JWT with Simple Forms Login



Progressive Web Applications

- ❖ PWAs are web apps developed using a number of specific technologies and standard patterns to allow them to take advantage of both web and native app features.
- ❖ Key Features
 - ❖ Discoverable
 - ❖ Installable
 - ❖ Linkable
 - ❖ Network Independent
 - ❖ Progressively Enhanced
 - ❖ Re-engageable
 - ❖ Responsive
 - ❖ Secure

Progressive Web Applications

- ❖ Service Workers
 - ❖ Service workers essentially act as proxy servers that sit between web applications, the browser, and the network (when available).
 - ❖ Enable the creation of effective offline experiences
 - ❖ Allow access to push notifications and background sync APIs
- ❖ Manifest
 - ❖ Lists all the information about the website in a JSON format
 - ❖ Information includes: Application Name, Path, Icons
- ❖ Https
 - ❖ Applications should be served using the Https protocol

React: Resources

- ❖ Official Site
 - ❖ <https://reactjs.org/>
- ❖ Awesome React tutorials
 - ❖ <https://github.com/enaqx/awesome-react>
- ❖ EggHead
 - ❖ <https://egghead.io/browse/frameworks/react>
- ❖ Youtube Channel(React Conf channel)
 - ❖ <https://www.youtube.com/channel/UCz5vTaEhh7dOHEyd1efcaQ>

Thank You

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