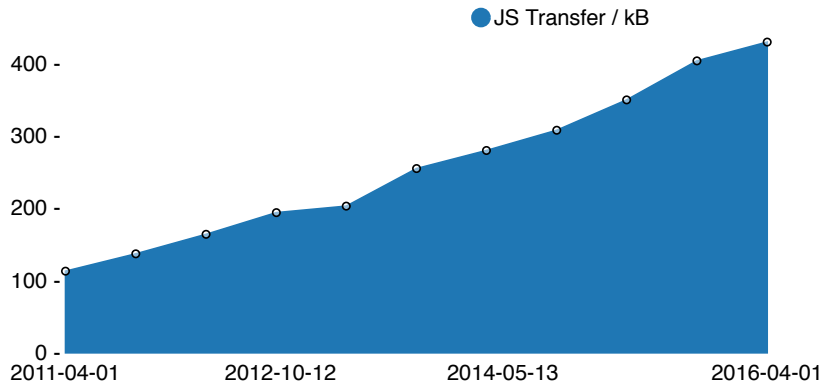
BEYOND FLUX

SCALABLE FRONTEND ARCHITECTURES USING PUBLISH/SUBSCRIBE

Michael Kurze @ goto Amsterdam 2016

WHY ARCHITECTURE?

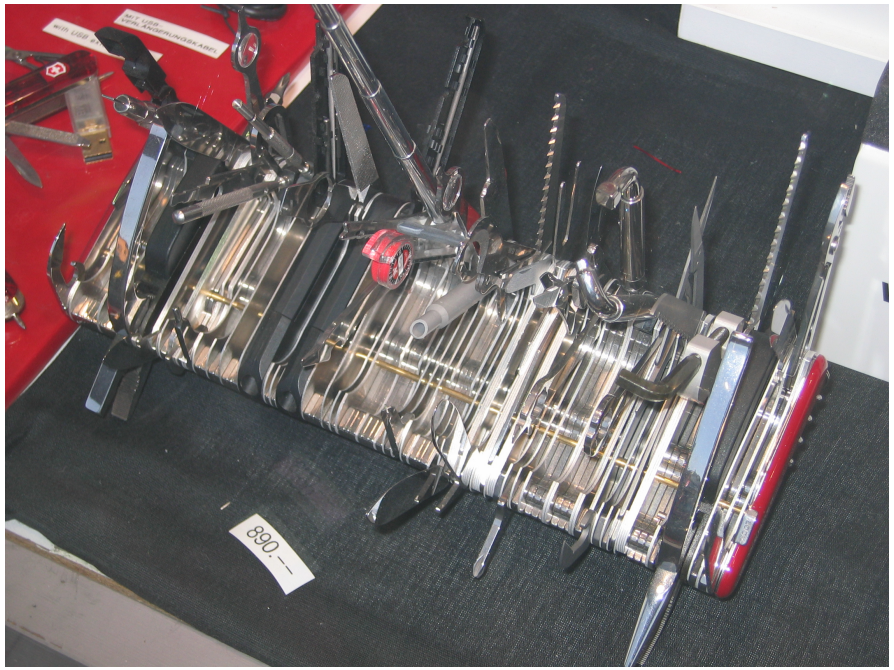
IT'S ABOUT TIME!



(Source: httparchive.org)

- We are *building* complex software *(requires tools)*,
- and we are *talking* about them *(requires a language)*.

COMPLEXITY



PLATFORM COMPLEXITY

DRIVING

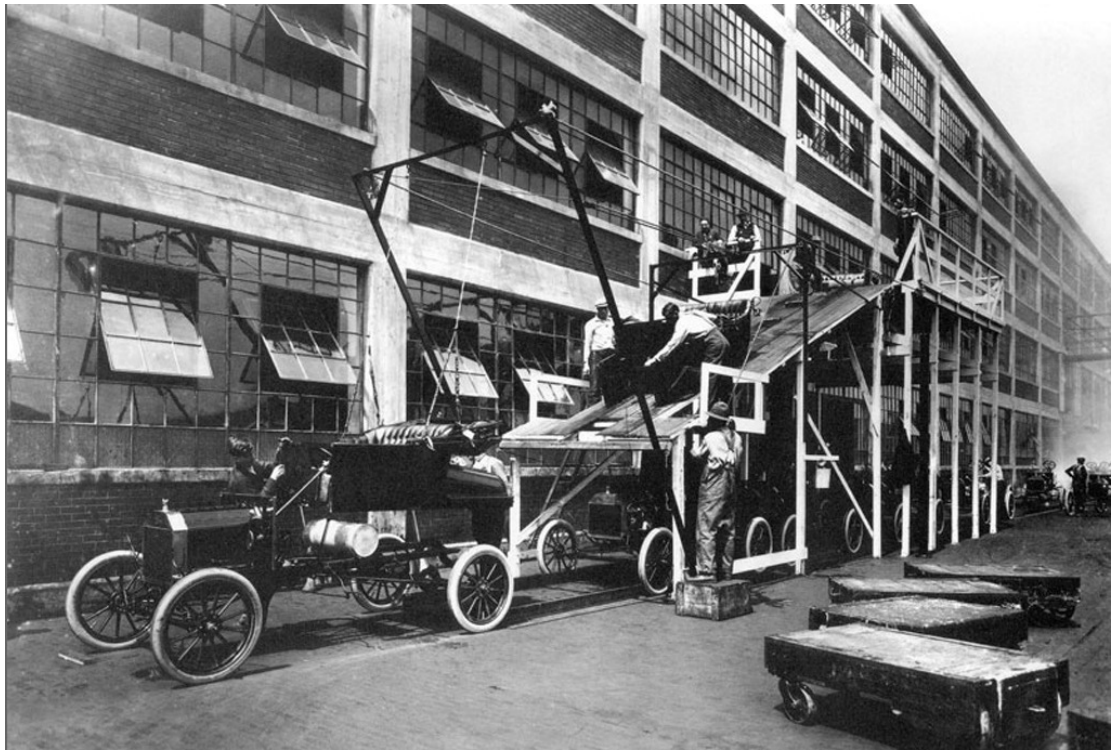
APPLICATION COMPLEXITY

REACTIVITY & RESPONSIVENESS

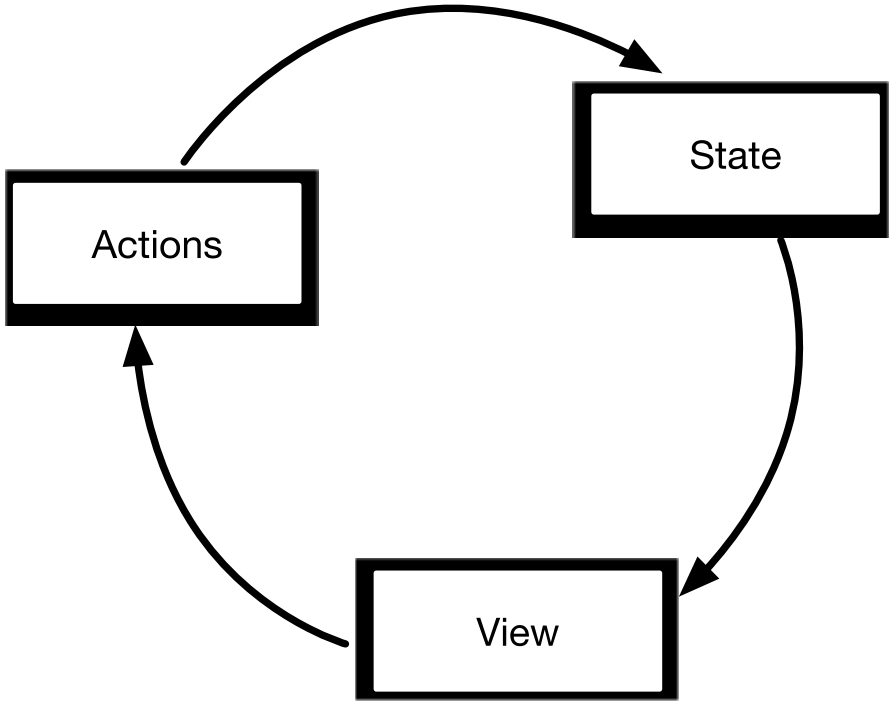
- synchronize state (across devices)
- provide immediate feedback
- continuous bi-directional communication (client/server)

http://www.reactivemanifesto.org

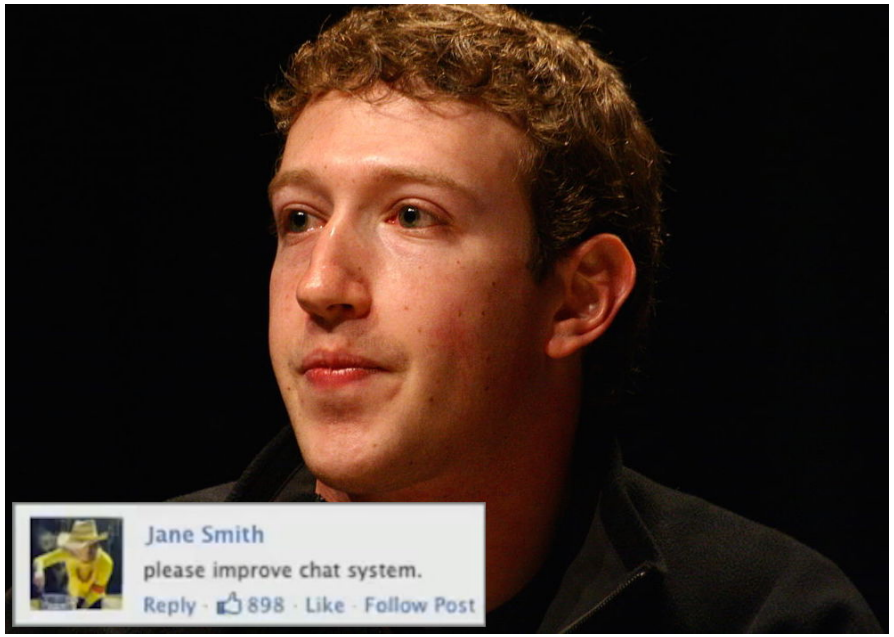
SCALEABILITY



UNIDIRECTIONAL FLOW

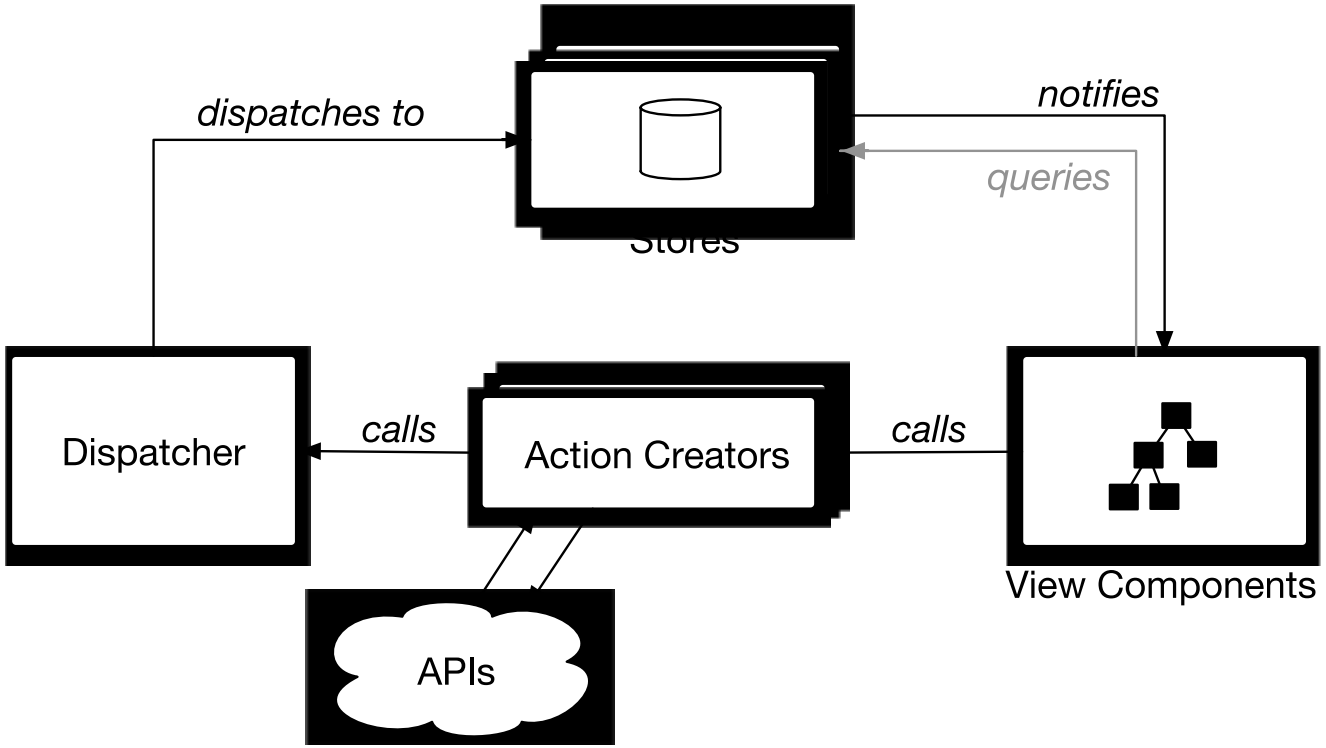


ONCE UPON A TIME ...



- UI inconsistencies in Facebook chat

FLUX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notifies
queries
Stores
Dispatcher
calls
Action Creators
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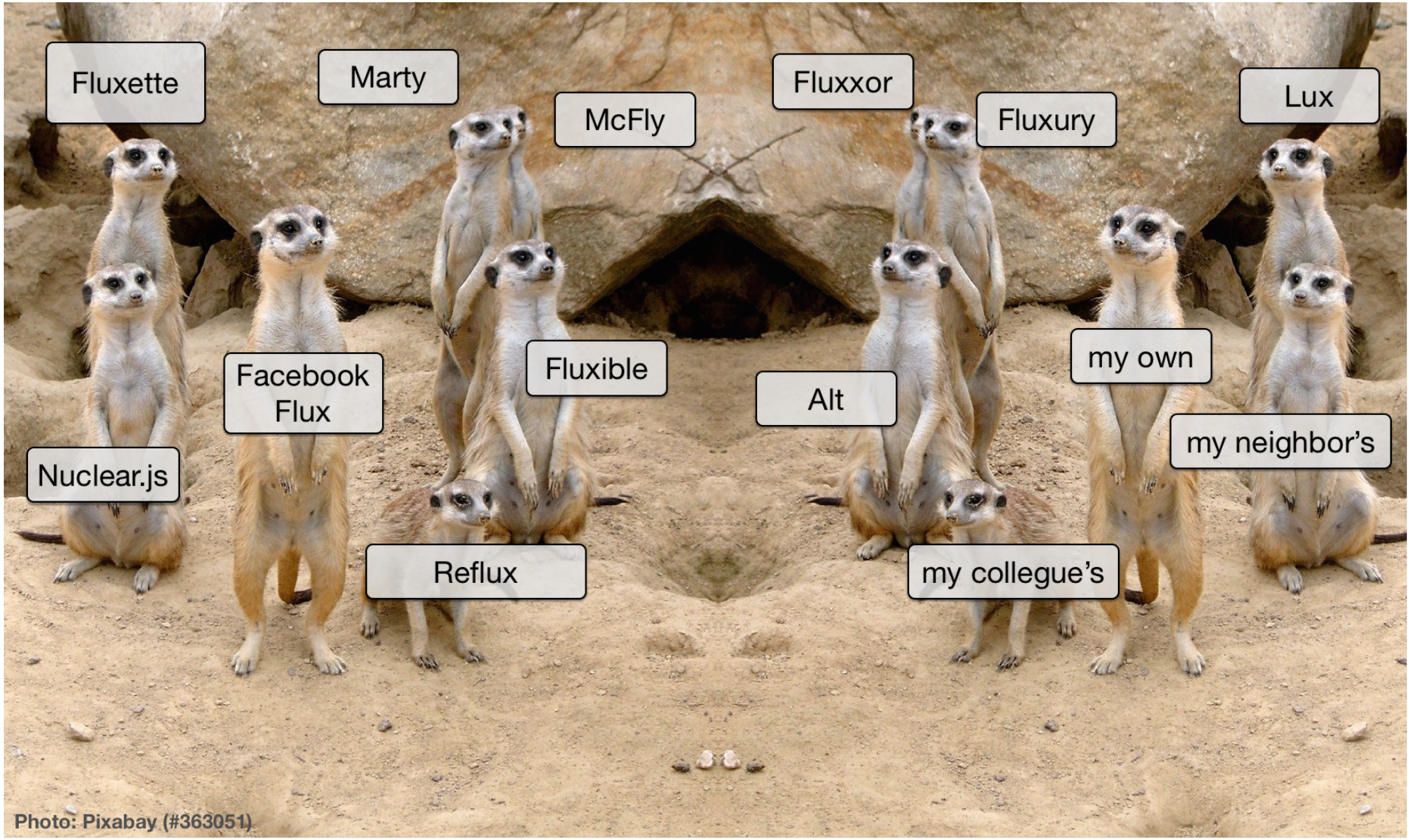
View Components
APIs


Fluxette
Marty
McFly
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Fluxury
Lux
Facebook Flux
Fluxible
Alt
my own
Nuclear.js
my neighbor's
Reflux
my collegue's
Photo: Pixabay (#363051)

FLUX - EXAMPLE

Flux Shop Demo

iPad 4 Mini - €500.01

Add to cart

H&M T-Shirt White - €10.99

Add to cart

Charli XCX - Sucker CD - €19.99

Add to cart

Your Cart

iPad 4 Mini - €500.01 x 1
H&M T-Shirt White - €10.99 x 3
Total: €532.98

Checkout

- https://github.com/voronianski/flux-comparison

FLUX - EXAMPLE - VIEW (1/3)

```
var React = require('react');
var FluxibleMixin = require('fluxible').FluxibleMixin;
var ProductStore = require('./stores/ProductStore');
var addToCart = require('./actions/addToCart');

var Products = React.createClass({
    mixins: [FluxibleMixin],
    render: function() {
        return <ul>
            {this.state.products.map(product =>
                <li>
                    <img src={product.image}/>
                    {product.title} - {product.price}€
                    <button onClick={() => this.addToCart(product)}
                            disabled={product.inventory === 0}>add</button>
                </li>
            )}
        </ul>;
    },

    addToCart: function(product) {
        this.executeAction(addToCart, { product: product });
    },

    // ...
});
```

FLUX - EXAMPLE - VIEW (2/3)

```
var React = require('react');
var FluxibleMixin = require('fluxible').FluxibleMixin;
var ProductStore = require('./stores/ProductStore');
var addToCart = require('./actions/addToCart');

var Products = React.createClass({

    // ...render, addToCart...

    getInitialState: function() {
        return this._getStateFromStores();
    },

    _getStateFromStores: function() {
        return {
           products: this.getStore(ProductStore).getAllProducts()
        };
    },

    statics: {
        storeListeners: {
            _onChange: [ProductStore]
        }
    },

    _onChange: function() {
        this.setState(this._getStateFromStores());
    }
});
```

FLUX - EXAMPLE - VIEW (3/3)

```
var React = require('react');
var FluxibleMixin = require('fluxible').FluxibleMixin;
var ProductStore = require('./stores/ProductStore');
var addToCart = require('./actions/addToCart');

var Products = React.createClass({ /* ... */ });
var ShoppingCart = require('./components/CartContainer.jsx');

var App = React.createClass({
    mixins: [FluxibleMixin],
    render: function() {
        return <div>
                    <Products />
                    <ShoppingCart />
                </div>;
    }
});

export function render(context) {
    React.withContext(
        context.getComponentContext(),
        function() {
            React.render(
                React.createElement(App),
                document.getElementById('fluxible-app')
            );
        }
    );
}
```

FLUX - EXAMPLE - ACTION

```
var shop = require('../../../api/shop');

// actions/addToCart.js
module.exports = function (context, payload, done) {
    context.dispatch('ADD_TO_CART', { product: payload.product });
    done();
};

// actions/cartCheckout.js
module.exports = function (context, payload, done) {
    var products = payload.products;

    context.dispatch('CART_CHECKOUT');

    shop.buyProducts(products, function () {
        context.dispatch('SUCCESS_CHECKOUT', { products: products });
        done();
    });
};
```

FLUX - EXAMPLE - DISPATCHER

```
var Fluxible = require('fluxible');
var CartStore = require('./stores/CartStore');
var ProductStore = require('./stores/ProductStore');

var app = new Fluxible();
app.registerStore(CartStore);
app.registerStore(ProductStore);


var view = require('./view')
var receiveProducts = require('./actions/receiveProducts');
var context = app.createContext();
context.executeAction(receiveProducts, {}, function (err) {
    if (err) {
        throw err;
    }
    return view.render(context);
});
```

FLUX - EXAMPLE - STORES

```
var createStore = require('fluxible/addons/createStore');
var ProductStore = createStore({
    storeName: 'ProductStore',
    initialize: function () {
        this._products = [];
    },

    handlers: {
        'ADD_TO_CART': 'decreaseInventory',
        'RECEIVE_PRODUCTS': 'handleReceive'
    },

    handleReceive: function (payload) {
        this._products = payload.products;
        this.emitChange();
    },

    decreaseInventory: function (payload) {
        this.dispatcher.waitFor('CartStore', function() {
            var product = payload.product;
            product.inventory = Math.max(product.inventory-1, 0);
            this.emitChange();
        });
    },

    getAllProducts: function () { return this._products; }
});
module.exports = ProductStore;
```

ADVANTAGES OF FLUX

compared to "classic" MVC (AngularJS, Backbone)

- strict separation: State / UI / Behavior
- each value stored exactly once
- clear data flow, good testability
- server-side rendering relatively simple

DISADVANTAGES OF FLUX

compared to "classic" MVC (AngularJS, Backbone)

- each store *sees all actions*
- hard-wired *store-dependencies*
- stores are (conceptually) *singletons*
- *anti-pattern:* transporting *mutable state* in actions

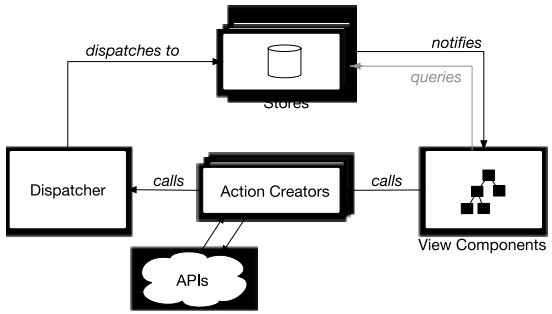
REDUX

THE EVOLUTION

(STATE, ACTION) → STATE

REDUX

Flux: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notifies
queries
Stores
Dispatcher
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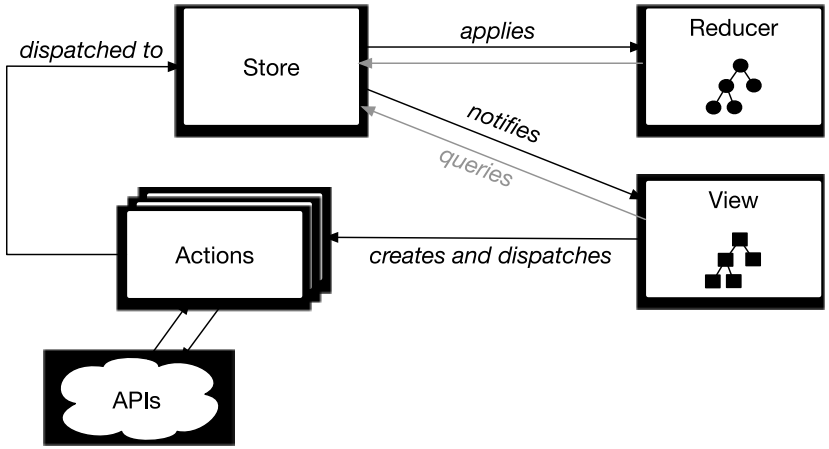

dispatched to
Store
applies
Reducer
notifies
queries
View
Actions
creates and dispatches
APIs

ADVANTAGES OF REDUX

vs. "vanilla" Flux

- functional composition
- snapshot/replay capabilities
- can yield performance boost (free dirty-checking)

DISADVANTAGES OF REDUX

vs. "vanilla" Flux

- must protect against mutating state, using e.g.
  - spread constructor `{...oldState, prop: newVal}` (ES201?)
  - (test with) recursive `Object.freeze()`
  - Immutable.js
- potentially steep learning curve (functional paradigm)
- container components know the whole state tree

THE REVOLUTION

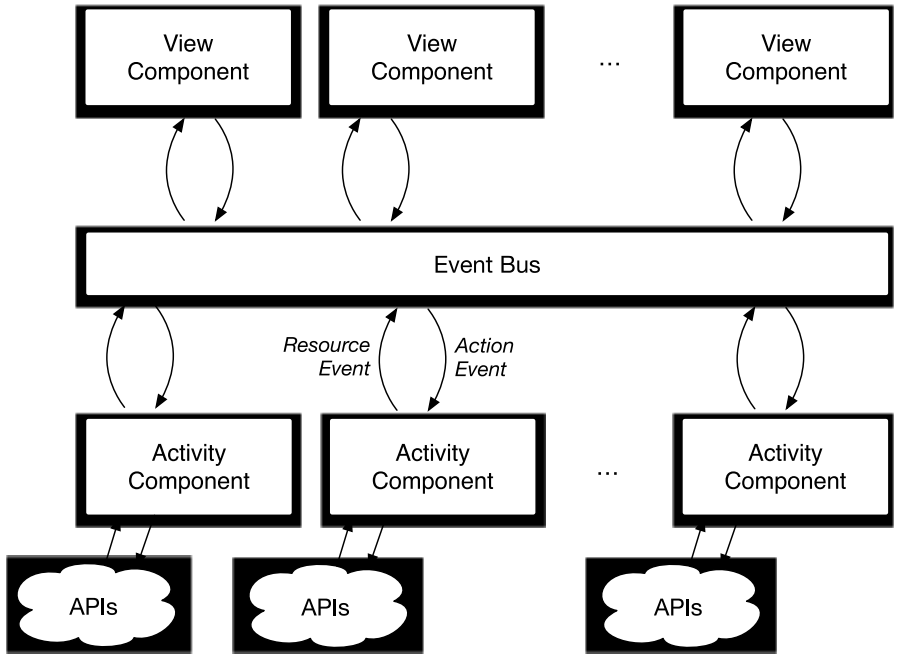
PUBLISH-SUBSCRIBE

an old pattern from the 80ies

DECOUPLING

- full *decoupling* of communicating components:
  - sender does not know about recipient(s)
  - recipient does not know about sender
- How? Broadcast of events through central *bus*
- selection of receivers through *topics*

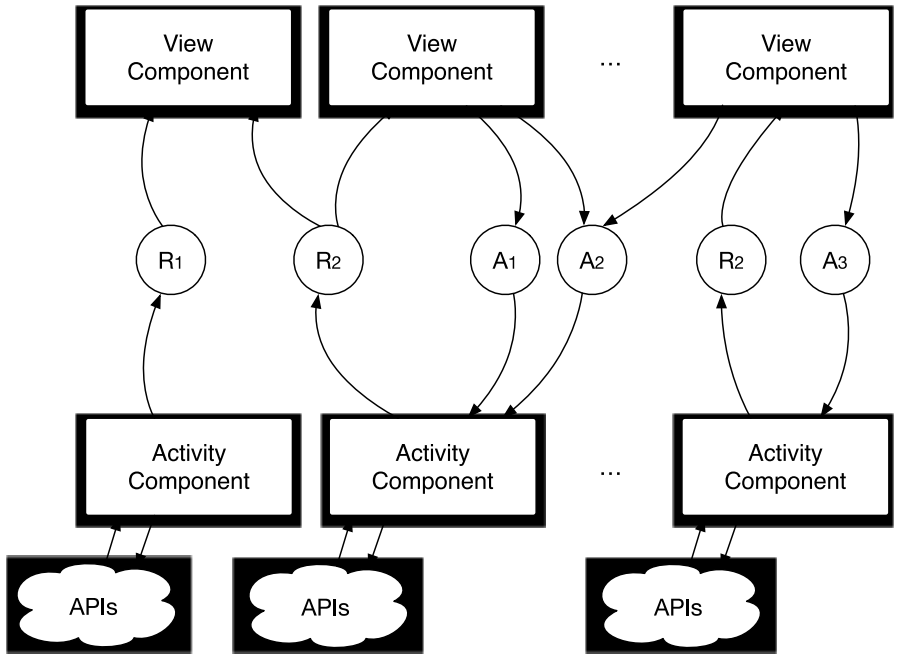
PUBSUB ARCHITECTURE



- event bus: connects senders/receivers (asynchronously)
- *view components,* like in Flux/Redux (+ create action events)
- *activity components,* like Flux stores (+ completion of async actions)
- unidirectional flow using event patterns

PUBSUB ARCHITECTURE

TOPICS FOR SCALABILITY



- topics for *resources* (state slices) and *actions* (intents to modify)
- topics connect components in a *configurable* way

PUBSUB (LAXARJS) - EXAMPLE - VIEW COMPONENT (1/2)

```
import React from 'react';
import patterns from 'laxar-patterns';

const injections = ['axContext', 'axReactRender'];
function create(context, reactRender) {

    patterns.resources.handlerFor(context)
        .registerResourceFromFeature('products', render);

    function render() {
        reactRender(<ul>
            {(context.resources.products || []).map(product =>
                <li>
                    <img src={product.image}/>
                    {product.title} - {product.price}€
                    <button onClick={() => addToCart(product)}
                            disabled={product.inventory === 0}>add</button>
                </li>
            )}
        </ul>);
    }

    // ... addToCart ...
```

PUBSUB (LAXARJS) - EXAMPLE - VIEW COMPONENT (2/2)

```
import React from 'react';
import patterns from 'laxar-patterns';

const injections = ['axContext', 'axReactRender'];
function create(context, reactRender) {

    // ... render ...

    const addToCartPublisher =
        patterns.actions.publisherForFeature(context, 'addToCart')

    function addToCart(product) {
        if(product.inventory > 0) {
            addToCartPublisher({ product: product });
        }
    }

    return { onDomAvailable: render };
}

export default {
    name: 'product-list-view',
    injections: injections,
    create: create
};
```

PUBSUB (LAXARJS) - EXAMPLE - EVENTS

```
{
     "widget": "product-list-view",
     "features": {
         "addToCart": { "action": "add-to-cart" },
         "products": { "resource": "product-list" }
     }
 },
 {
     "widget": "shopping-cart-view",
     "features": { ... }
 },
 {
     "widget": "products-activity",
     "features": {
         "products": { "resource": "product-list" },
         "decrementInventory": { "onActions": ["add-to-cart"] }
     }
 },
 {
     "widget": "shopping-cart-activity",
     "features": { ... }
 }
```

PUBSUB (LAXARJS) - EXAMPLE - ACTIVITY COMPONENT (1/2)

```
import ax from 'laxar';
import patterns from 'laxar-patterns';
import shop from '../../../api';

const injections = ['axContext'];
function create(context) {
    let products = [];
    const replaceProducts =
        patterns.resources.replacePublisherForFeature(context, 'products');

    context.eventBus.subscribe('beginLifecycleRequest', () => {
        shop.getProducts(list => {
            products = list;
            replaceProducts(products);
        });
    });

    // ... action handling (next) ...
}

export default {
    name: 'products-activity',
    injections: injections,
    create: create
};
```

PUBSUB (LAXARJS) - EXAMPLE - ACTIVITY COMPONENT (2/2)

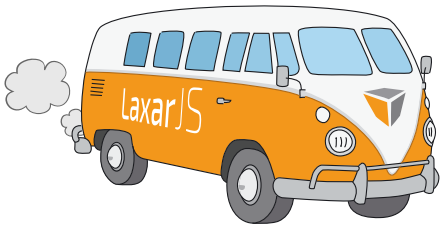
```
import ax from 'laxar';
import patterns from 'laxar-patterns';
import shop from '../../../api';

const injections = ['axContext'];
function create(context) {
    // ... products initialization (previous) ...

    patterns.actions.handlerFor(context)
        .registerActionsFromFeature('decrementInventory', ({ product }) => {
            products
                .filter(current => current.id == product.id)
                .forEach(current => {
                    current.inventory = Math.max(0, current.inventory - 1);
                });
            replaceProducts(products);
        });
}

export default {
    name: 'products-activity',
    injections: injections,
    create: create
};
```

PUBSUB IN PRACTICE



FROM EVENT BUS TO FRAMEWORK

http://www.laxarjs.org

- component configuration
- lifecycle: *when are event collaborators available?*
- services for view components: *where do I render my HTML to?*
- development tools (event log, visual composition structure)

ADVANTAGES OF PUB/SUB

vs. Flux/Redux

- *decoupling* of components
- *visible* architecture
- *flexibility* of composition *(patterns: resources, actions, flags, streams...)*
- *freedom* of implementation *(functional vs. imperative, React vs. AngularJS...)*

DISADVANTAGES OF PUB/SUB

vs. Flux/Redux

- *ecosystem* small
- *freedom* to make mistakes
- server-side rendering *not there yet*

CONCLUSION

IS THIS EVEN FLUX?!

> *"I define Flux as 'unidirectional data flow with changes described as plain objects'."*
>
> *(Dan Abramov, Author of Redux)*

> *"It's cool that you are inventing a better Flux by not doing Flux at all."*
>
> *(André Staltz, Author of Cycle.js)*

CONCLUSION*

	Flux	Redux	PubSub
unidirectional flow	+	+	+
complexity handling	o	+	+
reactivity	o	+	+
scalability (component isolation)	-	o	+
ecosystem	o	+	-
learning curve	+	o	+
snapshot/record/replay	o	+	o
longevity	o	?	+

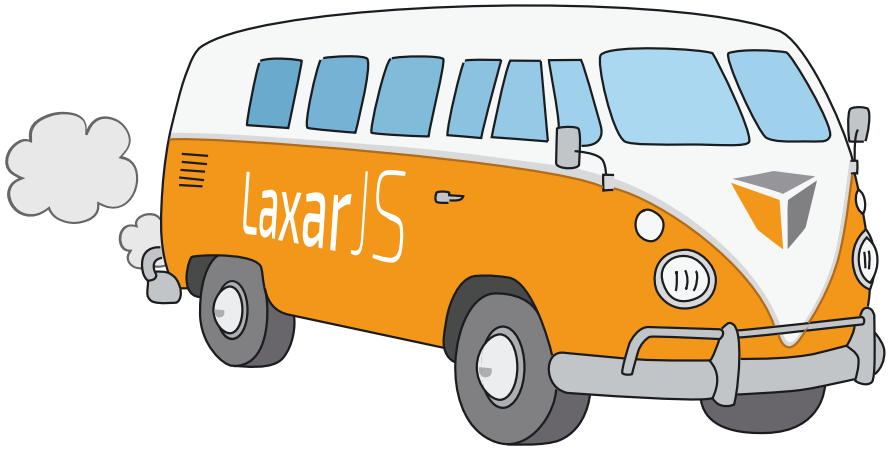
*** YOUR MILEAGE MAY VARY**

Redux  **PubSub**

BEYOND FLUX

Slides: github.com/x1b/beyond-flux-goto2016

Michael Kurze (@0b11011)



laxarjs.org

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