

React

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Agenda

Introduction to React	Creating React Applications	React Application Structure
Understanding Components	JSX	Components Deep Dive
Debugging	Virtual DOM	Server-side communication with HTTP Requests
Single Page Applications with Routing	Forms	Redux
Security	Unit Testing	Deployment

Software

Node.js and NPM

- Version 6.9 or higher

JavaScript Editor(Any one)

- **Visual Studio Code**
- Sublime Text
- Atom

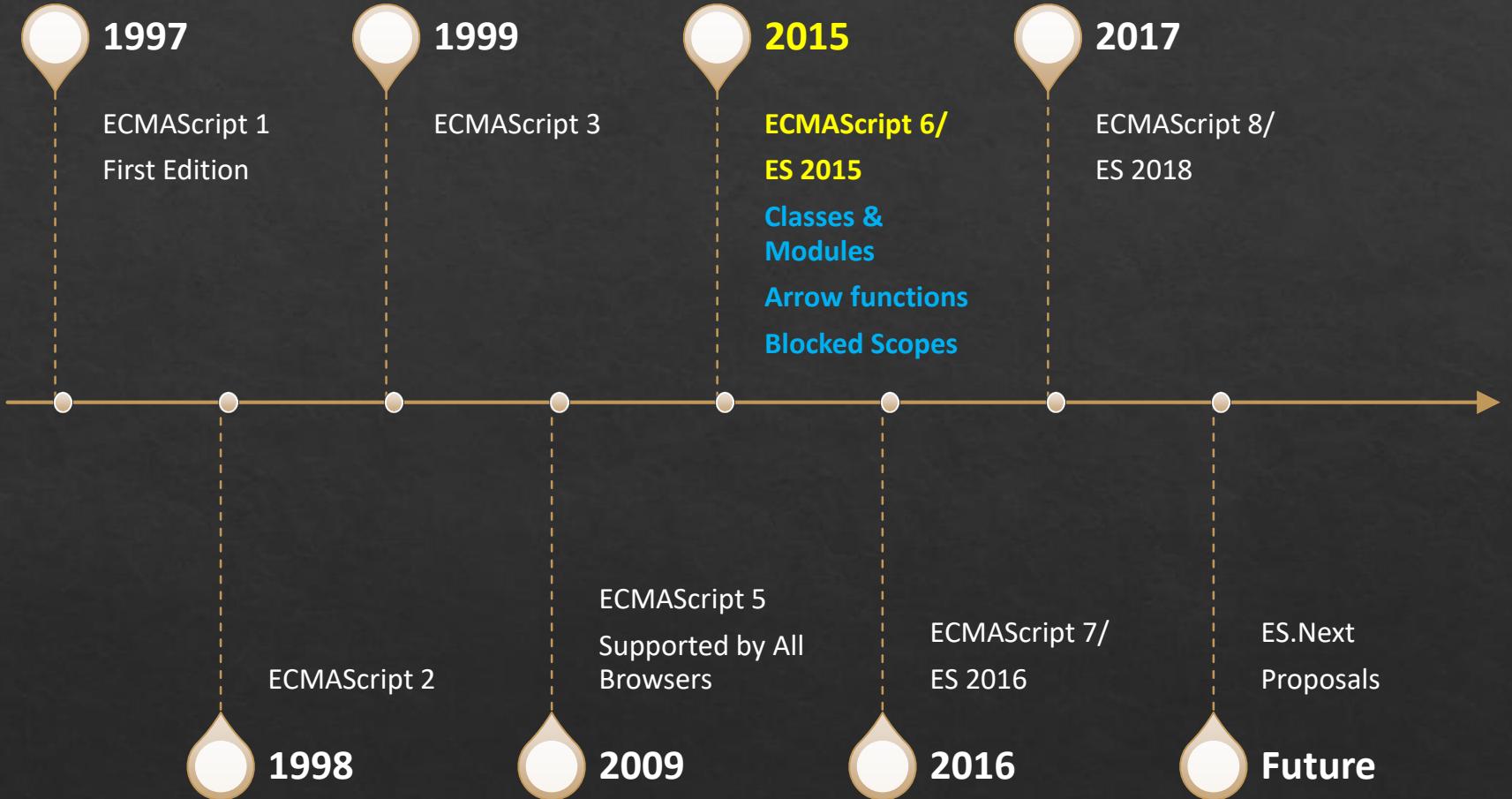
Browsers

- Chrome, Firefox

JavaScript

- ❖ JavaScript (JS) is an interpreted programming language.
- ❖ It's a dynamic language.
- ❖ Supports object-oriented programming.
- ❖ As part of web browsers, implementations allow
 - ❖ Client-side scripts to interact with the user.
 - ❖ Alter the document content that is displayed.
 - ❖ Control the browser.
 - ❖ Communicate asynchronously.
- ❖ JavaScript was developed by Brendan Eich at Netscape.
- ❖ Released in September 1995

ECMAScript Versions



Challenges with JavaScript

- ❖ Inconsistent browser implementations to access the DOM, XML parsing etc.
- ❖ JavaScript supports ***global variables***, which could cause conflicts when using multiple libraries.
- ❖ Creations of ***namespaces*** is not straight forward.
- ❖ Implementation of ***object-oriented code*** differs from conventional object-oriented languages.
- ❖ Some language features are complex to understand

ES6 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 Functions

Represents a function expression

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

They do not have their own *this*

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.

Spread and REST Operators

- ❖ **Spread syntax** allows
 - ❖ An iterable to be expanded in places where zero or more arguments are expected
 - ❖ Example: An array to be converted to a list of arguments of a method.
- ❖ **Rest parameter** syntax allows
 - ❖ To represent an indefinite number of arguments as an array.

Modules

- ❖ ES6 supports 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

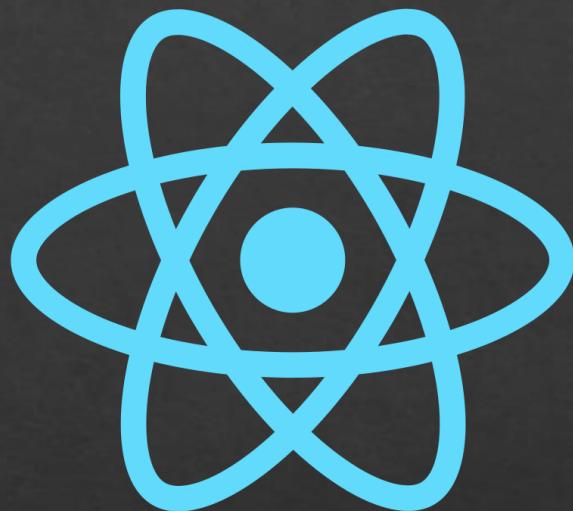
Modules

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

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

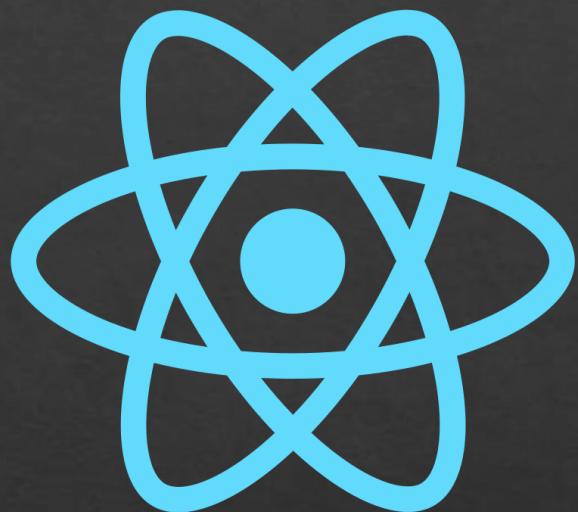
two.js

What is React?



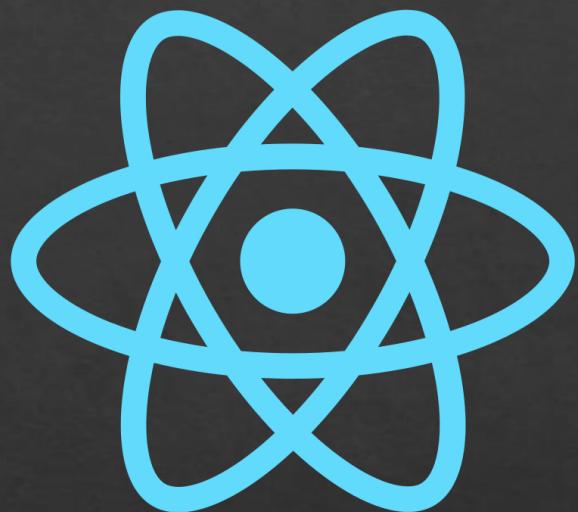
- ❖ A JavaScript library to build *User Interfaces*.
- ❖ Building applications for the *browser*.
- ❖ React allows to create custom HTML elements called *components*.
- ❖ Components are used to build *complex User Interface*
- ❖ Reacts promotes writing *maintainable, manageable and reusable code*.

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.

Alternatives



Angular

- Open-source front-end web application platform from Google.



Vue

- Open-source progressive JavaScript framework for building user interfaces.

Getting Started

The Two React libraries

- React
- ReactDOM

Babel

- The compiler for writing next generation JavaScript.

JSX

- A JavaScript extension syntax allowing quoting of HTML

Getting Started Playgrounds

CodePen

- <https://codepen.io/pen>

CodeSandbox

- <https://codesandbox.io/s/new>

Creating a React Project

Build Process: Why?

Manage Dependency

- Use multiple libraries

Optimize Code

- Small in size

Next Generation Features using ES6 and ES7

- Leaner code, Easier to read, Faster

More Productive

- CSS Auto Prefixes, Linting

Build Process: How?

Dependency Management Tool

- npm and yarn

Bundler

- WebPack

Complier

- Complies ES6 to ES5/ES3
- Babel + Presets

Development Server

- Web Server for development

Build Process: Tool

- ❖ The React team provides a tool called **Create-React-App**.
- ❖ Use to quickly start development on React with zero configuration
- ❖ Integrates the various tools and libraries required for the build process
 - ❖ Webpack, NPM, Yarn, Babel
- ❖ Uses the *react-scripts* package



Create Project

1

Install NodeJs

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

2

Install “create react app”

- **Tool to create react applications**
- **npm install –g create-react-app**

3

Create Application/Project

- **create-react-app reactapp**

4

Start the Application

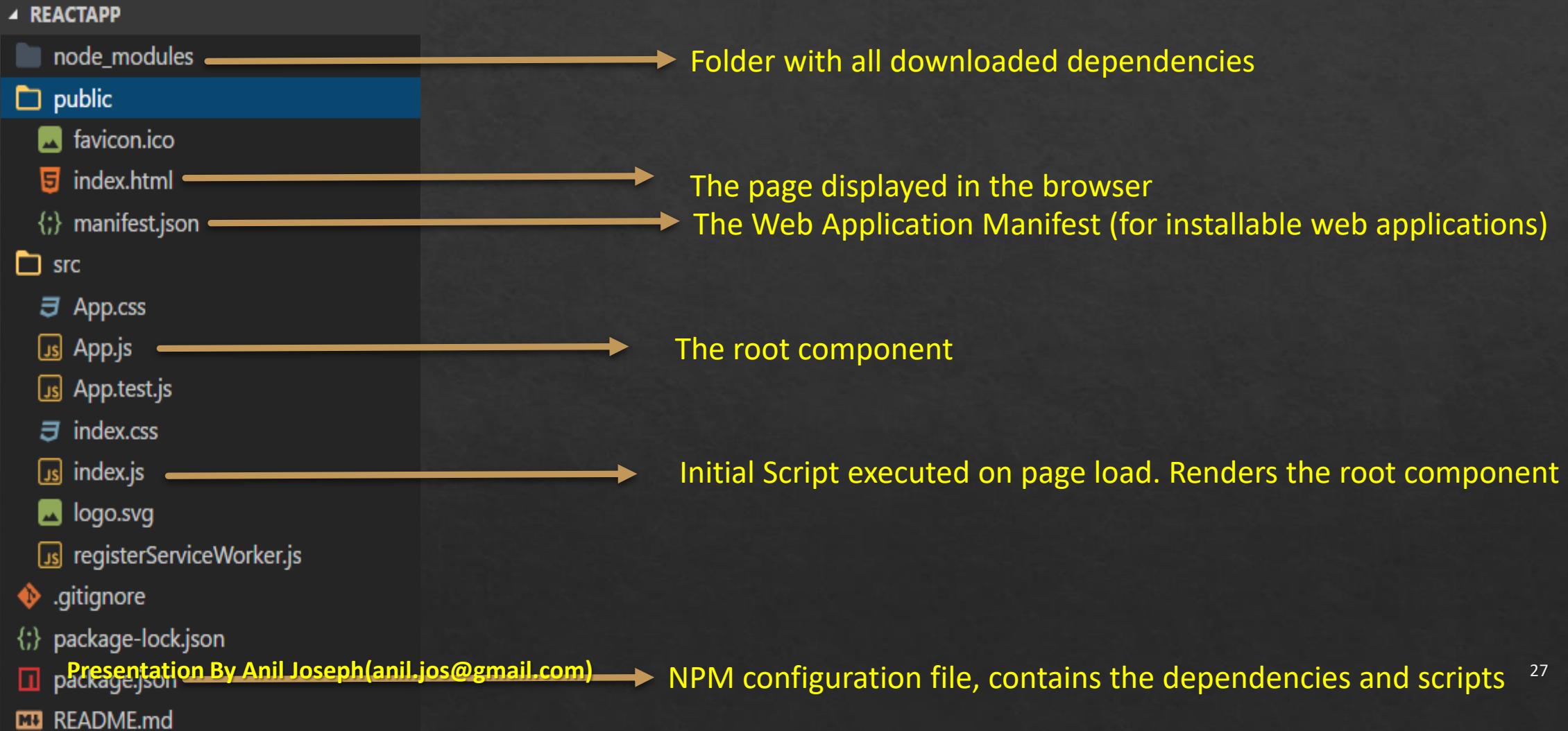
- **cd reactapp**
- **npm start**

react-scripts

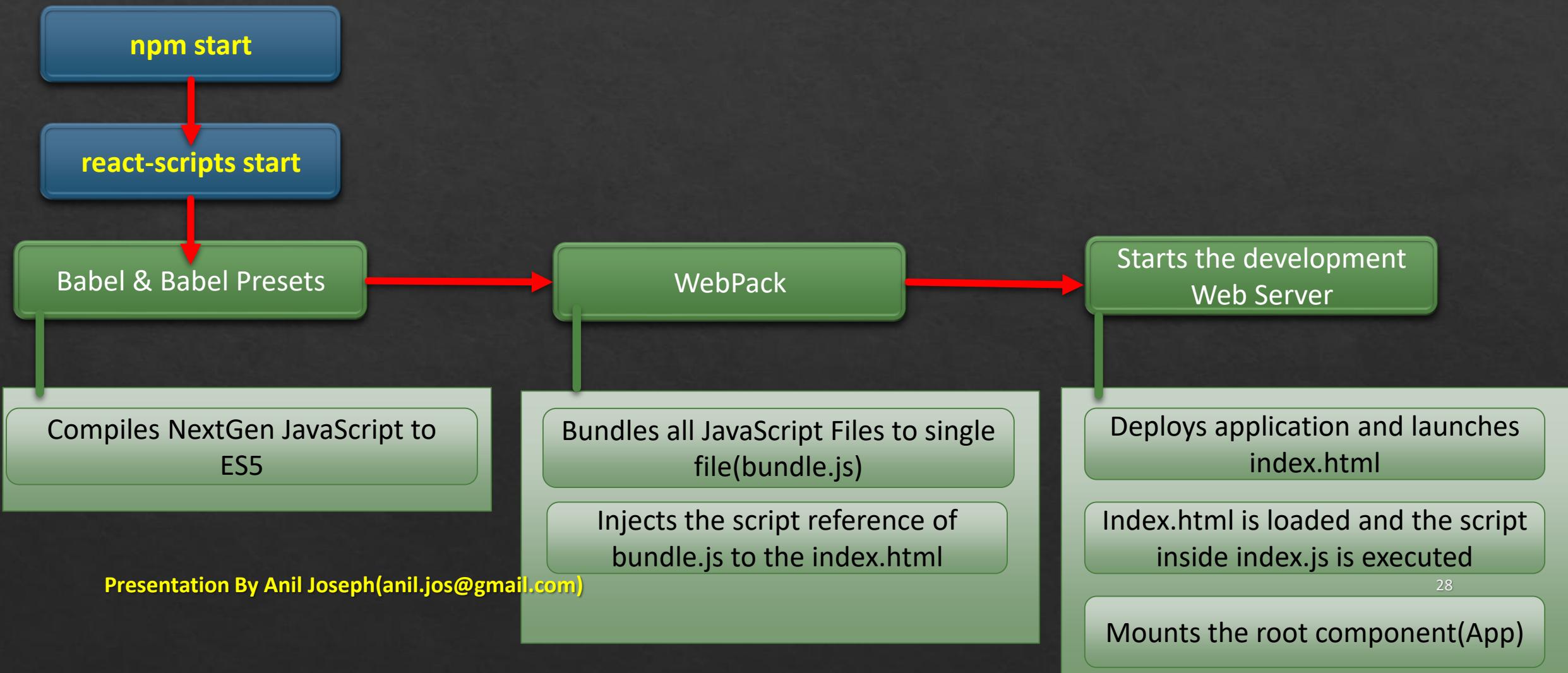
Package

- ❖ The tool `create-react-app` uses the “`react-scripts`” package.
- ❖ What’s Included?
 - ❖ React, JSX, ES6, and Flow syntax support.
 - ❖ Language extras beyond ES6 like the object spread operator.
 - ❖ Autoprefixed CSS, so you don’t need `-webkit-` or other prefixes.
 - ❖ A fast interactive unit test runner with built-in support for coverage reporting.
 - ❖ A live development server that warns about common mistakes.
 - ❖ A build script to bundle JS, CSS, and images for production, with hashes and sourcemaps.
 - ❖ An offline-first service worker and a web app manifest, meeting all the Progressive Web App criteria.
 - ❖ Hassle-free updates for the above tools with a single dependency.

Project Structure

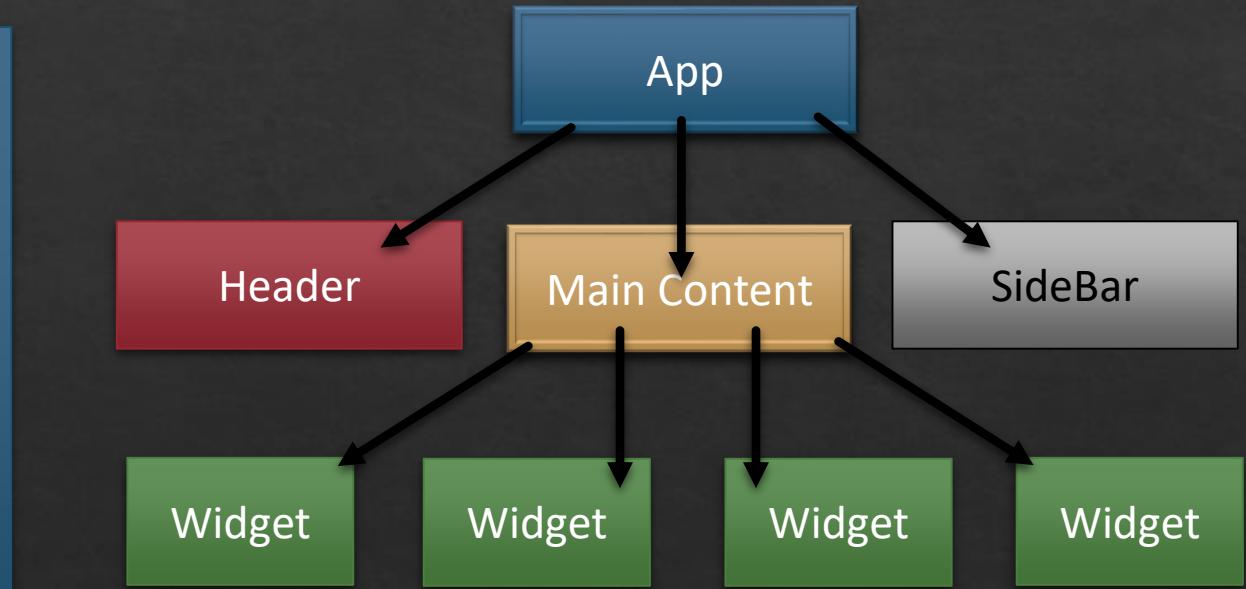
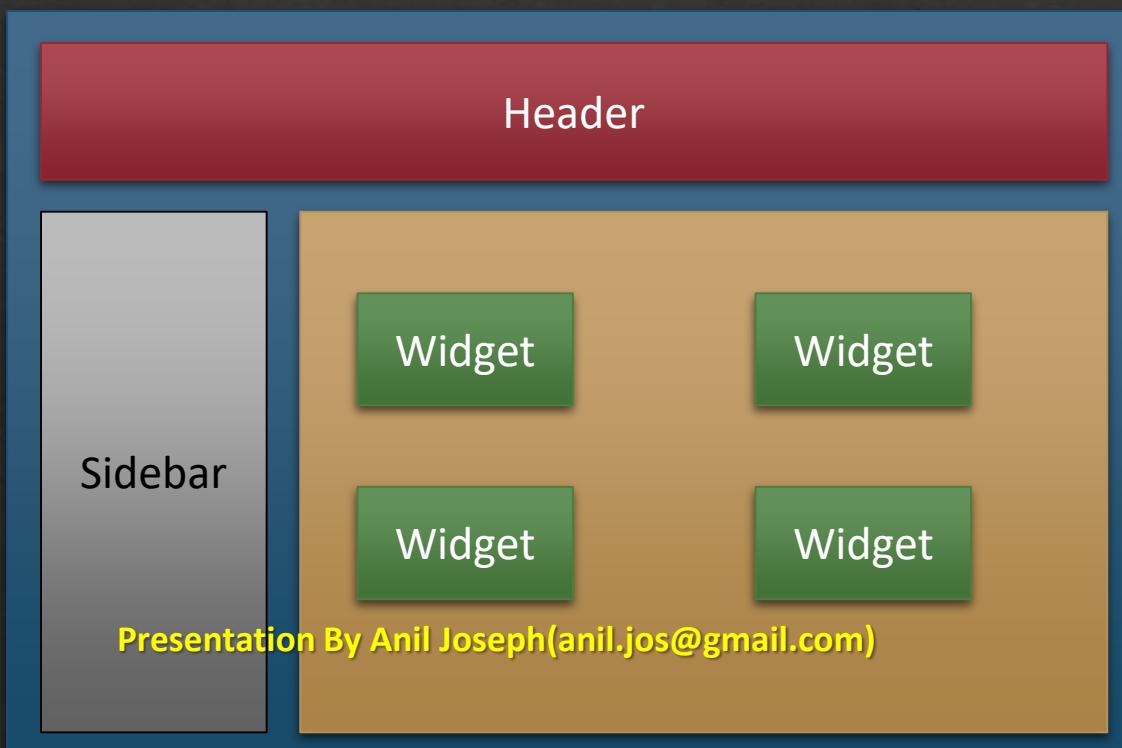


Project Execution



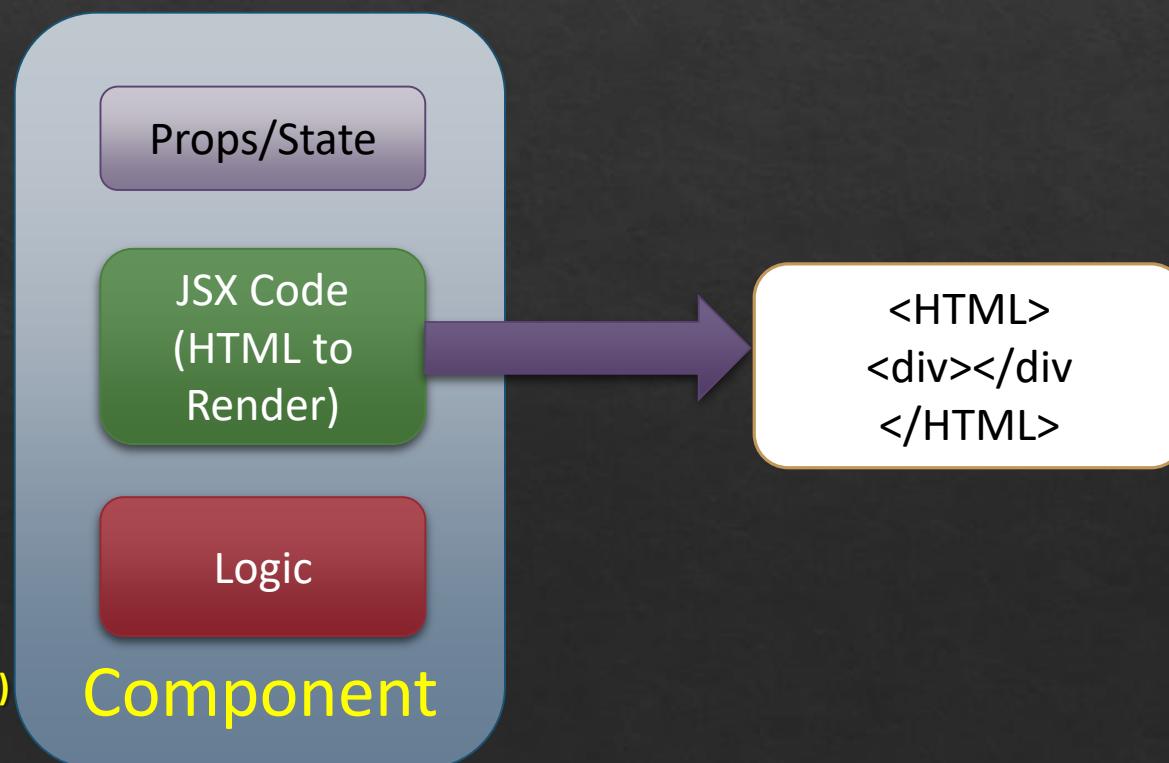
React Components

- ❖ Components are the **core building blocks of React applications**
- ❖ Creating a React Application is all about creating components.
- ❖ A React app 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

Class Based

- Containers
- Stateful

JSX

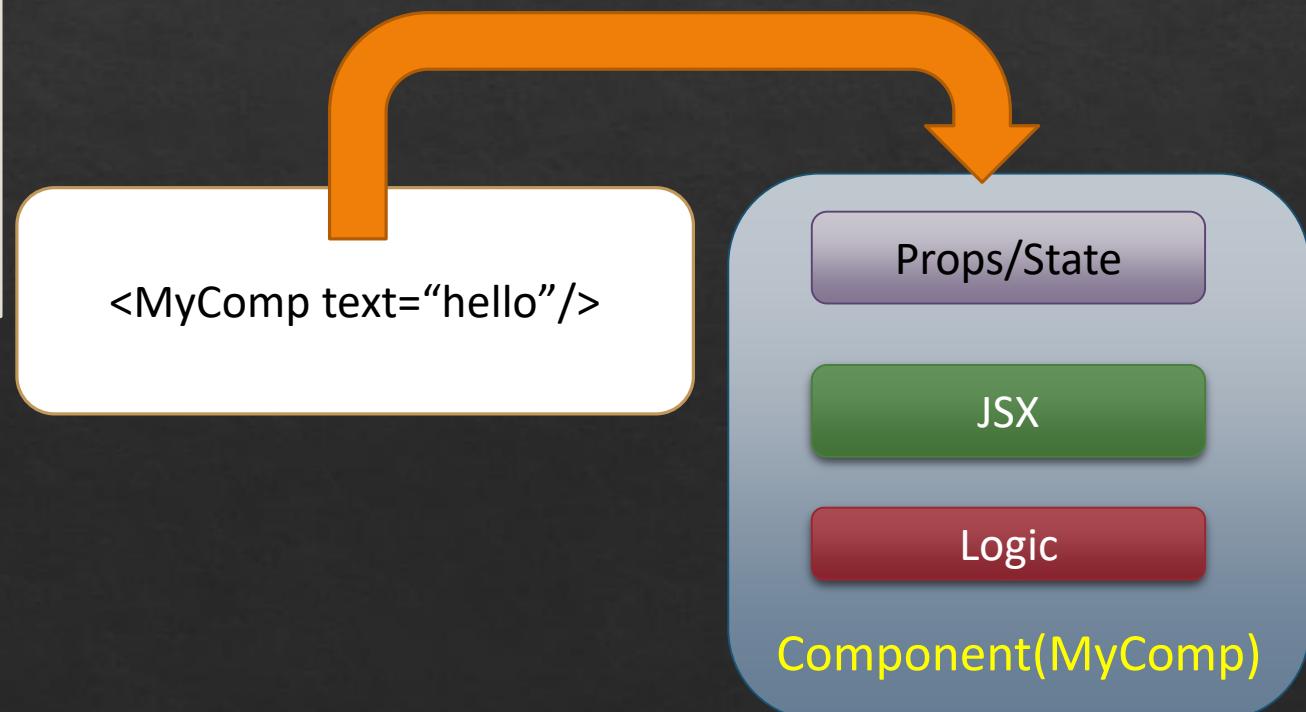
- ❖ JSX is a syntax extension for JavaScript.
- ❖ It was written to be used with React.
- ❖ JSX code looks a lot like HTML.
 - ❖ **It's actually JavaScript**
- ❖ A JSX *compiler* will translate any JSX into regular JavaScript.
- ❖ JSX elements are treated as JavaScript *expressions*.
 - ❖ They can go 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.***



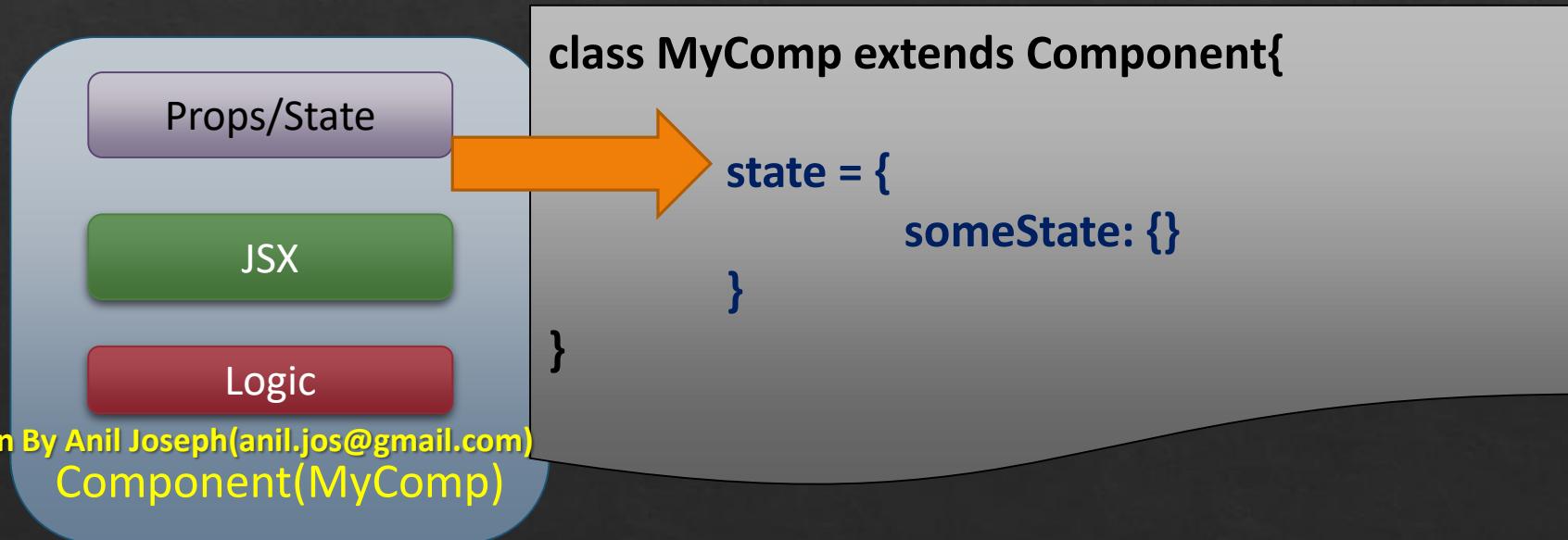
Props Types

Use Prop-Types for Type Checking the Component Properties

npm install prop-types

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

- Update State
- Don't Cause Side-Effects
- Configuration

render

- Prepare and Structure JSX code

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 Child Component Props

`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';`

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**

Immutability

- ❖ React components have the concept of *state*.
- ❖ Whenever state changes React re-renders the component.
- ❖ If state complicated (like with nested objects) it'd be hard to check whether your state changed or not.
 - ❖ Have to use *deep equality check*
- ❖ Immutability
 - ❖ *Whenever your object has to be mutated , don't mutate it*
 - ❖ *Create a copy*
- ❖ Immutability makes it easier to detect changes and update the 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(SPA)

Single-Page Applications are applications that load a **single** HTML **page** and dynamically update that **page** as the user interacts with the **app**.

SPAs use AJAX and HTML5 to create fluid and responsive **Web Applications**

Do not have constant **page** reloads.

Much of the work happens on the client side, in **JavaScript**.

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.

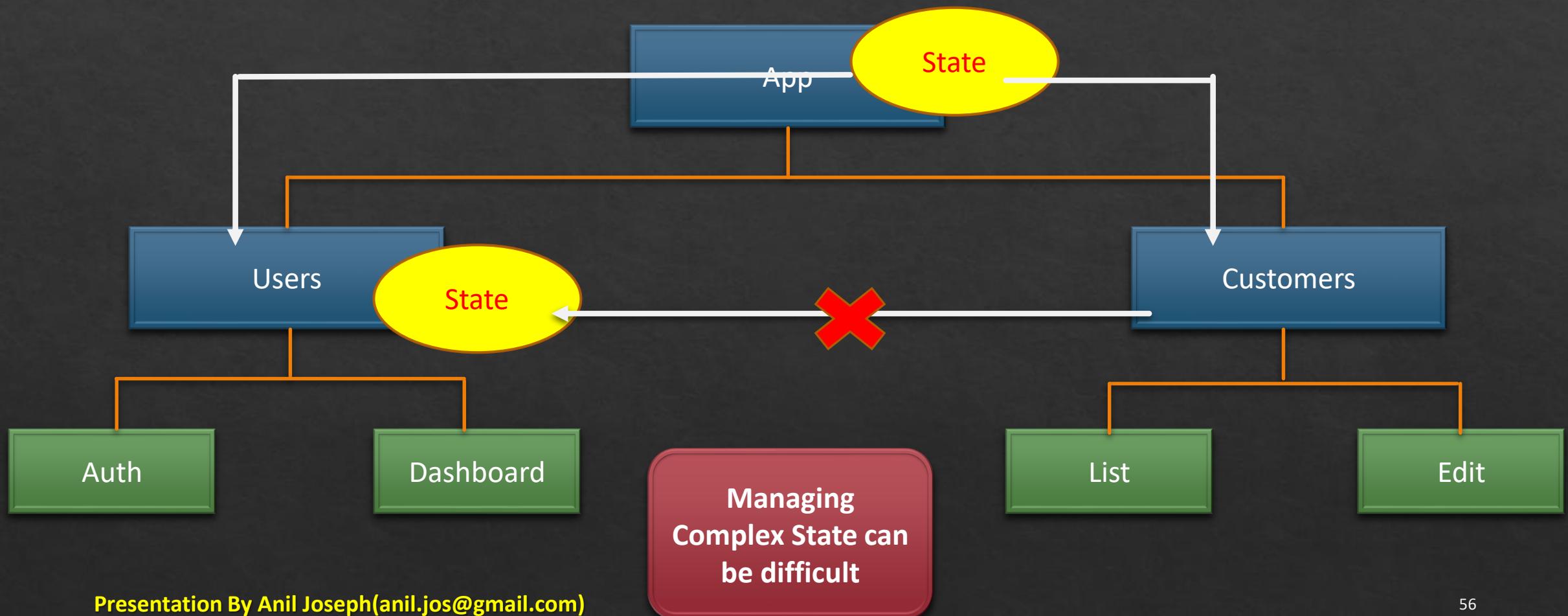
Redux

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

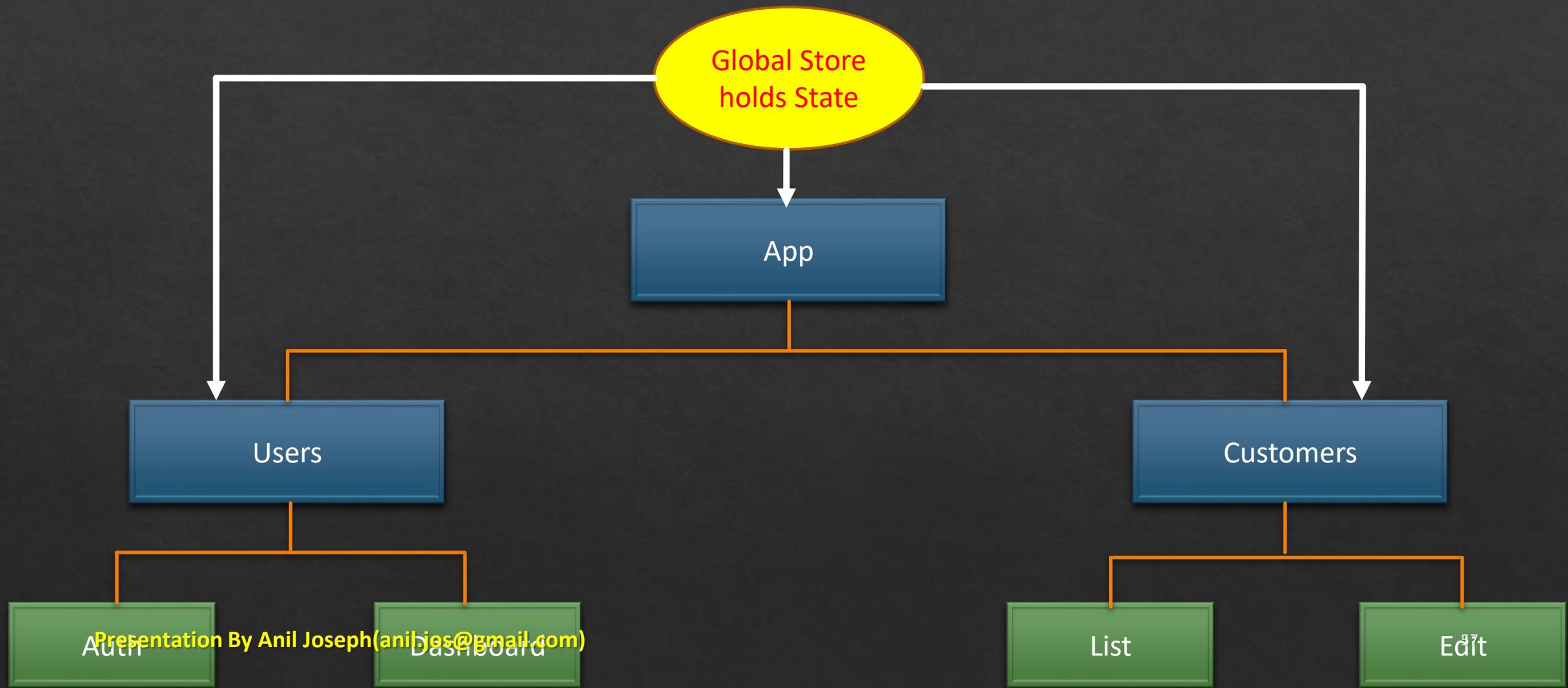
It is primarily used together with React or Angular for building user interfaces.

Redux was built on top of functional programming concepts.

Why Redux?

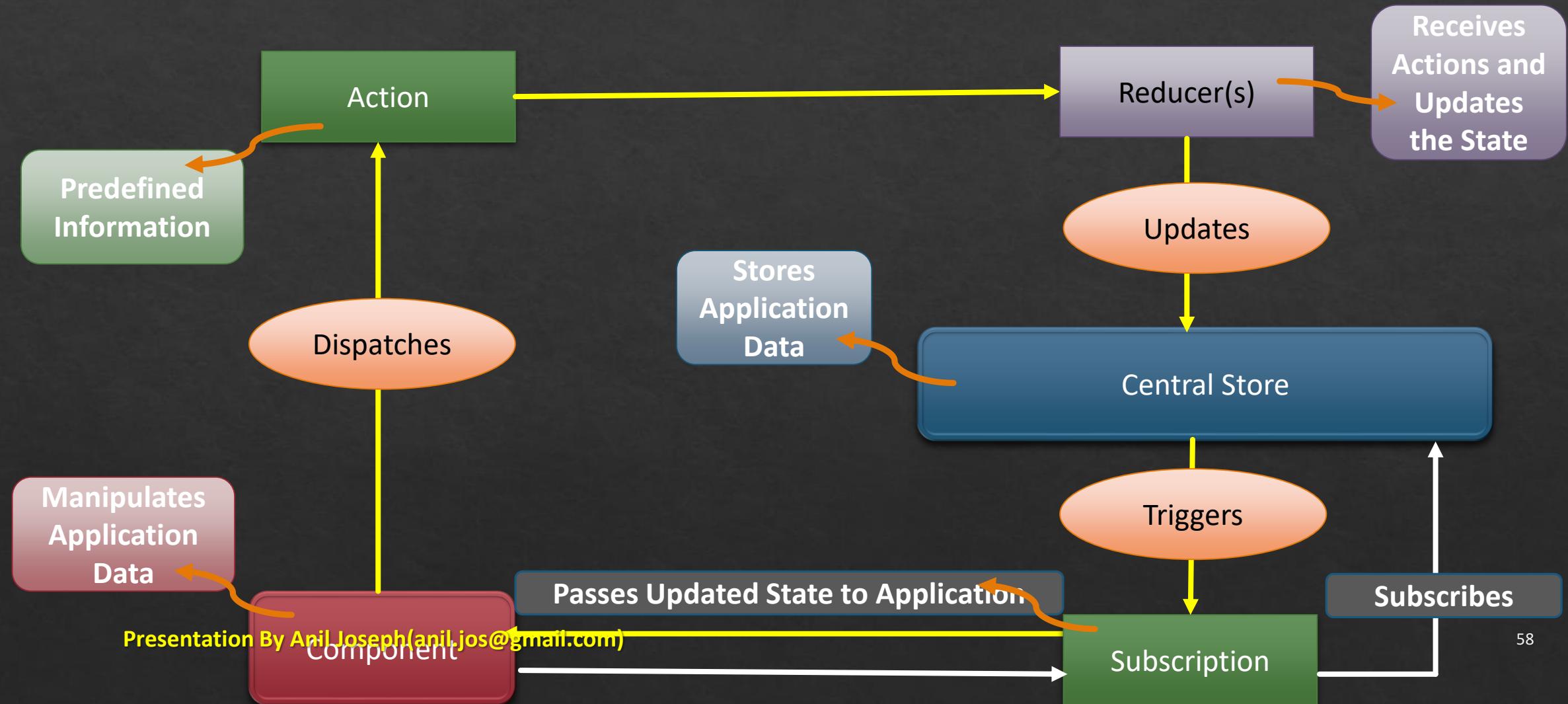


Redux State Management



Presentation By Anil Joseph(anil.jos@gmail.com)

Redux Flow



Redux Parts

Store

- Store is the object that holds the application state
- The entire state is represented by a single store.

Reducers

- In Redux, reducers are functions (pure)
- It takes the current state of the application and an action and then returns a new state.

Actions

- Actions are events dispatched to the store.
- Simple objects with a type property(mandatory) and payload
- Actions send data from the application (user interactions, internal events such as API calls, and form submissions) to the store.

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

Client State

- IsAuthenticated, Filter Information
- Managed by Redux

Redux React

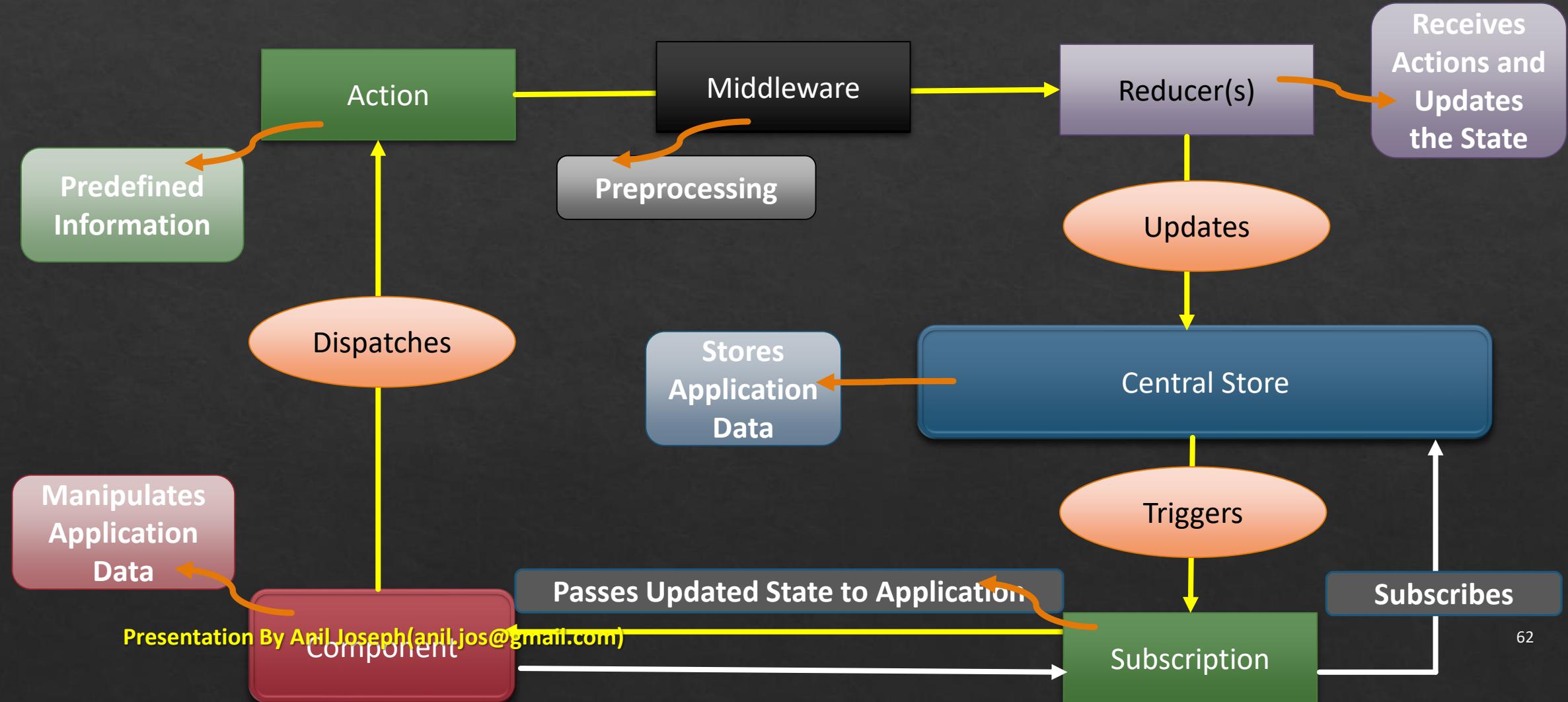
Redux react is a library that integrates Redux to a React Application

Comprises of Components & Functions

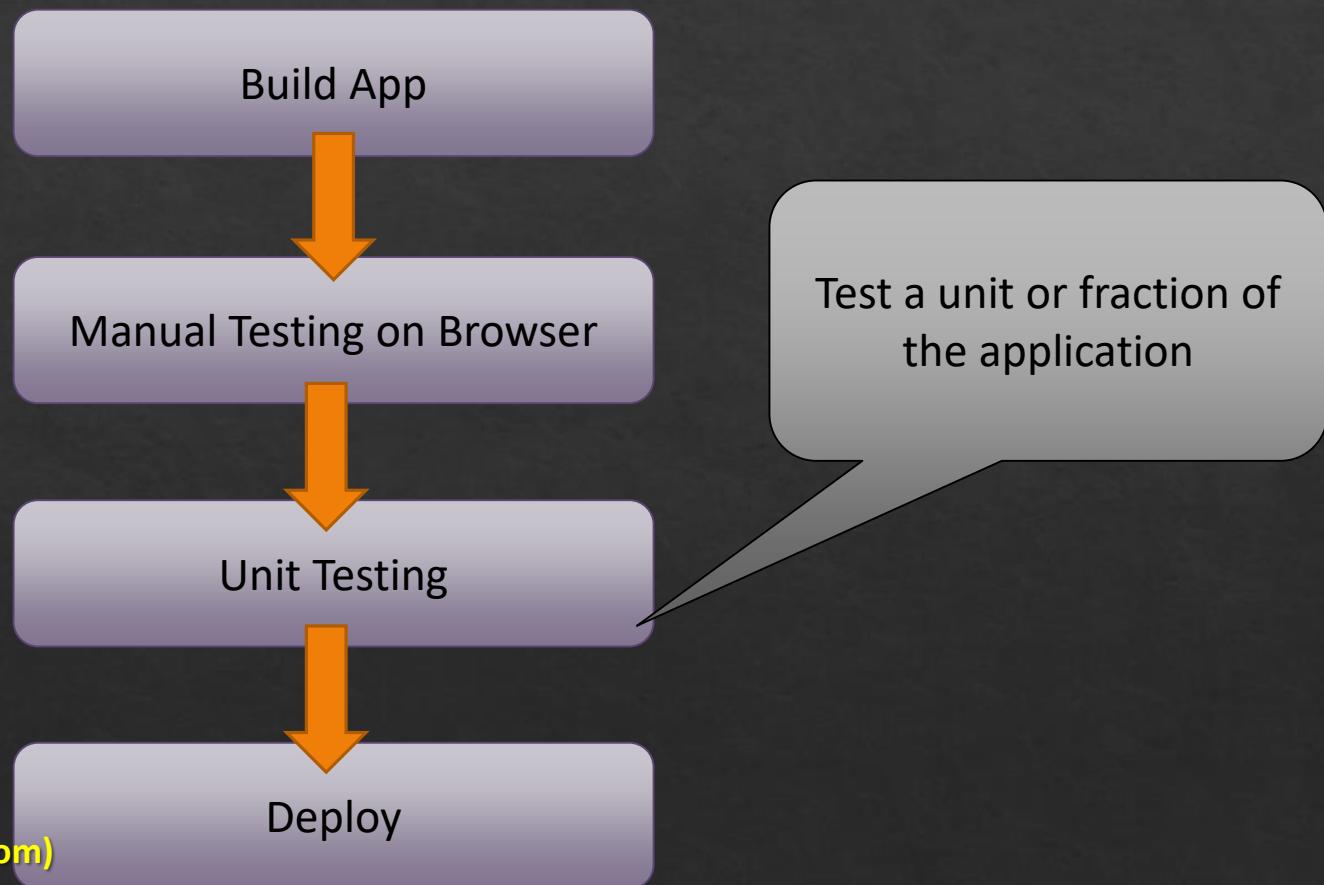
Installation

`npm install react-redux`

Redux Flow(Middleware)



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 Utils

Enzyme

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
```

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 Steps

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

Resources

React: <https://reactjs.org/>

Awesome React: <https://github.com/enaqx/awesome-react>

Tutorial: <https://egghead.io/courses/start-learning-react>