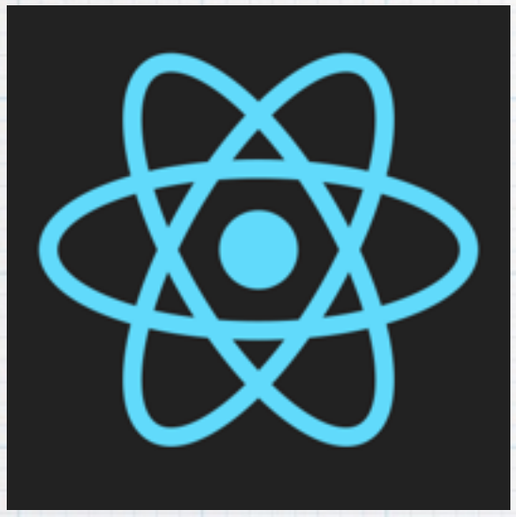


Workshop: React + Flux

Tim Coppieters

React?

React = JavaScript library that provides one-way data-binding from model to view.

React?

MVC

Model → View

(one-way!) data-binding

JS

```
var cat = {
    name: “kitty”,
    color: “pink”
}
```

HTML

React?

MVC

Model → View

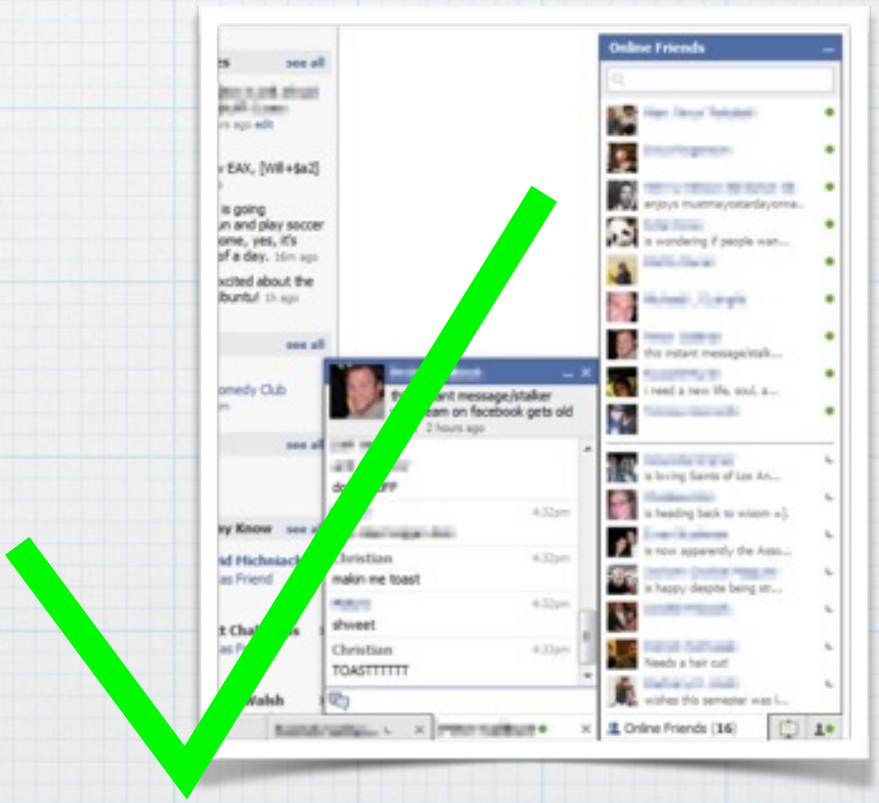
JS

```
var cat = {
    name: “kitty”,
    color: “blue”
}
```

HTML

When?

"Large applications with data that (frequently) changes over time"



Imperative/Stateful

```
function createKitten(name, color) {
    var kitten = {name: name, color: color};
    showDOMKitten(kitten);
    return kitten;
}
```

```
function showDOMKitten(kitten) {
    var dress = $('<div class="' + kitten.color + '">');
      .append(...)
    $('<div id="' + kitten.name '">')
                                    ns');
```

```
function updateColo                                  ten(kitten) {
    kitten.color = co                                '#' + kitten.name + ' .dress');
    updateDOMKitt                                    ss', kitten.color');
}
```

Fast

Terrible to manage

so why don't we write our code like this?

elarative/Stateless


```
function render(kitten) {
      return $('<div id="' + kitten.name '">')
          .append(
              $('<div class="' + kitten.color + '">');
                  .append(...));
}
```


```
var kitty ={name: 'kitty', color: 'pink'};
```

```
$('#kittens').html(render(kitty))
```

```
kitty.color = 'blue';
```

```
$('#kittens').html(render(kitty))
```

Easy to manage

Slow

React: Virtual DOM

recalculation of layout positioning, style sheets, etc.

Accessing the DOM is slow!

Keep a JavaScript object representation of the DOM that you entirely re-create when data changes.

Calculate minimal differences with previous version and execute necessary DOM operations to reflect changes.

React: Virtual DOM

JS

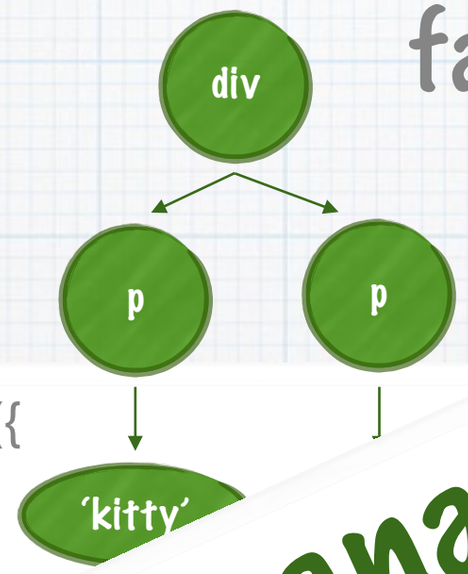
HTML

fast | slow

Virtual DOM

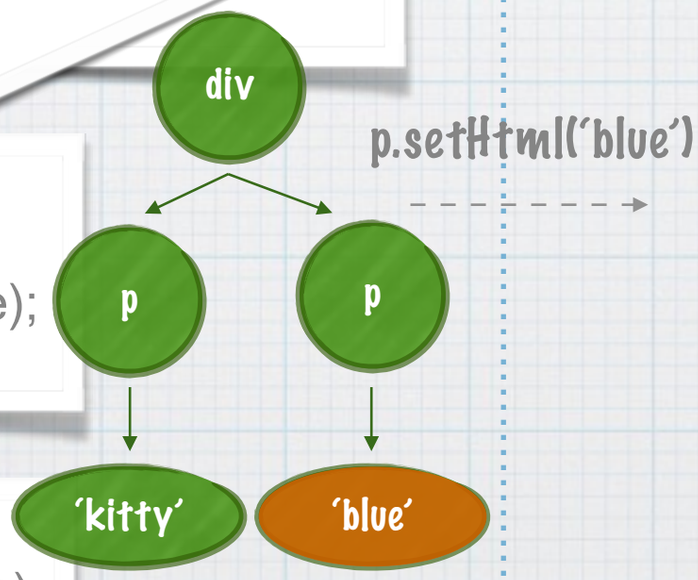
Real DOM

```
var KittenComponent = React.createClass({
  render: function() {
    return (
      React.createElement('div', null,
        React.createElement('p', null, this.
        React.createElement('p', {cla
    );
  }
});
```

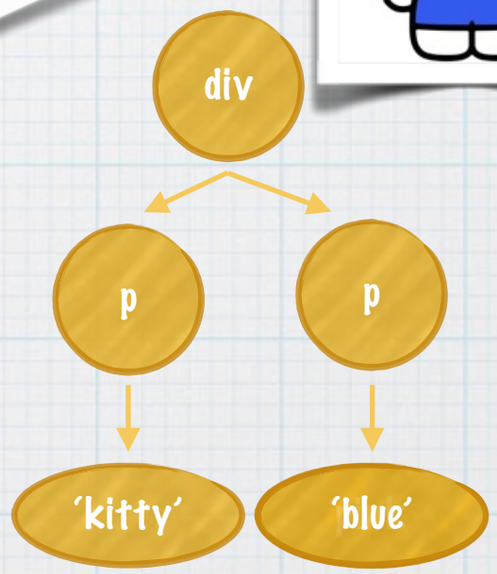


Easy to manage + Fast = Win!

```
var kitty = {name: 'kitty', color: 'pi
var node = document.body;
React.render(KittenComponent, {kitten: kitty}, node);
```



p.setHtml('blue')




```
kitty.color = 'blue';
React.render(KittenComponent, {kitten: kitty}, node);
```

pre-compiler
matter of taste,
but easy to copy pasta UI code from
your designer…

JSX Compiler

jsx (js + html)

```
var Kitten = React.createClass({
  render: function() {
    return (
      <div>
        <p> {this.props.name} </p>
        <p className={this.props.color}>
           {this.props.kitten.color}
         </p>
      </div>
    );
  }
});

React.render(<Kitten name="kitty"
                     color={getColor()} />,
             document.body);
```

javascript

```
var Kitten = React.createClass({
  render: function() {
    return (
      React.createElement(
        'div',
        React.createElement(
          'p',
          this.props.kitten.name),
        React.createElement(
          'p',
          {className: this.props.kitten.color},
          this.props.kitten.color));
    );
  }
});

React.render(Kitten({kitten: kitty,
                     color: getColor()}),
             document.body);
```

JSX Compiler*

Client-Side (Development)

```
<script src="http://fb.me/JSXTransformer-0.13.2.js"></script>
```

Server-Side (Production)

```
> jsx src/KittenBox.js lib/KittenBox.js
```

Server-Side++ (Development + Production)

```
> watchify -o lib/bundle.js -v -d src/app.js
```

Rendering

lower-case

HTML elements

```
var myDiv = <div className="kitten" />;
React.render(myDiv, document.body);
```

upper-case

Component

```
var MyComponent = React.createClass({ … });
React.render(<MyComponent property=“foo” />, document.body);
```

Components = Composing

```
var WorkshopComponent = React.createClass({
  render: function() {
    return (
      <div id="workshop">
        <TitleComponent title="Workshop" subtitle="JSConfBE" />
        <DividerComponent />
        <MainComponent />
      </div>
    );
  }
});

React.render(<WorkshopComponent />,
                    document.body);
```

```
var TitleComponent = React.createClass({
  render: function() {
    return (
      <div class="title">
        <h1> { this.props.title } </h1>
        <h2> { this.props.subtitle } </h2>
      </div>
    );
  }
});
```

Components = Composing

```
var QuestionsList = React.createClass({
    render: function() {
        var questions = this.props.questions.map(function (question) {
            return <QuestionItem question={question} />;
        };
         return (
            <ul id="questions">
                {questions}
            </ul>
        );
    }
});

React.render(<QuestionsList />, node);
```

```
var QuestionItem = React.createClass({
    render: function() {
        return (
         <li class="question">
             <p> {this.props.question.text} </p>
             <p> {this.props.question.author} </p>
         </li>
        );
    }
});
```

Component Data

props

immutable within the component

use as much as possible

```
var TitleComponent = React.createClass({
  render: function() {
    return (
      <div class="title">
        <h1> { this.props.title } </h1>
        <h2> { this.props.subtitle } </h2>
      </div>
    );
  }
});

React.render(<TitleComponent
                title="foo"
                subtitle={getSubTitle()} />,
              node);
```

state

if you need to respond to changes from user input, server responses...

```
var SwitchButton = React.createClass({
  getInitialState: function () {
     return {on: false}
  },
  handleClick: function () {
     this.setState({on: !this.state.on});
  },
  render: function() {
      var text = this.state.on ? 'off' : 'on';
      return (
         <button onClick={this.handleClick}>
           turn { text }!
         </button>
      );
  }
});
```

Use State

* It is not passed in from a parent via props.
* It can change over time.
* You cannot compute it based on any other state or props in your component.

Using State ✓

* Data that a component's event handlers may change to trigger a UI update.
* Small and JSON-serializable.
* Minimal possible representation

Using State 

* Computed data
* React Components
* Data from props

State in Component

* As many components as possible stateless (props)

* Common pattern: lots of stateless components with a stateful component above that passes state through props

* Put state that is shared between components in a common ancestor

Reconciliation Strategy

* = how react updates the DOM with a new render pass
* Children according to order

Reconciliating State

```
var Kitten = React.createClass({
   getInitialState: function() {
         return {color: ‘pink’};
   },
   handleClick: function () {
         this.setState({color: this.state.color == ‘pink’ ? ‘blue’ : ‘pink’});
   },
   render: function() {
     return (
        <div onClick={this.handleClick}>
            <p> {this.props.kitten.name} </p>
            <p className={this.state.color} />
        </div>
     );
   }
});
```

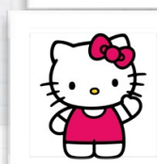

```
<ul>
      <Kitten kitten={kitten1} />
      <Kitten kitten={kitten2} />
</ul
```

```
<ul>
      <Kitten kitten={kitten2} />
</ul
```

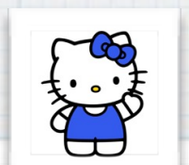
```
ul.removeChild(1);
ul.children(0).setHtml(“kitten 2”);
```

Reconciliating State

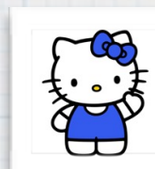
```
var Kitten = React.createClass({
   getInitialState: function() {
         return {color: ‘pink’};
   },
   handleClick: function () {
         this.setState({color: this.state.color == ‘pink’ ? ‘blue’ : ‘pink’});
   },
   render: function() {
     return (
        <div onClick={this.handleClick}>
            <p> {this.props.kitten.name} </p>
            <p className={this.state.color} />
        </div>
     );
   }
});
```




```
<ul>
      <Kitten key={kitten1.name} kitten={kitten1} />
      <Kitten key={kitten2.name} kitten={kitten2} />
</ul
```



```
<ul>
      <Kitten key={kitten2.name} kitten={kitten2} />
</ul
```



ul.removeChild(0);

Component API

```
var Box = React.createClass({
   getInitialState: function() {
         return {foo: 1, bar: 2};
   },
   doSomething: function () {
         this.setState({foo: 10});
   }
});
```

```
var Box = React.createClass({
   getInitialState: function() {
         return {...};
   },
   getDefaultProps: function() {
         return {...};
   },
   componentDidMount: function () {
   },
   componentWillUnmount: function () {
   },
   render: function() {
        return ( ... );
   }
});
```

Merges with provided props

After DOM is removed

After DOM is generated

e.g. when this Component is owned
by another component
and it no longer generates this component.

Component & DOM

```
var Box = React.createClass({
  componentDidMount: function () {
        var node = this.getDOMNode();
        React.findDOMNode(this);
  },
  submitForm: function () {
        var name = React.findDOMNode(this.refs.name).value;
        var color = React.findDOMNode(this.refs.color).value;
  },
  render: function() {
      return (
          <form onSubmit={this.submitForm}>
            <input ref="name" />
            <input ref="color" />
            <input type="submit" value="submit"/>
          </form>
        );
  }
});
```

Prop Validation

```
var KittenBox = React.createClass({
   propTypes: {
         name: React.PropTypes.string.isRequired,
         color: React.PropTypes.string
   },
   getDefaultProps: {
         return {color: ‘pink’};
   },
   render: function() {
       return (
           <div>
               <div> {this.props.name} </div>
               <div> {this.props.color} </div>
           </div>
       );
   }
});
```

optional

provide default

Prop Validation

```
function Kitten(name, color) {
      this.name = name;
      this.color = color;
}
```

```
var KittenBox = React.createClass({
   propTypes: {
         kitten: React.PropTypes.instanceOf(Kitten).isRequired
   },
   render: function() {
        return (
            <div>
                 <div> {this.props.kitten.name} </div>
                 <div> {this.props.kitten.color} </div>
            </div>
         );
   }
});
```

And many more

http://facebook.github.io/react/docs/reusable-components.html

More...

two-way data binding

className manipulation

* Addons

* Server-Side Rendering

```
var body = React.renderToString(WorkshopComponent(props));
```

http://facebook.github.io/react/docs/addons.html

React vs other MV(C)s

* Just a rendering library
  vs Full-fledged frameworks
* Full JavaScript expressiveness for rendering
  vs Restrictive GUI Constructs (e.g. ng-repeat)
* Virtual DOM Comparison
  vs Explicit Linking
* Overall Relatively Fast and memory efficient.
* Server-Side Rendering

Enough React already, what about Flux?

Flux = Design pattern that eschews MVC over a uni-directional data flow.

Case: KittenModel

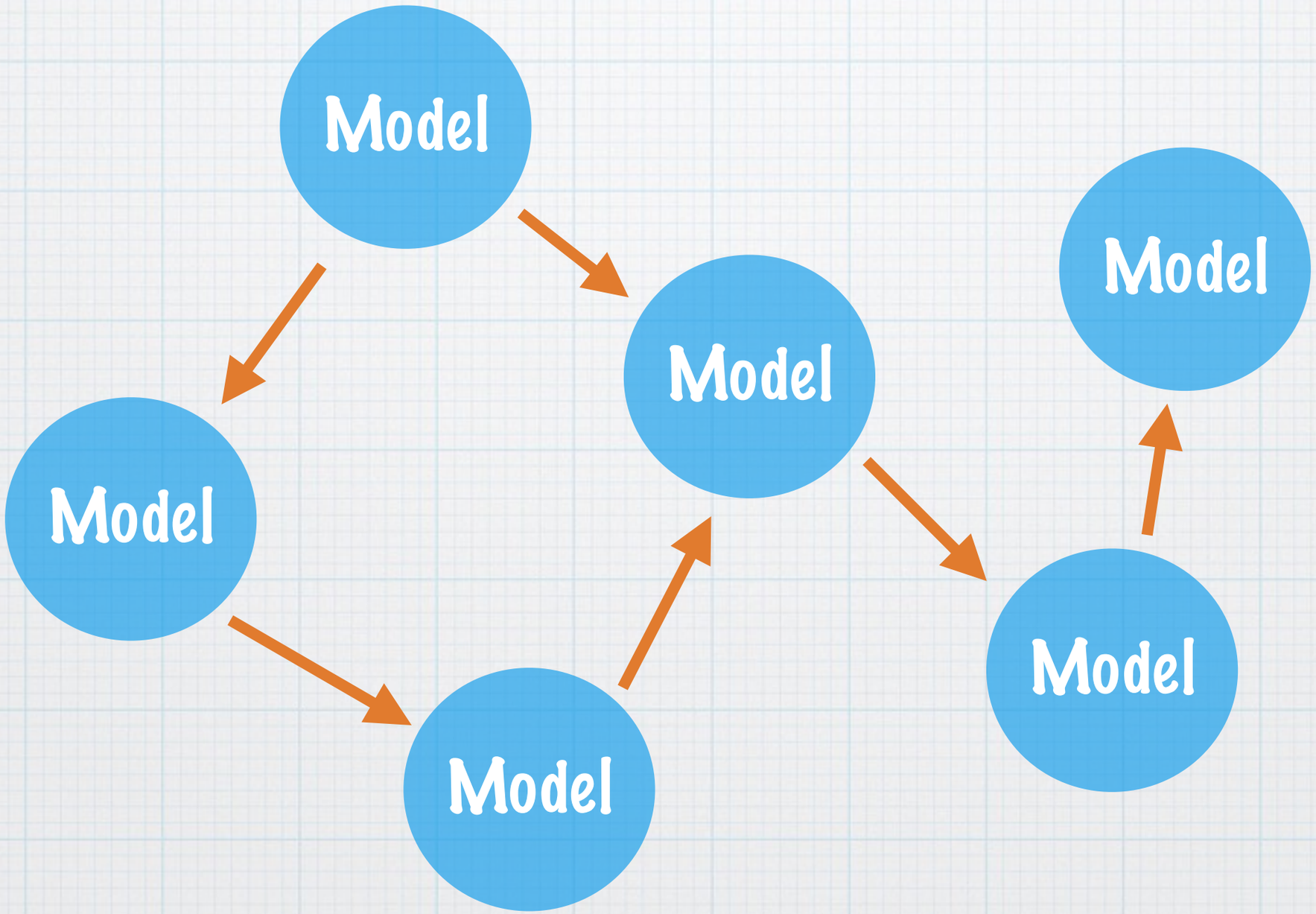
which user actions can change my kitten's color?

```
function KittenModel(name, color) {
	this.name = name;
	this.color = color;
}
KittenModel.prototype.updateColor = function (color) {
	this.color = color;
}
```

In MVC, you have to go and look at all of your controllers

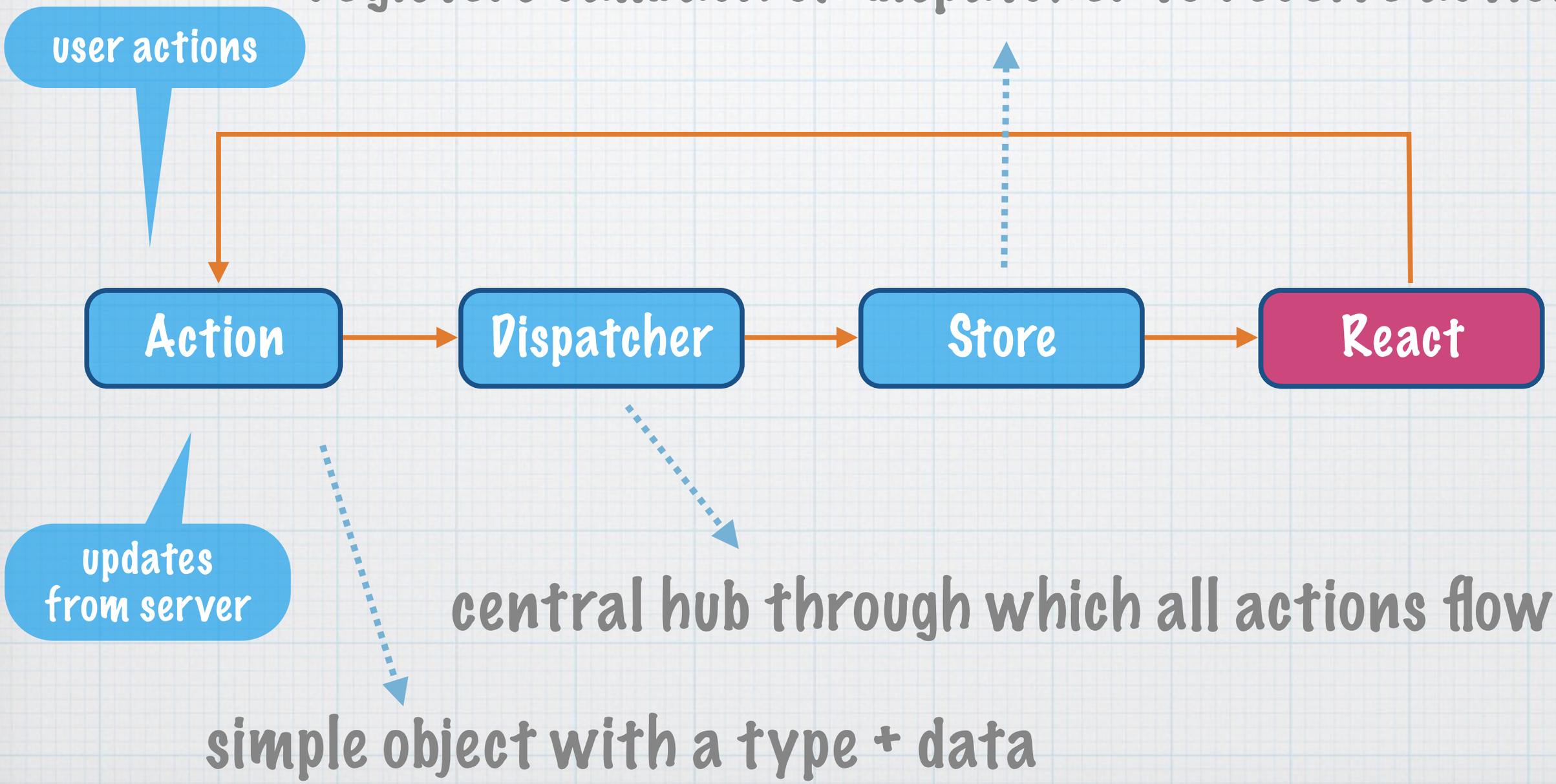
The M in MVC is not self-contained

Dependencies of Models

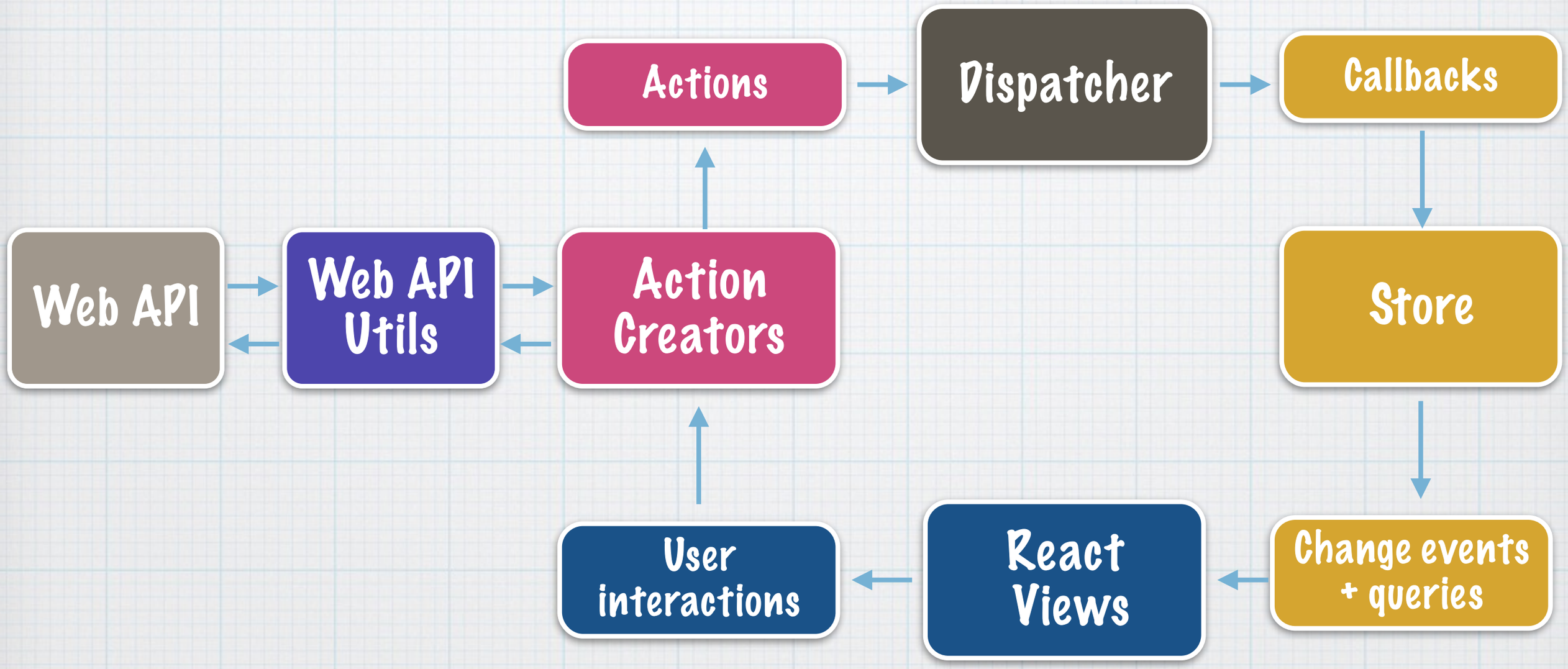


Flux: uni-directional data flow

registers callback on dispatcher to receive actions

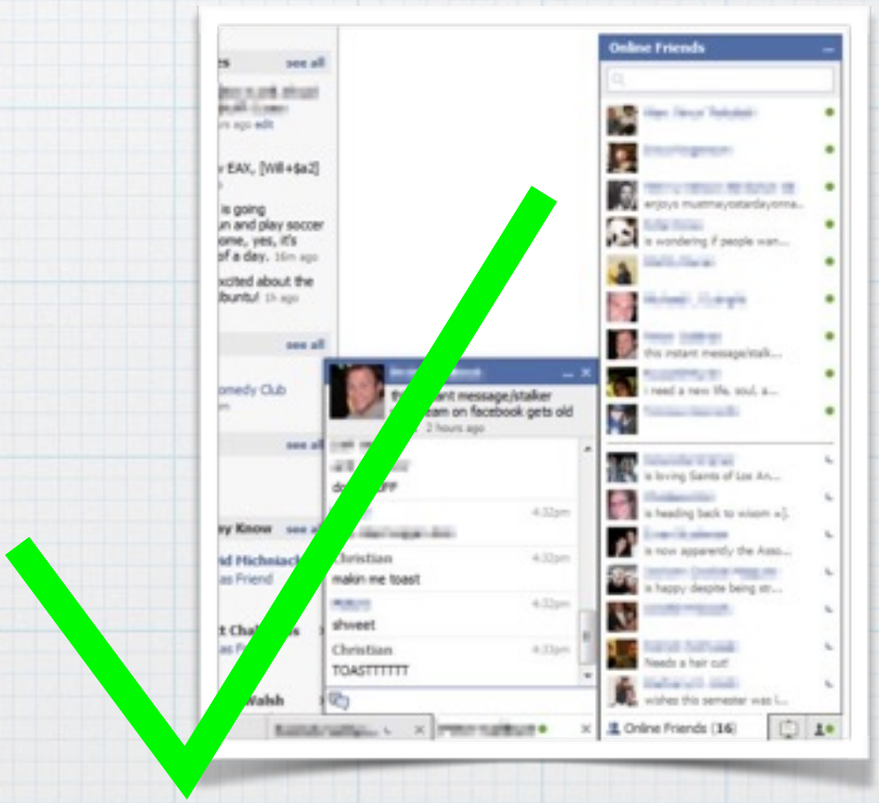


Flux: uni-directional data flow



When?

"Large applications with data that (frequently) changes over time"



Stores

in MVC the controller does the correct propagation

* Store contains data + logic about a certain **domain**. They can manage multiple "records", so not always like models.
* Accepts updates and appropriately reconciles them = **inversion of control**
* All **update patterns are internal** to the store, nobody knows about it.
* **No external update methods** like "setColor(color)", only the callback registered to dispatcher.

Flux Pattern Implementation

* Stores -> EventEmitter
* Views -> React
* Action -> just an object
* Action Creators -> Lib of functions
* Web API (utils) -> Lib of functions
* Dispatcher -> require('flux').Dispatcher

File Structure

- actions
  - KittenActionCreators.js
- components
  - KittenApp.js
  - Header.js
  - Footer.js
  - KittenList.js
- constants
  - AppConstants.js
- dispatcher
  - AppDispatcher.js
- stores
  - KittenStore.js
- utils
  - KittenWebAPI.js
  - KittenWebUtils.js
- app.js

Intermezzo

foo.js

```
var private = 42;
function privateFunction() { … }
module.exports = {
        exportedFunction: function () { privateFunction(); }
};
```

bar.js

```
var foo = require('./foo.js');
foo.exportedFunction()
```

* node.js require module system
* browserify

```
> browserify src/app.js public/bundle.js
```

utils/KittenWebAPIUtils.js

```
socket.on('kitten:new', function (kitten) {
    KittenActionCreators.receiveKitten(kitten);
});
```

AppDispatcher.js

```
var Dispatcher = require('flux').Dispatcher;

module.exports = new Dispatcher();
```

actions/KittenActionCreators.js

```
module.exports = {
    receiveKitten: function (kitten) {
        AppDispatcher.dispatch({
            type: ActionTypes.RECEIVE_RAW_KITTEN,
            rawKitten: kitten
        });
    }
};
```

utils/KittenWebUtils.js

```
module.exports = {
    convertRawKitten: function (rawKitten) {
        return {
            name: rawKitten.name,
            color : rawKitten.color,
            DateOfBirth: new Date(rawKitten.DateOfBirth)
        };
    };
};
```

constants/AppConstants.js

```
module.exports = {
    ActionTypes: {
        RECEIVE_RAW_KITTEN: "RECEIVE_RAW_KITTEN"
    }
};
```

stores/KittenStore.js

```
var assign          = require('object-assign');
var EventEmitter    = require('events').EventEmitter;
var utils           = require('../utils/KittenWebUtils');
var AppDispatcher = require('../dispatcher/AppDispatcher');
var ActionTypes     = require('../constants/AppConstants').ActionTypes;

var kittens = [];
var CHANGE_EVENT = 'change';

function _addRawKitten(rawKitten) {
    kittens.push(utils.convertRawKitten(kitten));
}

var KittenStore = assign({}, EventEmitter.prototype, {
    ...
    getAll: function () {
        return kittens;
    },
    getSortedByDateOfBirth: function () {
        return kittens.sortBy(function (kitten) { return kitten.DateOfBirth; });
    }
});

KittenStore.dispatchToken = AppDispatcher.register(function (action) {
    switch(action.type) {
        case ActionTypes.RECEIVE_RAW_KITTEN:
            _addRawKitten(action.rawKitten);
            KittenStore.emitChange();
            break;
    }
});
module.exports = KittenStore;
```

```
var KittenStore = ... {
    emitChange: function () {
        this.emit(CHANGE_EVENT);
    },
    addChangeListener: function (cb) {
        this.on(CHANGE_EVENT, cb);
    },
    removeChangeListener: function (cb) {
        this.remove(CHANGE_EVENT, cb);
    }
}
```

components/KittenList.js

```
var KittensBox = React.create({
    getInitialState: function () {
        return {kittens: KittenStore.getSortedByDateOfBirth()};
    },
    componentDidMount: function () {
        KittenStore.addChangeListener(this._onChange);
    },
    componentDidUnmount: function () {
        KittenStore.removeChangeListener(this._onChange);
    },
    _onChange: function () {
        this.setState({kittens: KittenStore.getSortedByDateOfBirth()});
    },
    render: function () {
        return (
            <div id="kittens">
                <h1> These are my kittens </h1>
                <KittenList kittens={this.state.kittens} />
            </div>
        );
    }
});
```

Dispatch: WaitFor*

```
KittenStore.dispatchToken = AppDispatcher.register(function (action) {
    switch(action.type) {
        case ActionTypes.RECEIVE_RAW_KITTEN:
            AppDispatcher.waitFor(PawStore.dispatchToken);
            _addRawKitten(action.rawKitten);
            KittenStore.emitChange();
            break;
    }
});
module.exports = KittenStore;
```

To work!

* https://github.com/ticup/jsconfbe2015

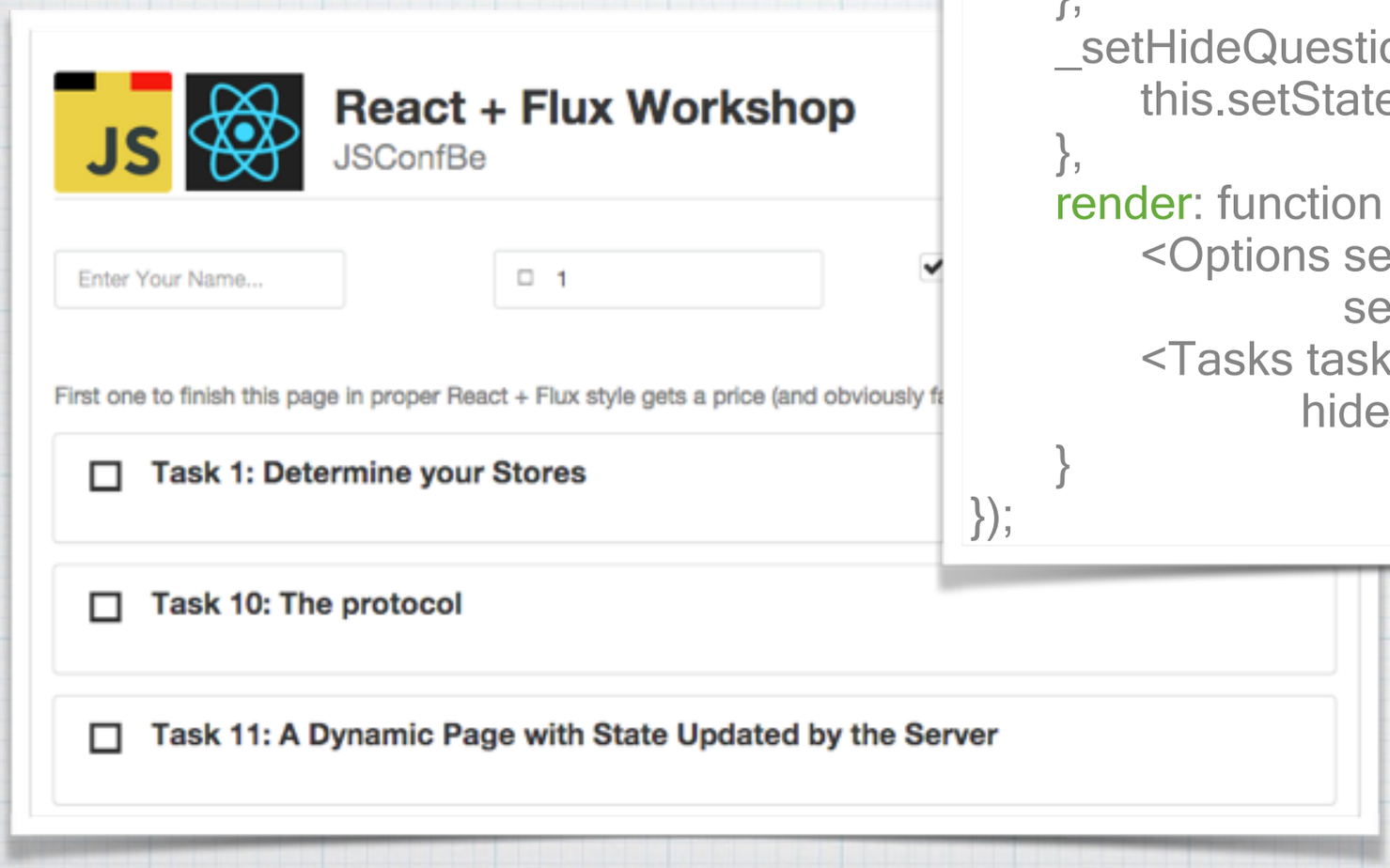
Common Component Problems

* attributes: "class" -> "className"
* Uncaught TypeError: type.toUpperCase is not a function
  -> One of your component files isn't exporting a Component
* is render returning something? (one element)

https://facebook.github.io/react/html-jsx.html

State Update: Inversion Of Control

```
var MainComponent = React.createClass({
    getInitialState: function () {
        return {taskFilter: “”, hideQuestions: false};
    },
    _setTaskFilter: function (val) {
        this.setState({taskFilter: val});
    },
    _setHideQuestions: function (val) {
        this.setState({hideQuestions: val});
    },
    render: function () {
        <Options setTaskFilter={this._setTaskFilter}
                 setHideQuestion={this._setHideQuestions} />
        <Tasks taskFilter={this.state.taskFilter}
               hideQuestions={this.state.hideQuestions} />
    }
});
```



State Update: Inversion Of Control++

```
var MainComponent = React.createClass({
    getInitialState: function () {
        return {taskFilter: OptionStore.getTaskFilter(),
                hideQuestions: OptionStore.getHideQuestions()};
    },
    componentDidMount: function () {
        OptionStore.addChangeListener(this._onChange);
    },
    _onChange: function () {
        this.setState({OptionStore.getTaskFilter(), OptionStore.getHideQuestions()});
    },
    render: function() {
        <Options />
        <Tasks taskFilter={this.state.taskFilter}
                hideQuestions={this.state.hideQuestions} />
    }
});
```