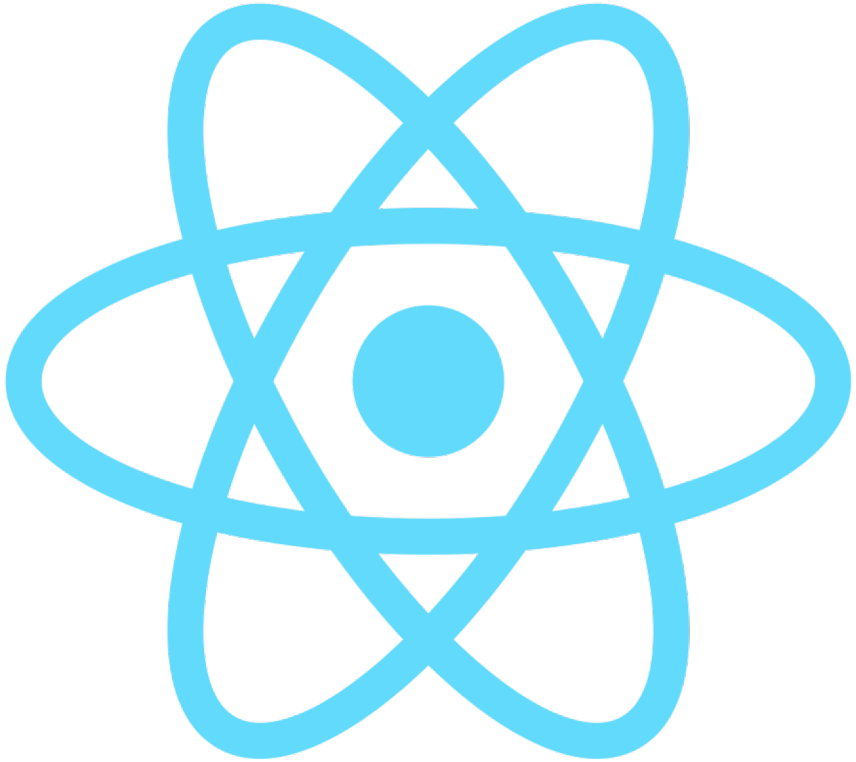
ITMD 465/565
Rich Internet Applications

Lecture 11

Fall 2019 – October 30, 2019

Tonight's Agenda

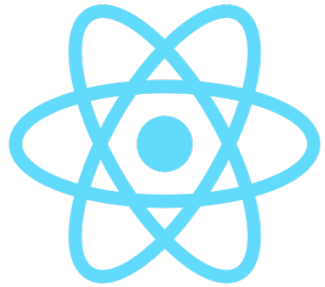
- Finish Class 10 Slides
- ReactJS Introduction / Fundamentals
- Elements, Components, State, Props



ReactJS

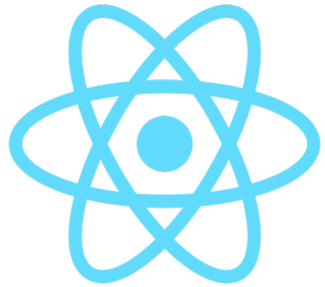
JavaScript library for building user interfaces

React JS



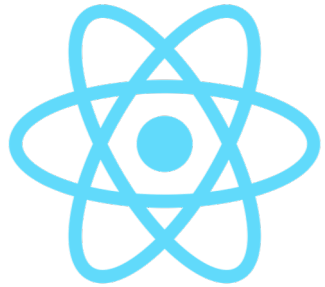
- Created at Facebook by software engineer Jordan Walke
- An early prototype in 2011 (FaxJS) shipped as a search element on Facebook. Jordan then worked on a prototype for the hard to manage Facebook Ads which became react.
- Deployed in newsfeed in 2011 and instagram.com in 2012 after Facebook acquired them.
- Open sourced at JSConf US May 2013
- Used to build interactive user interfaces for applications that have frequent data changes.
- When the components internal data changes it automatically updates the markup.
- Can be used to build UI components, single page applications (SPA), and iOS, Android or UWP when using React Native.
- https://en.wikipedia.org/wiki/React_(JavaScript_library)
- https://reactjs.org/
- https://facebook.github.io/react-native/

React JS



- What is React? A library for building user interfaces.
- Composition, Unidirectional Dataflow, Explicit Mutations, Just JavaScript
- You compose a user interface with components
- Component Based - Components are encapsulated chunks and manage their own state and can be nested inside each other
- Component logic is all in JavaScript and there are no HTML templates used
- Data is passed to the component through **properties** or **props** with a one way data flow
- Properties or props are a set of **immutable** values that gets passed to the components render function
- Components should not directly modify the values in props. Instead pass callback functions from the parents via props.

React JS



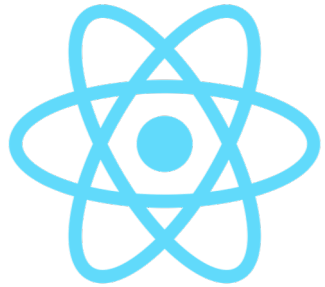
- Uses a “Virtual DOM” in the background and only updates the visible DOM when needed, including only updating the parts that need to.
- Can be used to build single page application or just components on an existing website or web application
- It can be directly used in the browser in a script tag or with a bundler to package all the JS files in one big file.
- Works well as a node js project. All modules used are typically node modules.
- There is a Create React App node package that will produce a skeleton app as a starting point with a preconfigured build pipeline.
- https://reactjs.org/docs/installation.html
- https://reactjs.org/docs/react-api.html

React JS - Composition

- You compose the UI out of multiple components

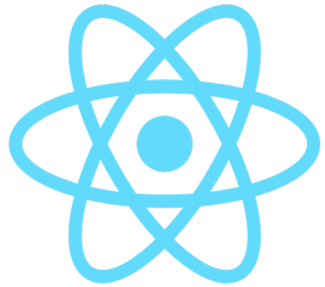
```
<Container>
    <NavBar />
    <Header />
    <DatePicker>
      <Calendar />
    </DatePicker>
    <Footer />
</Container>
```

React JS – Unidirectional Dataflow



- In a React app data flows from parent component to child component
- Data is passed as **props** to the component and the props are **immutable**
- If a component needs to save data/state it needs to do that in itself or get that data as props from a parent
- Props are added to a component as attributes of the component (in JSX) or as the second argument to a createElement() function call
- Different than a normal JS/Jquery app that is all event driven and just listening for events and modifying the DOM directly
- Remember Data flows down to the component and is immutable
- <HeaderComponent name="brian" />
- If you need to pass data back up the chain you need to pass down a function to run and call that function within the component

React JS – Unidirectional Dataflow



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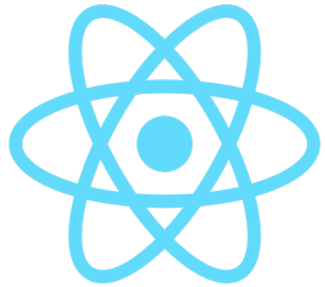
- Different than a normal JS/Jquery app that is all event driven and just listening for events and modifying the DOM directly
- Rember Data flows down to the component and is immutable
- <HeaderComponent name="brian" />
- Parent communicates with children using props, and children communicate with parents using callbacks

React JS – Explicit mutations



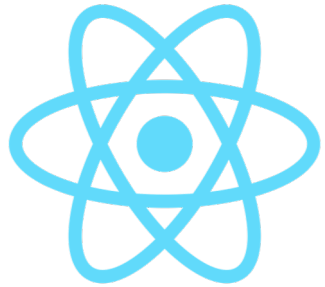
- You will explicitly change or mutate the components state to update the component
- This makes mutations explicit
- You use the setState() function to trigger this state mutation and pass it the updated state items

```
this.setState({
    name: 'brian',
    class: 'itmd4565'
})
```

Can also pass setState() a function that looks at the known good previous state

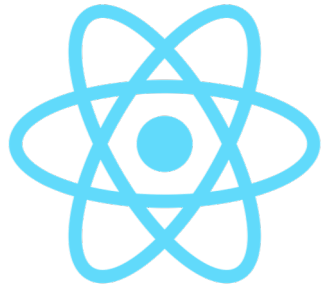
```
this.setState(prevState => ({
    seconds: prevState.seconds + 1
}))
```

React JS - JSX



- Can use an optional JSX syntax in your JavaScript code although typically JSX is used
- JSX is a JavaScript syntax extension
- This allows us to use what looks like HTML tag syntax to render our components.
- If we don’t use JSX we need use the React.createElement() function in its place
- JSX allows you to evaluate JavaScript expressions in your JSX with curly brackets { }
- Custom HTML attributes are passed in but need to start with data-
- Since JSX is not supported by browsers or runtimes you need to convert it to plain JS with a tool like babel.
- https://reactjs.org/docs/introducing-jsx.html

React JS – React Elements



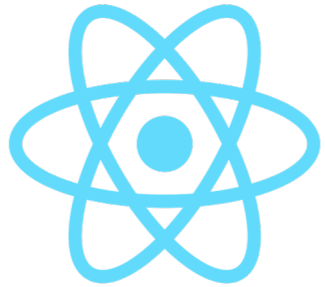
- Fundamental object and concept in React apps
- A React element is a JavaScript object representation that describes how you would like it to appear on the screen. This is a JavaScript representation of a DOM Node.
- Use React.createElement() to create an element
- All JSX will be converted to React Elements by babel

React.createElement(type, [props], [...children])

```
const element = React.createElement(
    'div',
    {id: 'button'},
    'Login Now'
)
```

- If you are not passing props use `null`, `props should be an object`

React JS – ReactDOM



- React does not provide a way to use elements in a web page by itself
- react-dom provides the DOM-specific methods that you can use to interact with the DOM in a web page
- We use the ReactDOM.render() method to render a React element into the web DOM

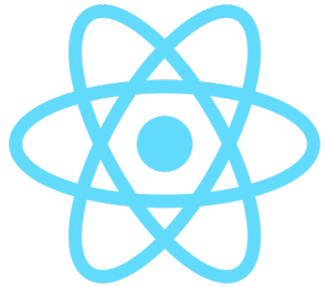
```
ReactDOM.render(element, container[, callback]);

const element = <h1>Hello, world</h1>;

ReactDOM.render(
    element, document.getElementById('app')
);
```

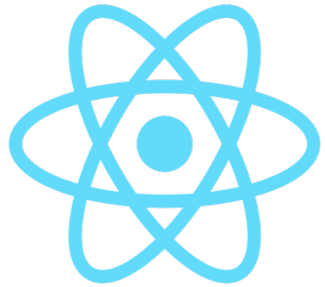
- https://reactjs.org/docs/react-dom.html

React JS - Components



- **A component is a function or a Class which optionally accepts input and returns a React element.**
- React components can be function based or class based
- React component names should start with a capital letter
- Optionally input via props are passed in to the function or class
- A component always returns a React element
- How do you decide if you want to use a function or class?
- If your component needs to save any data or state within the component you need to use a class and save the data in the components state.
- https://reactjs.org/docs/react-component.html

React JS – Functional Components



- Stateless functional components can be written as a simple function

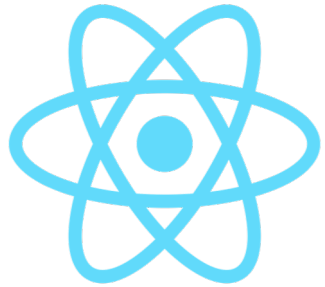
```
function HelloHeader(props){
    return (
        <h1>Hello World!</h1>
    );
}
```

Or

```
const HelloHeader = (props) => {
    return (
        <h1>Hello World!</h1>
    );
}

ReactDOM.render(<HelloHeader />, document.getElementById('app'));
```

React JS - Components

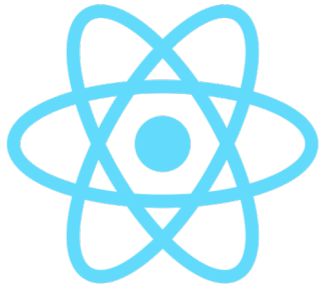


- Components should be designed as small possibility reusable elements that are added to a react app.
- Create components as ES6 classes. There was an old deprecated syntax that used React.createClass() instead of ES6 classes but it has been removed.
- **The only required method in the component class is the render() function**
- A basic example is below

```
Class HelloHeader extends React.Component {
    render() {
        return <h1>Hello World!</h1>;
    }
}

ReactDOM.render(<HelloHeader />, document.getElementById('app'));
```

React JS - Components

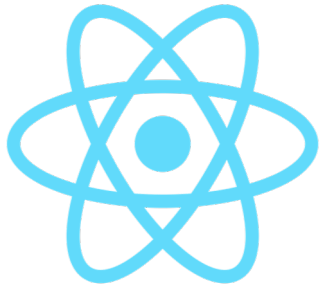


- The same basic component is below without JSX

```
Class HelloHeader extends React.Component {
    render() {
        return React.createElement('h1', null, 'Hello
World!');
    }
}
```

https://reactjs.org/docs/react-without-jsx.html

React JS - Components



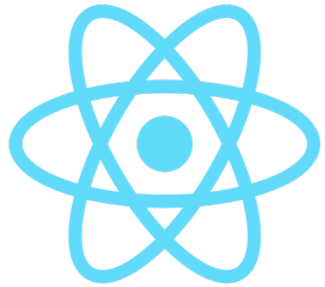
- Components can use other components

```
Class HelloHeader extends React.Component {
    render() {
        return <h1>Hello World!</h1>;
    }
}


Class Page extends React.Component {
    render(){
        return(
            <div>
                <HelloHeader />
            </div>

        );
    }
}
```

React JS – Data Flow



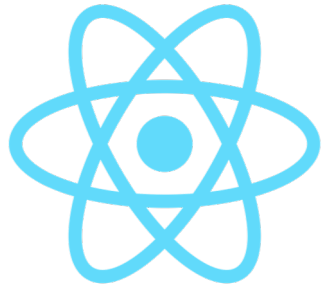
- Data flows from parent to child via properties and are available in the child with `this.props.` And properties are immutable.

```
Class HelloHeader extends React.Component {
    render() {
        return <h1>Hello {this.props.name}</h1>;
    }
}


Class Page extends React.Component {
    render(){
        return(
            <div>
                <HelloHeader name='Brian' />
            </div>

        );
    }
}
```

React JS – Data Flow

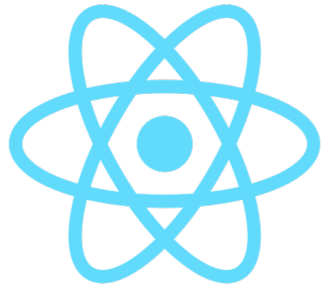


- Inverse Data Flow – Child to Parent
- Pass a parents event handler as a property on the child then in the child call that handler to pass data back to the parent for setting state or something else.

```
Class Page extends React.Component {
   render(){
      return (
         <MainHeader />
            <Greeting searchFunction={this.searchHandler}>Hello World!</Greeting>
         <MainFooter />
      );
   }

   searchHandler(e){
      console.log(e);
   }
}
```

React JS – State

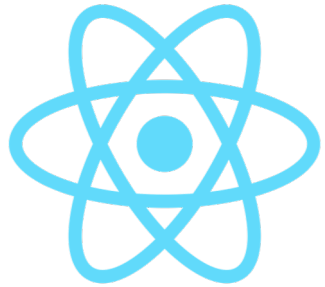


- State is place we can store data in a component and change the data to see a reflection in the UI.
- It is available in the this.state object
- Must add a constructor to your class and initialize the state there.

```
class App extends React.Component {
   constructor(props) {
      super(props);
      this.state = { header: "Header from state...", content: "Content from state..." }
   }
   render() {
      return ( <div> <h1>{this.state.header}</h1> <h2>{this.state.content}</h2> </div> );
   }
}
```

- Try to make the state as simple as possible and keep as many components stateless as possible. If you have many components that need state you should make a parent component that has the state in it and pass it down through props.

React JS – State



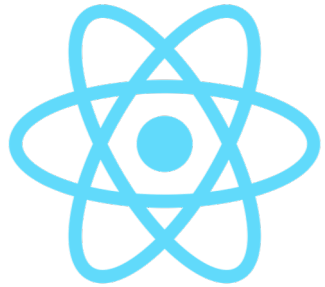
- Do not try to modify the state object directly

```
// Wrong
this.state.comment = ‘Hello’;

// Correct
this.setState( { comment: ‘Hello’ } );
```

- If you need to set state in one component from another you need to pass handlers down to the child component that then calls setState() in the parent that has the state object.
- The React library watches this state and when it detects changes it compares it to the browser DOM and updates only what is necessary

React JS

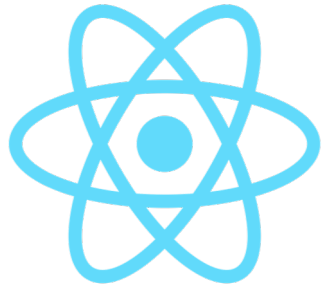


- Typically used with a Node JS project to manage dependencies but not necessary.
- If you write JSX you need to transpile to plain JS
- If you use ES6 features you may also want to compile with babel to support older devices
- For node based projects
  - npm install --save react react-dom
- Can be used in browser with a script tag too

```
<script crossorigin src="https://unpkg.com/react@16/umd/react.development.js"></script>
<script crossorigin src="https://unpkg.com/react-dom@16/umd/react-dom.development.js"></script>
```

- https://reactjs.org/docs/installation.html

React JS and Babel



- Babel is used to convert JSX to plain JavaScript React calls.
- Babel can also compile our ES6 to ES5
- Babel can be directly used in the browser for development purporses

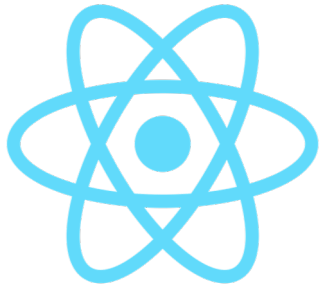
```
<script src="https://unpkg.com/@babel/standalone/babel.min.js"></script>
<!-- Your custom script here -->
<script type="text/babel">
    const getMessage = () => "Hello World";
    document.getElementById('output').innerHTML = getMessage();
</script>
```

- Need to configure the babel presets or it won't do anything. Typically in a .babelrc file.
- Need to load modules for the presets you want to use and then add them to the .babelrc
- https://babeljs.io/docs/setup/#installation

React JS and bundleing

- In an application that is all written in React it is common to use a bundler tool like webpack or browserify
- Browserify - http://browserify.org/
- Webpack - https://webpack.js.org/
- These tools take all the JavaScript files and combine them into a single file to load on your app.
- Browsers can not require or import other JavaScript files so this traces down all the imports/requires and inlines them into the final script.
- Each has a plugin ecosystem to do many other things too, like minified output
- We will look at webpack in a future class

React JS Resources



- https://reactjs.org/
- https://facebook.github.io/react-native/
- https://babeljs.io/
- http://browserify.org/
- https://webpack.js.org/
- https://learn.co/lessons/react-create-element
- https://www.tutorialspoint.com/reactjs/reactjs_state.htm
- https://ihatetomatoes.net/react-tutorial-for-beginners/
- I'll look for more

Assignments

Reading/Assignments

- Quiz will be posted later this week
- I will post a new Lab soon. Will cover things we didn't finish but won't be due until we do.
- It will be a very simple lab building some simple React components
- I wanted to see what we cover tonight first
- Details will go out via email