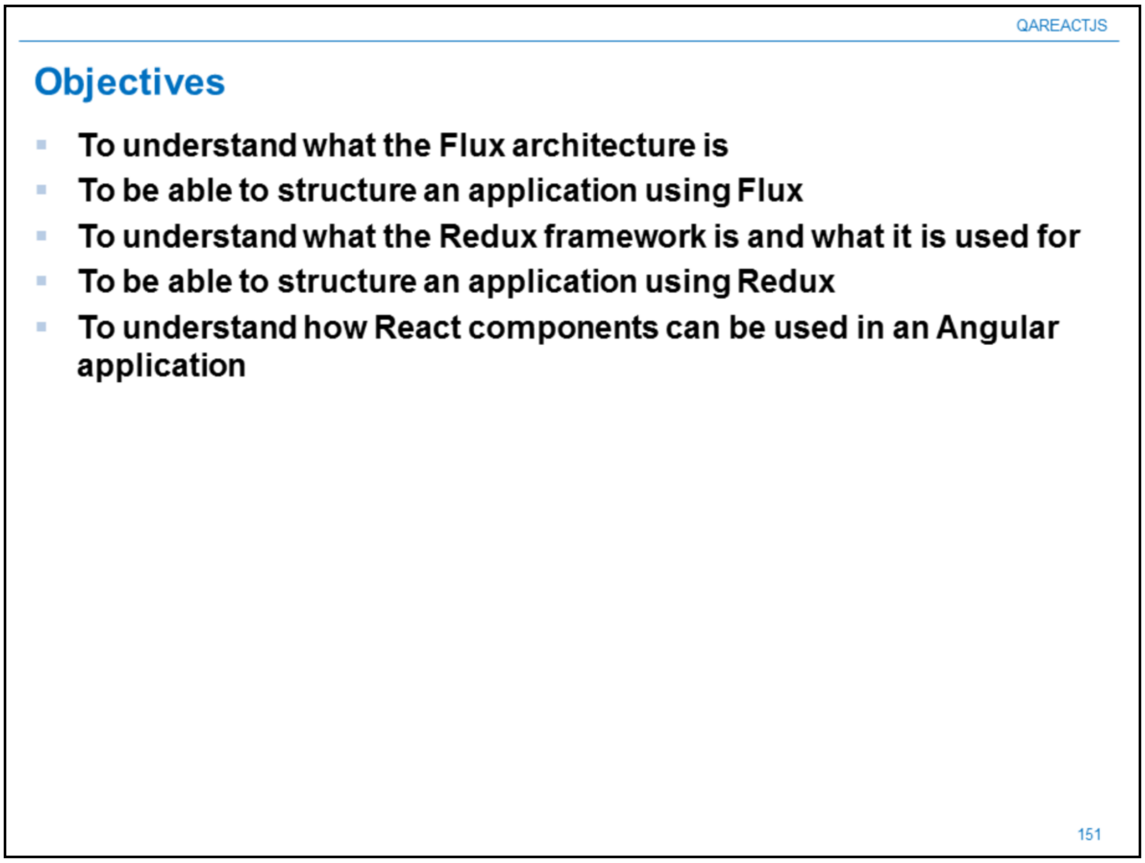
QAREACTJS

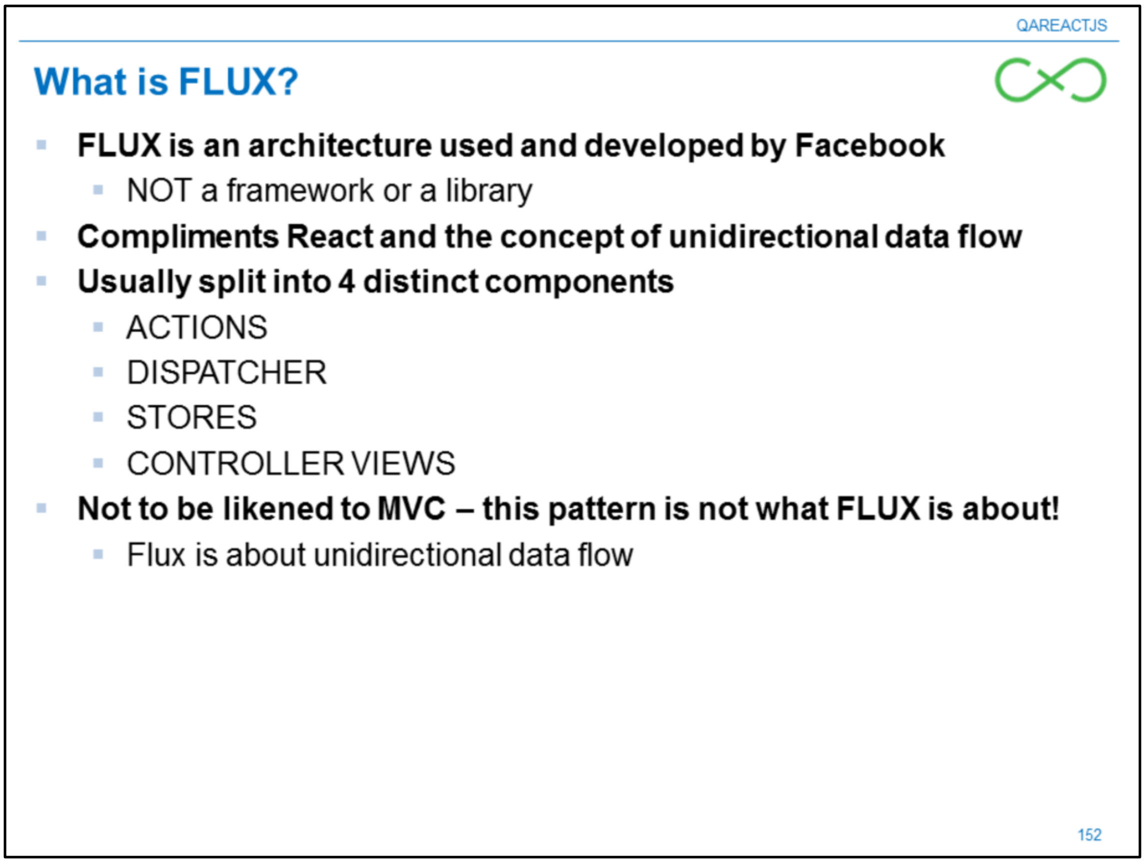
React with Flux, Redux and Angular

Developing Applications using ReactJS



Objectives

- To understand what the Flux architecture is
- To be able to structure an application using Flux
- To understand what the Redux framework is and what it is used for
- To be able to structure an application using Redux
- To understand how React components can be used in an Angular application



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What is FLUX?

- **FLUX is an architecture used and developed by Facebook**
  - NOT a framework or a library
- **Compliments React and the concept of unidirectional data flow**
- **Usually split into 4 distinct components**
  - ACTIONS
  - DISPATCHER
  - STORES
  - CONTROLLER VIEWS
- **Not to be likened to MVC – this pattern is not what FLUX is about!**
  - Flux is about unidirectional data flow

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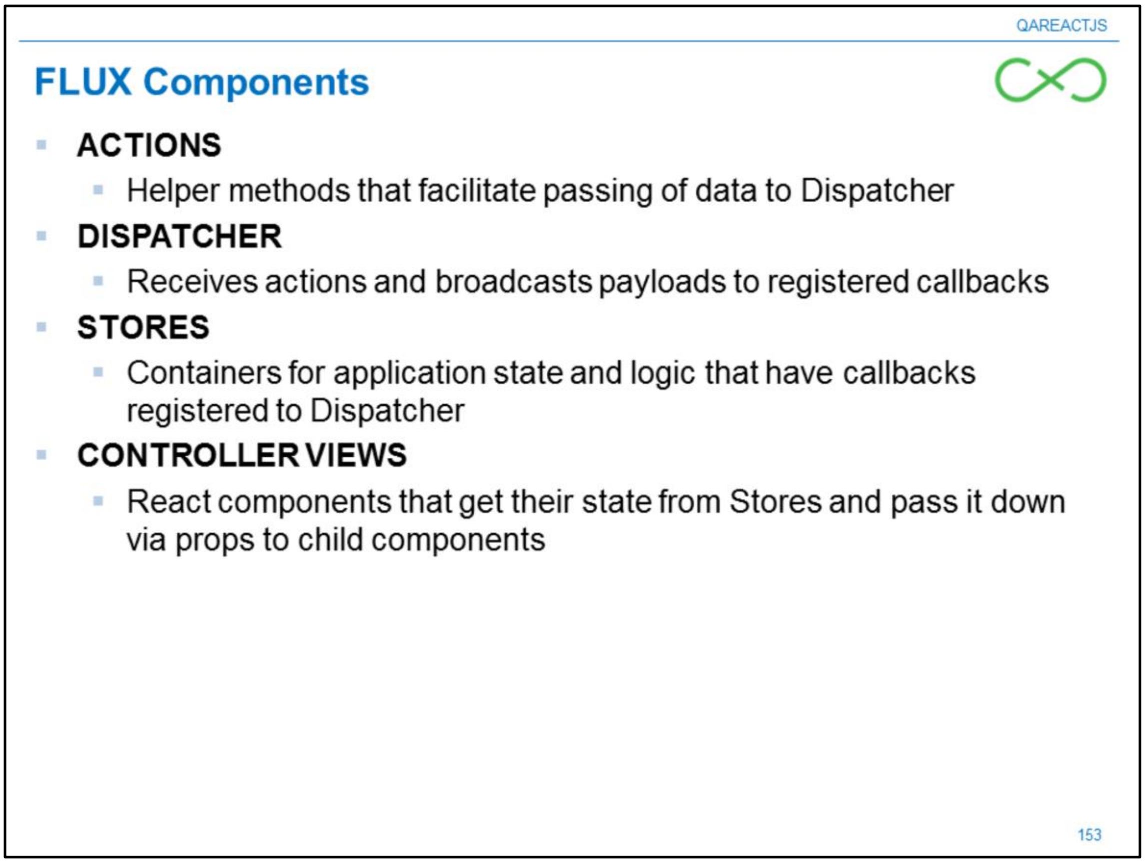
Flux Logo from: https://facebook.github.io/flux/



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FLUX Components

- **ACTIONS**
  - Helper methods that facilitate passing of data to Dispatcher
- **DISPATCHER**
  - Receives actions and broadcasts payloads to registered callbacks
- **STORES**
  - Containers for application state and logic that have callbacks registered to Dispatcher
- **CONTROLLER VIEWS**
  - React components that get their state from Stores and pass it down via props to child components

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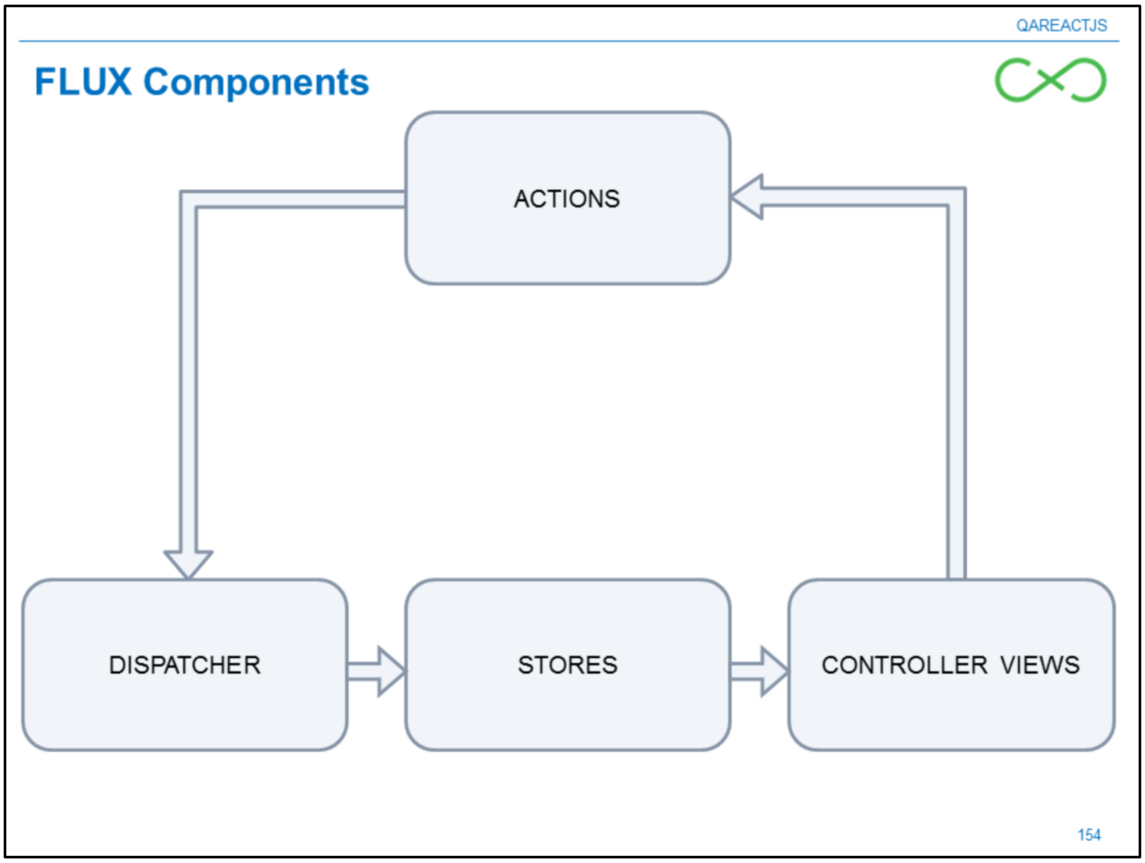
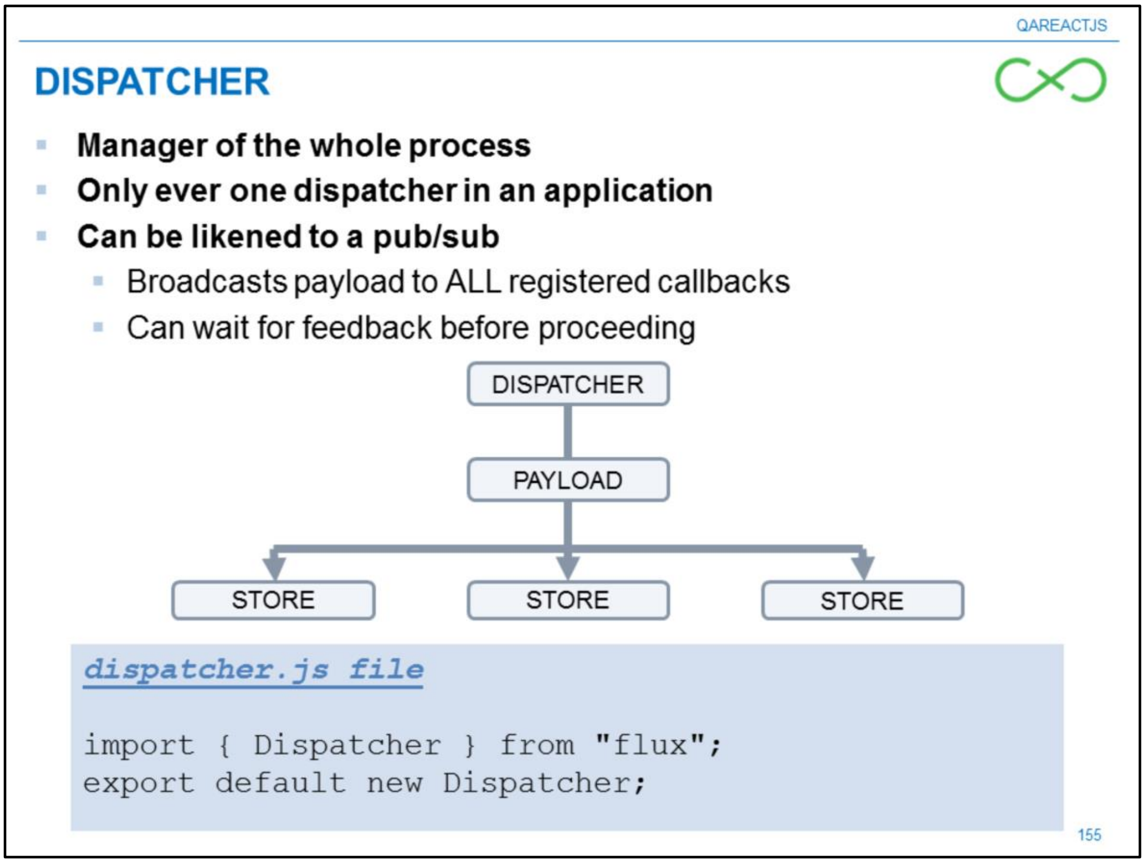


FLUX Components



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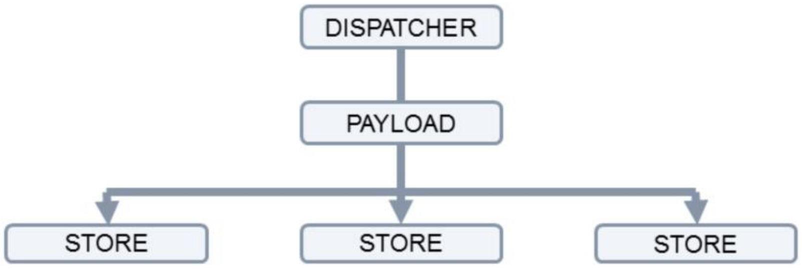
DISPATCHER

- Manager of the whole process
- Only ever one dispatcher in an application
- Can be likened to a pub/sub
  - Broadcasts payload to ALL registered callbacks
  - Can wait for feedback before proceeding



dispatcher.js file

```
import { Dispatcher } from "flux";
export default new Dispatcher;
```

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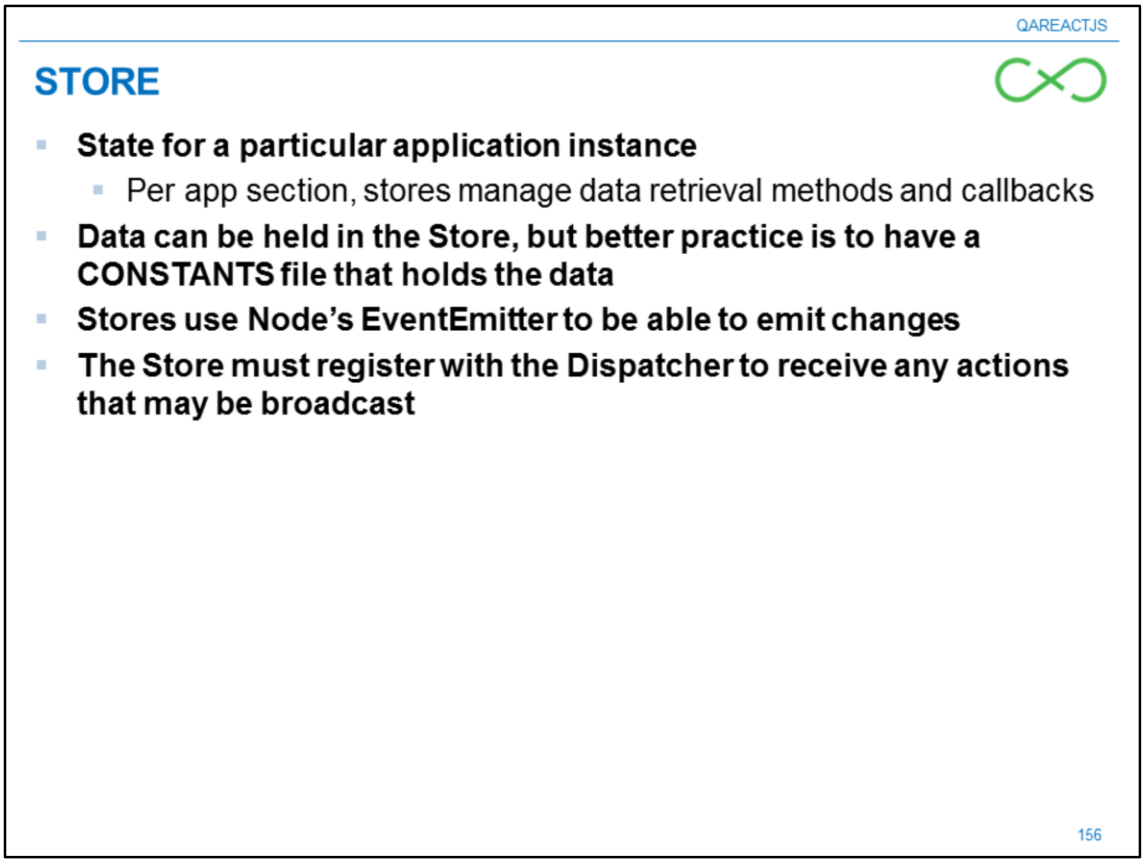
The code show can function as a Dispatcher with nothing else. However, in more complex applications, it may be desirable to define some methods within the Dispatcher, especially if your application has view triggered actions and server/API triggered actions. In such cases, a dispatcher.js file may take the following form:

```
Import { Dispatcher } from “flux”;
var AppDispatcher = new Dispatcher();


AppDispatcher.handleViewAction = (action) => {
    this.dispatch({
        source: ‘VIEW_ACTION’,
        action
    });
}
// Other methods could then be defined
export default AppDispatcher
```

When the AppDispatcher.handleViewAction is called, an action payload is broadcast to all registered callbacks and the action can be acted upon either the appropriate Stores and the results in Store update. Dependencies can also be defined and marshalled for callbacks on Stores. If a particular part of an application is dependent on another being updated, the dispatcher can ensure that this happens using waitFor().



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STORE

- **State for a particular application instance**
  - Per app section, stores manage data retrieval methods and callbacks
- **Data can be held in the Store, but better practice is to have a CONSTANTS file that holds the data**
- **Stores use Node's EventEmitter to be able to emit changes**
- **The Store must register with the Dispatcher to receive any actions that may be broadcast**

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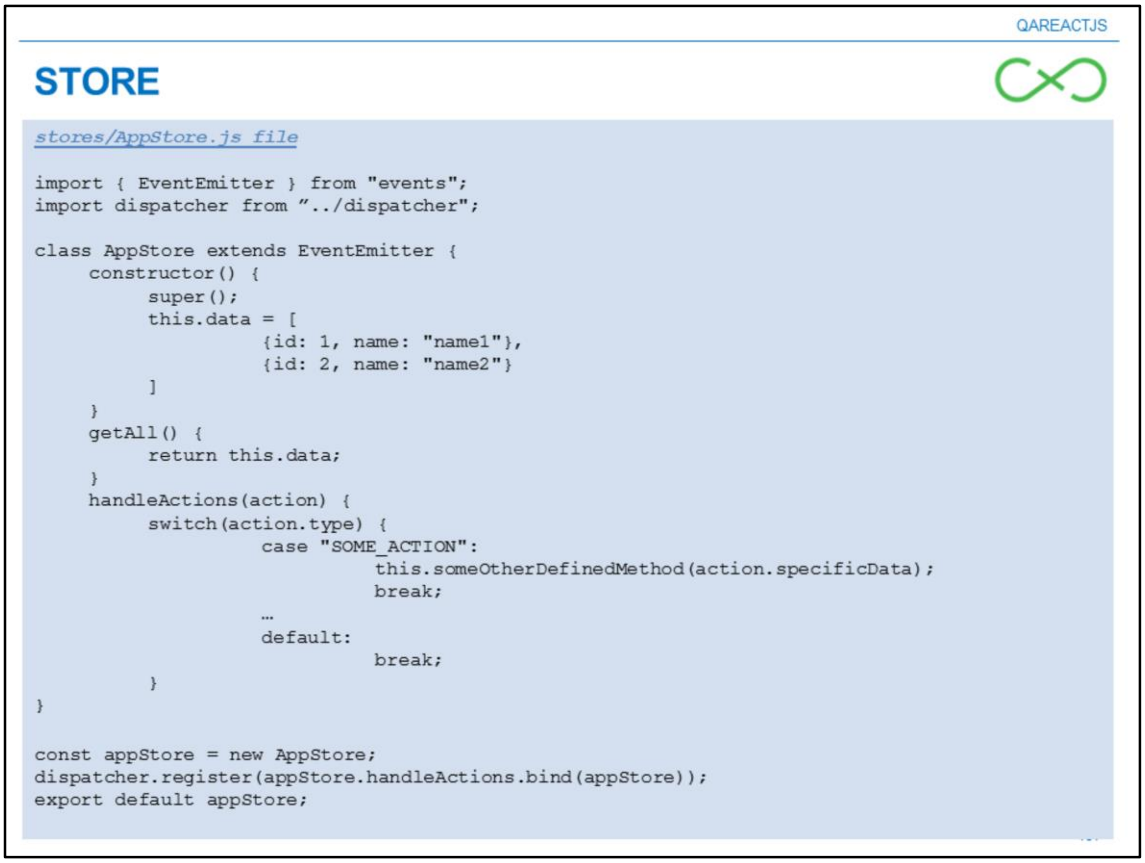

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STORE

stores/AppStore.js file

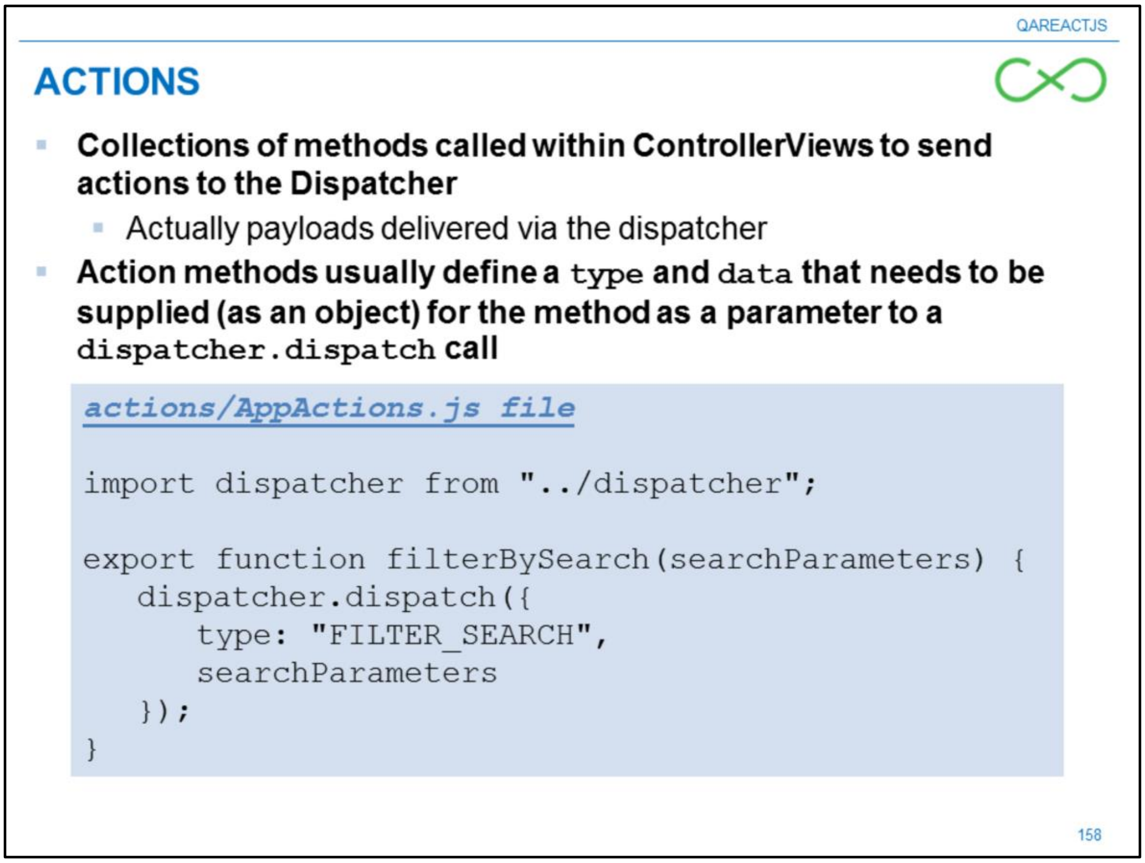
```
import { EventEmitter } from "events";
import dispatcher from "../dispatcher";

class AppStore extends EventEmitter {
     constructor() {
          super();
          this.data = [
                    {id: 1, name: "name1"},
                    {id: 2, name: "name2"}
          ]
     }
     getAll() {
          return this.data;
     }
     handleActions(action) {
          switch(action.type) {
                    case "SOME_ACTION":
                              this.someOtherDefinedMethod(action.specificData);
                              break;
                    …
                    default:
                              break;
          }
}

const appStore = new AppStore;
dispatcher.register(appStore.handleActions.bind(appStore));
export default appStore;
```

This code sets up a sample Store. Not all of the methods have been included but it could be used as a template for any Store. The handleActions is what will determine if the Store responds to an action that has been broadcast by the Dispatcher. If there is no *CASE* in the *SWITCH* then nothing will happen. If a *CASE* is found, then the appropriate method from the AppStore class will be called with any specific data that is needed from the action object supplied by the Dispatcher. The AppStore methods will be used by components to update their state to update the ControllerView.

Each method defined should emit a change so that the ControllerView can pick up on this and execute appropriately.



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ACTIONS

- **Collections of methods called within ControllerViews to send actions to the Dispatcher**
  - Actually payloads delivered via the dispatcher
- **Action methods usually define a `type` and `data` that needs to be supplied (as an object) for the method as a parameter to a `dispatcher.dispatch` call**

actions/AppActions.js file

```
import dispatcher from "../dispatcher";

export function filterBySearch(searchParameters) {
    dispatcher.dispatch({
        type: "FILTER_SEARCH",
        searchParameters
    });
}
```

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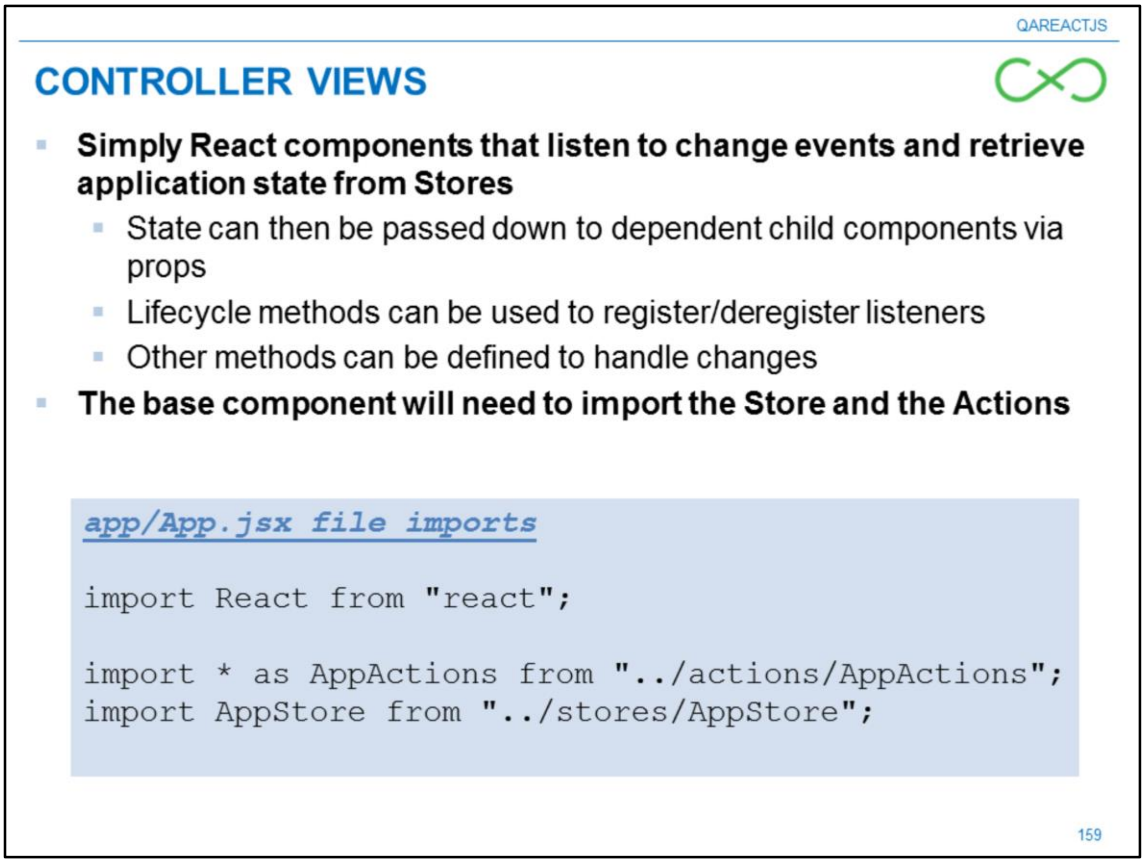
There may be several methods defined within this file.



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CONTROLLER VIEWS

- **Simply React components that listen to change events and retrieve application state from Stores**
  - State can then be passed down to dependent child components via props
  - Lifecycle methods can be used to register/deregister listeners
  - Other methods can be defined to handle changes
- **The base component will need to import the Store and the Actions**

```
app/App.jsx file imports

import React from "react";

import * as AppActions from "../actions/AppActions";
import AppStore from "../stores/AppStore";
```

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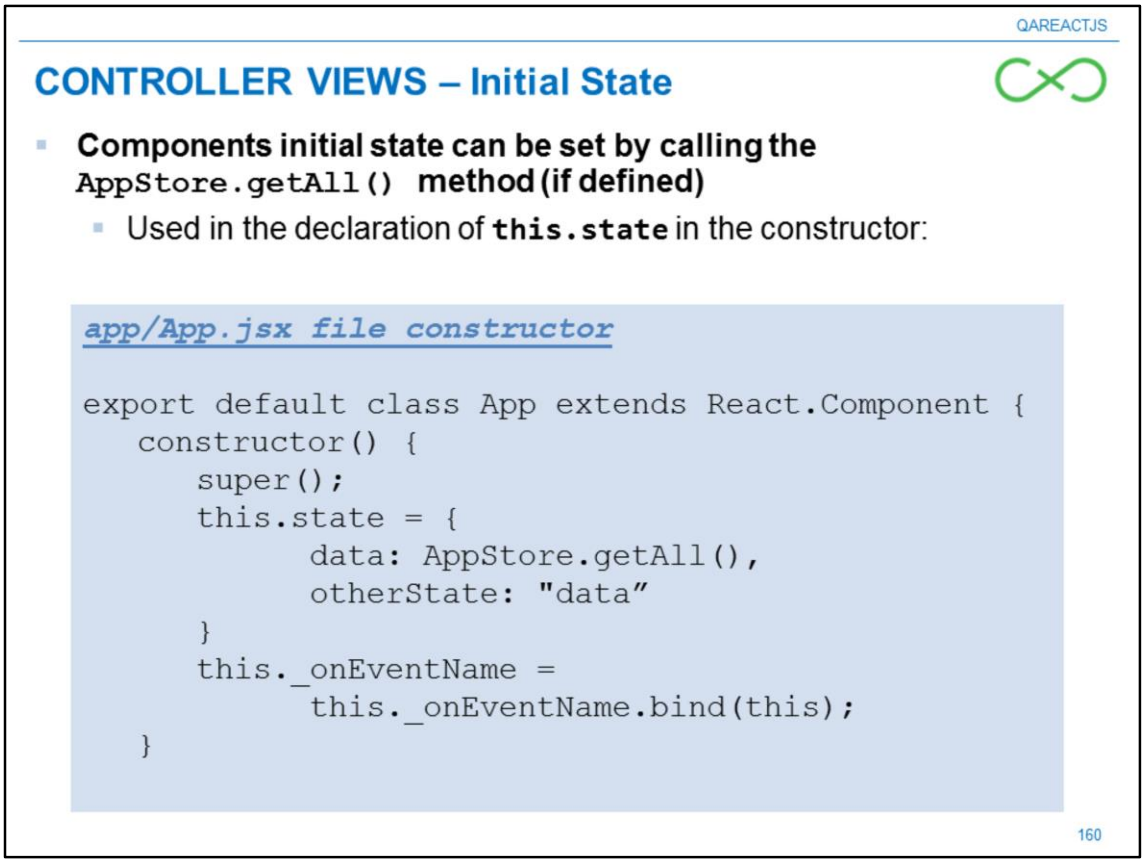
The line:

import * as AppActions from “./actions/AppActions”;

essentially means import all of the functions declared in the AppActions file and allow them to be called with the qualified name AppActions. So for a method filterBySearch(searchParams) in the AppActions file, the method could be called using AppActions.filterBySearch(searchParams).



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CONTROLLER VIEWS – Initial State

- **Components initial state can be set by calling the `AppStore.getAll()` method (if defined)**
  - Used in the declaration of **`this.state`** in the constructor:

app/App.jsx file constructor

```
export default class App extends React.Component {
   constructor() {
      super();
      this.state = {
            data: AppStore.getAll(),
            otherState: "data"
      }
      this._onEventName =
            this._onEventName.bind(this);
   }
```

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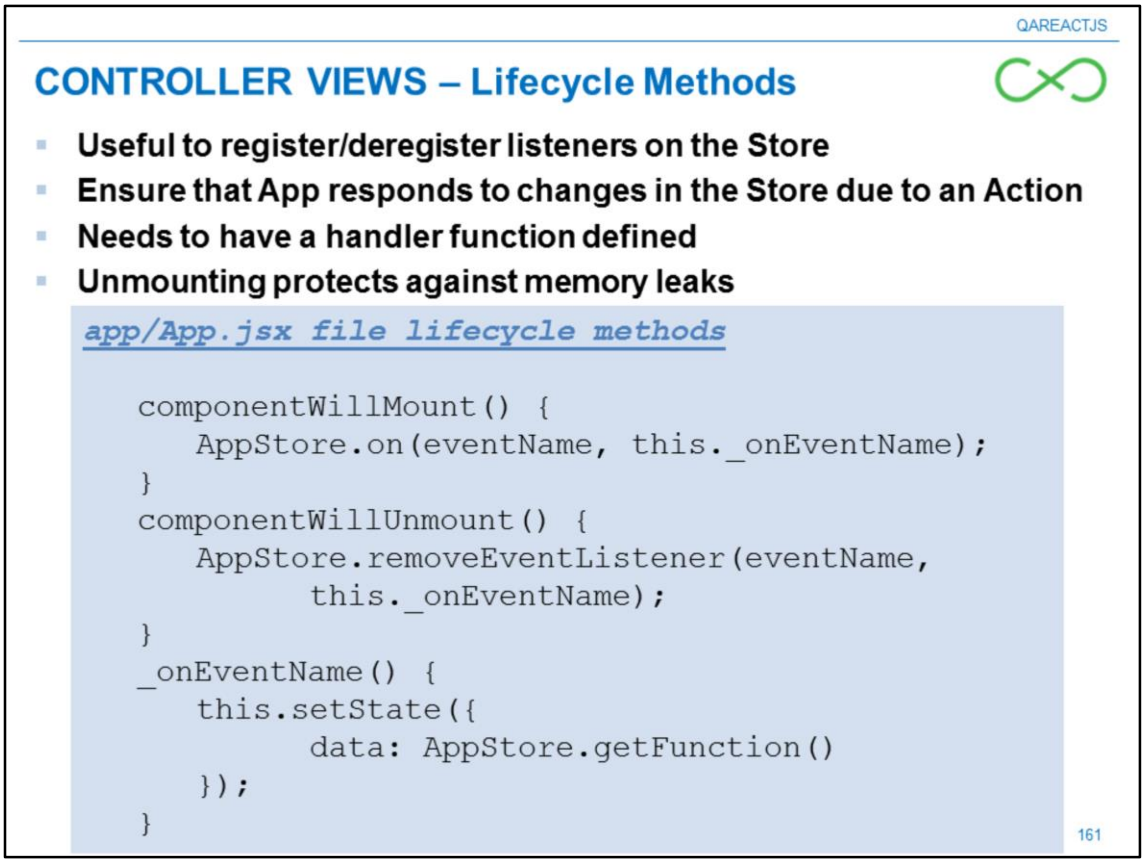
`this._onEventName = this._onEventName.bind(this);` binds the call of the `_onEventName` function to the App class rather than on the calling object. This will be used in the next section where reacting to changes are discussed.



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CONTROLLER VIEWS – Lifecycle Methods

- Useful to register/deregister listeners on the Store
- Ensure that App responds to changes in the Store due to an Action
- Needs to have a handler function defined
- Unmounting protects against memory leaks

app/App.jsx file lifecycle methods

```
componentWillMount() {
   AppStore.on(eventName, this._onEventName);
}
componentWillUnmount() {
   AppStore.removeEventListener(eventName,
         this._onEventName);
}
_onEventName() {
   this.setState({
         data: AppStore.getFunction()
   });
}
```

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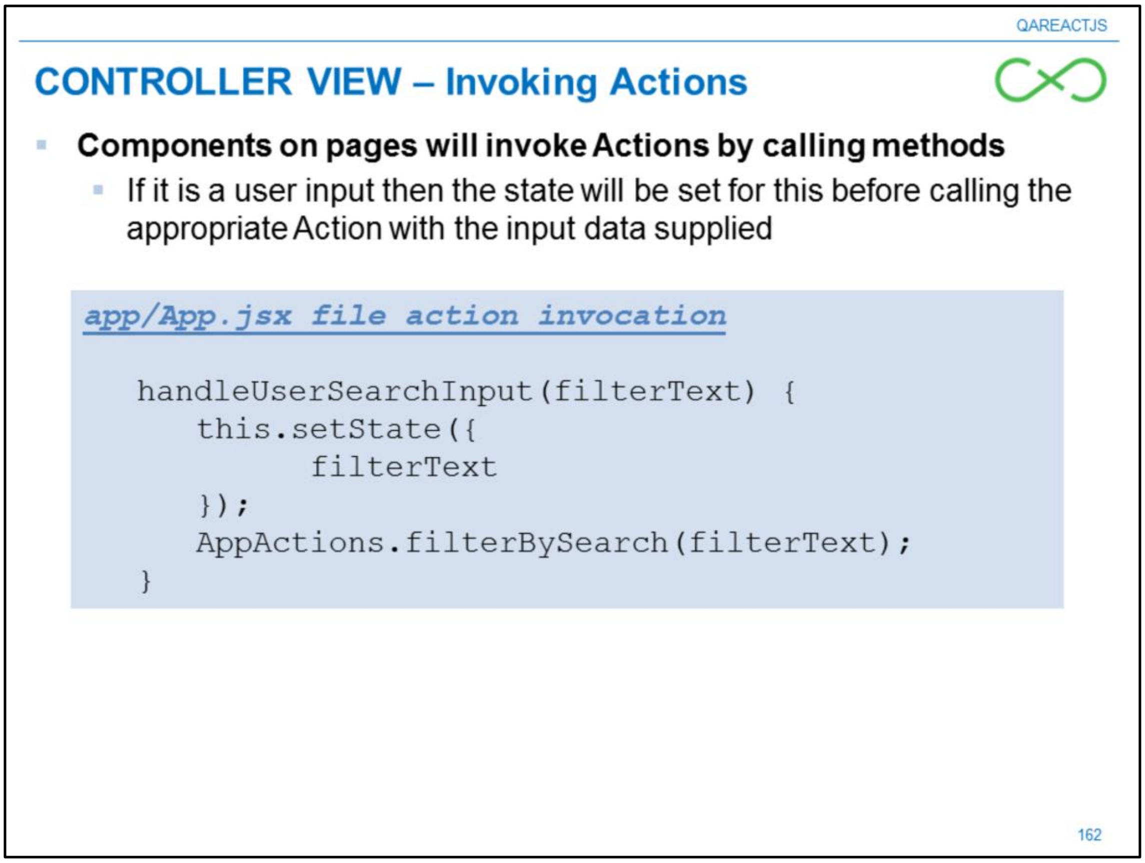
As components exist in a virtual DOM, every time the component is created a new event listener is created and the old component stays in memory. This is bad!

To circumvent this, using the removeEventListener call when the component unmounts means that the component is fully removed from memory.

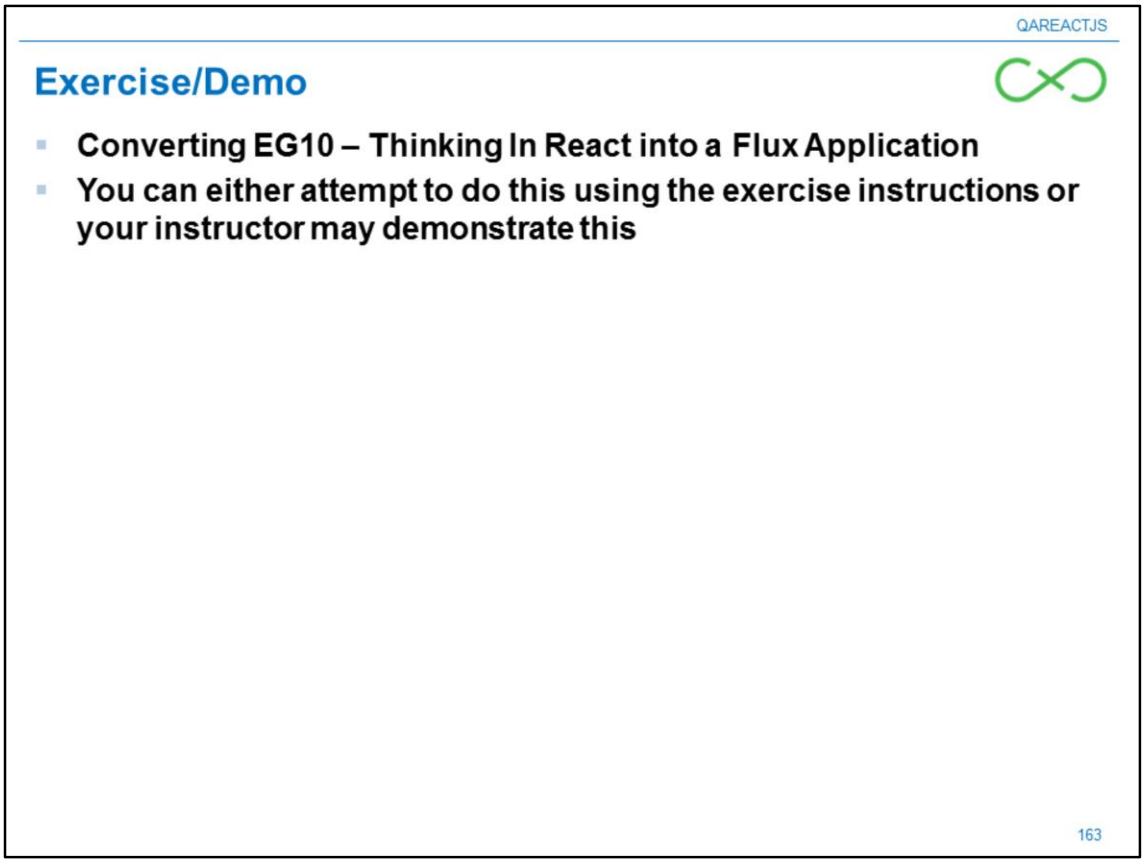


CONTROLLER VIEW – Invoking Actions

- **Components on pages will invoke Actions by calling methods**
  - If it is a user input then the state will be set for this before calling the appropriate Action with the input data supplied

app/App.jsx file action invocation

```
   handleUserSearchInput(filterText) {
      this.setState({
            filterText
      });
      AppActions.filterBySearch(filterText);
   }
```



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Exercise/Demo

- Converting EG10 – Thinking In React into a Flux Application
- You can either attempt to do this using the exercise instructions or your instructor may demonstrate this

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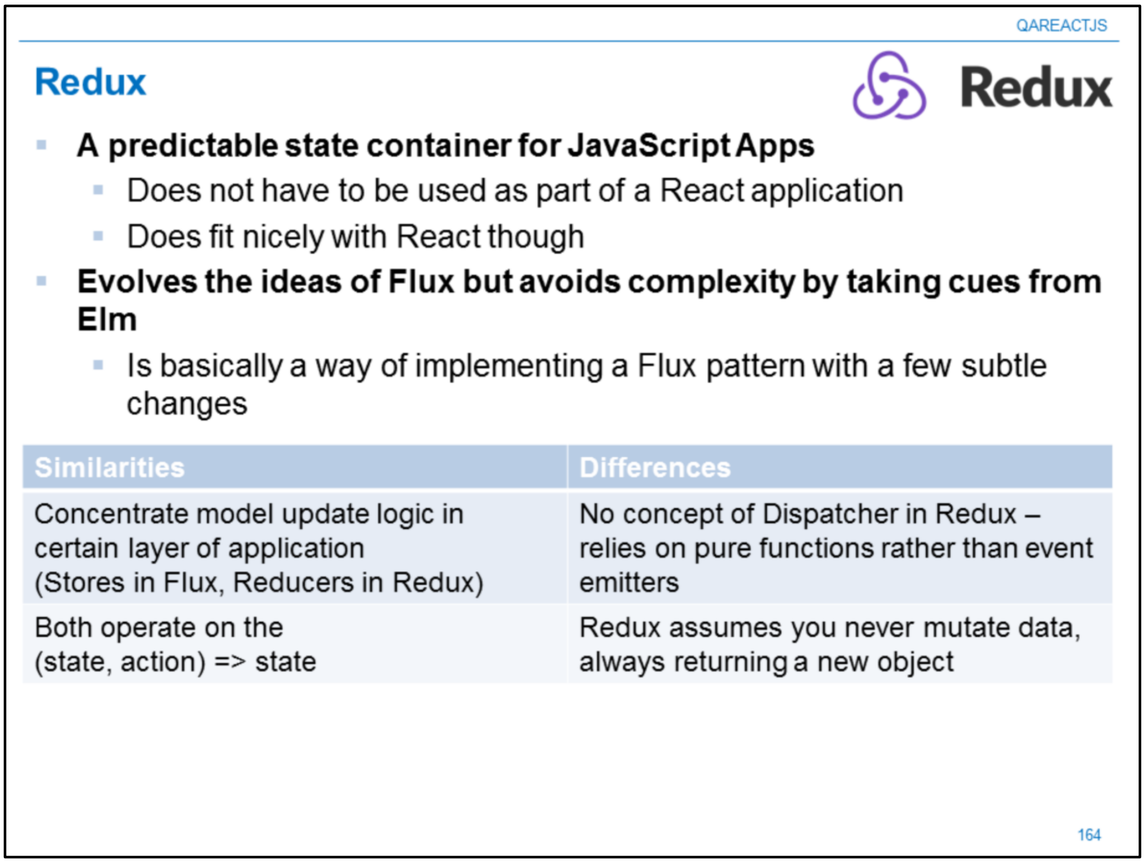

Redux

Redux

- **A predictable state container for JavaScript Apps**
  - Does not have to be used as part of a React application
  - Does fit nicely with React though
- **Evolves the ideas of Flux but avoids complexity by taking cues from Elm**
  - Is basically a way of implementing a Flux pattern with a few subtle changes

Similarities	Differences
Concentrate model update logic in certain layer of application (Stores in Flux, Reducers in Redux)	No concept of Dispatcher in Redux – relies on pure functions rather than event emitters
Both operate on the (state, action) => state	Redux assumes you never mutate data, always returning a new object

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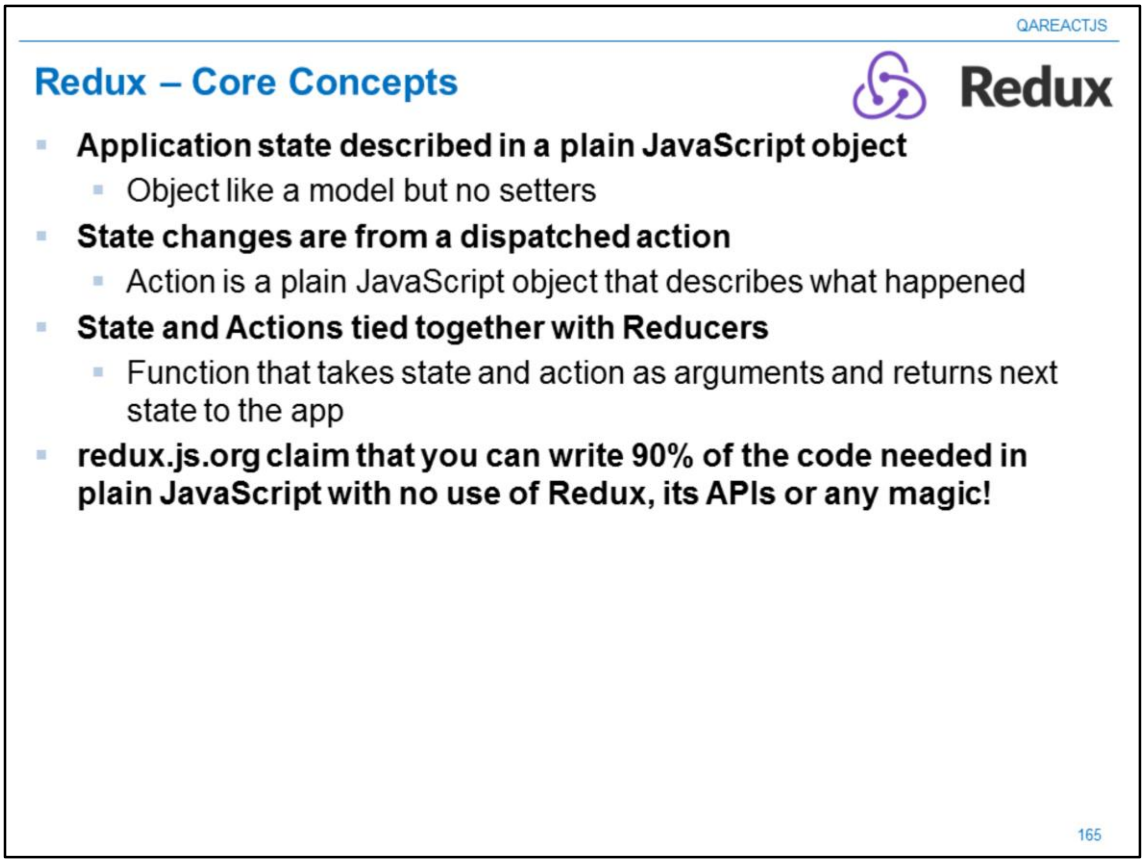
Redux logo from: http://redux.js.org/



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Redux – Core Concepts

Redux

- **Application state described in a plain JavaScript object**
  - Object like a model but no setters
- **State changes are from a dispatched action**
  - Action is a plain JavaScript object that describes what happened
- **State and Actions tied together with Reducers**
  - Function that takes state and action as arguments and returns next state to the app
- **redux.js.org claim that you can write 90% of the code needed in plain JavaScript with no use of Redux, its APIs or any magic!**

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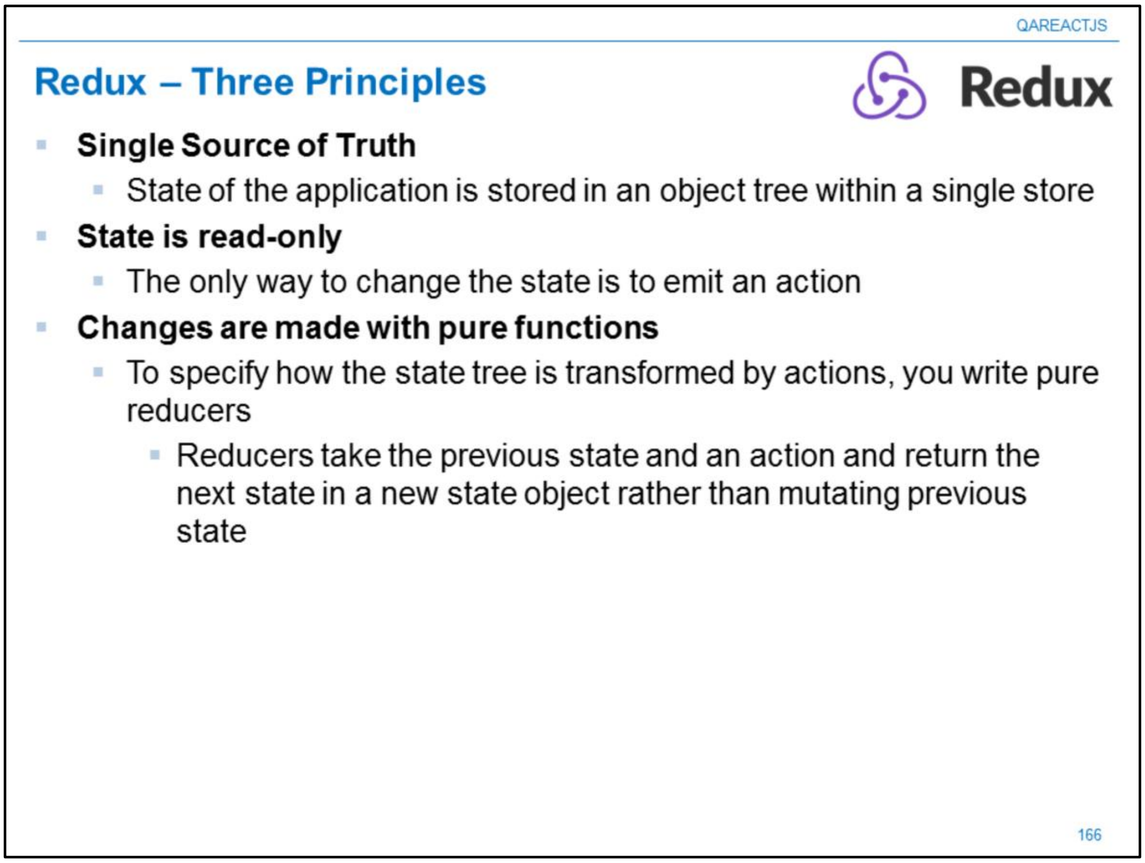

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Redux – Three Principles

Redux

- **Single Source of Truth**
  - State of the application is stored in an object tree within a single store
- **State is read-only**
  - The only way to change the state is to emit an action
- **Changes are made with pure functions**
  - To specify how the state tree is transformed by actions, you write pure reducers
    - Reducers take the previous state and an action and return the next state in a new state object rather than mutating previous state

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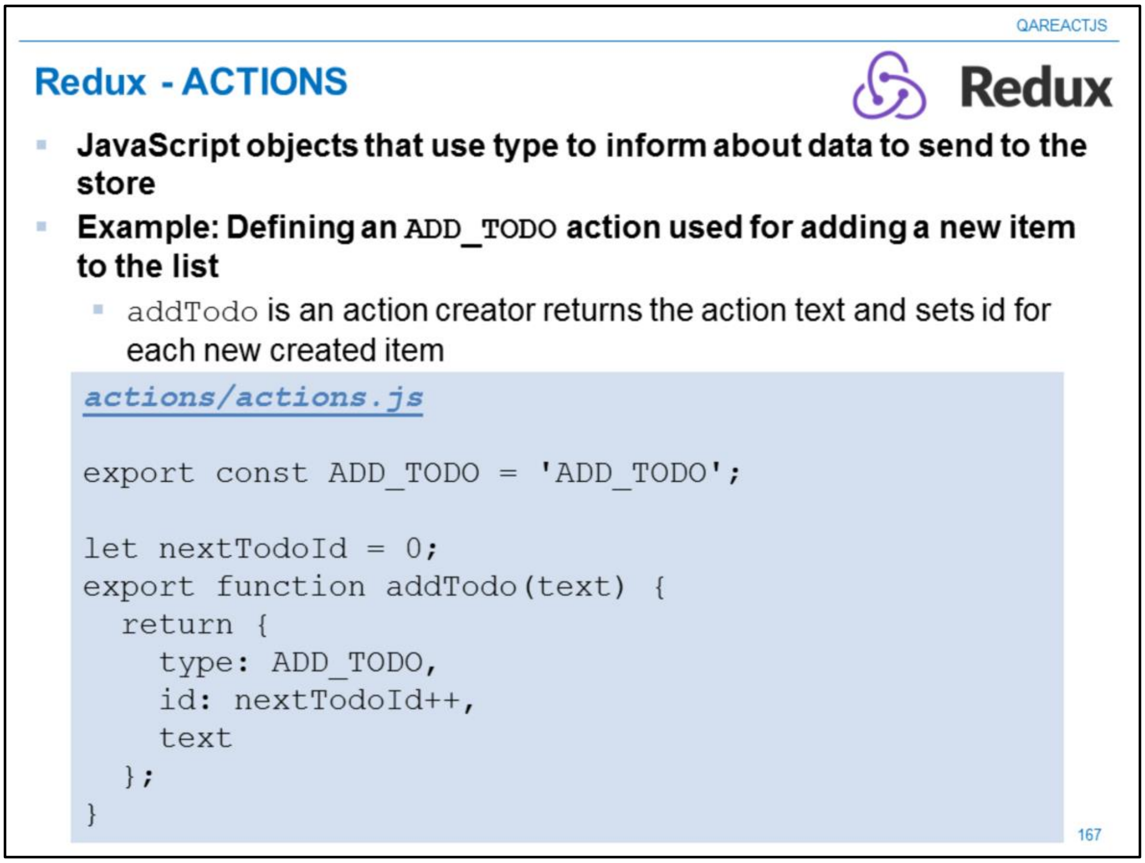

Redux - ACTIONS

- **JavaScript objects that use type to inform about data to send to the store**
- **Example: Defining an `ADD_TODO` action used for adding a new item to the list**
    - `addTodo` is an action creator returns the action text and sets id for each new created item

actions/actions.js

```
export const ADD_TODO = 'ADD_TODO';

let nextTodoId = 0;
export function addTodo(text) {
  return {
    type: ADD_TODO,
    id: nextTodoId++,
    text
  };
}
```

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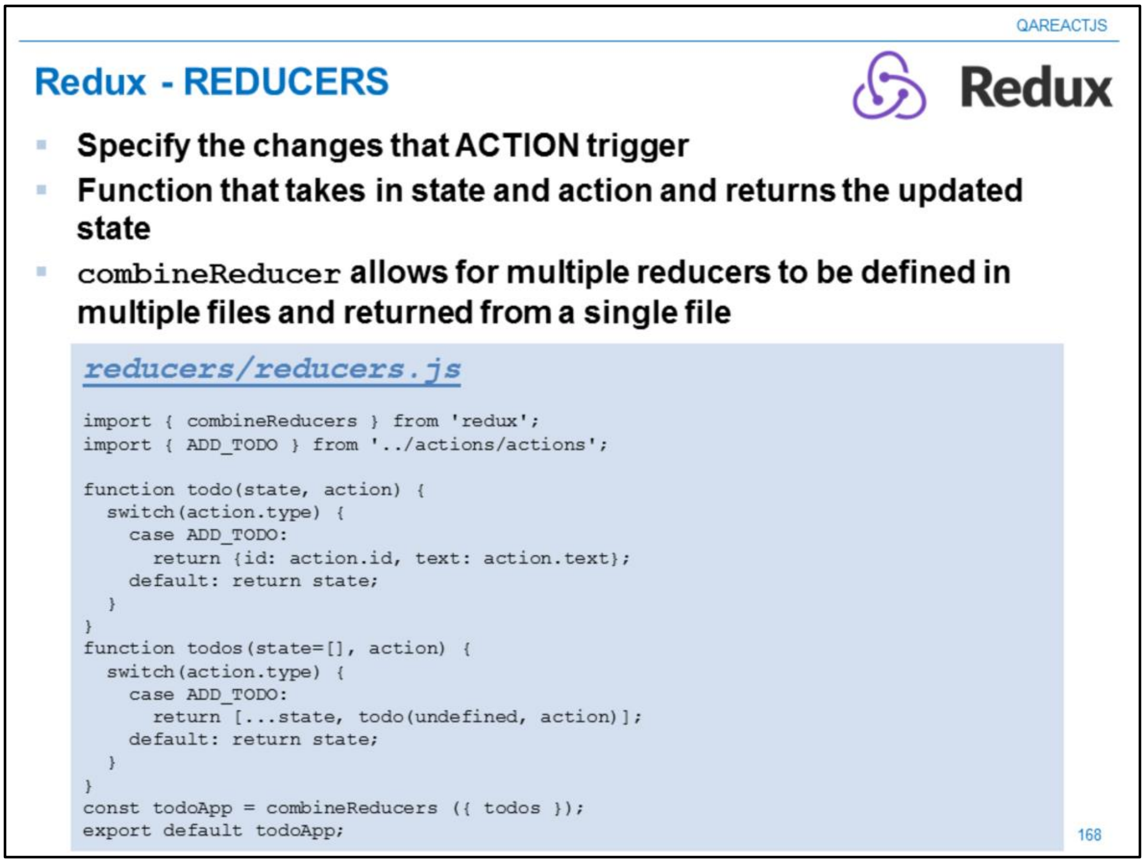

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Redux - REDUCERS

- Specify the changes that ACTION trigger
- Function that takes in state and action and returns the updated state
- `combineReducer` allows for multiple reducers to be defined in multiple files and returned from a single file

reducers/reducers.js

```
import { combineReducers } from 'redux';
import { ADD_TODO } from '../actions/actions';

function todo(state, action) {
  switch(action.type) {
    case ADD_TODO:
      return {id: action.id, text: action.text};
    default: return state;
  }
}
function todos(state=[], action) {
  switch(action.type) {
    case ADD_TODO:
      return [...state, todo(undefined, action)];
    default: return state;
  }
}
const todoApp = combineReducers ({ todos });
export default todoApp;
```

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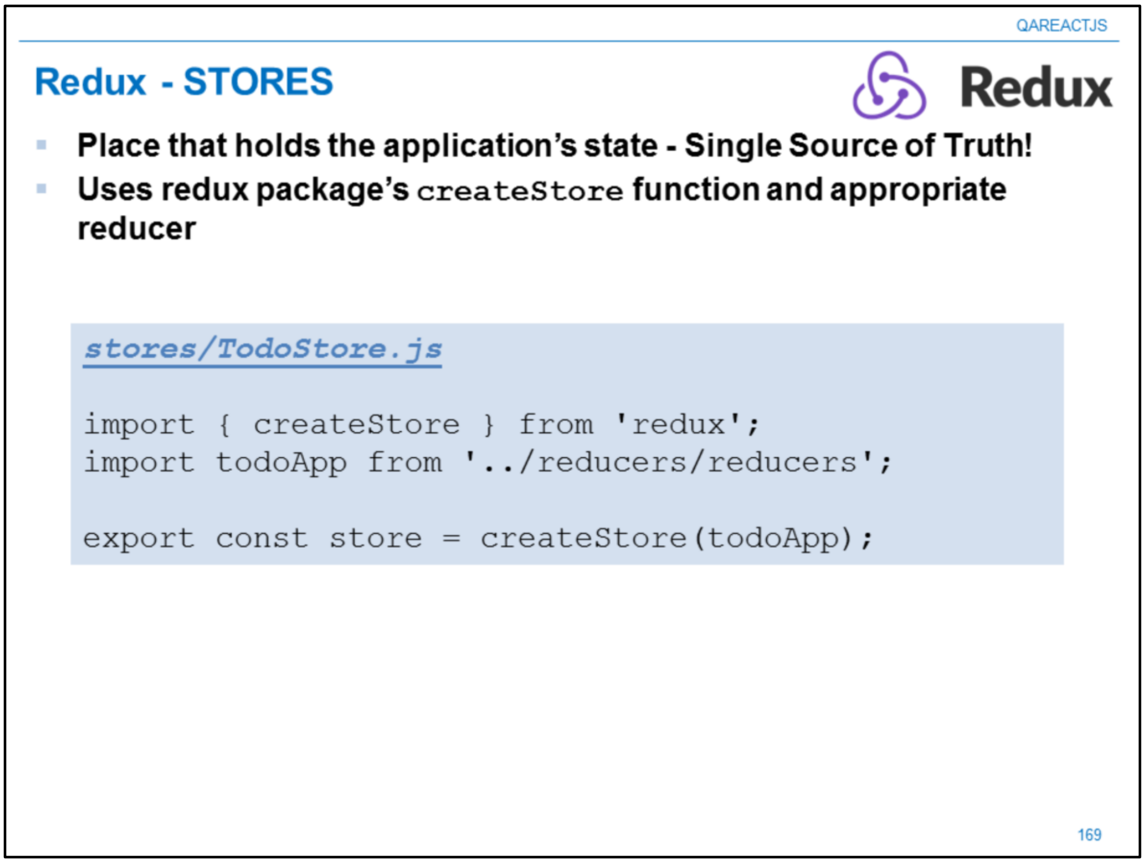
For the examples given in this course, reducers are held in a single file. In practice, individual reducers should be contained in their own files and exported. The reducers.js file should import each reducer and supply it in the object passed into the combineReducers method. The const that this returns to is what is exported and used in any file that needs to access the reducers.



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Redux - STORES

Redux

- **Place that holds the application's state - Single Source of Truth!**
- **Uses redux package's `createStore` function and appropriate reducer**

stores/TodoStore.js

```
import { createStore } from 'redux';
import todoApp from '../reducers/reducers';

export const store = createStore(todoApp);
```

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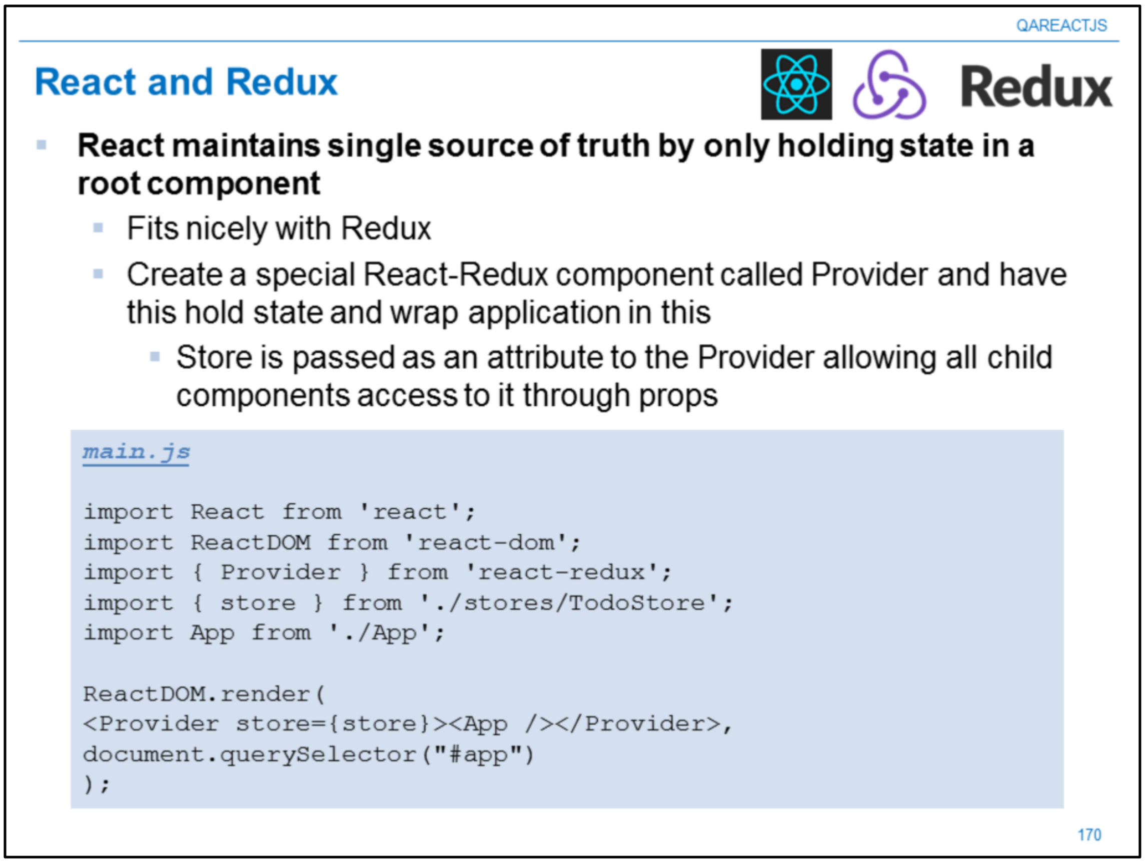

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React and Redux

- **React maintains single source of truth by only holding state in a root component**
  - Fits nicely with Redux
  - Create a special React-Redux component called Provider and have this hold state and wrap application in this
    - Store is passed as an attribute to the Provider allowing all child components access to it through props

main.js

```
import React from 'react';
import ReactDOM from 'react-dom';
import { Provider } from 'react-redux';
import { store } from './stores/TodoStore';
import App from './App';

ReactDOM.render(
<Provider store={store}><App /></Provider>,
document.querySelector("#app")
);
```

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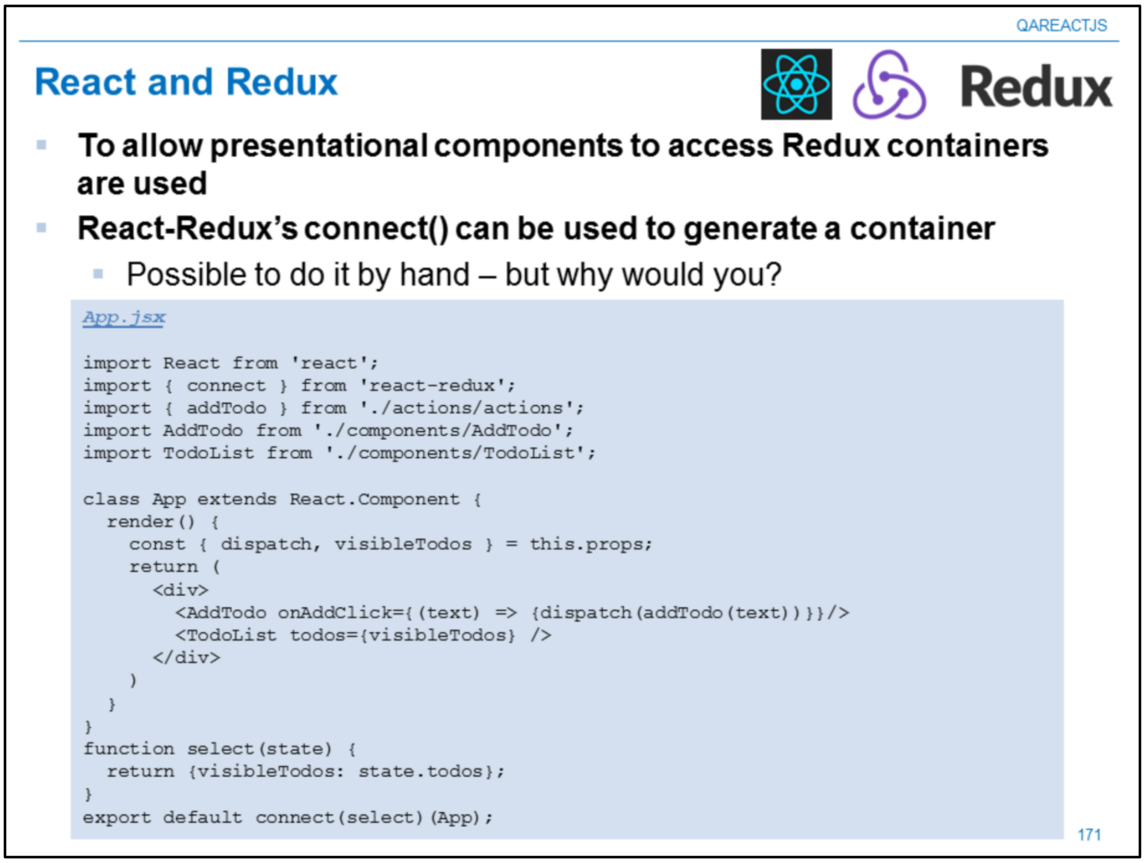
React logo from: https://facebook.github.io/react/



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React and Redux

- **To allow presentational components to access Redux containers are used**
- **React-Redux's connect() can be used to generate a container**
  - Possible to do it by hand – but why would you?

App.jsx

```
import React from 'react';
import { connect } from 'react-redux';
import { addTodo } from './actions/actions';
import AddTodo from './components/AddTodo';
import TodoList from './components/TodoList';

class App extends React.Component {
  render() {
    const { dispatch, visibleTodos } = this.props;
    return (
      <div>
        <AddTodo onAddClick={(text) => {dispatch(addTodo(text))}}/>
        <TodoList todos={visibleTodos} />
      </div>
    )
  }
}
function select(state) {
  return {visibleTodos: state.todos};
}
export default connect(select)(App);
```

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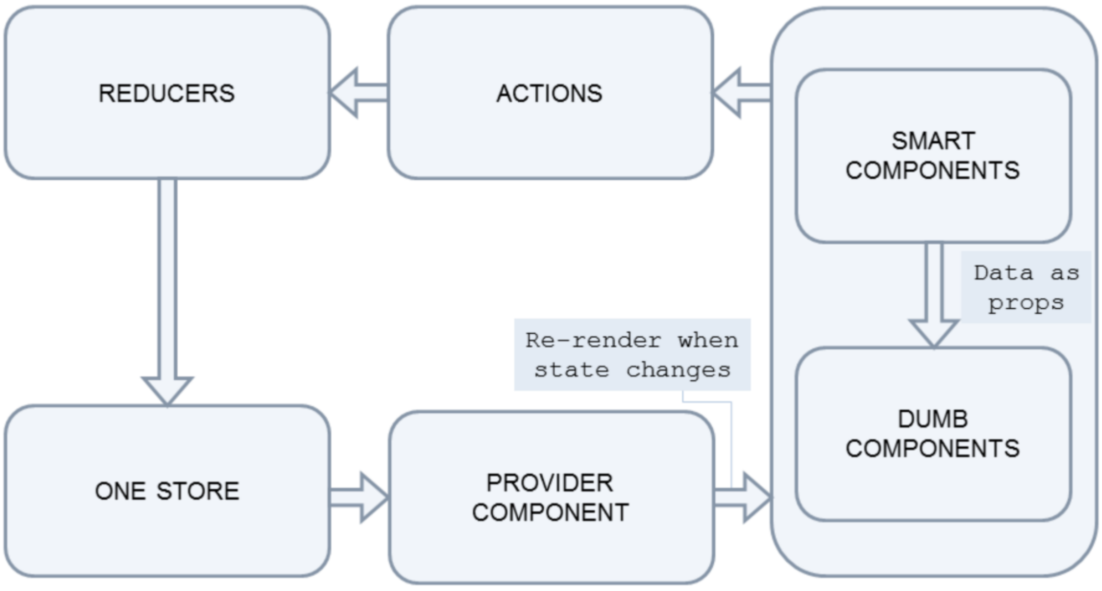
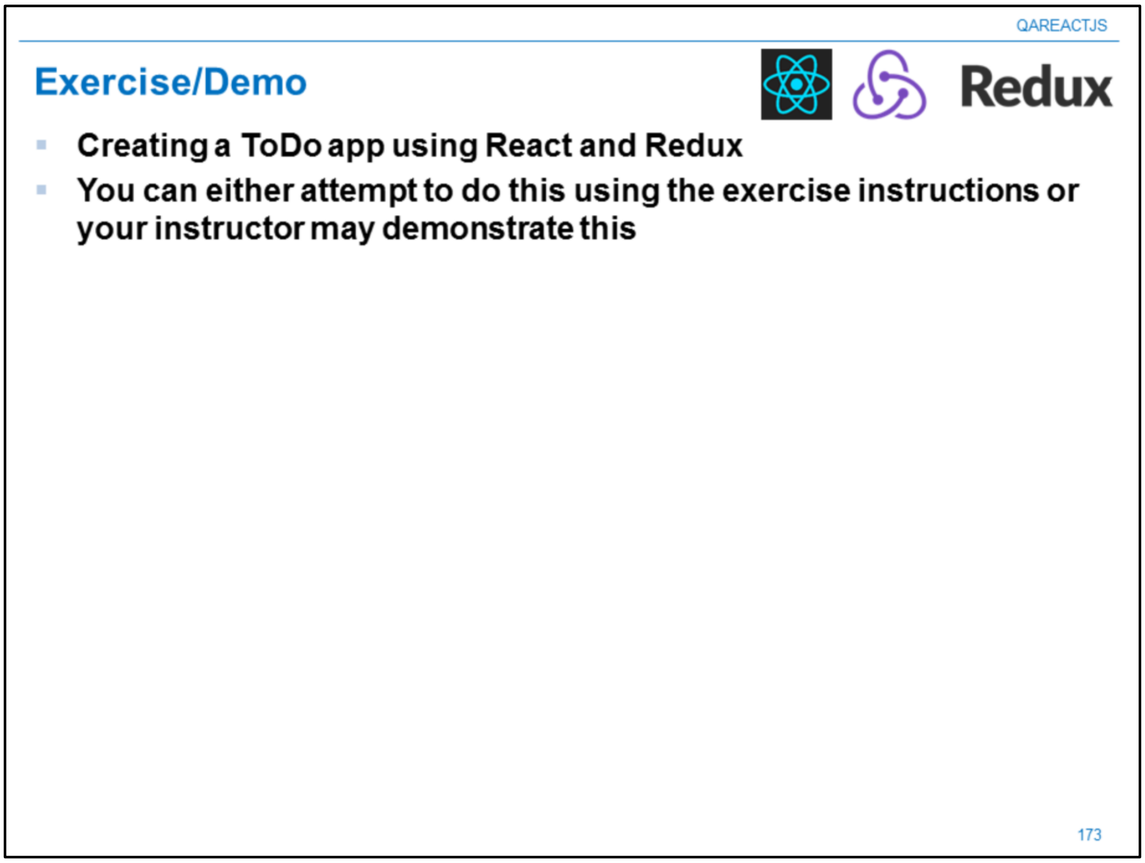
A container component is essentially a React component that uses store.subscribe() to access part of the state from the store and supply props to presentational components it renders.

In the code on the slide, the connect function is used to connect the App component to the the store. The select function is important here as it takes the state from the store and returns props (visibleTodos) to use in components.

React and Redux

- **Data flow:**





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Exercise/Demo

Redux

- Creating a ToDo app using React and Redux
- You can either attempt to do this using the exercise instructions or your instructor may demonstrate this

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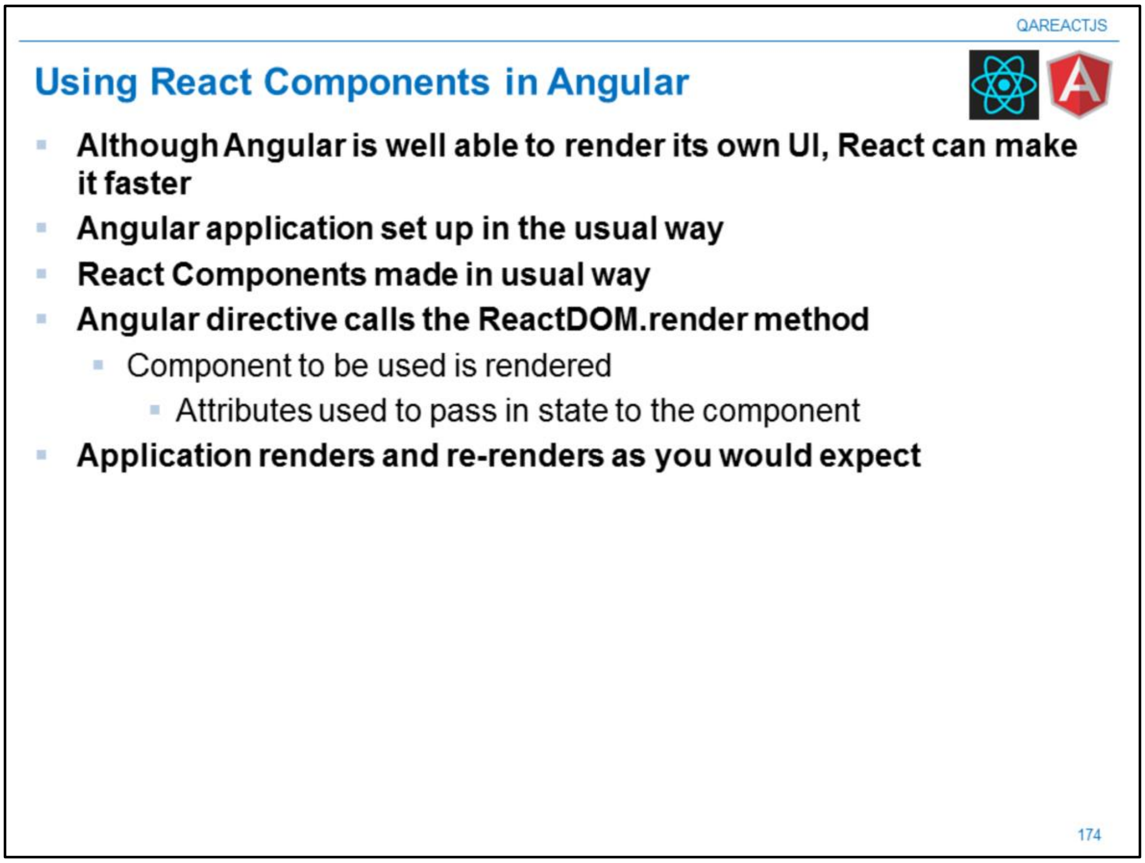
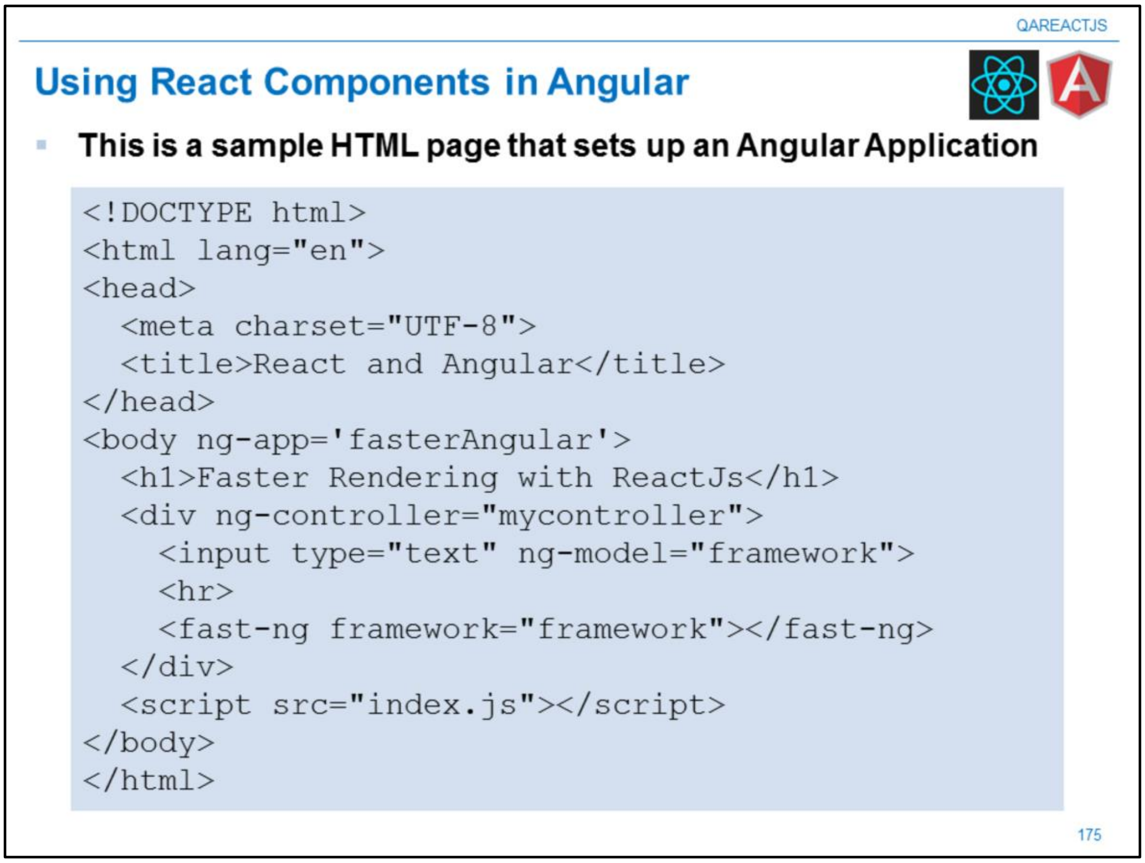


Using React Components in Angular

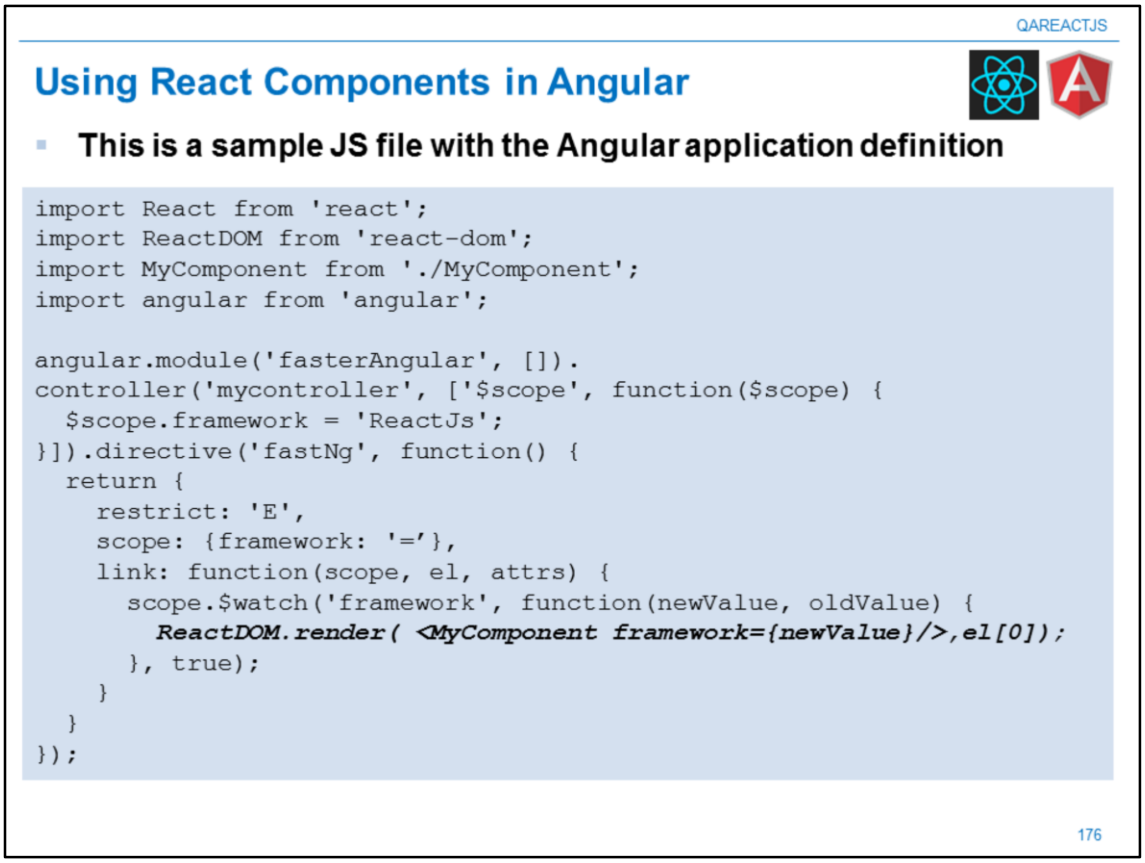
- **Although Angular is well able to render its own UI, React can make it faster**
- **Angular application set up in the usual way**
- **React Components made in usual way**
- **Angular directive calls the ReactDOM.render method**
  - Component to be used is rendered
    - Attributes used to pass in state to the component
- **Application renders and re-renders as you would expect**



Using React Components in Angular

- This is a sample HTML page that sets up an Angular Application

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>React and Angular</title>
</head>
<body ng-app='fasterAngular'>
  <h1>Faster Rendering with ReactJs</h1>
  <div ng-controller="mycontroller">
    <input type="text" ng-model="framework">
    <hr>
    <fast-ng framework="framework"></fast-ng>
  </div>
  <script src="index.js"></script>
</body>
</html>
```

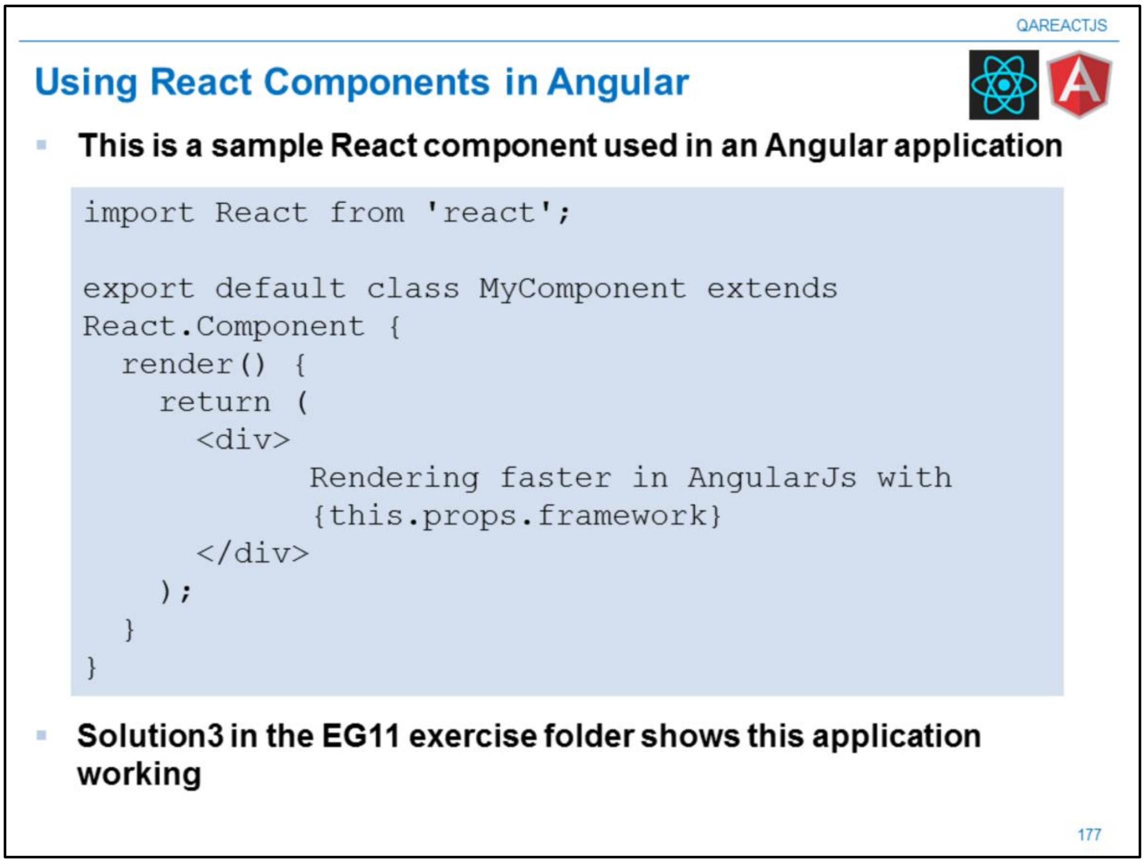


Using React Components in Angular

- **This is a sample JS file with the Angular application definition**

```
import React from 'react';
import ReactDOM from 'react-dom';
import MyComponent from './MyComponent';
import angular from 'angular';

angular.module('fasterAngular', []).
controller('mycontroller', ['$scope', function($scope) {
  $scope.framework = 'ReactJs';
}]).directive('fastNg', function() {
  return {
    restrict: 'E',
    scope: {framework: '=’},
    link: function(scope, el, attrs) {
      scope.$watch('framework', function(newValue, oldValue) {
        ReactDOM.render( <MyComponent framework={newValue}/>,el[0]);
      }, true);
    }
  }
});
```



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Using React Components in Angular

- **This is a sample React component used in an Angular application**

```
import React from 'react';

export default class MyComponent extends
React.Component {
  render() {
    return (
      <div>
            Rendering faster in AngularJs with
            {this.props.framework}
      </div>
    );
  }
}
```

- **Solution3 in the EG11 exercise folder shows this application working**

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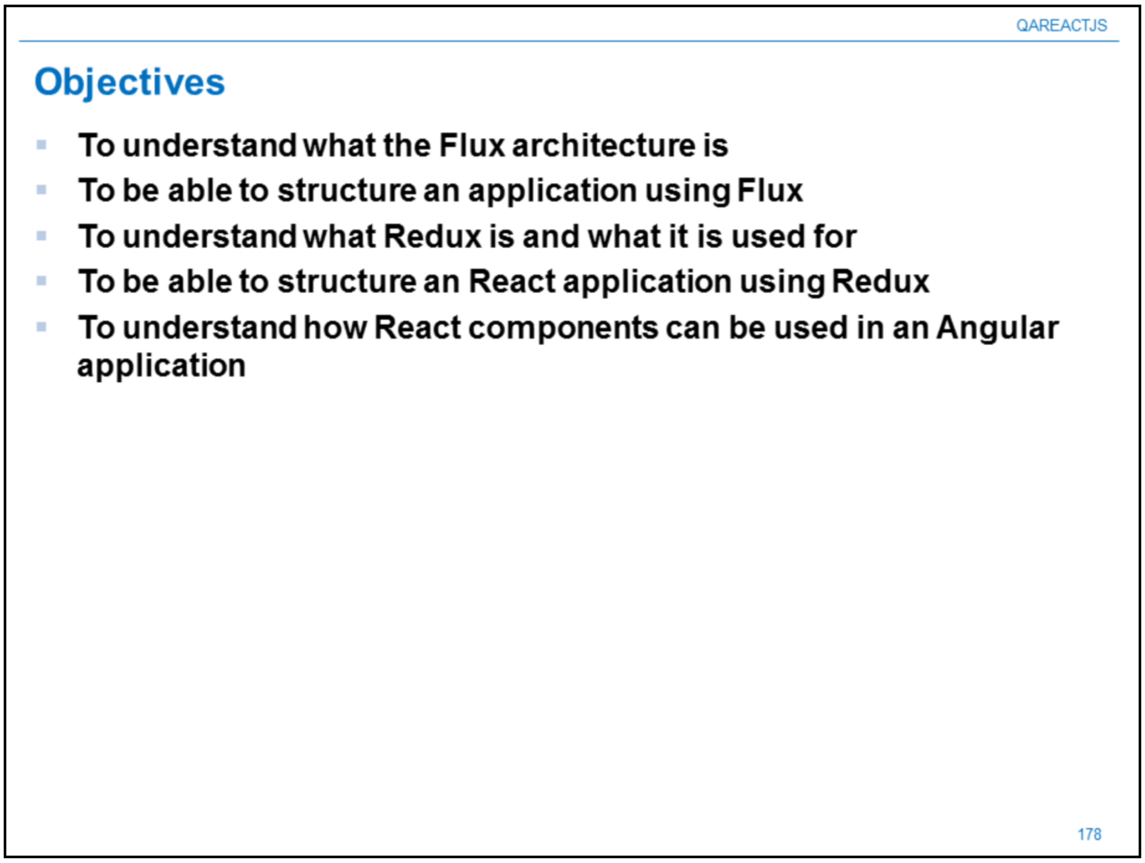

Objectives

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- To be able to structure an application using Flux
- To understand what Redux is and what it is used for
- To be able to structure an React application using Redux
- To understand how React components can be used in an Angular application