React Course Notes

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# What is React?

React is a JavaScript library for building user interfaces. The user interfaces are built by splitting them in Components.

# Next Generation JS

## Let & Const

Different way of creating variables.

## Let

Used for variable values. Values that will be change by the logic processing.

## Const

Const is used for values that won’t change.

## Arrow Functions

Solves problem with the “this” keyword.

const functionName = (arguments) => {

//Logic

}

Automatic return for one-liners.

const functionName = onlyOneArgument => “hey”;

## Exports & Imports (Modules)

Inside of a JS-File you can import content of another file.

#### Default Export

Always exports what’s named on the export per default. Therefor when you import the you can use whatever name you like. See picture below(class person.js).

#### Named Export and Import

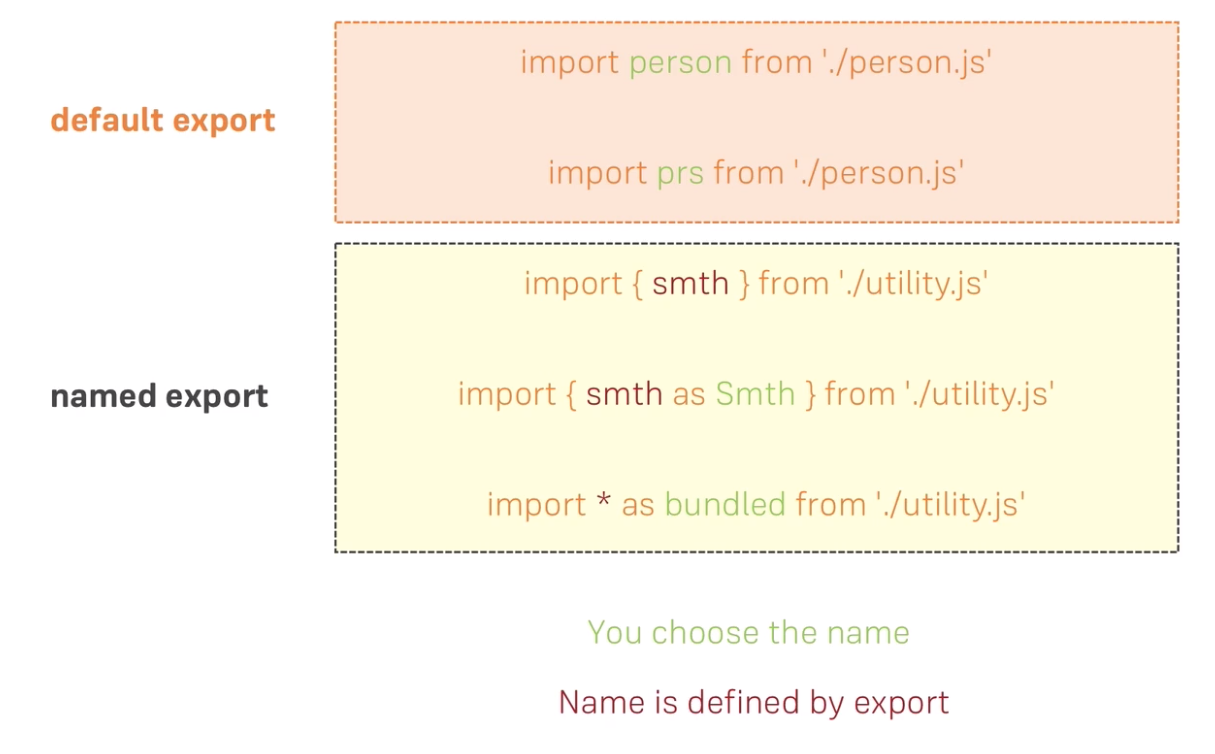
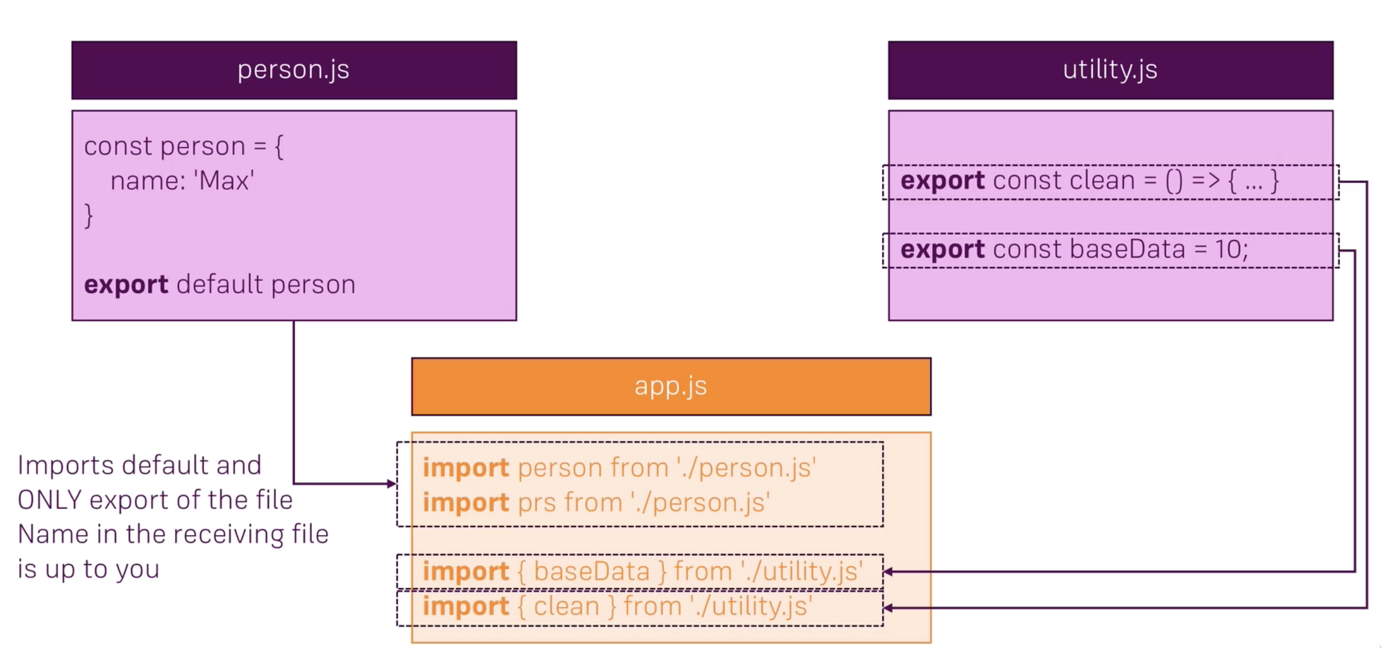
With named exports you can have multiple exports. See picture below(class utility.js). The named imports are called between curly braces. Further export and Import details on Figure 2

Figure 1 Exports and Imports Example

Figure 2 Default and Named Export

## Spread & Rest Operators

#### Spread

Used to split up array element OR object properties.

Examples:

To save values oldArray in newArray and add new values:

const newArray = […oldArray,1,2];

To save properties of oldObject in newObject as key-value-pairs and add a new property:

const newObject = {…oldObject, newProp:5}

#### Rest

Used to merge a list of function arguments into an array.

Example:

Merges all arguments passed to the function into an array.

function sortArgs(…args){

return args.sort();

}

## Destructuring

Easily extract array elements or objects properties and store them in variables. Not same as spread because destructuring allows you to pull single values or properties and store them in oppose to spread saving the whole array/object.

#### Array destructuring

[a,b] = [‘Hello’, ‘Mr.’, ‘Max’]

console.log(a); //Hello

console.log(b); //Mr

[a, ,b] = [‘Hello’, ‘Mr.’, ‘Max’]

console.log(a); //Hello

console.log(b); //Max

#### Object destructuring

{name} = {name: ‘Max’, age: 20};

console.log(name);//Max

console.log(age);//undefined

## Array Functions

Array functions take function as an argument which is executed on each element in the array.

# JSX

Allows to write html-similar code. It’s not the real html-text, React translates it in the background to render the proper html. Components return one element which wraps all component-elements -> ex. div wraps p,h1etc.

# State and Props

React watches if state or props change and analyzes the code already rendered to the DOM and the code it would render after the change. Next it updates the existing DOM everywhere it needs to be updated so the new state/props are properly displayed.

## Props

To get something from outside the component by passing it as props.

Props are passed from the outside.

## State

To change some of the components values from inside the component. State is managed from the inside. State should be used when it makes sense, as too much state can make the application difficult to maintain.

## setState

There’s two ways of setting the state. One is if your new state is not dependent on your old state and the other if your new state is dependent on your old state.

1. The first way is simple and self explainatory:

this.setState({  
 value: newValue  
})

1. However, the second way is a bit more complicated. Even though you call *setState* synchronously it’s not guaranteed to be executed immediately. It’s executed when React find the best time to execute it. Because of that we need to use to optional syntax of the *setState* method that receives to arguments, namely *prevState* and *props*. The code for that:

this.setState((prevState, props) => {  
 return {  
 counter: prevState.counter+ 1  
 };  
});

# Stateless vs Stateful

## Stateless

A component without state. Best to have more stateless components, than stateful because it makes the app easier to maintain.

## Stateful

Stateful is a component that manages state. Functional component that manages its state with *useState* is also a Stateful component.

# Event Listening

You are able to listen to a lot of events all of them listed in the link below.

<https://reactjs.org/docs/events.html#supported-events>

# Lists and Conditionals

## Lists

To repeat an HTML element or group of elements the number of items you have in a list you use the “map” function. The “map” function is an array function which executes logic for each element in the list. See the example below.

<div>  
 {*this*.state.people.map((person, index) => {  
 *return* (  
 <Person *name*={person.name}  
 *age*={person.age}  
 *click*={() => *this*.*deletePerson*(index)}  
 *key*={person.id}  
 *changed*={(event) => *this*.*nameChangedHandler*(event, person.id)}  
 >Hobby</Person>  
 );  
 }}  
 </div>

The person component is repeated the with different values for each array element.

## Conditionals

There are two possibilities on the conditionals.

1. One is directly in the render-return where the whole JSX of the component is returned and it works as follows:

{1>2 ? <p>Hey Hey</p> : <p>Bye Bye</p>}

In this specific case “Bye Bye” is displayed on the website because one isn’t larger than 2. The part after the colon is the “else” part.

1. The second possibility is still in the render method but before the JSX-return.

*let* message = *null*;  
  
*if* (1>2) {  
 message = (  
 <p>Hey Hey</p>  
 );  
} else {

message = (  
 <p>Bye Bye</p>  
 );

}

This saves the wished JSX in the variable “message” according to the condition being true or false. This variable then can be inserted in the normal JSX code. Example:

*return* (  
 <div>  
 {message}  
 <p>Mr/Ms</p>  
</div>  
);

# Styling Components

## Dynamic styles

You can assign CSS properties and values to JavaScript objects. This way you can anytime change the CSS. Example:

*const* style = {  
 backgroundColor: 'lime',  
 font: 'inherit',  
 border: '1px solid transparent',  
 padding: '8px',  
 marginTop: '20px',  
 cursor: 'pointer',  
 color: '#3e3e3e'  
};

if (true) {

style.backgroundColor: ‘tomato’

}

This style is then assigned to the element you want the following way:

<button style={style}> Click Me </button>

## Dynamic classes

You can preprogram the style for a certain class in the CSS file then later set this class to an element through the React code. You create an empty array which will later hold the classes for the element. Then on you can add the classes you’d like to the array.

*let* classes = [];  
*if* (*1* <= 2){  
 classes.push(class-one);  
}  
*if* (*0* <= 1){  
 classes.push(class-two');  
}

To be able to set this array to an HTML element you need to join it on an empty space like this:

<h1 *className*={classes.join(' ')}>Hello World</h1>

## Radium for Sudo selectors and Media Queries

*Alternative to Radium is styled-components.*

Radium is a library you need to install via npm/yarn etc., which allows you to use sudo selectors and media queries in inline style (in component JS file). After you download it you need to import it in you component and then wrap the default export the following way:

export default Radium(App);

## Sudo selectors inline

Example for hover. Further sudo selectors work the same way.

*const* style = {  
 ':hover': {  
 backgroundColor: '#81c784',  
 }  
};

## Advanced features (Media-Queries, Keyframes)

To access the advanced features of Radium you need to wrap the JSX of you Root component in an StyleRoot-element like this:

<StyleRoot>

<!----App----->

</StyleRoot>

Then you can use the advanced feature like the example below:

*const* style = {  
 '@media (min-width:500px)' :{  
 width:'450px'  
 }  
};

Assign the style const to an element as usual.

## CSS Modules

-----------------------------------------------------------------------------------------------------------------

**IMPORTANT**

If you are using react-scripts 2.x or higher the, below the line described, steps do not apply. You only need to import the CSS classes. Example below:

import classes from ‘./App.module.css’;

-----------------------------------------------------------------------------------------------------------------

**For versions of react-scripts below 2.x**

CSS modules is a way of making the stylesheets not global. The first step on achieving this is by ejecting the project as follows:

npm run eject

Afterwards you go in the *webpack.config.dev.js* and extend the options of the *css-loader* with the following commands:

models: true,

localIdentName: ‘[name]\_[local]\_[hash:base64:5]

Then add the same lines in the *webpack.config.prod.js* file.

Then you can import your CSS files like this:

import classes from ‘./App.css’;

That way you import all classes of that specific stylesheet.

After this step you can set classes as the example below:

<p className={classes.ClassName}>Hello Mars</p>

# Error-handling

There is a type of error handling in react specifically for code that you know might fail, e.g. external API calls and similar. For this use case you can use ErrorBoundary if you use a React version 16+.

You can create an ErrorBoundary component looking something similar like this:

*import* React, {Component} *from* 'react';  
  
*class* ErrorBoundary *extends* Component {  
  
 state = {  
 hasError: *false*,  
 errorMessage: ''  
 }  
  
 componentDidCatch(error, errorInfo) {  
 *this*.setState({  
 hasError: *true*,  
 errorMessage: error  
 })  
 }  
  
 render() {  
 *if* (*this*.state.hasError){  
 *return* (<h1>Oooopsie error</h1>)  
 } *else* {  
 *return this*.props.children  
 }  
 }  
}  
  
*export default* ErrorBoundary;

Then wrap the child, that might throw the error in this component and in production (**only in production**) the ErrorBoundary component will be loaded.

# Components & React internals Deep dive

## Containers

Containers such as *App.js* should be lean (less JSX) and manage/manipulate the state.

## Class-Based vs Functional Components

Figure 3 Class-based vs Functional Components

If you use a version of react, that doesn’t support React Hooks and work with the state or need the Lifecycle Hooks work with Class-Based components. Use Functional Components in all other cases.

## Component Lifecycle

The Lifecycle is only available in class-based components. Functional Components have a similar equivalent, but it’s not the same. The following table lists those methods in the order of execution.

|  |  |
| --- | --- |
| Lifecycle Method | Explanation |
| constructor(props) | ES6 class Feature. If you create it you need to call *super(props)*. Can be used to set initial state. Shouldn’t be used for so called side effects (http-requests, local-storage etc.) those can trigger re-renders which we don’t want. |
| getDerivedStateFromProps  (props,state) | Used very rarely. In case your props can change and then you want to change state of that component. Again, you shouldn’t cause side effects here. |
| render() | Use to prepare & structure your JSX code. Once more no side effects, time-outs and similar. (This method calls all lifecycle method of its children components, so the next lifecycle-method in your parent component is executed once all lifecycle-methods of the children finished executing.) |
| componentDidMount() | Here you can cause side-effects. This method is perfect for http-requests. However you shouldn’t update state unless data coming from a server or similar. |

Component Lifecycle-methods call order when updating component props.

|  |  |
| --- | --- |
| getDerivedStateFromProps… | //As previous |
| shouldComponentUpdate (nextProps, nextState) | For performance optimization. |
| render() | //As previous |
| getSnapshotBeforeUpdate  (prevProps, prevState) | Used for DOM interaction, like getting the scrolling position of the used. For example during a component update you can get the location of the scroll where a use was and then when the component is finished updating get the user scroll to where he was before. |
| componentDidUpdate() | For http-request and other side effects. Attention to entering an endless loop, where you call http-request that triggers an update and you start the update-methods again and end up with the http-request call executing again and again. |
| componentWillUnmount() | When component gets unmounted from the DOM. For example, when you want to clean up something |

Component Lifecycle-methods call order when updating component state.

|  |  |
| --- | --- |
| shouldComponentUpdate (nextProps, nextState) | //As previous |
| render() | //As previous |
| componentDidUpdate() | //As previous |

## Functional-Component Lifecycle

Thanks to React Hooks functional components can have state now. Therefore they should have lifecycle methods to handle changes properly

|  |  |
| --- | --- |
| useEffect() | Executes for every Lifecycle. |
| useEffect() as componentDidMount | *useEffect*(() => {  }, []);  Empty array to make the method run only once. This way we say that this method has no dependencies and the method reruns only if the dependencies are changed. |
| useEffect() to run when something changes | *useEffect*(() => {  *//Http request simulation  setTimeout*(() => {  *alert*("Saved data")  }, 1000); }, [props.data]); |
| useEffect() as componentWillUnmount() | *useEffect*(() => {  return () => {  //Code here gets executed before the //component unmounts  }; }, []); |
| useEffect() as componentWillUnmount() without array-argument | *useEffect*(() => {  return () => {  //Executed whenever the component //re-renders/after it updated  }; }); |

## React.memo()

To imitate *shouldComponentUpdate* in a functional component you’d need to wrap the export in *React.memo().* It basically stores the component as it is and when the component is re-rendered if the inputs change it will re-render it. If no differences appear React will give back the store component.

Export wrapper:

export default React.memo(component);

## PureComponent

If you need to check if all of your props changed on the *shouldComponentUpdate* method before making sure whether you need to update or not, you can make the Component extend *PureComponent*(of course this only works for class components). *PureComponent* is a basic Component that you’d extend usually with the difference that it already implements the *shouldComponentUpdate-*method and makes full props comparison.

## How does React update the DOM

React compares two Virtual DOMs with one each other. It keeps two copies of the DOM, one of the old Virtual DOM and one of the Re-rendered Virtual DOM (this is the one that is created when the *render*­*­*-method is called). If there are differences the “real” DOM gets updated. It doesn’t completely replace the “real” DOM only swaps what’s new. If there are no differences the real DOM isn’t touched.

## Higher Order Component (HOC)

A HOC is a function that takes a Component as one of its parameters and enhances that component in some way. They just add something to the component, HTML, CSS or JS.

## Rendering Adjacent JSX elements

To return multiple HTML-elements without any outer div you can haven a HOC (basically empty functional component with no JSX) that wraps the adjacent elements.

Example of HOC:

*import* React *from* 'react';  
  
*const aux* = props => props.children;  
  
*export default aux*;

Then wrap you children as usual.

React also offers the same functionality on its own with the *React.Fragment*. Just import *Fragment* from the ‘react’ package and wrap the children with it.

## PropTypes

PropTypes allow you to use data-types on the props so you can output some kind of warning/error in case the wrong prop-type is passed. This is especially useful for open source packages that are used by developers. To use PropTypes you first need to download the package as this is not delivered with the react-package.

npm install --save prop-types

Then import:

import PropTypes from 'prop-types';

Afterwards just before the export of the class you can define your props:

Person.propTypes = {  
 click: PropTypes.func,  
 name: PropTypes.string,  
 age: PropTypes.number,  
 changed: PropTypes.func  
};

## Refs

Ref is used to access DOM elements (similar to document.getElementById(“id”)). Currently there are two possibilities on how to make a ref to an HTML-element in class-based component.

1. The older one works by adding the *ref* attribute to the HTML-element and pass an arrow function the following way:

<div ref={(inputEl) => {  
 this.inputEl = inputEl;  
}}/>

In the function you have a class property which gets the value of the HTML-element and can control it.

1. The other way (newer) requires a constructor in which you assign an empty ref to class-property like this:

constructor(props) {  
 super(Zprops);  
 this.inputElRef = React.createRef();  
}

Then the HTML-element doesn’t get a function passed, but a this specific property.

<div ref={this.inputElRef}/>

And again the element is accessible by the class-property.

1. In functional components that use React Hooks you can import the method *useRef()* to have a similar approach as the second one shown.

import React, {useRef} from 'react';

After you can assign a ref to a variable:

const btnRef = useRef();

At last you can assign the HTML-element to the ref-variable:

<button ref={btnRef} onClick={doSomething}>Switch Name</button>

## Context API

In case of long chains of passing props you can use React Context. Let’s say you have Components from A to D which are wrapped hierarchically and you want to pass props to the D component from the A component. With the usual method you would have to pass them to each child component until you reach the desired one. The Context API has a different method.

First you create a context-component:

import React from 'react';  
  
const contextName = React.createContext({

randomPropName: 0  
 //Here you put the props you’d like to pass with key: default value (not required, optional) annotation  
});  
  
export default contextName;

To pass the props to the Context-component you do the following:

<ContextName.Provider value={{ randomPropName: this.state.randomVar}}>  
 // Here you wrap the child-components which should be able to access the context values  
</ContextName.Provider>

The child Components of the components wrapped in *ContextName.Provider* also have access to the context-values.

To get the values in the child components:

< ContextName.Consumer>  
 {(context) => <div propName={context.randomPropName }>Hello</div>  
 }  
</ ContextName.Consumer>

In class components instead of wrapping whatever needed the property you have the following possibility as well:

static contextType = ContextName;

Then to access the context values:

this.context.randomPropName

This way you can access the values in the whole class not only in the JSX.

In functional components you can use React Hooks the following way to get the context saved in a variable and make it accessible in the whole file:

const context = useContext(AuthContext);

Use as usual JS object.

# Reaching out to the Web (Http / Ajax)

## Axios

Axios is a library that facilitates the making of http requests. It’s installed by npm and once imported in the file it can be used in any JS code.

All of the following examples are done with axios.

The *.then* is the promise that’s returned by the method because this method is asynchronous and waits for the server response. Any logic that requires the response should be executed in the function that *.then* takes as an argument.

On the place of the console.logs you can execute any logic that manipulates the server-response in any way.

#### GET Request

axios.get('https://jsonplaceholder.typicode.com/posts').then((response) => {  
 console.log(response);  
});

#### POST Request

In this example the argument *post* is a JSON object that’s passed to the backend.

axios.post('/posts', post).then(response => {  
 console.log(response);  
});

#### DELETE Request

axios.delete('/posts/'+this.props.id).then(response => {  
 console.log(response);  
});

#### Error Handling

axios.get('/posts').then((response) => {  
 console.log(response);  
}).catch(error => {  
 console.log(error);  
})

#### Instances

Instances are used in case you need different global configurations for different things. For example, environments like dev, prod etc.

The instances are created in a new file (you can have as much as you want). In those instances, you set the configuration similarly.

Example:

import axios from 'axios';  
  
const instance = axios.create({  
 baseURL: 'https://jsonplaceholder.typicode.com',  
});  
  
instance.defaults.headers.common['Authorization'] = 'Auth token form instace';  
  
export default instance;

Then you import the file in the component you want to use this instance in and use it like usual axios.

#### Global config

Any type of global configuration is set in index.js except in cases the configs have to differ at specific conditions (see Instances-chapter).   
Example for global configurations:

axios.defaults.baseURL = 'https://jsonplaceholder.typicode.com';  
axios.defaults.headers.common['Authorization'] = 'Auth token form index';  
axios.defaults.headers.post['Content-Type']='application/json';

#### Interceptors

Interceptors are used the intercept with the request and add or manipulate it in any way. For example, if you need to add headers on every request you’d use an interceptor. This is again done either in an instance of axios or in the index if you have only one global configuration.

Example:

axios.interceptors.response.use(request => {  
 console.log(request);  
 // Add header or similar  
 return request;  
}, error => {  
 console.log(error);  
 return Promise.reject(error);  
});

# Redux

“Redux has **one** main advantage, and that's the efficiency it provides. Redux allows you to store your state in what is called a "Redux Store" and uses actions to call reducers, which in turn manipulate your state however you see fit.”

Dylan Mestyanek, [Redux Basics](https://dev.to/dylanmesty/redux-basics-explained-from-a-beginner-s-perspective-abm)

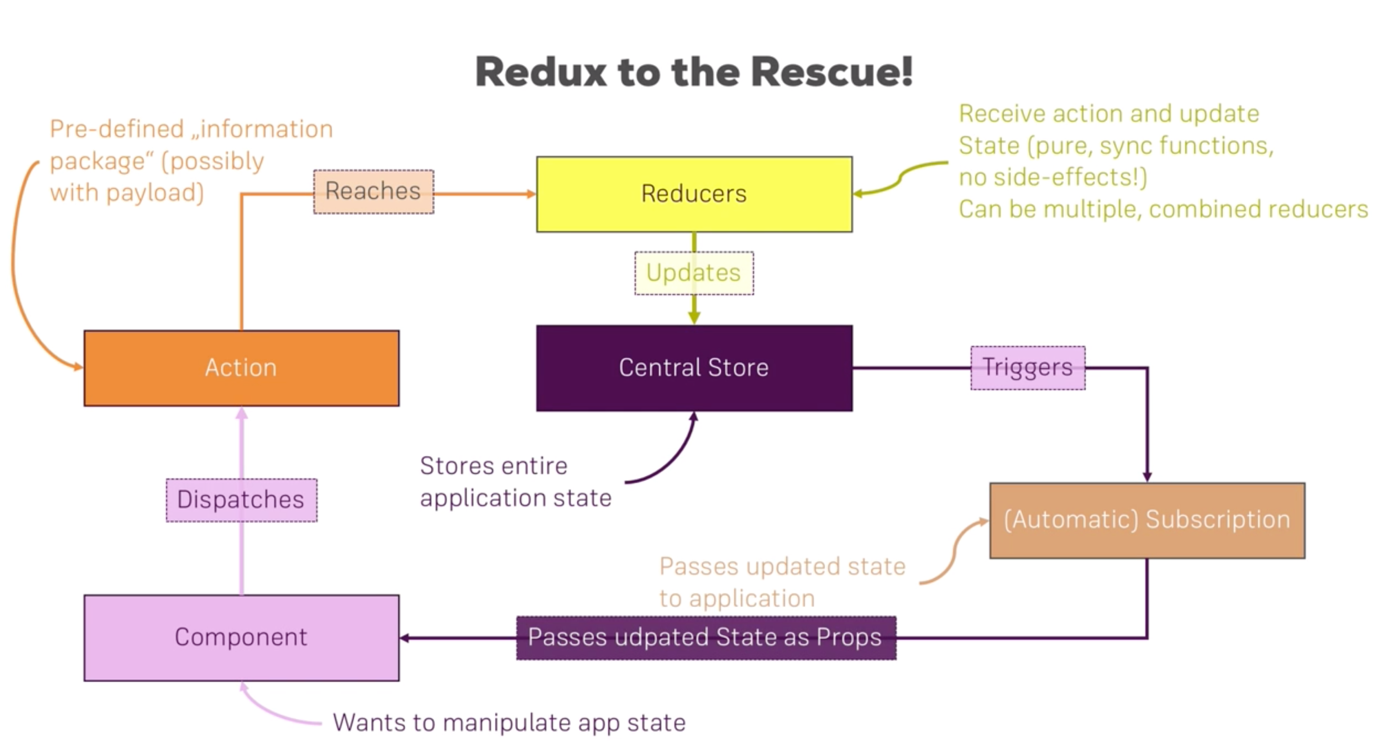


Figure 4 Redux Flow (starting with the Component)

To be able to use Redux in you React project there are two libraries you need to install with you package manager:

npm install --save redux

npm install –save react-redux

Installing Redux is needed to have the independent Redux library and React-Redux is used to connect React with Redux.

## The Redux Store

The Redux Store is where the state is stored globally, so we need to initialize the store globally in the *index.js* of the project.

Following lines of code are required for the imports:

import {createStore} from 'redux';

import {Provider} from 'react-redux';

import reducer from "./store/reducer";

After the imports initialize a constant the following way:

const store = createStore(reducer);

At last wrap you *App*-Component (in the *index.js* file) in a *Provider* and pass the store constant as props:

ReactDOM.render(<Provider store={store}><App/></Provider>, document.getElementById('root'));

## Actions & Connection component to reducer and store

Dispatching an action in the component is required so they can be detected by the reducer which then handles the state. This chapter explains how to connect your component to the reducer and the store and how to define actions.

At first manage the imports:

import {connect} from 'react-redux';

Next you need to create a constant that holds a function, which later will be managed by *connect* from React-Redux. The function will get the state from the redux-store passed as an argument. Then you can return an object (this object will be mapped to the props of the component) with the values you require from the state.

Example:

const mapStateToProps = state => {  
 return {  
 counter: state.counter  
 };  
};

However, this is to only get something from the state. If you want to update the state you need to create a second constant that maps the dispatch (which triggers actions) to your props. Again here you return an object (most likely with a function that is triggered with a certain action).

Example:

const mapDisplatchToProps = dispatch => {  
 return {  
 onIncrementCounter: () => dispatch({  
 type:'INCREMENT'  
 })  
 }  
};

The function *onIncrementCounter* can then be used like a usual function in the props.

The last thing that you need to do is manage you import the following way:

export default connect(mapStateToProps, mapDisplatchToProps)(Counter);

## Reducers

Reducers are like execution guidelines. They are basically functions full of *if…else* conditions, depending on the condition they change the state a differently.

A reducer is conventionally created in separate directory (called store) in the *src* folder. The JS file then has the following structure:

const initialState = {  
 counter: 0  
};  
  
const reducer = (state = initialState, action) => {  
 if (action.type === 'INCREMENT'){  
 return {  
 counter: state.counter + 1  
 }  
 }  
 return state;  
};  
  
export default reducer;

The reducer should always return a state in every condition and this state shouldn’t be undefined. So, in the arguments the *state* is set to have an intial value of *initialState*. The *action* shows what type of action was executed and depending on that we can decide what to do with the state.

## Immutably updating state

Mutable updating means directly altering a value in the state. When you mutate the internal state, React does not know what's changed, and even worse; it's notion of the current state is incorrect. So the DOM and virtual DOM will become out of sync.

Example:

const newState = state;

newState.value = state.value+1;

return newState;

This [link](https://redux.js.org/recipes/structuring-reducers/immutable-update-patterns/) explains the immutable update patterns and how to properly update your state.

## Outsourcing Action Types

Create a file with constants to hold all your action-types so you can reduce the chance of typos and unpredicted errors.

## Multiple Reducer

Splitting reducers is a good practice, so you don’t have too large files, which can quickly become confusing with all the conditions. The separate reducer files don’t differentiate with the usual reducer file, they are structured the same way. However, important note is that you don’t have access of the global state from the reducers now. One separate reducer has access only of its own state, other values should be passed as an argument to the dispatcher.

To combine the reducers you need to do the following in the *index.js* file:

First import them and the *combineReducers* method (combines multiple reducers into one):

import counterReducer from "./store/reducers/counter";  
import resultReducer from "./store/reducers/result";

import {createStore, combineReducers} from 'redux';

Then use the combine method and pass it as argument to the *createStore* method:

const store = createStore(combineReducers({  
 counterReducer: counterReducer,  
 resultReducer: resultReducer,  
}));

Then you can import the *store* in your component just like before. However, depending on which state-values you want to access (state of one or other separate reducer) after *state. c*omes the reducer name as you named it in the *combineReducers* arguments. See example:

const mapStateToProps = state => {  
 return {  
 ctr: state.counterReducer.counter,  
 storedResults: state.resultReducer.results  
 };  
};

From this point on the state-value is passed to the props and its usage is the same as previously described (see [Actions & Connection component to reducer and store](#_Actions_&_Connection)).