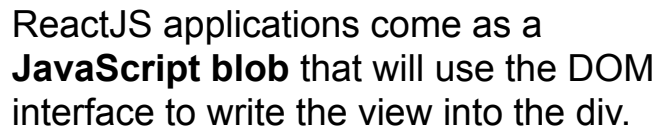# ReactJS Introduction

Mendel Rosenblum

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

```html
<!doctype html>
<html>
    <head>
        <title>CS142 Example</title>
    </head>
    <body>
        <div id="reactapp"></div>
        <script src="./webpackOutput/reactApp.bundle.js"></script>
    </body>
</html>
```
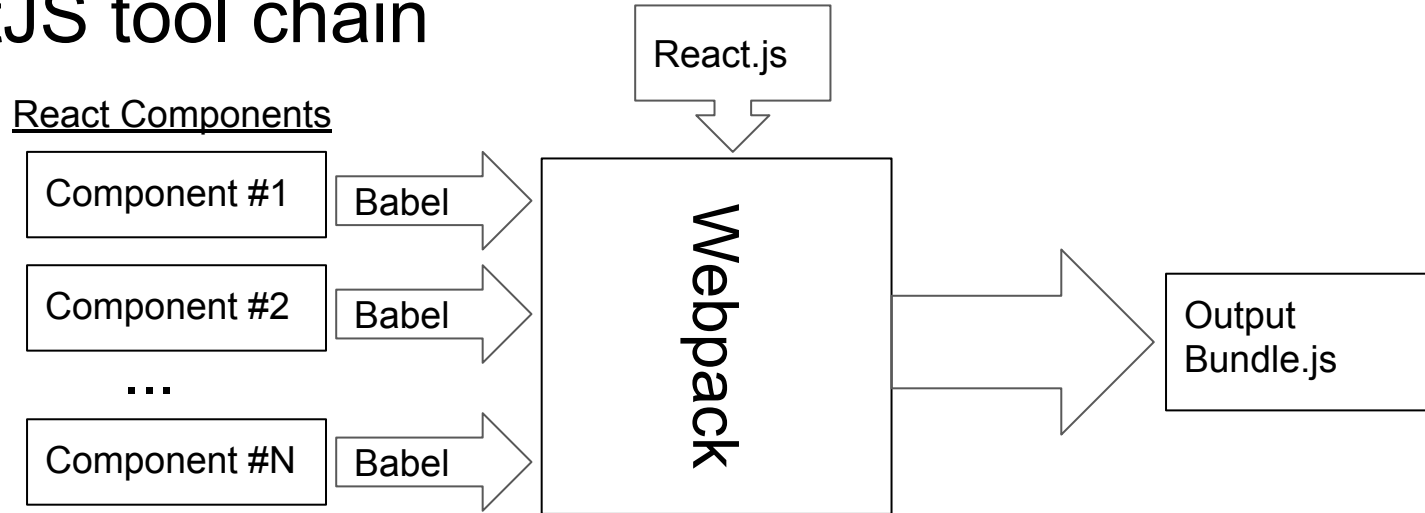
ReactJS applications come as a **JavaScript blob** that will use the DOM interface to write the view into the div.

ReactJS tool chain

React.js

React Components

Component #1 | Babel →

Component #2 | Babel →

...

Component #N | Babel →

Webpack

→ Output Bundle.js

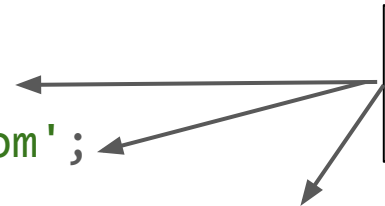**Babel** - Transpile language features (e.g. ECMAScript, JSX) to basic JavaScript

Webpack - Bundle modules and resources (CSS, images)

Output loadable with single `script` tag in any browser

reactApp.js - Render element into browser DOM

```javascript
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);
```

ES6 Modules - Bring in React and web app React components.

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

components/ReactAppView.js - ES6 class definition

```
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

```
<div>
    <label>Name: </label>
    <input type="text" … />
    <h1>Hello {this.state.yourName}!</h1>
</div>
```

```
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

Name: `Enter a name here`

Hello !

ReactAppView render() method w/o variables

```
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, '!')
    );
}
```

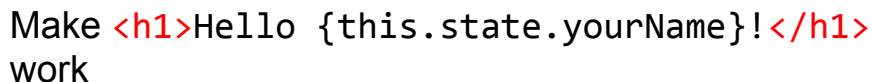# Use JSX to generate calls to createElement

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

Component state and input handling

```
import React from 'react';

class ReactAppView extends React.Component {
  constructor(props) {
    super(props);
    this.state = {yourName: ""};
  }

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

Make `<h1>`Hello {this.state.yourName}!`</h1>` work

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

One way binding: Type 'D' Character in input box

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

Name: D

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

```
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

```
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

```
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

```jsx
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

```
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

```
<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

```
import React from 'react';

import './ReactAppView.css';

class ReactAppView extends React.Component {
  ...
render() {
  return (
    <span className="cs142-code-name">
      ...
    </span>
  );
```
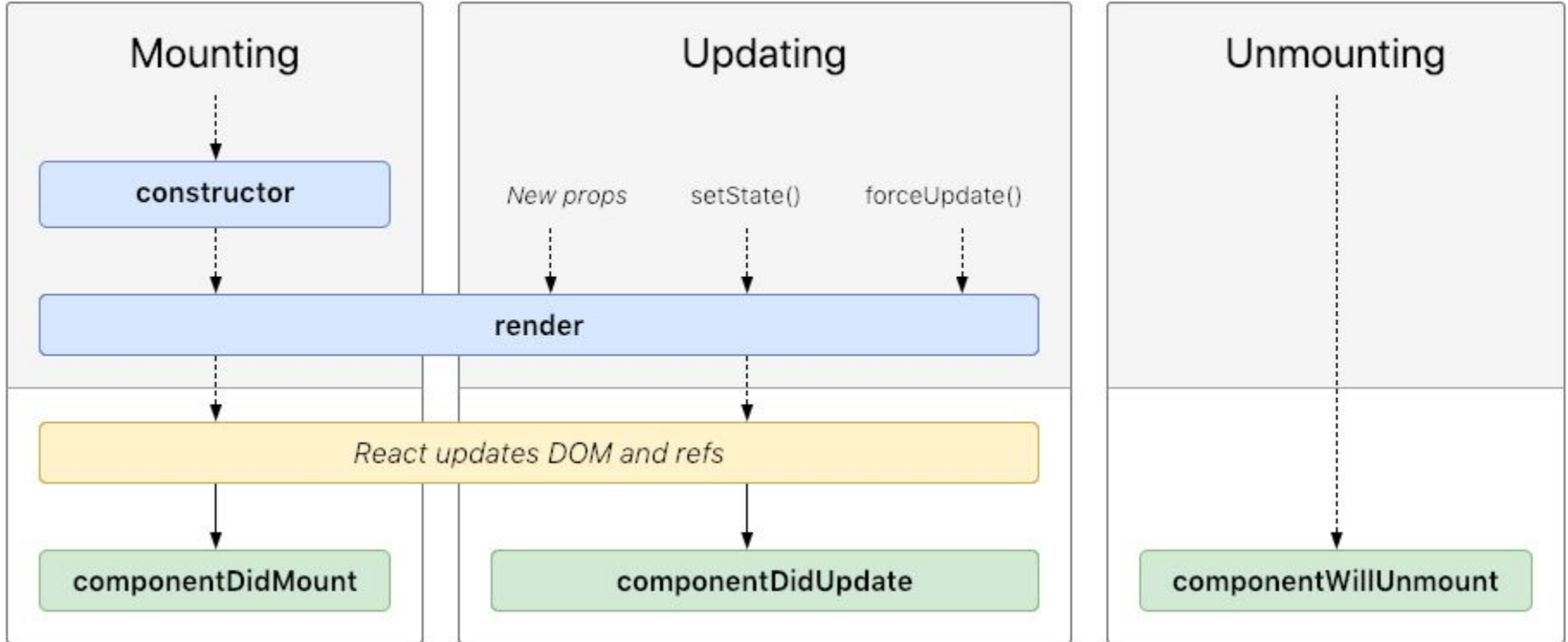
Webpack can import CSS style sheets:
```css
.cs142-code-name {
  font-family: Courier New, monospace;
}
```

Must use `className=` for HTML `class=` attribute (JS keyword conflict)

Component lifecycle and methods

Example of lifecycle methods

```
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

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

Or using destructuring...

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

Communicating between React components

- Passing information from parent to child: Use props (attributes)

  ```
  <ChildComponent param={infoForChildComponent> />
  ```

- Passing information from child to parent: Callbacks

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

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

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