Angular with Redux

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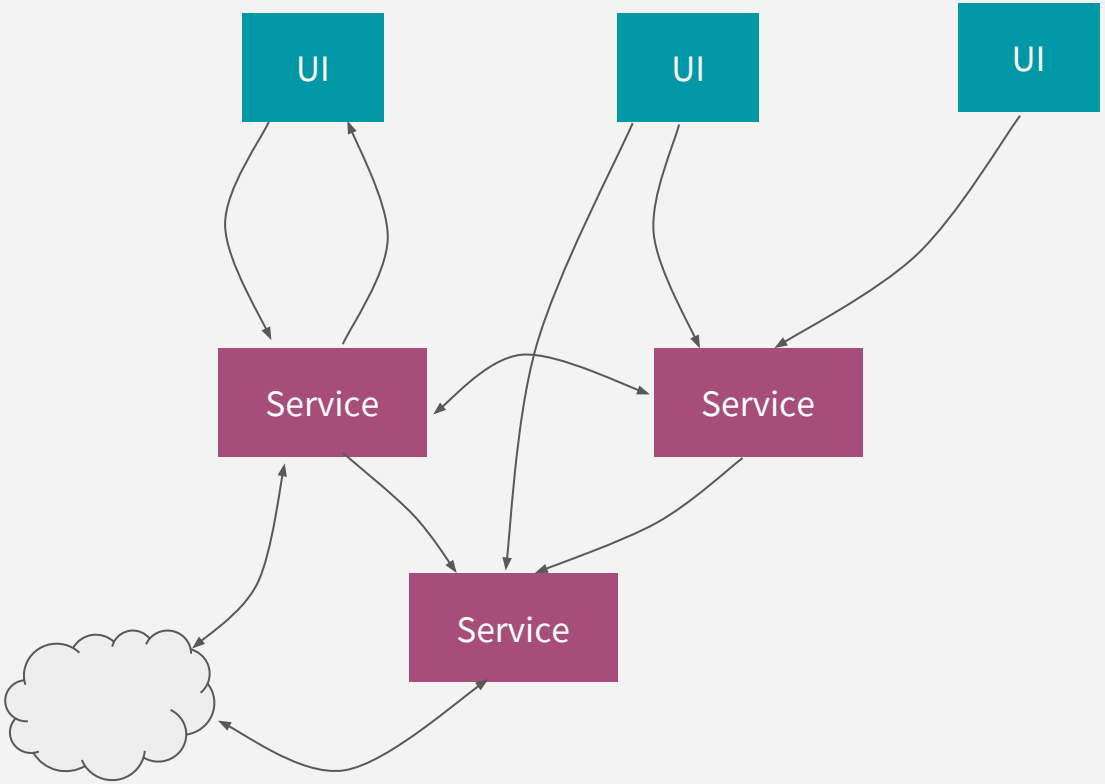
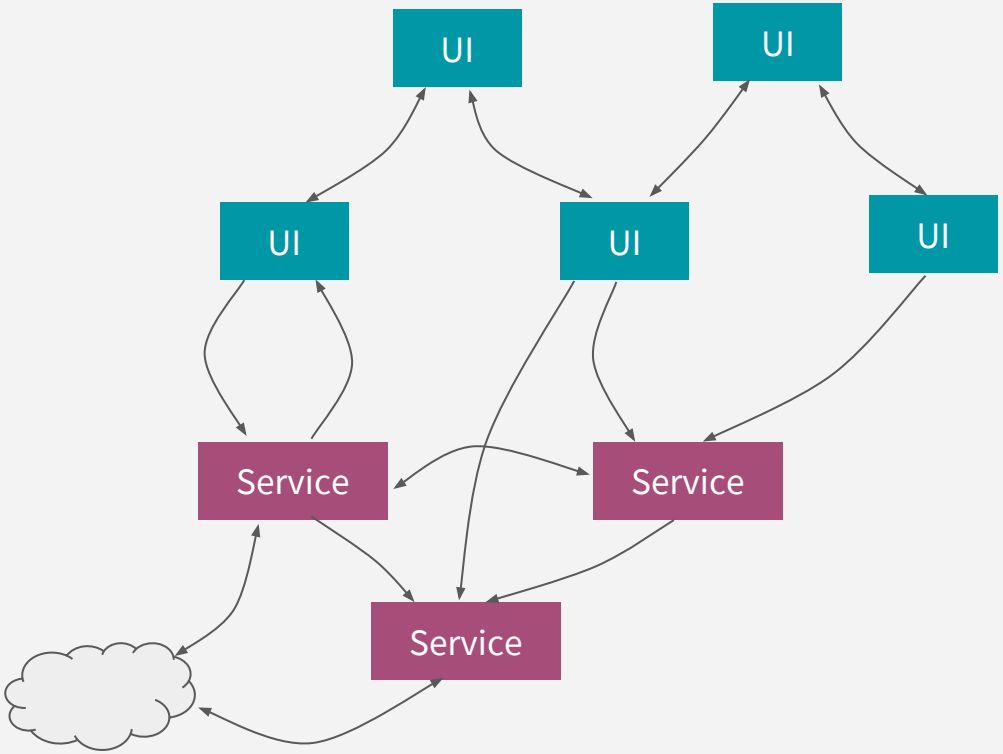
Why Redux?

What can go wrong with pure Angular?

client logic + dataflow with Angular



client logic + dataflow with Angular



- What is the current state of my app?
- Where are the parts of the state located?
- Why is the state the way it is?
- How did it happen?
- Something is wrong → Where do I have to look for the bug?

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    - Combine "State" and "Behaviour"

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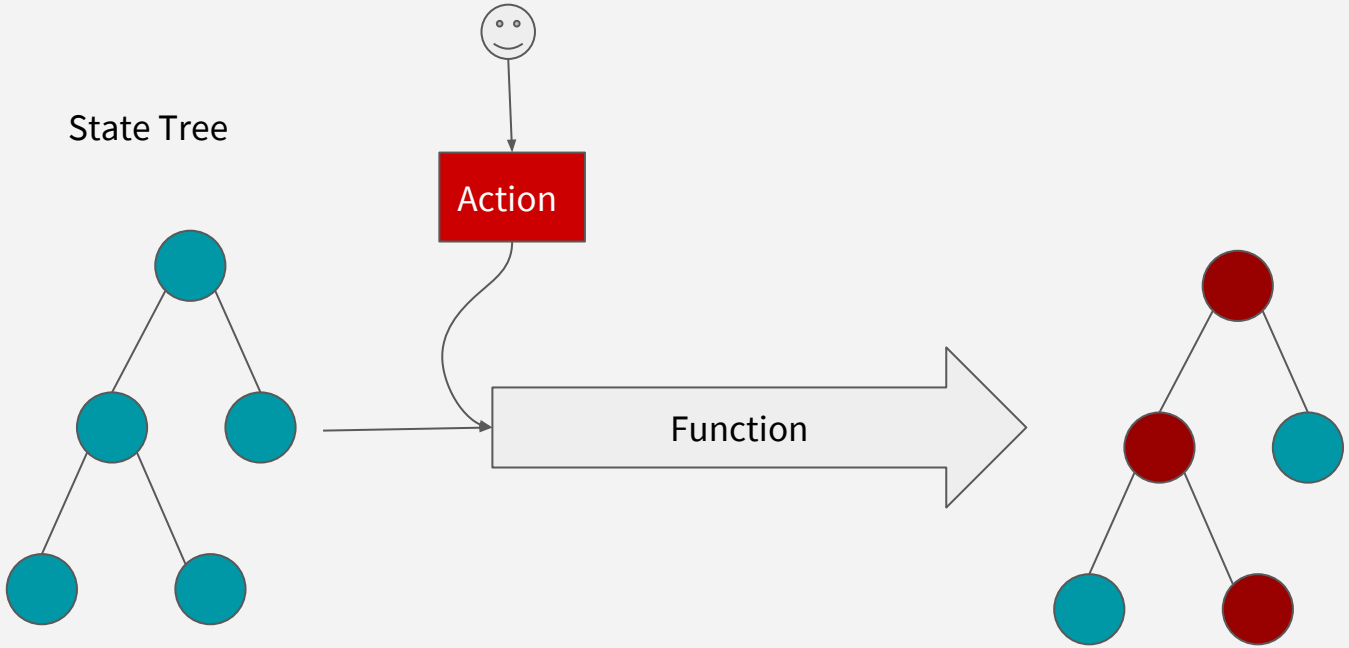
- Object Orientation:
  - ~~Combine~~ **Mix up** "State" and "Behaviour"
  - time is implicit

Redux

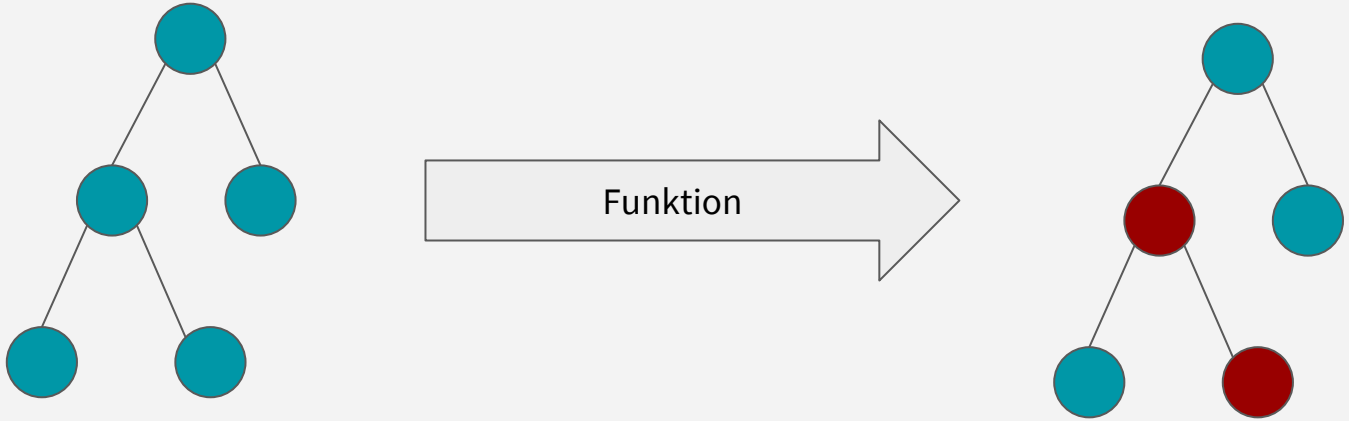
A functional approach to state-management

Functional Programming

- Pure Functions (no side-effects)
- Immutable Data (create new data instead of modifing existing data)


State Tree
Action
Function

Zustandsbaum



Zustands-Automat mit Überführungsfunktion

Where does Redux come from?
How does it work?

Before Redux: **Flux-Architecture**

Flux is a frontend architecture pattern (Alternative to MVC*)

Redux is a derivative of **Flux** + Implementation

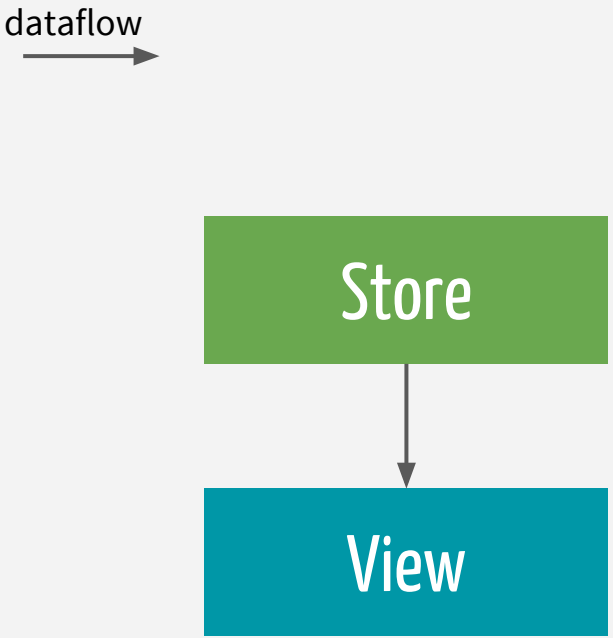
Flux is object-oriented + some functional ideas

Redux is (almost) fully functional

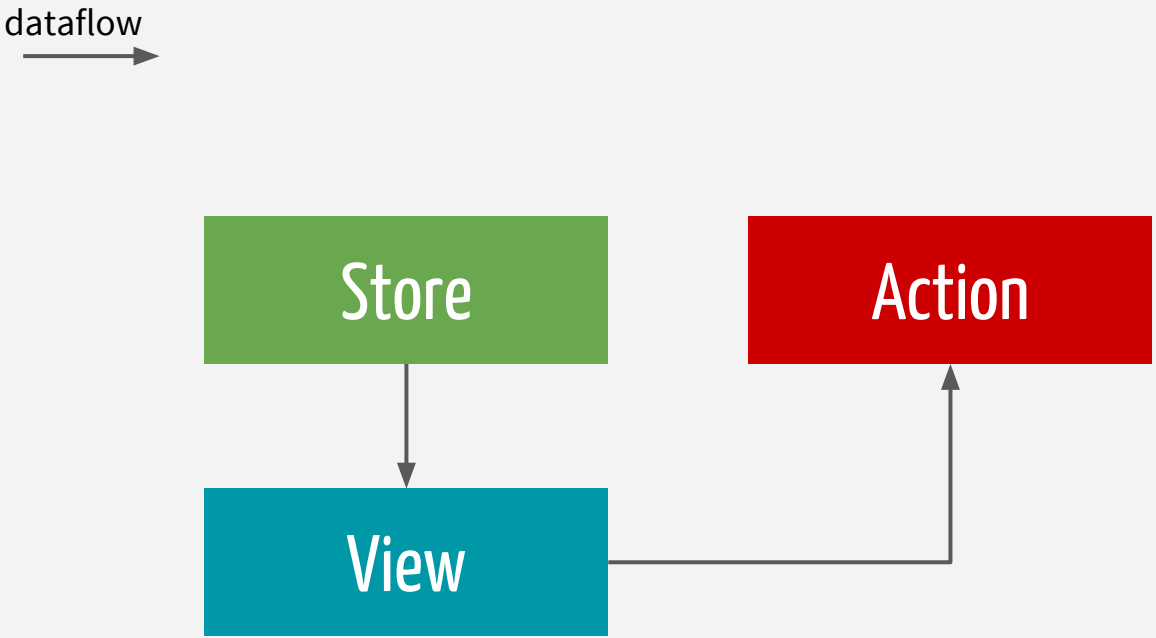
How does Flux work?

Store

- application state
- logic
- represents a business domain



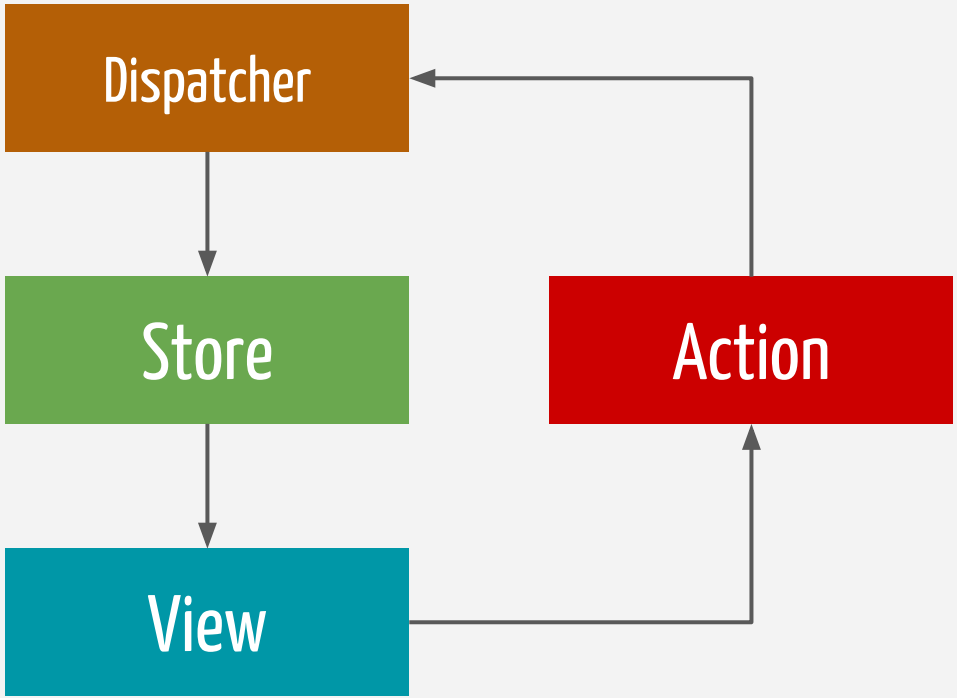
- View shows data of one or more Stores
- when the Store updates the View will update itself too



- View creates “Actions” based on user interaction
- an Action represents a business action
- comparable to *command pattern*

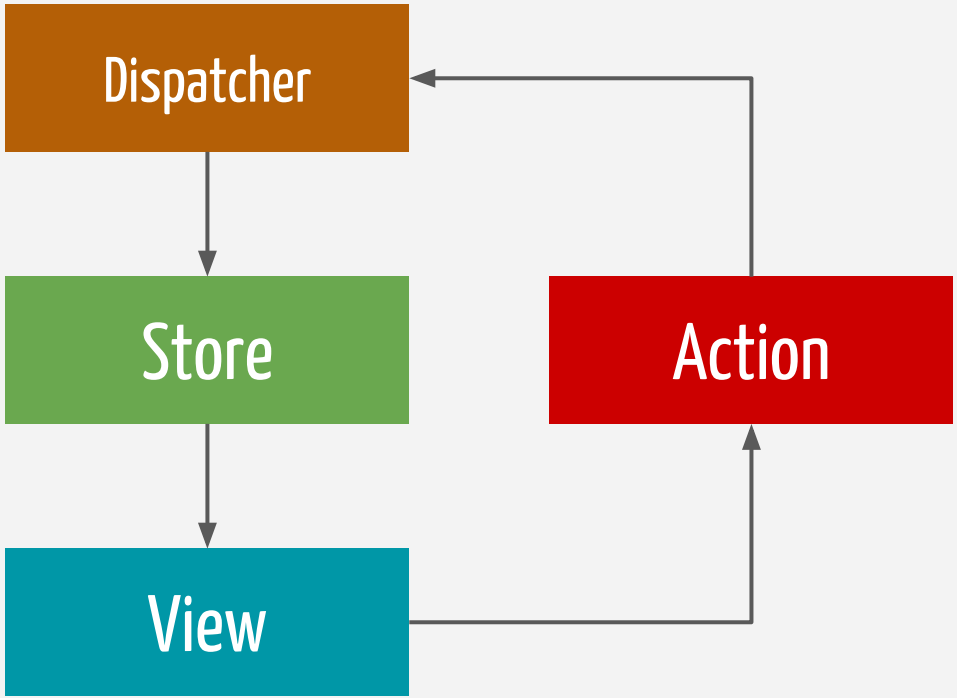
Example: Action

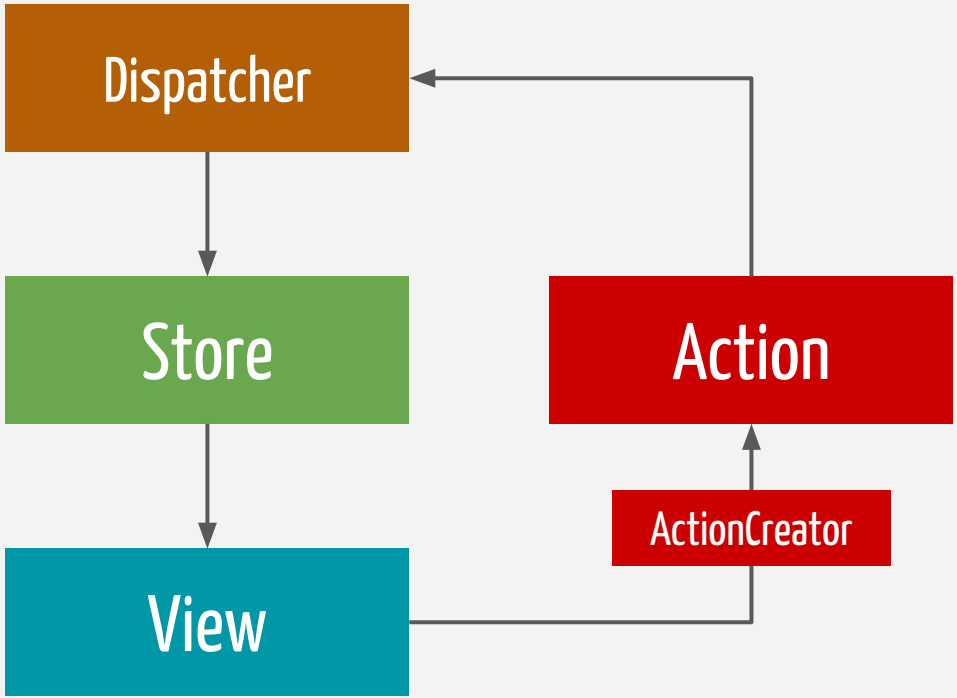
```
{
    type: "CREATE_USER_ACTION",
    payload: {
        username: "Luise",
        email: "luise@example.org"
    }
}
```



- Dispatcher takes **all** Actions and passes them to **all** Stores
- Stores decide on their own if and how they like to react to Actions

Single Directional Dataflow



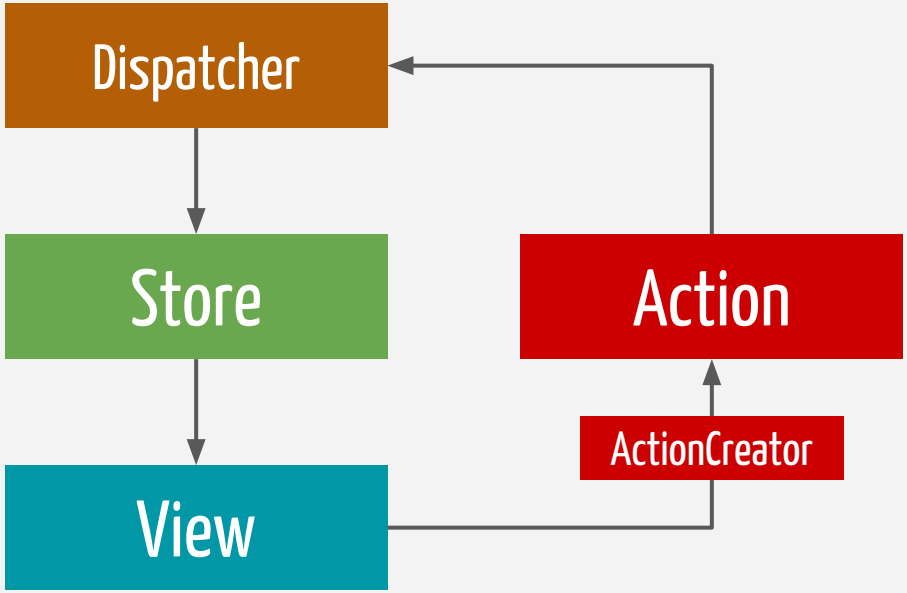


- a function that creates Actions
- decouples the View from the actual creation of Actions

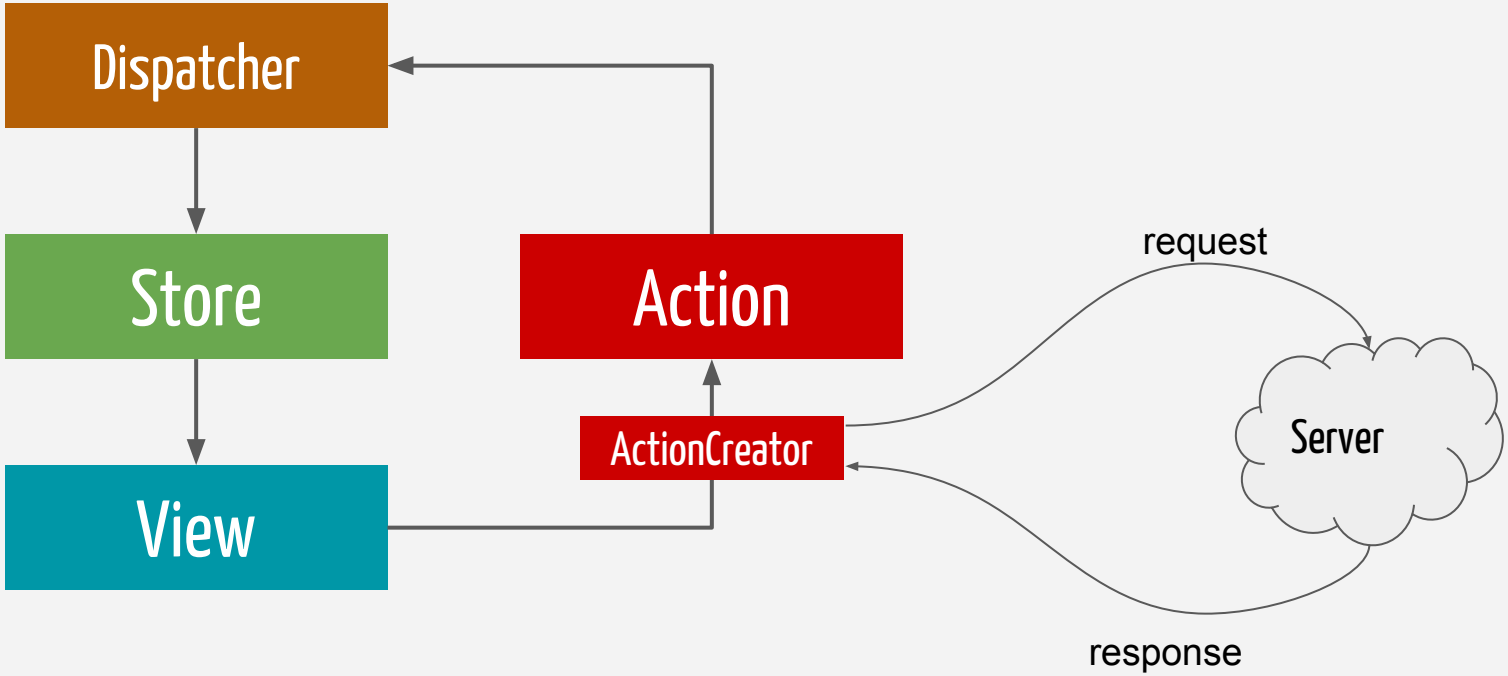
Example: ActionCreator

```
const createUser = (username, email) => {
    dispatch({
        type: "CREATE_USER_ACTION",
        payload: {
            username: username,
            email: email
        }
    });
};
```

How to do async operations? REST-Requests?



How to do async operations? REST-Requests?



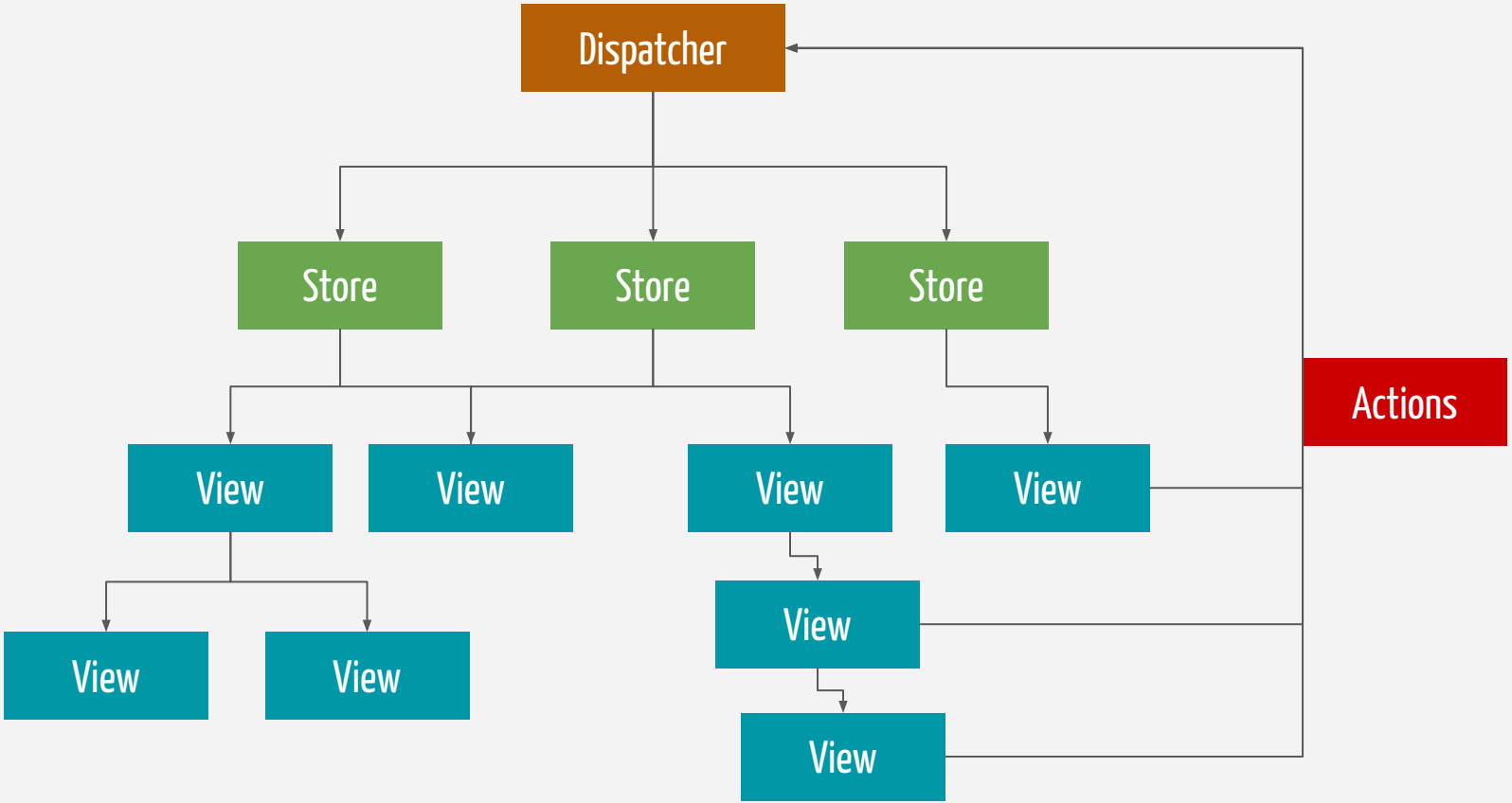
How to do async operations? REST-Requests?

ActionCreator can be asynchronous and create multpile Actions

1. Dispatch Action "FETCH_DATA_STARTED"
2. Request data from the server
3. When the data arrives → dispatch Action: "FETCH_DATA_SUCCESSFUL"
4. On timeout or error → dispatch Action: "FETCH_DATA_FAIL_TIMEOUT"

```
const fetchUsers = () => {
    dispatch({type: "FETCH_USERS_STARTED"});

    fetch("http://my.api.example.com/users")
        .then(response => response.json)
        .then(json => dispatch({
                type: "FETCH_USERS_SUCCESSFUL",
                payload: json
            }),
            error => dispatch({
                type: "FETCH_USERS_FAILED"
            })
        );
};
```


Dispatcher
Store
Store
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Actions
View
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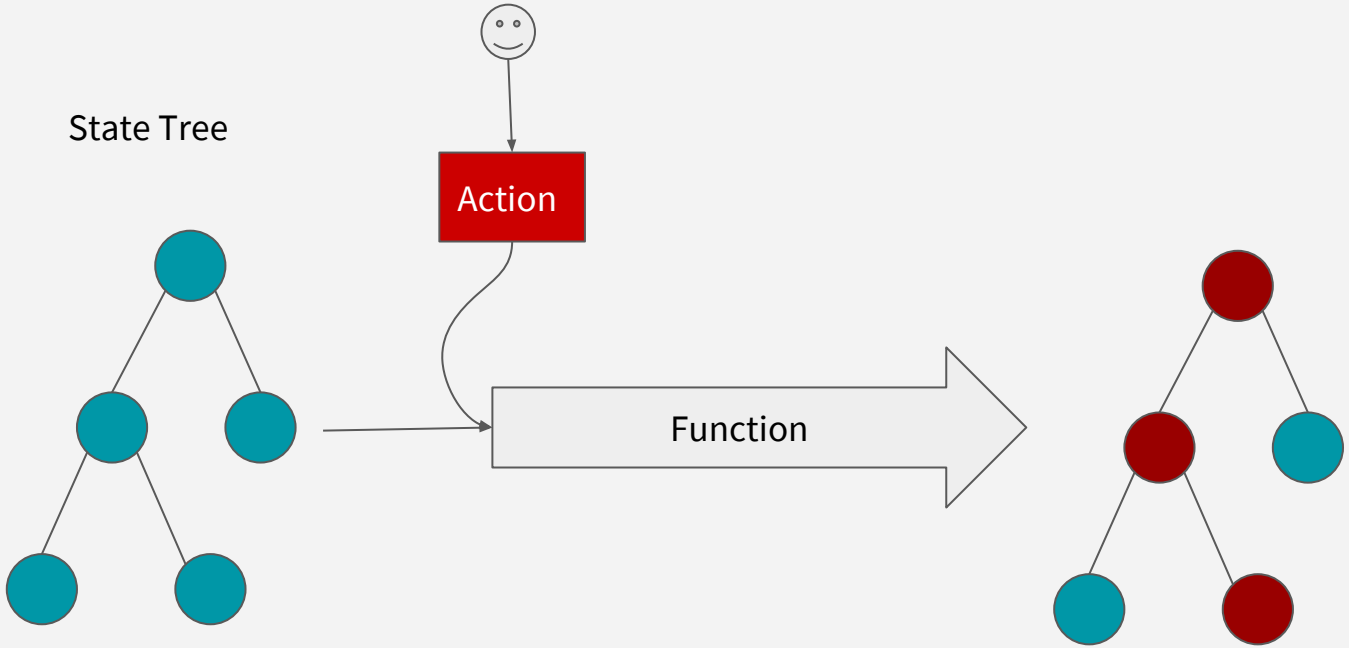
View

Flux in Functional: **Redux**

Redux

- Only 1 Store
- immutable State-Tree
- Reducer (transformation function):
  - signature: (state, action) → state
  - pure function
  - composable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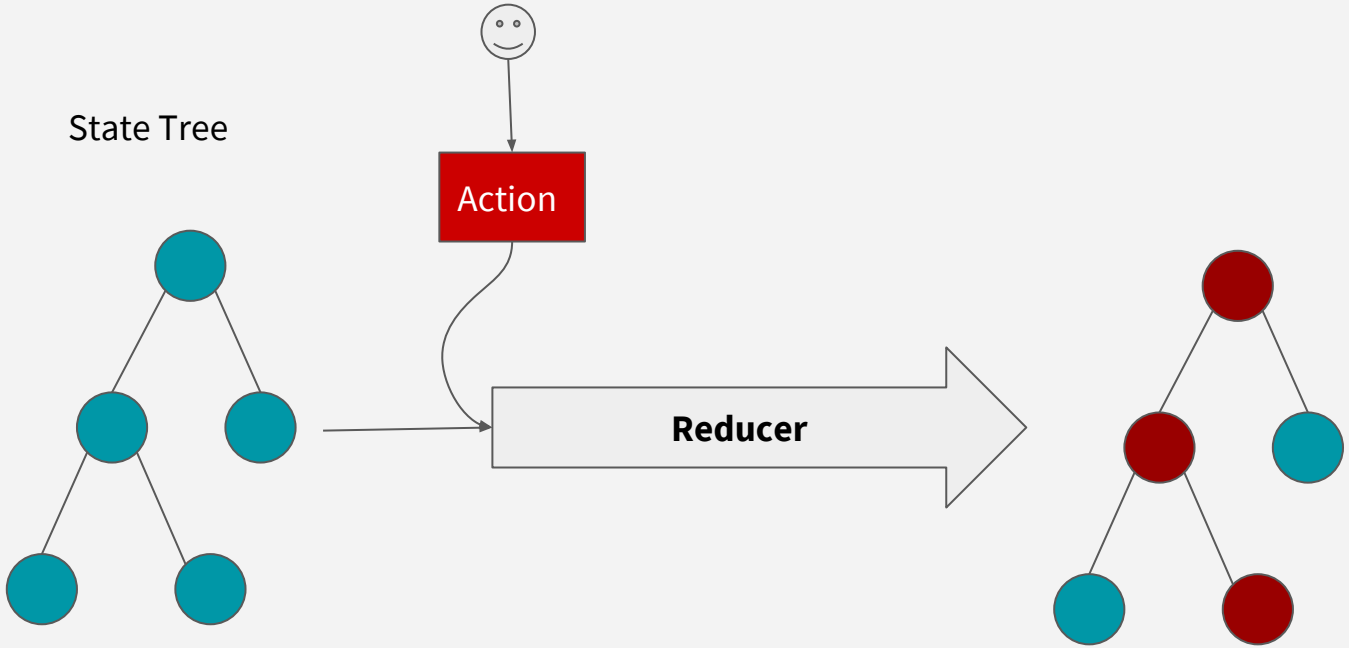
State Tree
Action
Reducer

Why the term "Reducer"?

```
var arr = [0,1,2,3];
var sum = arr.reduce(function(acc, val) {
                        return acc + val;
                    }, 0);
// sum is 6
```

Why the term "Reducer"?

Reducer Function

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Why the term "Reducer"?

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var sum = arr.reduce(function(acc, val) {
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                    }, 0);
// sum is 6
```

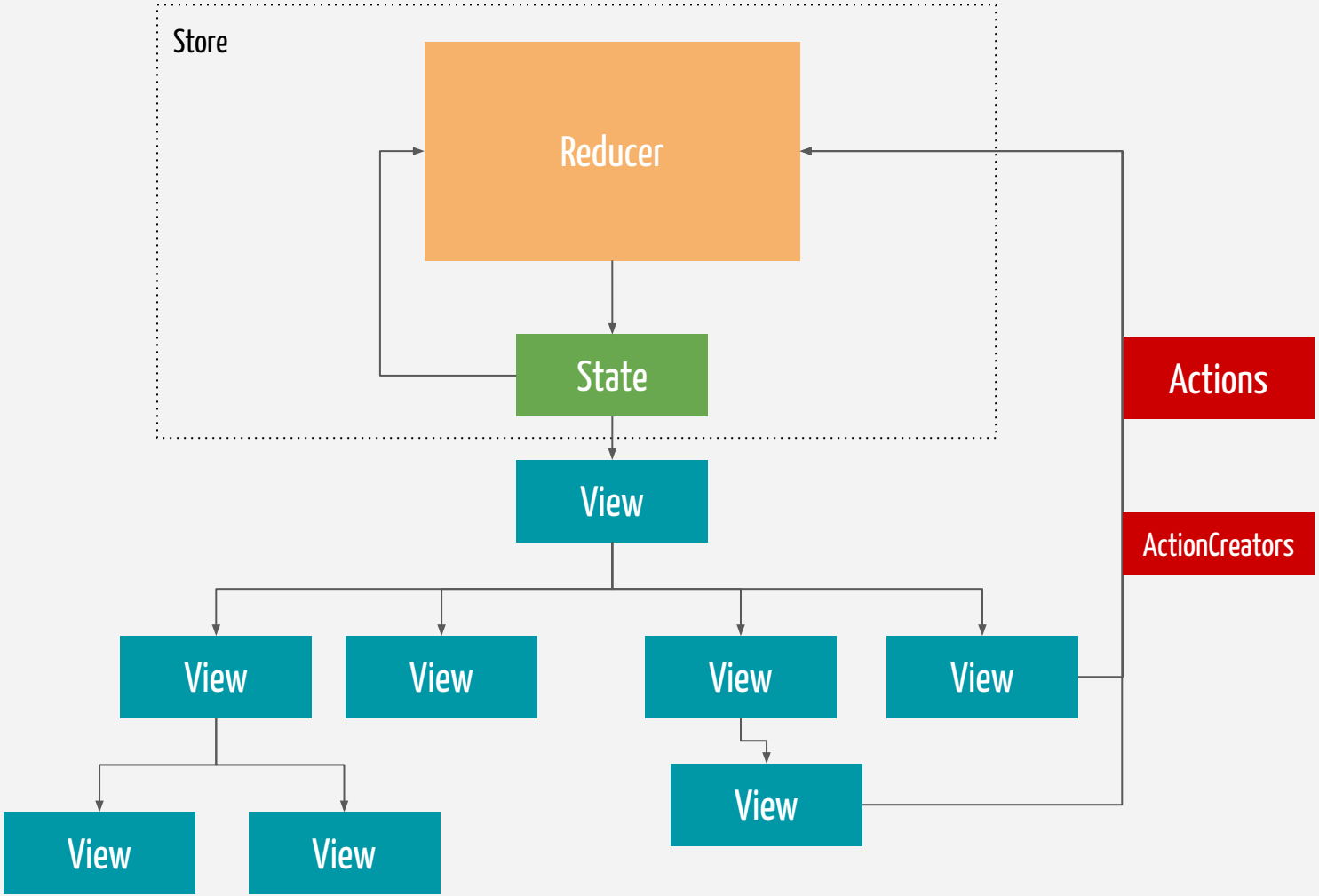
initialer Wert

Why the term "Reducer"?

```
var actions = [action1, action2, action3,...];

var currentState = actions.reduce(function(state, action) {
                        // calculate new state based
                        return newState;
                    }, initialState);
```

Redux = Flux + Reducer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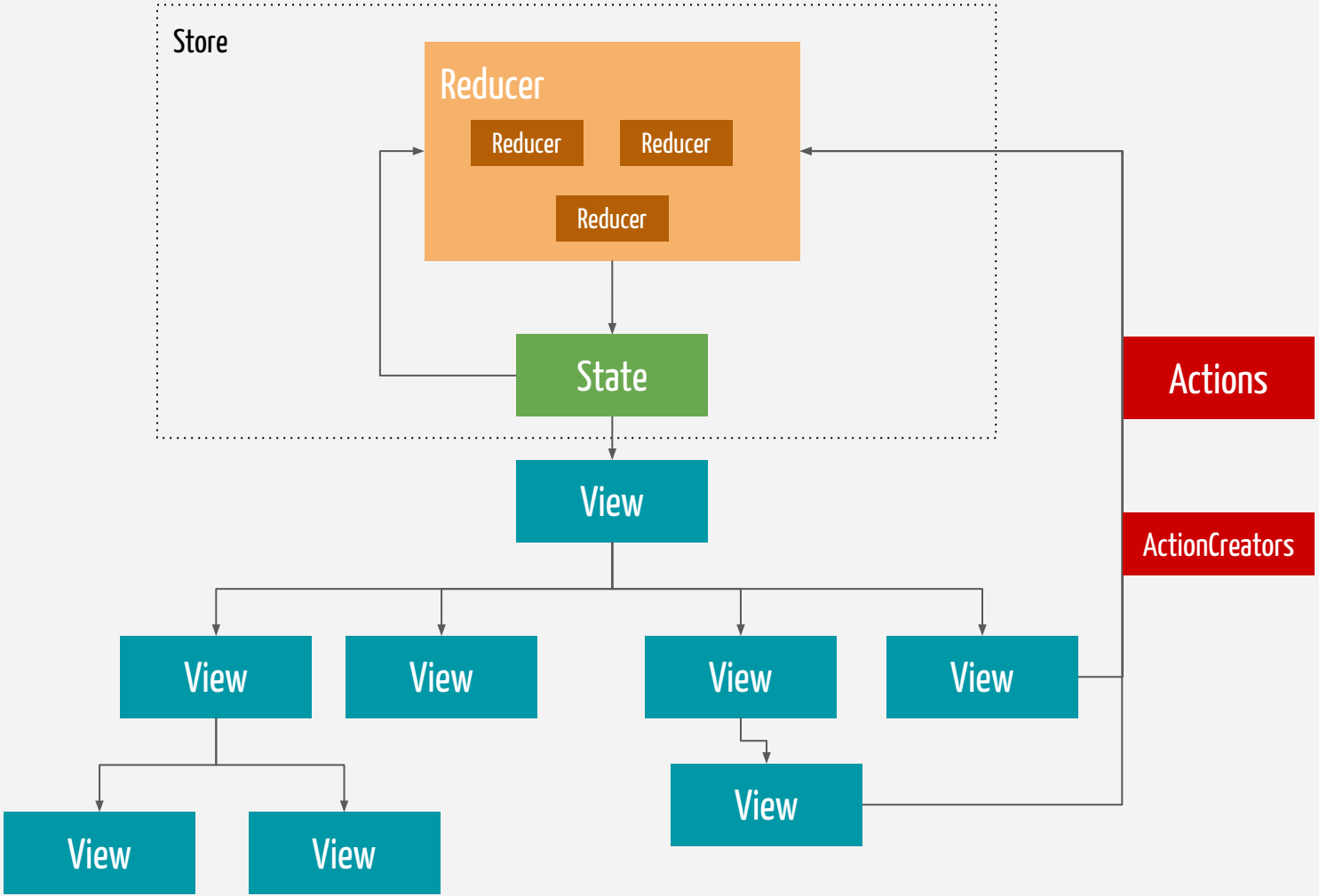
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Redux in Code?

```
// action types
const LOAD_START = 'LOAD_START'
const LOAD_FINISHED = 'LOAD_FINISHED'
```

```
const LOAD_START = 'LOAD_START'
const LOAD_FINISHED = 'LOAD_FINISHED'

type State = {
     items: Array<string>
     loading: boolean
}
```

```
const LOAD_START = 'LOAD_START'
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type State = {
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function reducer(state: State, action: Action): State {

}
```

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function reducer(state: State, action: Action): State {
     switch(action.type) {


          default: return state;
     }
}
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const LOAD_START = 'LOAD_START'
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function reducer(state: State, action: Action): State {
     switch(action.type) {
          case LOAD_START:
               // todo: set loading=true

               return ? // state should be immutable, we need a copy

          default: return state;
     }
}
```

Immutability in JavaScript / TypeScript?

```
const state = {
     items: ["hallo", "welt"],
     loading: false
}


let newState = Object.assign({}, state); // creates a copy
```

Immutability in JavaScript / TypeScript?

```
const state = {
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let newState = Object.assign({}, state);
newState.loading = true;
```

Immutability in JavaScript / TypeScript?

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const state = {
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const newState = Object.assign({}, state, { loading: true});
```

Immutability in JavaScript / TypeScript?

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const state = {
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let newState = Object.assign({}, state);
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const newState = Object.assign({}, state, { loading: true});

// ES7 / TypeScript 2.1
const newState = {...state, {loading: true}};
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Immutability in JavaScript / TypeScript?

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// ES7 / TypeScript 2.1
const newState = {...state, {looading: true}};  // no compile error in TypeScript
```

Immutability in JavaScript / TypeScript?

```
// ES7 / TypeScript 2.1
const newState = {...state, {looading: true}};  // no compile error in TypeScript


// npm install tassign

const newState = tassign(state, {looading: true});     // compile error

const newState = tassign(state, {loading: true});      // no compile error
```

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          default: return state;
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const LOAD_FINISHED = 'LOAD_FINISHED'

type State = {
     items: Array<string>
     loading: boolean
}

function reducer(state: State, action: Action): Reducer<State> {
     switch(action.type) {
          case LOAD_START:
               return tassign(state, { loading: true });

          case LOAD_FINISHED:
               let newItems = action.payload.items;

               return tassign(state, {
                    items: [...state.items, ...newItems],
                    loading: false
               });
          default: return state;
     }
```

- The whole state in one single data structure?
- One reducer contains all logic?

Reducer Composition

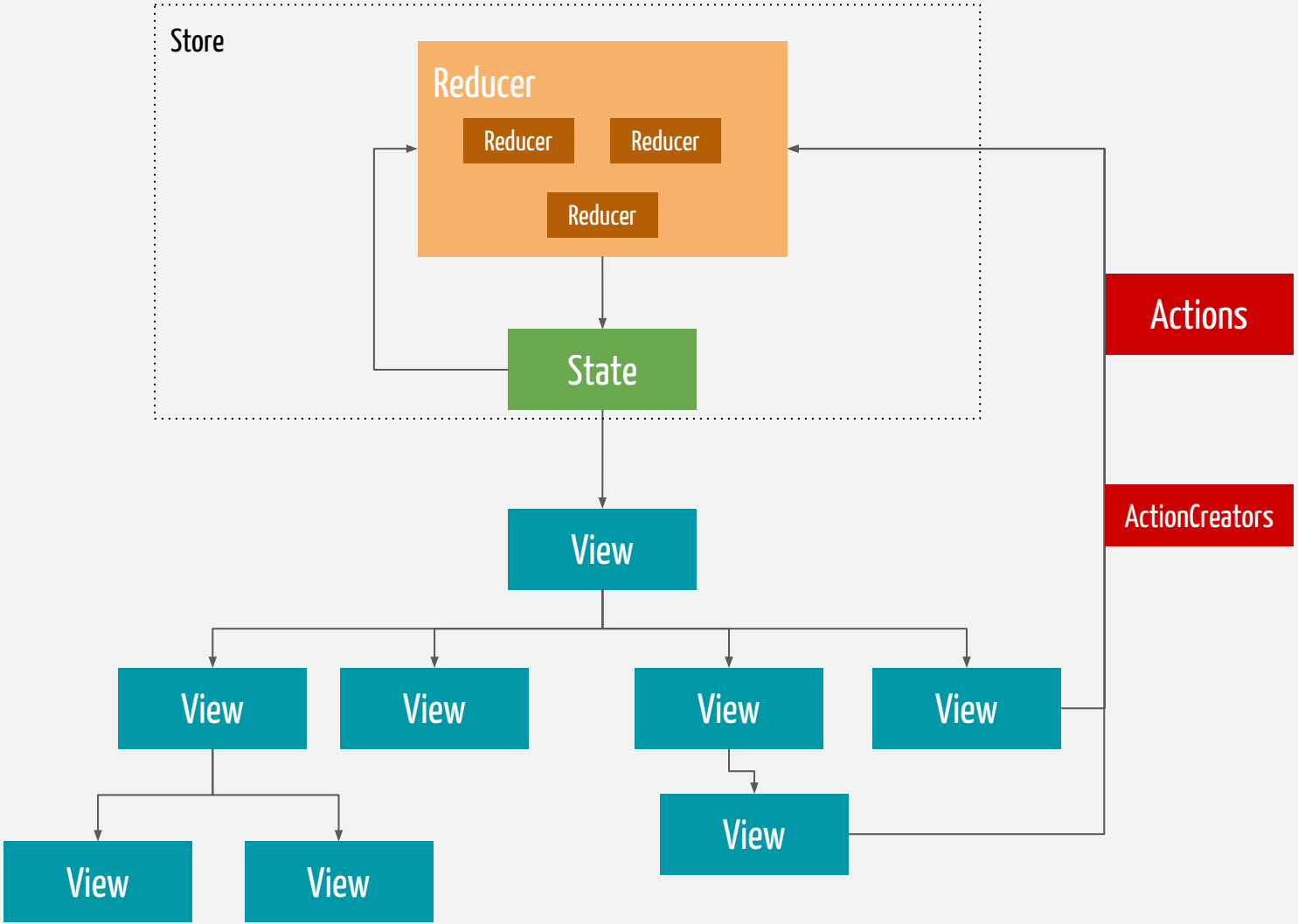
- The whole state in one single data structure?
- One reducer contains all logic?

```
import { combineReducers } from 'redux'

import userReducer from '../users'
import productsReducer from '../products'
import categoriesReducer from '../categories'

var rootReducer = combineReducers({
    users: userReducer,
    products: productsReducer,
    categories: categoriesReducer,
})
```

Angular + Redux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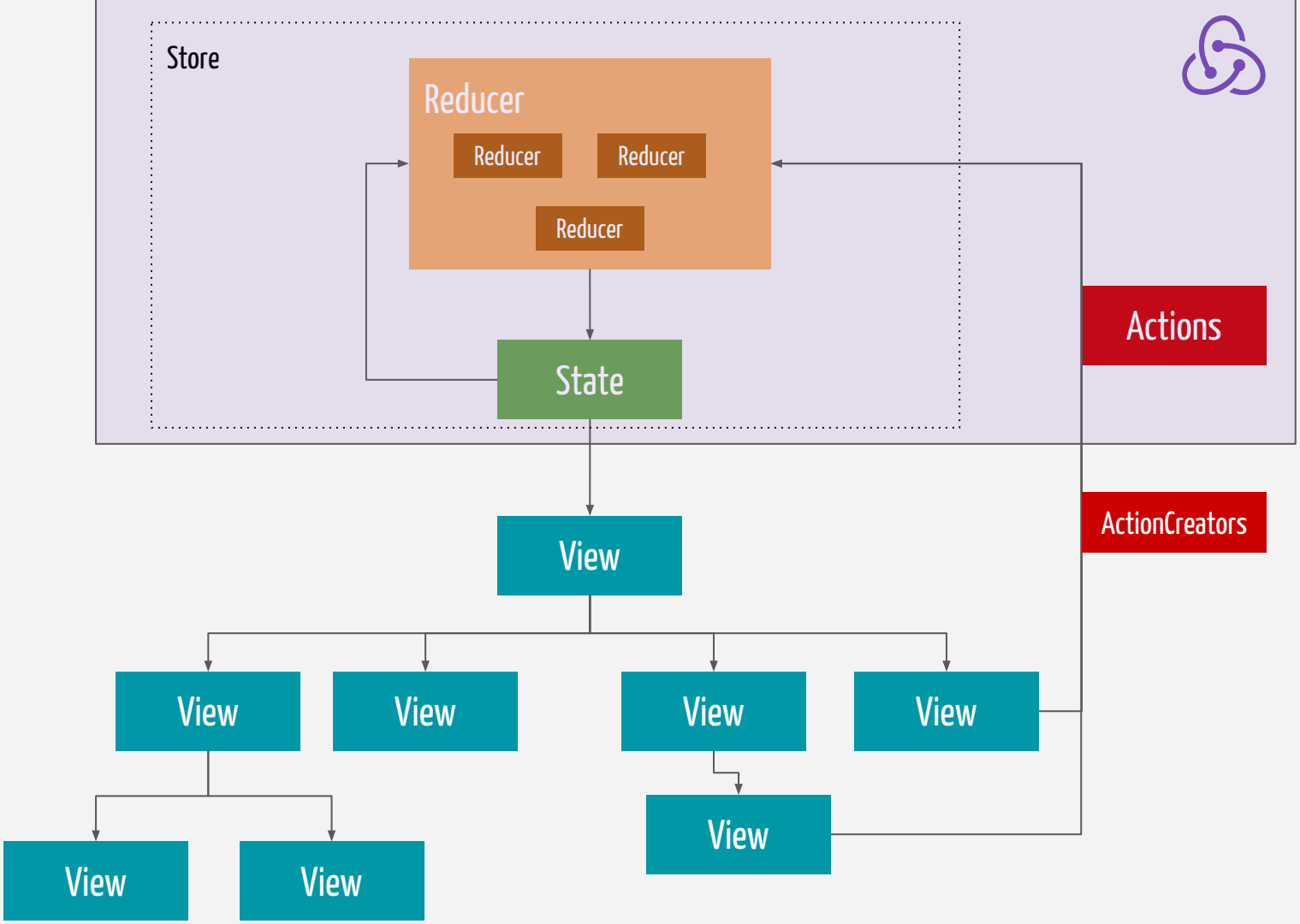
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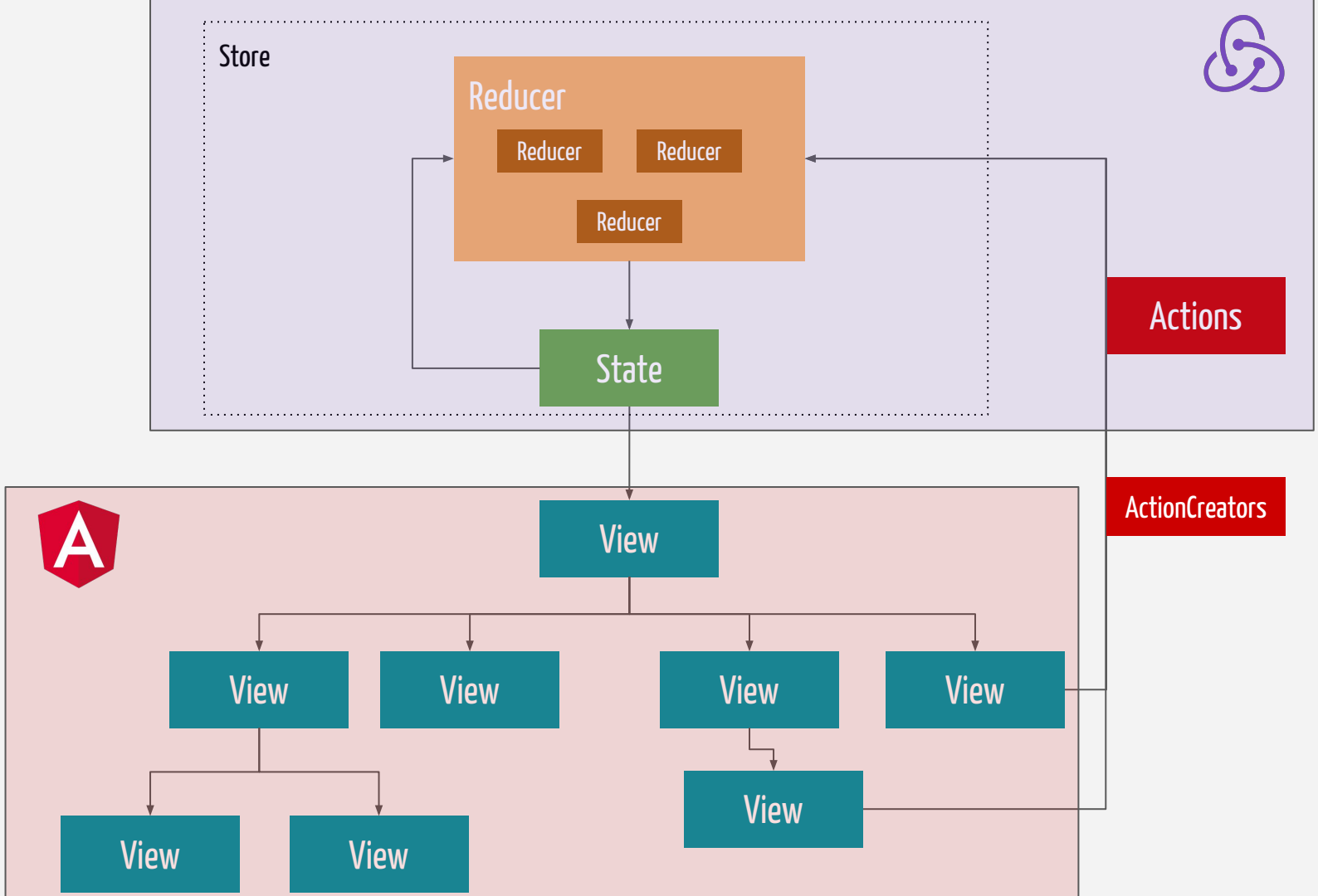
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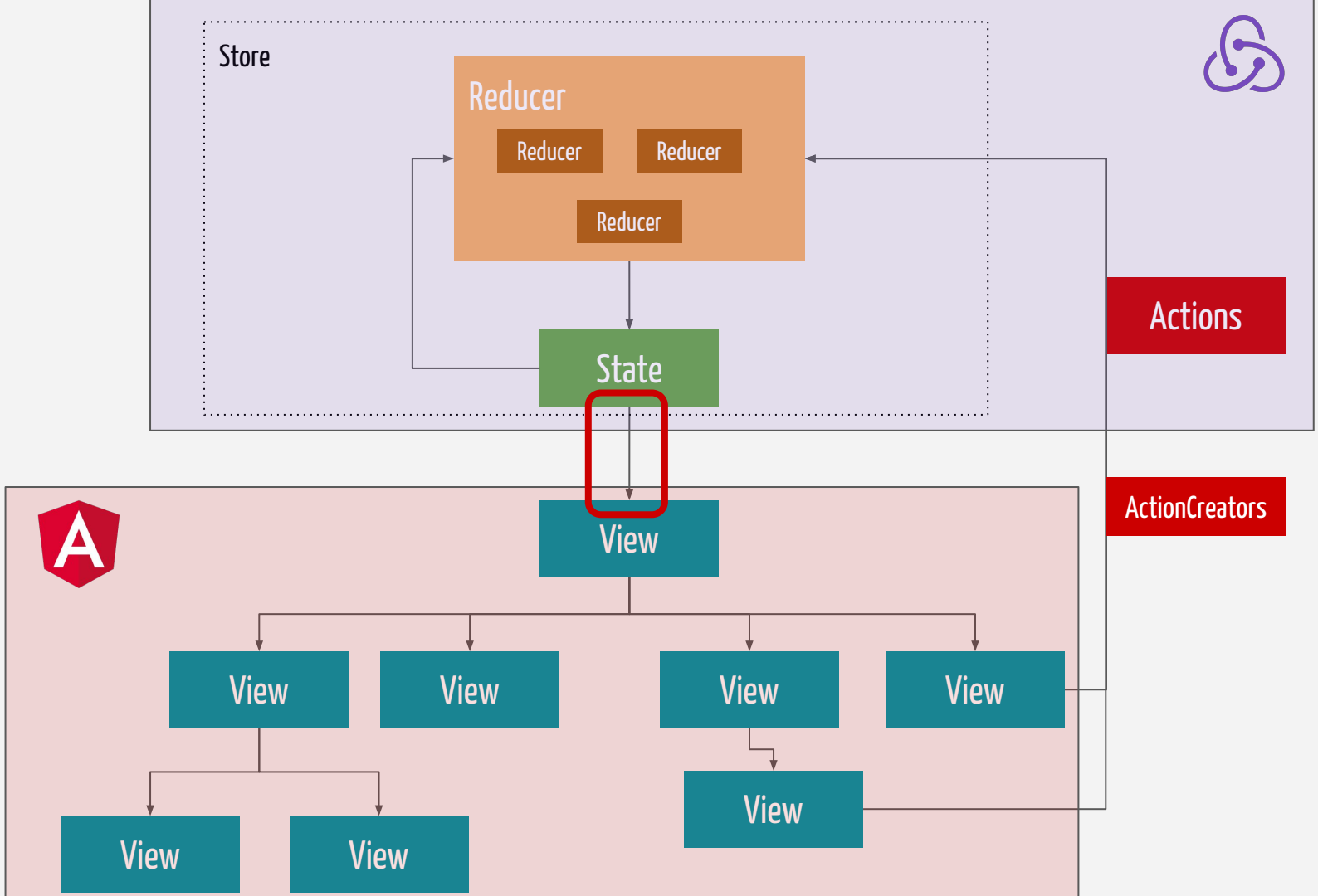
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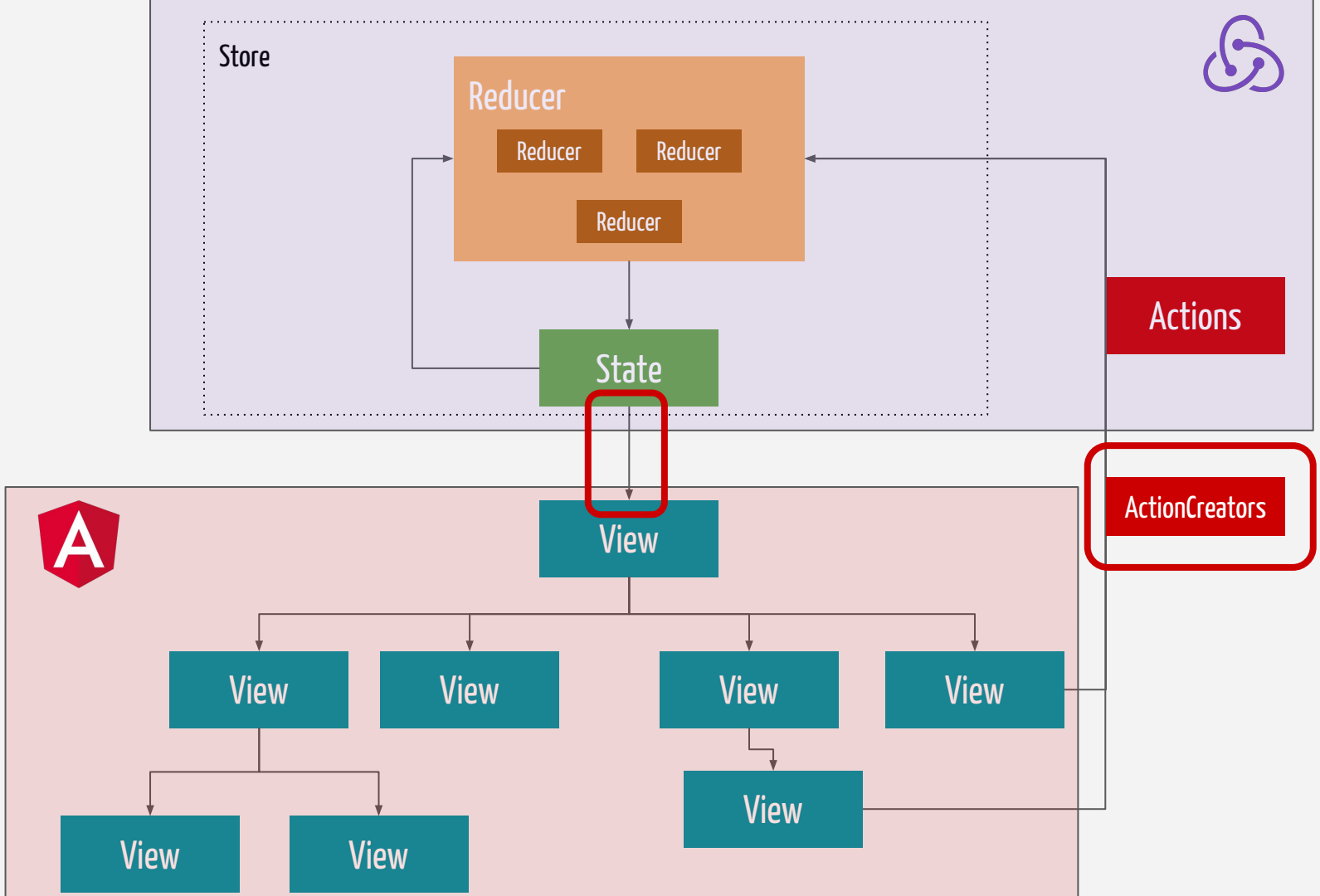
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angular-redux

Angular + Redux?

- https://github.com/angular-redux
- combines original redux lib with Angular
- pending questions:
  - ActionCreators needs dependency jnjection
  - How to get the data from the store into the UI components?

ActionCreators

```
import { Injectable } from '@angular/core'

@Injectable()
export class ProductsActionCreators {
}
```

```
import { NgRedux } from '@angular-redux/store'
import { AppState } from '../appstate'

@Injectable()
export class ProductsActionCreators {
    constructor(private ngRedux: NgRedux<AppState>) {}
}
```

```
import { Http } from '@angular/http'

@Injectable()
export class ProductsActionCreators {
    constructor(private ngRedux: NgRedux<AppState>, private http: Http) {}
}
```

```
@Injectable()
export class ProductsActionCreators {
    constructor(private ngRedux: NgRedux<AppState>, private http: Http) {}

    public loadProducts() {
    }
}
```

```
@Injectable()
export class ProductsActionCreators {
    constructor(private ngRedux: NgRedux<AppState>, private http: Http) {}

    public loadProducts() {
        this.ngRedux.dispatch({
            type: 'LOAD_PRODUCTS_START'
        })
    }
}
```

```
@Injectable()
export class ProductsActionCreators {
    constructor(private ngRedux: NgRedux<AppState>, private http: Http) {}

    public loadProducts() {
        this.ngRedux.dispatch({
            type: 'LOAD_PRODUCTS_START'
        })

        this.http.get('/api/products')
            .map(resp => resp.json())
    }
}
```

```
@Injectable()
export class ProductsActionCreators {
    constructor(private ngRedux: NgRedux<AppState>, private http: Http) {}

    public loadProducts() {
        this.ngRedux.dispatch({
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        this.http.get('/api/products')
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            .subscribe(res => {

             });
    }
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    public loadProducts() {
        this.ngRedux.dispatch({
            type: 'LOAD_PRODUCTS_START'
        })

        this.http.get('/api/products')
            .map(resp => resp.json())
            .subscribe(res => {
                this.ngRedux.dispatch({
                    type: 'LOAD_PRODUCTS_FINISHED',
                    payload: {
                        json: res
                    }
                })
             });
    }
}
```

How to get the data
from the store
into the UI components?

Selector function

- concept is well-tested in react-redux community
- Selector: a pure function that queries some data from the State
- `(state) → T`

```
function isLoading (state: AppState): boolean {

    return state.products.loadingFlag;

}
```

```
import { select } from '@angular-redux/store'
import { isLoading } from '../products-selectors'

@Component({
    selector: 'app-product-overview',
    templateUrl: '...'
})
export class ProductOverviewComponent {

    @select(isLoading)
    public loading: Observable<boolean>

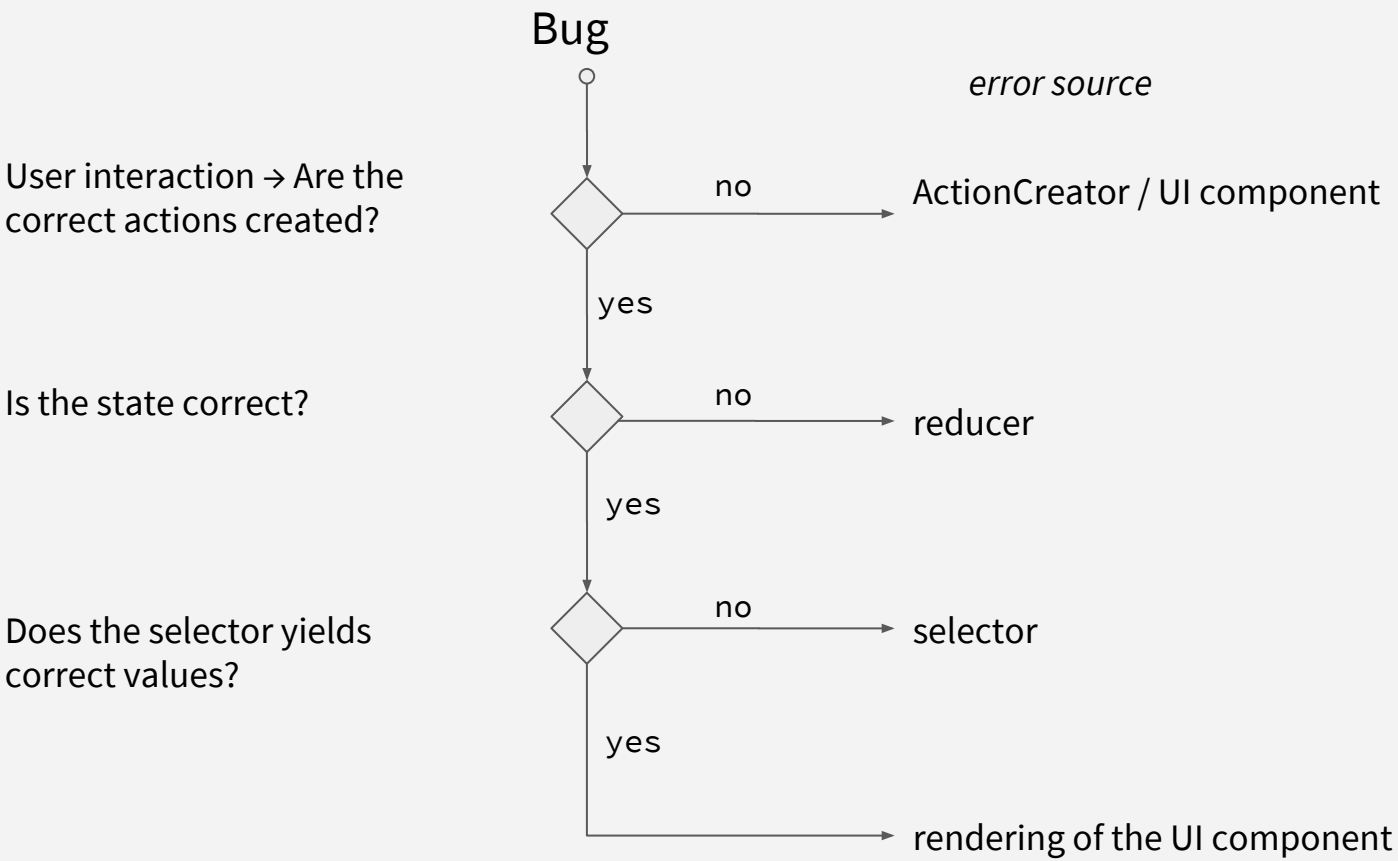
}
```

```
// products-overview.component.html
<div>
    <h1>Products</h1>
    …
    <p *ngIf="loading | async">Loading...</p>
</div>
```

Conclusion

Debugging

- Time-Travel-Debugging
- Whole application state is visible in one place
- clear solution process to find and fix bugs


Bug
error source
User interaction → Are the correct actions created?
no
ActionCreator / UI component
yes
Is the state correct?
no
reducer
yes
Does the selector yields correct values?
no
selector
yes
rendering of the UI component

More files

- Reducer, Selectors, ActionTypes, ActionCreators…
- however: files have clear responsibility
- learing curve: new devs may have problems in the beginning

testability

- Reducer and Selectors are pure functions
- asynchronous behaviour is encapsulated in ActionCreators
- UI components are conceptually similar to functions:
  - New data comes in → What is rendered?
  - Interaction by the user → Are correct ActionCreators invoked (Mocking)

Thinking functional, modelling state

- functional way of thinking may be unfamiliar to OOP developers
  - Pure Functions
  - Function Composition
  - Immutability
  - Reducer Functions

- How to model the state?
- How to compose the reducers?
- Asynchronous operations?

Simpler Transition React ⟵ ⟶ Angular

- Same basics for react and angular projects
- a lot of code can be reused without modification
- developer know how.
- concept is usable on other platforms too:
  - React-Native/NativeScript → Mobile
  - Java Desktop → JavaFX
  - ...

Q&A

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JUG Görlitz

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