ReactJS

- JavaScript framework for writing the web applications
  - Like AngularJS - Snappy response from running in browser
  - Less opinionated: only specifies rendering view and handling user interactions

- Uses Model-View-Controller pattern
  - View constructed from Components using pattern
  - Optional, but commonly used HTML templating

- Minimal server-side support dictated

- Focus on supporting for programming in the large and single page applications
  - Modules, reusable components, testing, etc.
ReactJS Web Application Page

ReactJS applications come as a JavaScript blob that will use the DOM interface to write the view into the div.
ReactJS tool chain

**React Components**

- Component #1
- Component #2
- ...  
- Component #N

**Babel** - Transpile language features (e.g. ECMAScript, JSX) to basic JavaScript

**Webpack** - Bundle modules and resources (CSS, images)

Output loadable with single script tag in any browser
import React from 'react';
import ReactDOM from 'react-dom';
import ReactAppView from './components/ReactAppView';

let viewTree = React.createElement(ReactAppView, null);
let where = document.getElementById('reactapp');
ReactDOM.render(viewTree, where);

Renders the tree of React elements (single component named ReactAppView) into the browser's DOM at the div with id=reactapp.

ES6 Modules - Bring in React and web app React components.
import React from 'react';

class ReactAppView extends React.Component {
  constructor(props) {
    super(props);
    ...
  }

  render() {
    ...
  }
};

export default ReactAppView;

Inherits from React.Component. props is set to the attributes passed to the component.

Require method render() - returns React element tree of the Component's view.
ReactAppView render() method

```javascript
render() {
    let label = React.createElement('label', null, 'Name: ');
    let input = React.createElement('input',
        { type: 'text', value: this.state.yourName,
          onChange: (event) => this.handleChange(event) },
    );
    let h1 = React.createElement('h1', null, 'Hello ', this.state.yourName, '!');

    return React.createElement('div', null, label, input, h1);
}
```

Returns element tree with `div` (label, input, and h1) elements.
ReactAppView render() method w/o variables

```javascript
render() {
    return React.createElement('div', null,
        React.createElement('label', null, 'Name: ')
        React.createElement('input',  
            { type: 'text', value: this.state.yourName,  
            onChange: (event) => this.handleChange(event) }
        React.createElement('h1', null,  
            'Hello ', this.state.yourName, '!')
    );
}
```
Use JSX to generate calls to createElement

```jsx
render() {
  return (
    <div>
      <label>Name: </label>
      <input type="text" value={this.state.yourName} onChange={this.handleChange} />
      <h1>Hello {this.state.yourName}!</h1>
    </div>
  );
}
```

- JSX makes building tree look like templated HTML embedded in JavaScript.
Component state and input handling

```javascript
import React from 'react';

class ReactAppView extends React.Component {
  constructor(props) {
    super(props);
    this.state = {yourName: ''};
  }
  handleChange(event) {
    this.setState({ yourName: event.target.value });
  }
  ....

  ● Input calls to setState which causes React to call render() again

  Make <h1>Hello {this.state.yourName}!</h1> work
```
One way binding: Type 'D' Character in input box

- JSX statement: `<input type="text" value={this.state.yourName} onChange={() => this.handleChange(event)}/>

  Triggers `handleChange` call with `event.target.value == "D"`

- `handleChange - this.setState({yourName: event.target.value});`

  `this.state.yourName` is changed to "D"

- React sees state change and calls render again:

- Feature of React - highly efficient re-rendering

  "Hello D!"
Calling React Components from events: A problem

class ReactAppView extends React.Component {
  ...
  handleChange(event) {
    this.setState({ yourName: event.target.value });
  }
  ...
}

Understand why:

<input type="text" value={this.state.yourName} onChange={this.handleChange} />

Doesn't work!
Calling React Components from events workaround

- Create instance function bound to instance

```javascript
class ReactAppView extends React.Component {
    constructor(props) {
        super(props);
        this.state = {yourName: ""};
        this.handleChange = this.handleChange.bind(this);
    }
    handleChange(event) {
        this.setState({ yourName: event.target.value });
    }
}
```
Calling React Components from events workaround

- Using public fields of classes with arrow functions

```javascript
class ReactAppView extends React.Component {
  constructor(props) {
    super(props);
    this.state = {yourName: ""};
  }
  handleChange = (event) => {
    this.setState({ yourName: event.target.value });
  }
  ...
}
```
Calling React Components from events workaround

- Using arrow functions in JSX

```javascript
class ReactAppView extends React.Component {
    
    handleChange(event) {
        this.setState({ yourName: event.target.value });
    }

    render() {
        return (  
            <input type="text" value={this.state.yourName} 
            onChange={(event) => this.handleChange(event)} />
        );
    }
}
```
A digression: camelCase vs dash-case

Word separator in multiword variable name

- Use dashes: active-buffer-entry
- Capitalize first letter of each word: activeBufferEntry

Issue: HTML is case-insensitive but JavaScript is not. ReactJS's JSX has HTML-like stuff embedded in JavaScript.

ReactJS: Use camelCase for attributes

AngularJS: Used both: dashes in HTML and camelCase in JavaScript!
Programming with JSX

● Need to remember: JSX maps to calls to React.createElement
  ○ Writing in JavaScript HTML-like syntax that is converted to JavaScript function calls

● React.createElement(type, props, ...children);
  ○ type: HTML tag (e.g. h1, p) or React.Component
  ○ props: attributes (e.g. type="text") Uses camelCase!
  ○ children: Zero or more children which can be either:
    ■ String or numbers
    ■ A React element
    ■ An Array of the above
JSX templates must return a valid children param

- Templates can have JavaScript scope variables and expressions
  - `<div>{foo}</div>`
    - Valid if foo is in scope (i.e. if foo would have been a valid function call parameter)
  - `<div>{foo + 'S' + computeEndingString()}</div>`
    - Valid if foo & computeEndString in scope

- Template must evaluate to a value
  - `<div>{if (useSpanish) { ... } }</div>` - Doesn't work: if isn't an expression
  - Same problem with "for loops" and other JavaScript statements that don't return values

- Leads to contorted looking JSX: Example: Anonymous immediate functions
  - `<div>{ (function() { if ...; for ..; return val; })() }</div>`
Conditional render in JSX

- Use JavaScript Ternary operator (?:)
  ```jsx
  <div>{this.state.useSpanish ? <b>Hola</b> : "Hello"}</div>
  ```

- Use JavaScript variables

```javascript
let greeting;
const en = "Hello"; const sp = <b>Hola</b>;
let {useSpanish} = this.prop;
if (useSpanish) {greeting = sp} else {greeting = en};
<div>{greeting}</div>
```
Iteration in JSX

● Use JavaScript array variables

```javascript
let listItems = [];
for (let i = 0; i < data.length; i++) {
    listItems.push(<li key={data[i]}>Data Value {data[i]}</li>);
}
return <ul>{listItems}</ul>;
```

● Functional programming

```javascript
<ul>{data.map((d) => <li key={d}>Data Value {d}</li>)}</ul>
```

key= attribute improves efficiency of rendering on data change
Styling with React/JSX - lots of different ways

```javascript
import React from 'react';
import './ReactAppView.css';
class ReactAppView extends React.Component {
  ...
  render() {
    return (
      <span className="cs142-code-name">
        ...
      </span>
    );
  }
}
```

Webpack can import CSS style sheets:
```
.cs142-code-name {
  font-family: Courier New, monospace;
}
```

Must use `className=` for HTML `class=` attribute (JS keyword conflict)
Component lifecycle and methods

http://projects.wojtekmaj.pl/react-lifecycle-methods-diagram/
Example of lifecycle methods - update UI every 2s

class Example extends React.Component {
...
    componentDidMount() { // Start 2 sec counter
        const incFunc = () => this.setState({ counter: this.state.counter + 1 });
        this.timerID = setInterval(incFunc, 2 * 1000);
    }

    componentWillUnmount() { // Shutdown timer
        clearInterval(this.timerID);
    }
...

Stateless Components

- React Component can be function (not a class) if it only depends on props

  ```javascript
  function MyComponent(props) {
    return <div>My name is {props.name}</div>;
  }
  ```

  Or using destructuring...

  ```javascript
  function MyComponent({name}) {
    return <div>My name is {name}</div>;
  }
  ```

- Much more concise than a class with `render` method
  - But what if you have one bit of state...
React Hooks - Add state to stateless components

- **Inside of a "stateless" component add state:** `useState(initialStateValue)`
  - `useState` parameter: `initialStateValue` - the initial value of the state
  - `useState` return value: An two element polymorphic array
    - 0th element - The current value of the state
    - 1st element - A set function to call (like `this.setState`)

- **Example: a bit of state:**
  ```javascript
  const [bit, setBit] = useState(0);
  ```

- **How about lifecycle functions (e.g. `componentDidUpdate`, etc.)?**
  - `useEffect(lifecycleFunction, dependency array)`
    - `useEffect` parameter `lifecycleFunction` - function to call when something changes
import React, { useState } from 'react';

function Example() {
    const [count, setCount] = useState(0);
    return (
        <div>
            <p>You clicked {count} times</p>
            <button onClick={() => setCount(count + 1)}>Click me</button>
        </div>
    );
}
import React, { useState, useEffect } from 'react';

function Example() {
  const [count, setCount] = useState(0);
  const [fetch, setFetch] = useState(false);
  useEffect(() =>{
    setCount(modelFetch());
    setFetch(true);
  }, [fetched]);
  return (
    <div>
      <p>You clicked {count} times</p>
      <button onClick={() => setCount(count + 1)}>Click me</button>
    </div>
  );
}
Communicating between React components

- Passing information from parent to child: Use props (attributes)
  
  ```jsx
  <ChildComponent param={infoForChildComponent} />
  ```

- Passing information from child to parent: Callbacks

  ```jsx
  this.parentCallback = (infoFromChild) => {
    /* processInfoFromChild */
  }

  <ChildComponent callback={this.parentCallback} />
  ```

- React Context ([https://reactjs.org/docs/context.html](https://reactjs.org/docs/context.html))
  - Global variables for subtree of components